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Long-Term Water Transfers Environmental Impact Statement/ Environmental Impact Report

Final

March 2015

U.S. Department of the Interior
Bureau of Reclamation
Mid-Pacific Region
Sacramento, California

San Luis & Delta-Mendota
Water Authority

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Prepared by

United States Department of the Interior
Bureau of Reclamation
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San Luis & Delta-Mendota Water Authority

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Los Banos, California

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Long-Term Water Transfers
Final Environmental Impact Statement/Environmental Impact Report

Lead Agencies: U.S. Department of the Interior, through the Bureau of Reclamation (Reclamation) and the San Luis & Delta-Mendota Water Authority (SLDMWA)

State Clearinghouse # 2011011010

ABSTRACT

This Long-Term Water Transfers Environmental Impact Statement/Environmental Impact Report (EIS/EIR) evaluates the potential impacts of alternatives to help address Central Valley Project (CVP) water supply shortages. SLDWMA Participating Members and other CVP water contractors in the San Francisco Bay Area experience severe reductions in CVP water supplies during dry hydrologic years. A number of entities upstream from the Sacramento-San Joaquin Delta have expressed interest in transferring water to reduce the effects of CVP shortages to these agencies. The alternatives evaluated in this EIS/EIR include transfers of CVP and non CVP water or transfers from north of the Delta to CVP contractors south of the Delta that require the use of CVP and SWP facilities. Water would be made available for transfer through groundwater substitution, cropland idling, crop shifting, reservoir release, and conservation. This EIS/EIR evaluates potential impacts of water transfers over a 10-year period, 2015 through 2024.

This EIS/EIR has been prepared according to requirements of the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). Direct, indirect, and cumulative impacts resulting from the project alternatives on the physical, natural, and socioeconomic environment of the region are addressed.

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Executive Summary

Hydrologic conditions, climatic variability, consumptive use within the watershed, and regulatory requirements for operation of water projects commonly affect water supply availability in California. This variability strains water supplies, making advance planning for water shortages necessary and routine. In the past decades, water entities have been implementing water transfers to supplement available water supplies to serve existing demands, and such transfers have become a common tool in water resource planning.

The United States Department of the Interior, Bureau of Reclamation manages the Central Valley Project (CVP), which includes storage in reservoirs (such as Shasta, Folsom, and Trinity reservoirs) and diversion pumps in the Sacramento-San Joaquin Delta (Delta) to deliver water to users in the San Joaquin Valley and San Francisco Bay Area. When these users experience water shortages, they may look to water transfers to help reduce potential impacts of those shortages.

A water transfer involves an agreement between a willing seller and a willing buyer, and available infrastructure capacity to convey water between the two parties. To make water available for transfer, the willing seller must take an action to reduce the consumptive use of water (such as idle cropland or pump groundwater in lieu of using surface water) or release additional water from reservoir storage. This water would be conveyed to the buyers' service area for beneficial use. Water transfers would be used only to help meet existing demands and would not serve any new demands in the buyers' service areas. Pumping capacity at the Delta pumps is generally only available in dry or critically dry years.

Reclamation and the San Luis & Delta-Mendota Water Authority (SLDMWA) are completing a joint Environmental Impact Statement/Environmental Impact Report (EIS/EIR) pursuant to the National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) for water transfers from 2015 through 2024. Reclamation is serving as the Lead Agency under NEPA and SLDMWA is the Lead Agency under CEQA. Reclamation would facilitate transfers proposed by buyers and sellers. The SLDMWA, consisting of federal and exchange water service contractors in western San Joaquin Valley, San Benito, and Santa Clara counties, helps negotiate transfers in years when the member agencies could experience shortages.

This EIS/EIR evaluates water transfers that would be purchased by CVP contractors in areas south of the Delta or in the San Francisco Bay Area. The transfers would be conveyed through the Delta using CVP or State Water

Project (SWP) pumps, or facilities owned by other agencies in the San Francisco Bay Area.

This EIS/EIR addresses water transfers to CVP contractors from CVP and non-CVP sources of supply that must be conveyed through the Delta using both CVP, SWP, and local facilities. These transfers require approval from Reclamation and/or the Department of Water Resources (DWR), which necessitates compliance with NEPA and CEQA. Other transfers not included in this EIS/EIR could occur during the same time period, but they would receive separate environmental compliance from the implementing agencies (as necessary).

ES.1 Purpose and Need/Project Objectives

The purpose and need statement (under NEPA) and project objectives (under CEQA) describe the underlying need for and purpose of a proposed project. The purpose and need statement and objectives are a critical part of the environmental review process because they are used to identify the range of reasonable alternatives and focus the scope of analysis.

ES.1.1 Purpose and Need

The purpose of the Proposed Action is to facilitate and approve voluntary water transfers from willing sellers upstream of the Delta to water users south of the Delta and in the San Francisco Bay Area. Water users have the need for immediately implementable and flexible supplemental water supplies to alleviate shortages.

ES.1.2 Project Objectives

SLDMWA has developed the following objectives for long-term water transfers through 2024:

- Develop supplemental water supply for member agencies during times of CVP shortages to meet existing demands.
- Meet the need of member agencies for a water supply that is immediately implementable and flexible and can respond to changes in hydrologic conditions and CVP allocations.

Because shortages are expected due to hydrologic conditions, climatic variability, and regulatory requirements, transfers are needed to meet water demands.

ES.2 Study Area

The Study Area for potential transfers encompasses the potential buyers and sellers that could participate, which are shown in Figure ES-1.

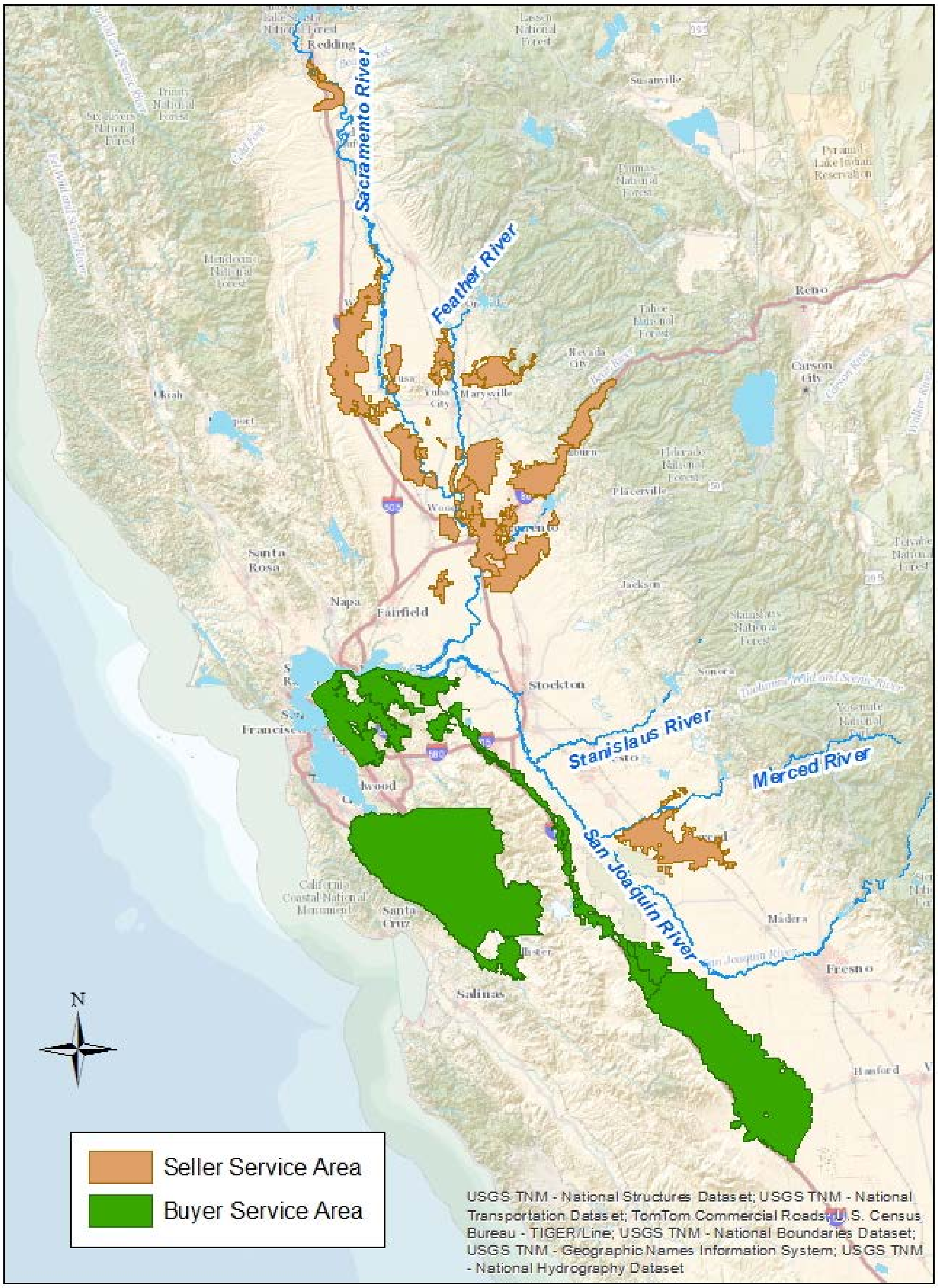

Figure ES-1. Potential sellers would transfer water to buyers in the Central Valley or Bay Area

ES.2.1 Water Agencies Requesting Transfers

Several CVP contractors have identified interest in purchasing transfer water to reduce potential water shortages and have requested to be included in the EIS/EIR; these agencies are shown in Table ES-1.

Table ES-1. Potential Buyers

San Luis & Delta-Mendota Water Authority Participating Members
Byron-Bethany Irrigation District
Del Puerto Water District
Eagle Field Water District
Mercy Springs Water District
Pacheco Water District
Panoche Water District
San Benito County Water District
San Luis Water District
Santa Clara Valley Water District
Westlands Water District
Contra Costa Water District
East Bay Municipal Utility District

ES.2.1.1 SLDMWA

SLDMWA consists of ~~29~~ 28 member agencies representing water service contractors and San Joaquin River Exchange Contractors, but not all SLDMWA member agencies are participating in the proposed activities that are the subject of this EIS/EIR. Reclamation has an operations and maintenance agreement with SLDMWA to operate and maintain the physical works and appurtenances associated with the Jones Pumping Plant, the Delta-Mendota Canal, the O'Neill Pump/Generating Plant, the San Luis Drain, and associated works. One function SLDMWA serves is to help negotiate water transfers with and on behalf of its member agencies when CVP allocations have been reduced and there is a need for supplemental water.

The SLDMWA service area consists primarily of agricultural lands on the west side of the San Joaquin Valley. Agricultural water use occurs on approximately 850,000 irrigated acres. Water for habitat management occurs on approximately 120,000 acres of refuge lands, which receive approximately 250,000 to 300,000 acre-feet (AF) of water per year. Relative to agricultural uses, there is limited municipal and industrial (M&I) water use in the San Joaquin Valley area. The majority of the M&I use in the SLDMWA service area occurs in the San Felipe Division, primarily the Santa Clara Valley Water District (WD).

South-of-Delta agricultural service contractors, many of which are members of the SLDMWA, experience severe cutbacks in CVP allocations in most years. In 2009, deliveries were cut back to ten percent of CVP contract amounts for agricultural water service contracts. In 2014, agricultural service contracts received a zero percent allocation. Note that the Exchange Contractors are not included in these allocations. SLDMWA member agencies use water transfers as a method to supplement water supplies in years when CVP allocations are reduced.

ES.2.1.2 Contra Costa WD

The Contra Costa WD was formed in 1936 to purchase and distribute CVP water for irrigation and industrial uses. Today, the Contra Costa WD encompasses more than 214 square miles, serves a population of approximately 500,000 people in Central and East Contra Costa County, and is Reclamation's largest urban CVP contractor in terms of contract amount.

Contra Costa WD is almost entirely dependent on CVP diversions from the Delta for its water supply. The 48-mile Contra Costa Canal conveys water throughout the service area. Contra Costa WD's long-term CVP contract with Reclamation was renewed in May 2005 and has a term of 40 years. The contract with Reclamation provides for a maximum delivery of 195,000 AF per year from the CVP for M&I purposes, but Contra Costa WD has historically received well below this contract amount. Contra Costa WD also has limited water supply from groundwater, recycled water, and some long-term water purchase agreements.

ES.2.1.3 East Bay Municipal Utility District (MUD)

East Bay MUD was created in 1923 to provide water service to the east San Francisco Bay Area. Today, East Bay MUD provides water and wastewater services to approximately 1.3 million people over a 332 square mile area in Alameda and parts of Contra Costa counties.

Ninety percent of East Bay MUD's water supply comes from the Mokelumne River watershed in the Sierra Nevada. East Bay MUD has a CVP contract with Reclamation to divert water from the Sacramento River for M&I purposes. East Bay MUD's long-term CVP contract with Reclamation was renewed in April 2006 and has a term of 40 years. The contract provides up to 133,000 AF in a single dry year, not to exceed a total of 165,000 AF in three consecutive dry years. CVP water is available to East Bay MUD only in dry years when certain storage conditions within the East Bay MUD system are met (East Bay MUD 2011). As a result East Bay MUD does not forecast frequent use of CVP water.

ES.2.2 Potential Willing Sellers

Table ES-2 lists the agencies that have expressed interest in being a seller in the Long-Term Water Transfers EIS/EIR and the potential maximum quantities available for sale. Actual purchases could be less, depending on hydrology, the amount of water the seller is interested in selling in any particular year, the interest of buyers, and compliance with Central Valley Project Improvement Act (CVPIA) transfer requirements, among other possible factors. Because of the uncertainty of hydrologic and operating conditions in the future, it is likely that only a portion of the potential transfers identified in Table ES-2 would occur.

Table ES-2. Potential Sellers (Upper Limits)

Water Agency	Maximum Potential Transfer
Sacramento River Area of Analysis	
Anderson-Cottonwood Irrigation District	5,225
Conaway Preservation Group	35,000
Cranmore Farms	8,000
Eastside Mutual Water Company	2,230
Glenn-Colusa Irrigation District	91,000
Natomas Central Mutual Water Company	30,000
Pelger Mutual Water Company	3,750
Pleasant Grove-Verona Mutual Water Company	18,000
Reclamation District 108	35,000
Reclamation District 1004	17,175
River Garden Farms	9,000
Sycamore Mutual Water Company	20,000
Te Velde Revocable Family Trust	7,094
American River Area of Analysis	
City of Sacramento	5,000
Placer County Water Agency	47,000
Sacramento County Water Agency	15,000
Sacramento Suburban Water District	30,000
Yuba River Area of Analysis	
Browns Valley Irrigation District	8,100
Cordua Irrigation District	12,000
Feather River Area of Analysis	
Butte Water District	17,000
Garden Highway Mutual Water Company	14,000
Gilsizer Slough Ranch	3,900
Goose Club Farms and Teichert Aggregates	10,000
South Sutter Water District	15,000
Tule Basin Farms	7,320
Merced River Area of Analysis	
Merced Irrigation District	30,000
Delta Region Area of Analysis	
Reclamation District 2068	7,500
Pope Ranch	2,800
Total	*511,094*

ES.3 Development and Screening of Preliminary Alternatives

NEPA and CEQA require an EIS and EIR, respectively, to identify a reasonable range of alternatives and provide guidance on the identification and screening of such alternatives. Both NEPA and CEQA include provisions that alternatives reasonably meet the purpose and need/project objectives, and be potentially feasible. For this EIS/EIR, the Lead Agencies followed a structured, documented process to identify and screen alternatives for inclusion in the EIS/EIR. Figure ES-2 illustrates the process that the Lead Agencies conducted to identify and screen alternatives.

Figure ES-2. Alternatives Development and Screening Process

ES.3.1 Public Scoping and Screening Criteria Results

During public scoping, the public provided input regarding potential alternatives to the Proposed Action. The Lead Agencies reviewed the purpose and need/project objectives statement, public scoping comments, and previous studies in their initial effort to develop conceptual alternatives. This process identified an initial list of measures described in more detail in Appendix A, Alternatives Development Report. The initial list included more than 27 measures. The Lead Agencies then developed and applied a set of screening considerations to determine which measures should move forward for further analysis and be considered as project alternatives.

The Lead Agencies determined that they would screen the alternatives based on their ability to meet key elements of the purpose and need/basic project objectives:

- Immediate: the term proposed for this EIS/EIR is 2015 through 2024. This period is relatively short, and measures need to be able to provide some measurable benefit within this time period.

- Flexible: project participants need water in some years, but not in others. They need measures that have the flexibility to be used only when needed.

- Provide Water: project participants need measures that have the capability of providing additional water to regions that are experiencing shortages.

Measures had to satisfy these key elements in order to move forward to the alternatives formulation phase. Appendix A includes a detailed discussion of the screening process and results.

ES.3.2 Selected Alternatives

The measures that moved forward for more detailed analysis in this EIS/EIR are those that best meet the NEPA purpose and need and CEQA objectives, minimize negative effects, are potentially feasible, and represent a range of reasonable alternatives. Some alternatives do not fully meet the purpose and need/project objectives, but they have potential to minimize some types of environmental effects or help provide a reasonable range of alternatives for consideration by decision-makers.

Measures that were carried forward from scoping and the screening process for alternatives formulation include:

- Agricultural Conservation (Seller Service Area)
- Cropland Idling Transfers - rice, field crops, grains
- Cropland Idling Transfers - alfalfa
- Groundwater Substitution
- Crop Shifting
- Reservoir Release

The measures remaining after the initial screening were combined into three action alternatives that were selected to move forward for analysis in the EIS/EIR (in addition to the No Action/No Project Alternative). Table ES-3 presents the alternatives carried forward for analysis in the EIS/EIR. Analysis of these alternatives will provide the information needed to make a decision, and potentially to mix and match elements of the alternatives, if needed, to create an alternative that would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any significant environmental effects.

Table ES-3. Alternatives Selected for Analysis in the EIS/EIR

Alternative Number	Alternative Name	Description
Alternative 1	No Action/ No Project	The No Action/No Project Alternative represents the state of the environment without the Proposed Action or any of the alternatives. In the No Action/No Project Alternative, the Buyer Service Area would experience water shortages and could increase groundwater pumping, idle cropland, or retire land to address those shortages.
Alternative 2	Full Range of Transfers (Proposed Action)	This alternative combines all potential transfer measures that met the purpose and need and were carried forward through the screening process.
Alternative 3	No Cropland Modifications	The No Cropland Modifications Alternative includes the following measures: • Agricultural conservation (Seller Service Area) • Groundwater substitution • Reservoir release
Alternative 4	No Groundwater Substitution	The No Groundwater Substitution Alternative includes the following measures: • Agricultural conservation (Seller Service Area) • Cropland idling transfers – rice, field crops, grains, alfalfa • Crop shifting • Reservoir release

ES.4 Potential Water Transfer Methods

A water transfer temporarily moves water from a willing seller to a willing buyer. To make water available, the seller must take an action to reduce consumptive use or use water in storage. Water transfers must be consistent with State and Federal law. Transfers involving water diverted through the Delta are governed by existing water rights, applicable Delta pumping limitations, reservoir storage capacity and regulatory requirements.

The biological opinions on the Coordinated Operations of the CVP and SWP (U.S. Fish and Wildlife Service [USFWS] 2008; National Oceanic and Atmospheric Administration Fisheries Service [NOAA Fisheries] 2009) analyze transfers through the Delta from July to September (commonly referred to as the "transfer window") that are up to 600,000 AF in ~~dry and~~ critically ~~dry~~ years and dry years (following dry or critical years). For all other year types, the maximum transfer amount is up to 360,000 AF. Through Delta transfers would be limited to the ~~period when USFWS and NOAA Fisheries find transfers to be acceptable, typically~~ July through September period~~, unless a change is made in a particular water year based on concurrence from USFWS and NOAA Fisheries~~.

This EIS/EIR analyzes transfers to CVP contractors. These transfers could be conveyed through the Delta using either CVP or SWP facilities, depending on availability. Some transfers may not involve CVP contractors as sellers, but they may use CVP facilities. Any non-CVP water that would use CVP facilities would need a Warren Act contract, which is subject to NEPA compliance. This document analyzes the impacts of conveying or storing non-CVP water in CVP facilities to address compliance needs for transfers facilitated by execution of a contract pursuant to the Warren Act of February 21, 1911 (36 Stat. 925).

Some transfers may be accomplished through forbearance agreements rather than transfers that involve the State Water Resources Control Board (SWRCB). Under such agreements, a CVP seller would forbear (i.e., temporarily suspend) the diversion of some of their Base Supply, which in the absence of forbearance, would have been diverted for use on lands within the CVP sellers' service areas. This forbearance would be undertaken in a manner that allows Reclamation to deliver the forborne water supply as Project water to a purchasing CVP water agency. A forbearance agreement would not change the way that water is made available for transfer, conveyed to buyers, or used by the buyers; therefore, it would not change the environmental effects of the transfer.

ES.4.1 Groundwater Substitution

Groundwater substitution transfers occur when sellers choose to pump groundwater in lieu of diverting surface water supplies, thereby making the surface water available for transfer. Sellers making water available through groundwater substitution actions are agricultural and M&I users. Water could be made available for transfer by the agricultural users during the irrigation season of April through September. If there are issues related to water supply availability or conveyance capacity at the Delta, sellers could shorten the window when transfer water is available by switching between surface water sources and groundwater pumping for irrigation or M&I use.

Groundwater substitution would temporarily decrease levels in groundwater basins near the participating wells. Water produced from wells initially comes from groundwater storage. Groundwater storage would refill (or "recharge") over time, which affects surface water sources. Groundwater pumping captures some groundwater that would otherwise discharge to streams as baseflow and can also induce recharge from streams. Once pumping ceases, this stream depletion continues, replacing the pumped groundwater slowly over time until the depleted storage fully recharges.

ES.4.2 Reservoir Release

Buyers could acquire water by purchasing surface water stored in reservoirs owned by non-Project entities (not part of the CVP or SWP). To ensure that purchasing this water would not affect downstream users, Reclamation would limit transferred water to what would not have otherwise been released downstream absent the transfer.

When the willing seller releases stored reservoir water for transfer, these reservoirs are drawn down to levels lower than without the water transfer. To refill the reservoir, a seller must capture some flow that would otherwise have gone downstream. Sellers must refill the storage at a time when downstream users would not have otherwise captured the water, either in downstream reservoirs or at the CVP and SWP (collectively "the Projects") or non-Project pumps in the Delta. Typically, refill can only occur during Delta excess conditions as defined in the "Agreement Between the United States of America and the State of California for Coordinated Operation of the Central Valley Project and State Water Project" (commonly referred to as the "Coordinated Operations Agreement", or "COA"), as "periods when it is agreed that releases from upstream reservoirs plus unregulated flow exceed Sacramento Valley in basin uses, plus exports," or when any downstream reservoirs are in flood control operations. Refill of the storage vacated for a transfer may take more than one season to refill if the above conditions are not met in the wet season following the transfer. Each reservoir release transfer would include a refill agreement between the seller and Reclamation (developed in coordination with DWR) to prevent impacts to downstream users following a transfer.

ES.4.3 Cropland Idling

Cropland idling makes water available for transfer that would have been used for agricultural production. Water would be available on the same pattern throughout the growing season as it would have been consumed had a crop been planted. The irrigation season generally lasts from April or May through September for most crops in the Sacramento Valley.

ES.4.4 Crop Shifting

For crop shifting transfers, water is made available when farmers shift from growing a higher water use crop to a lower water use crop. The difference between the water used by the two crops would be the amount of water that can be transferred. Transfer water generated by crop shifting is difficult to account for. Farmers generally rotate between several crops to maintain soil quality, so water agencies may not know what type of crop would have been planted in a given year absent a transfer. To calculate water available from crop shifting, agencies would estimate what would have happened absent a transfer using an average water use over a consecutive 5-year baseline period. The change in consumptive use between this baseline water use and the lower water use crop determines the amount of water available for transfer.

ES.4.5 Conservation

Conservation transfers must include actions to reduce the diversion of surface water by the transferring entity by reducing irrecoverable water losses. The amount of reduction in irrecoverable losses determines the amount of transferrable water. Conservation measures may be implemented on the water-district and individual user scale. These measures must reduce the irrecoverable losses at a site without reducing the amount of water that otherwise would have been available for downstream beneficial uses. Irrecoverable losses include water that would not be usable because it currently flows to a salt sink, to an inaccessible or degraded aquifer, or escapes to the atmosphere.

ES.5 Environmental Consequences/Environmental Impacts

A summary of the environmental impacts identified for the action alternative (including beneficial effects pursuant to NEPA) is presented in Tables ES-4 and ES-5. The No Action/No Project Alternative considers the potential for changed conditions during the 2015-2024 period when transfers could occur, but because this period is relatively short, the analysis did not identify changes from existing conditions. Alternative 1 is therefore not included in the tables.

The purpose of Table ES-4 is to consolidate and disclose the significance determinations made pursuant to CEQA made throughout the EIS/EIR. The impacts listed in Table ES-4 are NEPA impacts as well as CEQA impacts, but they are judged for significance only under CEQA. Pursuant to NEPA, significance is used to determine whether an EIS or some other level of documentation is required, and once the decision to prepare an EIS is made, the magnitude of the impact is evaluated and no further judgment of significance is required. Table ES-5 summarizes impacts for resources that were analyzed only under NEPA and do not include findings of significance.

Table ES-4. Potential Impacts Summary

Potential Impact	Alternative	Significance to CEQA	Proposed Mitigation	Significance After Mitigation Pursuant to CEQA
3.1 Water Supply				
Groundwater substitution transfers could decrease flows in surface water bodies following a transfer while groundwater basins recharge, which could decrease pumping at Jones and Banks Pumping Plants and/or require additional water releases from upstream CVP reservoirs.	2, 3	S	WS-1: Streamflow Depletion Factor	LTS
Water supplies on the rivers downstream of reservoirs could decrease following stored reservoir water transfers, but would be limited by the refill agreements	2, 3, 4	LTS	None	LTS
Changes in Delta diversions could affect Delta water levels ~~and cause local users' diversion pumps to be above the water surface.~~	2, 3, 4	LTS	None	LTS
Transfers would increase water supplies in the Buyers Service Area	2, 3, 4	B	None	B
3.2 Water Quality				
Cropland idling transfers could result in increased deposition of sediment on water bodies.	2, 4	LTS	None	LTS
Cropland idling/shifting transfers could change the water quality constituents associated with leaching and runoff.	2, 4	LTS	None	LTS
Cropland idling/shifting transfers could change the quantity of organic carbon in waterways.	2, 4	LTS	None	LTS
Groundwater substitution transfers could introduce contaminants that could enter surface waters from irrigation return flows.	2, 3	LTS	None	LTS
Water transfers could change reservoir storage in CVP and SWP reservoirs and could result in water quality impacts.	2, 3, 4	LTS	None	LTS

Potential Impact	Alternative	Significance to CEQA	Proposed Mitigation	Significance After Mitigation Pursuant to CEQA
Water transfers could change reservoir storage non-Project reservoirs participating in reservoir release transfers, which could result in water quality impacts.	2, 3, 4	LTS	None	LTS
Water transfers could change river flow rates in the Seller Service Area and could affect water quality.	2, 3, 4	LTS	None	LTS
Water transfers could change Delta inflows and could result in water quality impacts.	2, 3, 4	LTS	None	LTS
Water transfers could change Delta outflows and could result in water quality impacts.	2, 3, 4	LTS	None	LTS
Water transfers could change Delta salinity and could result in water quality impacts.	2, 3, 4	LTS	None	LTS
Diversion of transfer water at Banta Carbona ID, West Stanislaus ID, and Patterson ID could affect water quality in the Delta-Mendota Canal.	2, 3, 4	LTS	None	LTS
Use of transfer water in the Buyer Service Area could result in increased irrigation on drainage impaired lands in the Buyer Service Area which could affect water quality.	2, 3, 4	LTS	None	LTS
Water transfers could change reservoir storage in San Luis Reservoir and could result in water quality impacts.	2, 3, 4	LTS	None	LTS
3.3 Groundwater Resources				
Groundwater substitution transfers could cause a reduction in groundwater levels in the Seller Service Area.	2, 3	S	GW-1: Mitigation and Monitoring Plans	LTS
Groundwater substitution transfers could cause subsidence in the Seller Service Area.	2, 3	S	GW-1: Mitigation and Monitoring Plans	LTS

Potential Impact	Alternative	Significance to CEQA	Proposed Mitigation	Significance After Mitigation Pursuant to CEQA
Groundwater substitution transfers could cause changes to groundwater quality in the Seller Service Area.	2, 3	LTS	None	LTS
Cropland idling transfers could cause reduction in groundwater levels in the Seller Service Area due to decreased applied water recharge.	2, 4	LTS	None	LTS
Water transfers via cropland idling could cause groundwater level declines in the Seller Service Area that lead to permanent land subsidence or changes in groundwater quality.	2, 4	LTS	None	LTS
Water transfers could reduce groundwater pumping during shortages in the Buyer Service Area, which could increase groundwater levels, decrease subsidence, and improve groundwater quality.	2, 3, 4	B	None	B
3.4 Geology and Soils				
Cropland idling transfers in the Seller Service Area that temporarily convert cropland to bare fields could increase soil erosion.	2, 4	LTS	None	LTS
Cropland idling water transfers could cause expansive soils in the Seller Service Area to shrink due to the reduction in applied irrigation water.	2, 4	LTS	None	LTS
Use of transfer water on agricultural fields in the Buyer Service Area could increase soil erosion.	2, 3, 4	LTS	None	LTS
Use of transfer water on agricultural fields in the Buyer Service Area could increase soil movement.	2, 3, 4	LTS	None	LTS
Changes in streamflows in the Sacramento and San Joaquin Rivers and their tributaries as a result of water transfers could result in increased soil erosion.	2, 3, 4	LTS	None	LTS

Potential Impact	Alternative	Significance to CEQA	Proposed Mitigation	Significance After Mitigation Pursuant to CEQA
3.5 Air Quality				
Increased groundwater pumping for groundwater substitution transfers would increase emissions of air pollutants in the Sellers Service Area.	2, 3	S	AQ-1: Reducing pumping to reduce emissions, AQ-2: Operate electric engines	LTS
Water transfers via cropland idling could reduce vehicle exhaust emissions from reduced operations in the Sellers Service Area.	2, 4	B	None	B
Water transfers via cropland idling would increase fugitive dust emissions from wind erosion of bare fields and decrease fugitive dust emissions associated with land preparation and harvesting in the Sellers Service Area.	2, 4	B	None	B
Use of water from transfers on agricultural fields in the Buyer Service Area could reduce windblown dust.	2, 3, 4	B	None	B
Water transfers via groundwater substitution and cropland idling could exceed the general conformity de minimis thresholds.	2, 3, 4	LTS	None	LTS
3.6 Climate Change				
Increased groundwater pumping for groundwater substitution transfers could increase emissions of greenhouse gases.	2, 3	LTS	None	LTS
Water transfers via cropland idling could reduce vehicle exhaust emissions from reduced operations in the study area.	2, 4	LTS	None	LTS
Changes to the environment from climate change could affect the action alternatives.	2, 3, 4	LTS	None	LTS
Use of water from transfers on agricultural fields in the Buyer Service Area could affect emissions.	2, 3, 4	LTS	None	LTS

Potential Impact	Alternative	Significance to CEQA	Proposed Mitigation	Significance After Mitigation Pursuant to CEQA
3.7 ~~Aquatic Resources~~Fisheries				
Transfer actions could affect reservoir storage and reservoir surface area in reservoirs supporting fisheries resources	2, 3, 4	LTS	None	LTS
Groundwater substitution could reduce stream flows supporting fisheries resources in small streams	2, 3	LTS	None	LTS
Transfer actions could ~~decrease~~ alter flows of rivers and creeks supporting fisheries resources in the Sacramento and San Joaquin river watersheds	2, 3, 4	LTS	None	LTS
Transfer actions could alter hydrologic conditions in the Delta, altering associated habitat availability and suitability	2, 3, 4	LTS	None	LTS
Transfer actions could affect the habitat of special-status species associated with mainstem rivers, tributaries, and the Delta.	2, 3, 4	LTS	None	LTS
3.8 Vegetation and Wildlife				
Groundwater substitution could reduce groundwater levels and available groundwater for~~supporting~~ natural communities	2, 3	LTS	None	LTS
Transfers could impact reservoir storage and reservoir surface area and alter habitat availability and suitability associated with those reservoirs	2, 3, 4	LTS	None	LTS
Groundwater substitution could reduce stream flows supporting natural communities in small streams	2, 3	S	GW-1	LTS
Cropland Idling/shifting could alter habitat availability and suitability for upland species	2, 4	LTS	None	LTS

Potential Impact	Alternative	Significance to CEQA	Proposed Mitigation	Significance After Mitigation Pursuant to CEQA
Transfers could reduce flows in large rivers in the Sacramento and San Joaquin River watersheds, altering habitat availability and suitability associated with these rivers	2, 3, 4	LTS	None	LTS
Transfer actions could alter hydrologic conditions in the Delta, altering associated habitat availability and suitability	2, 3, 4	LTS	None	LTS
Transfer actions could impact San Luis Reservoir storage and surface area.	2, 3, 4	LTS	None	LTS
Cropland idling/shifting under could alter the amount of suitable habitat for natural communities and , special-status wildlife species, and migratory birds associated with seasonally flooded agriculture and associated irrigation waterways	2, 4	LTS	None	LTS
Transfer actions could alter planting patterns and urban water use in the Buyer Service Area	2, 3, 4	LTS	None	LTS
Transfers could affect wetlands that provide habitat for special status plant species.	2, 3, 4	LTS	None	LTS
Transfers could affect giant garter snake and Pacific pond turtle by reducing aquatic habitat.	2, 3, 4	LTS	None	LTS
Transfers could affect the San Joaquin kit fox by reducing available habitat.	2, 3, 4	LTS	None	LTS
Transfers could impact special status bird species and migratory birds.	2, 3, 4	LTS	None	LTS
3.9 Agricultural Land Use				
Cropland idling water transfers could permanently or substantially decrease the amount of lands categorized as Prime Farmland, Farmland of Statewide Importance, or Unique Farmland under the FMMP.	2	LTS	None	LTS

Potential Impact	Alternative	Significance to CEQA	Proposed Mitigation	Significance After Mitigation Pursuant to CEQA
	4	S	Mitigation Measure LU-1: Avoiding changes in FMMP land use classifications	LTS
Cropland idling water transfers could convert agricultural lands under the Williamson Act and other land resource programs to an incompatible use.	2, 4	LTS	None	LTS
Cropland idling water transfers could conflict with local land use policies.	2, 4	NI	None	NI
Water transfers could provide water to irrigators in the Buyer Service Area to irrigate existing crop fields and maintain agricultural land uses.	2, 3, 4	B	B	B
3.13 Cultural Resources				
Transfers that draw down reservoir surface elevations beyond historically low levels could result in a potentially significant effect on cultural resources.	2, 3, 4	LTS	None	LTS
Stored reservoir release transfers that draw down reservoir surface elevations at local reservoirs beyond historically low levels could affect cultural resources.	2, 3, 4	LTS	None	LTS
3.14 Visual Resources				
Water transfers could degrade the existing landscape character or scenic attractiveness of Class A and B visual resources at CVP and SWP reservoirs	2, 3, 4	LTS	None	LTS
Water transfers could degrade the existing landscape character or scenic quality of Class A and B visual resources along surface water bodies	2, 3, 4	LTS	None	LTS
Stored reservoir release transfers could substantially degrade the existing landscape character or scenic attractiveness of Class A and B visual resources participating reservoirs	2, 3, 4	LTS	None	LTS

Potential Impact	Alternative	Significance to CEQA	Proposed Mitigation	Significance After Mitigation Pursuant to CEQA
Cropland idling transfers could substantially degrade the existing landscape character and scenic attractiveness of Class A and B visual resources	2, 4	LTS	None	LTS
Water transfers could substantially degrade the existing landscape character and quality in the Buyer's Service Area	2, 3, 4	LTS	None	LTS
3.15 Recreation				
Changes in surface water elevation at Shasta, Folsom, Merle Collins, Oroville, Camp Far West, and Lake McClure reservoirs as a result of water transfers could affect reservoir-based recreation.	2, 3, 4	LTS	None	LTS
Changes in surface water elevations at Hell Hole and French Meadows Reservoirs as a result of water transfers could affect reservoir-based recreation.	2, 3, 4	LTS	None	LTS
Changes in river flows from water transfers could affect river-based recreation on the Sacramento, Yuba, Feather, American, San Joaquin, and Merced rivers.	2, 3, 4	LTS	None	LTS
Changes in average flow into the Delta from the San Joaquin River from water transfers could affect river-based recreation.	2, 3, 4	NI	None	NI
Changes in surface water elevation at San Luis Reservoir as a result of water transfers could affect reservoir-based recreation	2, 3, 4	NI	None	NI
3.16 Power				
Acquisition of water via groundwater substitution or crop idling may cause changes in power generation from CVP and SWP reservoirs	2, 3, 4	LTS	None	LTS

Potential Impact	Alternative	Significance to CEQA	Proposed Mitigation	Significance After Mitigation Pursuant to CEQA
Acquisition of water via stored reservoir water may cause changes in power generation from the facilities that ~~sell~~ provide water	2, 3, 4	LTS	None	LTS
3.17 Flood Control				
Water transfers would change storage levels in CVP and SWP reservoirs, potentially affecting flood control	2, 3, 4	LTS	None	LTS
Water transfers ~~could~~ would ~~decrease~~ change storage levels in non-Project reservoirs and potentially affecting flood control	2, 3, 4	B	None	B
Water transfers could ~~change~~ increase river flows, potentially affecting flood capacity or levee stability	2, 3, 4	LTS	None	LTS
Water transfers would change storage at San Luis Reservoir, potentially affecting flood control	2, 3, 4	LTS	None	LTS

Key:
B = beneficial
LTS = less than significant
NI = no impact
None = no feasible mitigation identified and/or required
S = significant

Table ES-5. Impacts for NEPA-Only Resources

Potential Impact	Alternative	Impact
3.10 Regional Economics		
Seller Service Area		
Revenues from cropland idling water transfers could increase incomes for farmers or landowners selling water.	2, 4	Beneficial
Cropland idling transfers in Glenn, Colusa, and Yolo counties could reduce employment, labor income, and economic output for businesses and households linked to agricultural activities.	2, 4	Employment: -492 Labor Income: -$19.38 Million Output: -$90.43 Million
Cropland idling transfers in Sutter and Butte counties could reduce economic output, value added, and employment for businesses and households linked to agricultural activities.	2, 4	Employment: -163 Labor Income: -$5.50 Million Output: -$26.76 Million
Cropland idling transfers in Solano County could reduce economic output, labor income, and employment for businesses and households linked to agricultural activities.	2, 4	Employment: -32 Labor Income: -$1.13 Million Output: -$4.58 Million
Cropland idling transfers could have adverse local economic effects.	2, 4	Adverse
Water transfers from idling alfalfa could increase costs for dairy and other livestock feed.	2, 4	Adverse, but minimal
Cropland idling transfers could decrease net revenues to tenant farmers whose landowners choose to participate in transfers.	2, 4	Adverse
Crop shifting transfers could change economic output, value added, and employment for businesses and households linked to agricultural activities.	2, 4	Adverse, but minimal
Crop shifting transfers could change economic output, value added, and employment for businesses and households linked to agricultural activities.	2, 4	Adverse, but minimal
Economic effects associated with cropland idling could conflict with economic policies and objectives set forth in local plans.	2, 4	Adverse
Economic effects associated with cropland idling could conflict with economic policies and objectives set forth in local plans.	2, 4	Adverse
Reductions in local sales associated with cropland idling transfer effects could reduce tax revenues and increase costs to county governments.	2, 4	Adverse, but minimal
Groundwater substitution transfers could increase groundwater pumping costs for water users in areas where groundwater levels decline as a result of the transfer.	2, 3	Adverse
Revenues from groundwater substitution water transfers could increase incomes for farmers or landowners selling water.	2, 3	Beneficial
Groundwater substitution water transfers could increase management costs for local water districts.	2, 3	Adverse
Revenues received from stored reservoir and conservation transfers could increase operating incomes for sellers.	2, 3, 4	Beneficial, but minimal

Potential Impact	Alternative	Impact
Buyer Service Area		
Water transfers would provide water for agricultural uses that could support revenues, economic output, and employment.	2, 3, 4	Beneficial
Water transfers would provide water for M&I uses that could support revenues, economic output, and employment.	2, 3, 4	Beneficial
3.11 Environmental Justice		
Cropland idling transfers could adversely and disproportionately affect minority and low-income farm workers in the Seller Service Area.	2, 4	No disproportionately high or adverse effect
Crop shifting transfers could adversely and disproportionately affect minority and low-income farm workers in the Seller Service Area.	2, 3	No disproportionately high or adverse effect
Use of cropland modification transfers could adversely and disproportionately affect minority and low-income farm workers in the Buyer Service Area.	2, 3, 4	Beneficial
3.12 Indian Trust Assets		
Groundwater substitution transfers could adversely affect ITAs by decreasing groundwater levels, which would potentially interfere with the exercise of a federally-reserved water right use, occupancy, and or character	2, 3	No effect
Groundwater substitution transfers could adversely affect ITAs by reducing the health of tribal members by decreasing water supplies	2, 3	No effect
Groundwater substitution transfers could affect ITAs by affecting fish and wildlife where there is a federally-reserved hunting, gathering, or fishing right.	2, 3	No effect
Groundwater substitution transfers could adversely affect ITAs by causing changes in stream flow temperatures or stream depletion, which would potentially interfere with the exercise of a federally-reserved Indian right	2, 3	No effect
Use of groundwater substitution transfers could affect reservations or Rancherias in the Buyer Service Area to reduce CVP shortages.	2, 3, 4	Beneficial

ES.~~5~~6 Growth Inducing Impacts

Water proposed for transfer would be transferred from willing sellers to buyers to meet existing demands when there are shortages in Central Valley Project supplies. The proposed water transfers would not directly or indirectly affect growth beyond what is already planned. The term proposed for the transfers under the Proposed Action is 10 years beginning in 2015. The Proposed Action would not induce development growth or remove a barrier for growth because it is not a reliable source of water that could be used to approve development projects by local agencies. Therefore, the Proposed Action would have no growth inducing impacts.

ES.~~6~~7 References

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Abbreviations and Acronyms

μg/m^3	micrograms per cubic meter
AB	Assembly Bill
ac	acre
AD	Anno Domini
AF	acre-feet
AG	Agriculture
AP	Agricultural Preserve
AP-42	Compilation of Air Pollutant Emission Factors
APCD	Air Pollution Control District
AQMD	Air Quality Management District
ARBCA	American River Basin Cooperating Agencies
ARBCUP	American River Basin Regional Conjunctive Use Program
ARPA	Archaeological Resources Protection Act
ASIPs	action specific implementation plans
ATCM	Airborne Toxic Control Measure
ATV	all-terrain vehicle
BA	biological assessment
BAMM	Best Available Mitigation Measures
BARDP	Bay Area Regional Desalination Project
BC	Before Christ
BCC	birds of conservation concern
BDCP	Bay-Delta Conservation Plan
bgs	below ground surface
bhp	brake-horsepower
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BMO	basin management objective
BMPs	best management practices
BO	Biological Opinion
BRCP	Butte Regional Conservation Plan
CA	California Aqueduct
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
Cal/EPA	California Environmental Protection Agency
CALFED	State (CAL) and Federal (FED) agencies participating in the Bay-Delta Accord

Caltrans	California Department of Transportation
CARB	California Air Resources Board
CCAA	California Clean Air Act
CCCC	California Climate Change Center
CCR	California Code of Regulations
CCSM	Community Climate System Model
CDFA	California Department of Food and Agriculture
CDFG	California Department of Fish and Game (currently the California Department of Fish and Wildlife)
CDFW	California Department of Fish and Wildlife
CDPH	California Department of Public Health
CDPR	California Department of Parks and Recreation
CEC	California Energy Commission
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFCP	California Farmland Conservancy Program
CFR	Code of Federal Regulations
cfs	cubic feet per second
CH_4	methane
cm	centimeters
cm/s	centimeters per second
CNDDB	California Natural Diversity Database
CNPPA	California Native Plant Protection Act
CNPS	California Native Plant Society
CNRM	Centre National de Recherches Meteorologiques
CO	carbon monoxide
CO	Conservation
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COA	Coordinated Operation Agreement
CPRR	Central Pacific Railroad
CPUC	California Public Utilities Commission
CRHR	California Register of Historical Resources
CRP	Conservation Reserve Program
CSHMS	California Scenic Highway Mapping System
CV	Central Valley
CVHM	Central Valley Hydrologic Model

CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CV-SALTS	Central Valley Salinity Alternatives for Long-Term Sustainability
CWA	Clean Water Act
CWHR	California Wildlife Habitat Relationships
CWSRA	California Wild and Scenic Rivers Act
DDT	dichlorodiphenyltrichloroethane
Delta	Sacramento-San Joaquin Delta
DEM	digital elevation model
DLRP	Division of Land Resource Protection
DMC	Delta-Mendota Canal
DOC	Department of Conservation
DOI	Department of the Interior
DPM	diesel particulate matter
DPS	Distinct Population Segment
DWR	Department of Water Resources
EA	Environmental Assessment
EC	electrical conductivity
EDD	Employment Development Department
eGRID	Emissions & Generation Resource Integrated Database
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EIS/EIR	Environmental Impact Statement/Environmental Impact Report
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
ETAW	evapotranspiration of applied water
EWA	Environmental Water Account
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FMMP	Farmland Mapping and Monitoring Program
FONSI	Finding of No Significant Impact
FORTRAN	Formula Translating System programming language
FR	Federal Register
FSZ	Farmland Security Zone
FWCA	Fish and Wildlife Coordination Act
GAMA	Groundwater Ambient Monitoring and Assessment
GAMAQI	Guide for Assessing and Mitigating Air Quality Impacts

GCM	global climate model
GFDL	Geophysical Fluids Dynamics Laboratory
GHG	greenhouse gas
GIS	geographic information system
GMP	Groundwater Management Plan
GPS	Global Positioning System
GWP	global warming potential
HCP	Habitat Conservation Plan
hp	horsepower
ID	Irrigation District
IMPLAN	IMpact analysis for PLANning
InSAR	Interferometric Sythetic Aperture Radar
IO	input-output
IPCC	Intergovernmental Panel on Climate Change
IPR	indirect potable reuse
ITAs	Indian Trust Assets
km	kilometer
lbs/day	pounds per day
LOD	Level of Development
LU	Land Use
M&I	municipal and industrial
m/d	meters per day
MBTA	Migratory Bird Treaty Act
MCL	maximum contaminant level
MFP	Middle Fork Project
mg/L	milligrams per liter
MicroFEM	finite-element program for multiple-aquifer steady-state and transient groundwater flow modeling
MIG	Minnesota Implan Group
MSCS	Multi-Species Conservation Strategy
MT/yr	metric tons per year
$MTCO_2e$/yr	metric tons carbon dioxide equivalent per year
MUD	Municipal Utility District
MW	megawatts
MWC	Mutual Water Company
n.d.	no date
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards

NAGPRA	Native American Graves Protection and Repatriation Act
NASS	National Agricultural Statistics Service
NBHCP	Natomas Basin Habitat Conservation Plan
NCAR	National Center for Atmospheric Research
NCCP	Natural Community Conservation Plan
NCCPA	Natural Community Conservation Planning Act
NEPA	National Environmental Policy Act
NF	National Forest
NFIP	National Flood Insurance Program
NHPA	National Historic Preservation Act
NO_2	nitrogen dioxide
NOAA Fisheries	National Oceanic and Atmospheric Administration Fisheries Service
NOx	nitrogen oxides
NPS	National Park Service
NRA	National Recreation Area
NRCS	Natural Resources Conservation Service
NRDC	Natural Resources Defense Council
NRHP	National Register of Historic Places
NRP	Natural Resources Policy
NSV IRWMP	Northern Sacramento Valley Integrated Regional Water Management Plan
NWR	national wildlife refuge
NWSRA	National Wild and Scenic Rivers Act
NWSRS	National Wild and Scenic Rivers System
O_3	ozone
OAIT	Office of American Indian Trust
OPR	Office of Planning and Research
Pb	lead
PCBs	polychlorinated biphenyls
PCCP	Placer County Conservation Plan
PCM	Parallel Climate Model
PEIS/EIR	Programmatic Environmental Impact Statement/Environmental Impact Report
PG&E	Pacific Gas and Electric Company
PM_{10}	inhalable particulate matter with an aerodynamic diameter less than or equal to 10 microns
$PM_{2.5}$	fine particulate matter with an aerodynamic diameter less than or equal to 2.5 microns

ppb	parts per billion
ppm	parts per million
PRBO	Point Reyes Bird Observatory
PRC	Public Resources Code
PRISM	Parameter-elevation Relationships on Independent Slopes Model
PSD	prevention of significant deterioration
RD	Reclamation District
Reclamation	U.S. Department of the Interior, Bureau of Reclamation
ROD	Record of Decision
ROG	reactive organic gas
RPA	Reasonable and Prudent Alternative
RPR	Rare Plant Rank
RWA	Regional Water Authority
RWQCB	Regional Water Quality Control Board
RWQCBCV	Regional Water Quality Control Board, Central Valley
SACFEM	Sacramento Valley Groundwater Model
SACFEM2013	Sacramento Valley Finite Element Groundwater Model
SacIGSM	Sacramento County Integrated Groundwater and Surface Water Model
SB	Senate Bill
SCV	Santa Clara Valley
SDWA	Safe Drinking Water Act
SGA	Sacramento Groundwater Authority
SIP	state implementation plan
SJMSCP	San Joaquin County Multi-Species Habitat Conservation and Open Space Plan
SJRRP	San Joaquin River Restoration Program
SLDMWA	San Luis & Delta-Mendota Water Authority
SMS	Scenery Management System
SMSHCP	Solano Multispecies Habitat Conservation Plan
SO_2	sulfur dioxide
SOI	sphere of influence
SOx	sulfur oxides
SR	State Route
SRA	State Recreation Area
SSC	Species of Special Concern
SSHCP	South Sacramento Habitat Conservation Plan
SVRR	Sacramento Valley Railroad

SWP	State Water Project
SWRCB	State Water Resources Control Board
TAF	thousand acre-feet
TCR	The Climate Registry
TDS	total dissolved solids
TMDL	Total Maximum Daily Load
TOM	Transfer Operations Model
tpy	tons per year
UCCE	University of California Cooperative Extension
UGB	urban growth boundary
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UWMP	Urban Water Management Plan
VOC	volatile organic compound
WaterSMART	Sustain and Manage America's Resources for Tomorrow
WC	Water Code
WD	Water District
WFA	Water Forum Agreement
WQCP	Water Quality Control Plan
WSP	Water Shortage Policy
WUE	water use efficiency
WY	water year
YNHP	Yolo Natural Heritage Program
μS/cm	microsiemen per centimeter

Chapter 1 Introduction

Hydrologic conditions, climatic variability, consumptive use within the watershed, and regulatory requirements for operation of water projects commonly affect water supply availability in California. This variability strains water supplies, making advance planning for water shortages necessary and routine. In the past decades, water entities have been implementing water transfers to supplement available water supplies to serve existing demands and transfers have become a common tool in water resource planning.

The United States Department of the Interior, Bureau of Reclamation manages the Central Valley Project (CVP), which includes storage in reservoirs (such as Shasta, Folsom, and Trinity reservoirs) and diversion pumps in the Sacramento-San Joaquin Delta (Delta) to deliver water to users in the San Joaquin Valley and San Francisco Bay area. When these users experience water shortages, they may look to water transfers to help reduce potential impacts of those shortages.

Transfers are allowed under California State law and under Federal law. Water users have been encouraged to seek alternative sources of water through willing buyers/willing seller agreements. The purpose of this EIS/EIR is to analyze the effects of transfers between listed buyers and sellers which will streamline the environmental review process and make transfers more implementable relative to NEPA and CEQA requirements, especially when hydrologic conditions and available pumping capacity are unknown until right before the transfer season.

A water transfer involves an agreement between a willing seller and a willing buyer, and available infrastructure capacity to convey water between the two parties. To make water available for transfer, the willing seller must take an action to reduce the consumptive use of water (such as idle cropland or pump groundwater in lieu of using surface water) or release additional water from reservoir storage. This water would be conveyed to the buyers' service area for beneficial use. Water transfers would only be used to help meet existing demands and would not serve any new demands in the buyers' service areas.

Reclamation and the San Luis & Delta-Mendota Water Authority (SLDMWA) are completing a joint Environmental Impact Statement/Environmental Impact Report (EIS/EIR), in compliance with the National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA), for water transfers from 2015 through 2024. Reclamation is serving as the Lead Agency under NEPA and SLDWMA is the Lead Agency under CEQA. Reclamation would facilitate transfers proposed by buyers and sellers. The SLDMWA, consisting of federal and exchange water service contractors in western San Joaquin

Valley, San Benito, and Santa Clara counties, helps negotiate transfers in years when the member agencies could experience shortages.

This EIS/EIR evaluates the transfer of water transfers ~~that would be~~ purchased by CVP contractors in areas south of the Delta or in the San Francisco Bay Area. The ~~transfers~~ water would be conveyed through the Delta using CVP or State Water Project (SWP) pumps, or facilities owned by other agencies in the San Francisco Bay Area.

This EIS/EIR addresses the transfer of water ~~transfers~~ to CVP contractors from CVP and non-CVP sources of supply that must be conveyed through the Delta using CVP, SWP, and local facilities. These transfers require approval from Reclamation and/or Department of Water Resources (DWR), which necessitates compliance with NEPA and CEQA. Other transfers not included in this EIS/EIR could occur during the same time period, subject to their own environmental review (as necessary). Non-CVP transfers are analyzed in combination with the potential alternatives in the cumulative analysis.

1.1 Purpose and Need/Project Objectives

The purpose and need statement (under NEPA) and project objectives (under CEQA) describe the underlying need for and purpose of a proposed project. The purpose and need statement and objectives are a critical part of the environmental review process because they are used to identify the range of reasonable alternatives and focus the scope of analysis.

1.1.1 Purpose and Need

The purpose of the Proposed Action is to facilitate and approve voluntary water transfers from willing sellers upstream of the Delta to water users south of the Delta and in the San Francisco Bay Area. Water users have the need for immediately implementable and flexible supplemental water supplies to alleviate shortages.

1.1.2 Project Objectives

SLDMWA has developed the following objectives for long-term water transfers through 2024:

- Develop supplemental water supply for member agencies during times of CVP shortages to meet existing demands.

- Meet the need of member agencies for a water supply that is immediately implementable and flexible and can respond to changes in hydrologic conditions and CVP allocations.

Because shortages are expected due to hydrologic conditions, climatic variability, and regulatory requirements, transfers are needed to meet water demands.

1.2 Project Background

1.2.1 Reclamation and the CVP

Reclamation's Mid-Pacific Region is responsible for managing the CVP, which stores and delivers irrigation water to the Sacramento and San Joaquin valleys, water to cities and industries in Sacramento, the San Joaquin Valley, and the east and south Bay Areas. The CVP also delivers water to fish hatcheries and wildlife refuges throughout the Central Valley, and for protection, restoration and enhancement of fish, wildlife, and associated habitats in the Central Valley. Figure 1-1 shows major CVP facilities and the CVP service area.

The CVP has approximately 270 water service contracts. CVP water allocations for agricultural, environmental, municipal and industrial (M&I) users vary based on factors such as hydrology, water rights, reservoir storage, environmental considerations, and operational limitations. Each year Reclamation determines the amount of water that can be delivered to each district and municipality based on conditions for that year. These allocations are expressed as a percentage of the maximum contract volumes of water according to the contracts, or historical use for M&I contractors in a water short year, held between Reclamation and the various water districts, municipalities, and other entities. Reclamation and the CVP contractors recognize that delivery of full contract quantities is not likely to occur every year (in most years). Table 1-1 summarizes CVP allocations, as percentages of Ccontract amountTotal, delivered to agricultural and M&I water contractors north and south of the Delta from 2000 through 2014. Water shortages lead to severe water constraints especially in the southern portion of the CVP.

Figure 1-1. Major CVP Facilities and CVP Service Areas

Table 1-1. CVP Water Supply Allocation Percentages 2000 through 2014

Year	Year Type[1]	Irrigation[2]		M&I	
		North of Delta (%)	South of Delta (%)	North of Delta (%)	South of Delta (%)
2000	AN	100	65	100	90
2001	D	60	49	85	77
2002	D	100	70	100	95
2003	AN	100	75	100	100
2004	BN	100	70	100	95
2005	AN	100	90	100	100
2006	W	100	100	100	100
2007	D	100	50	100	75
2008	C	40	40	75	75
2009	D	40	10	100	60
2010	BN	100	45	100	75
2011	W	100	80	100	100
2012	BN	100	40	100	75
2013	D	75	20	100[3]	70
2014	C	0	0	50	50

Source: Reclamation 2014a

Notes:

[1] Based on the Sacramento Valley Water Year Index

[2] Includes water service contracts, does not include Sacramento River Settlement and San Joaquin River Exchange Contractors

[3] In 2013, American River M&I users received 75 percent of contract amount.

Key:

M&I = municipal and industrial

C = Critical

D = Dry

BN = Below Normal

AN = Above Normal

W = Wet

1.2.2 Water Agencies Requesting Transfers

~~Several~~ A number of CVP contractors have identified interest in purchasing transfer water to reduce potential water shortages and have requested to be included in the EIS/EIR. Table 1-2 summarizes all purchasing agencies, further referred to as buyers.

Table 1-2. Potential Buyers

San Luis & Delta-Mendota Water Authority Participating Members
Byron-Bethany Irrigation District
Del Puerto Water District
Eagle Field Water District
Mercy Springs Water District
Pacheco Water District
Panoche Water District
San Benito County Water District
San Luis Water District
Santa Clara Valley Water District
Westlands Water District
Contra Costa Water District
East Bay Municipal Utility District

1.2.2.1 SLDMWA

SLDMWA consists of 28 member agencies representing water service contractors and San Joaquin River Exchange Contractors. Figure 1-2 shows the SLDMWA service area and identifies participating members included in Table 1-2. Not all of SLDMWA member agencies are participating in this EIS/EIR.

Reclamation has an operation~~s~~ and maintenance agreement with SLDMWA to operate and maintain the physical works and appurtenances associated with the Jones Pumping Plant, the Delta-Mendota Canal, the O'Neill Pump/Generating Plant, the San Luis Drain, and associated works. One function SLDMWA serves is to help negotiate water transfers with and on behalf of its member agencies when CVP allocations have been reduced and there is a need for supplemental water.

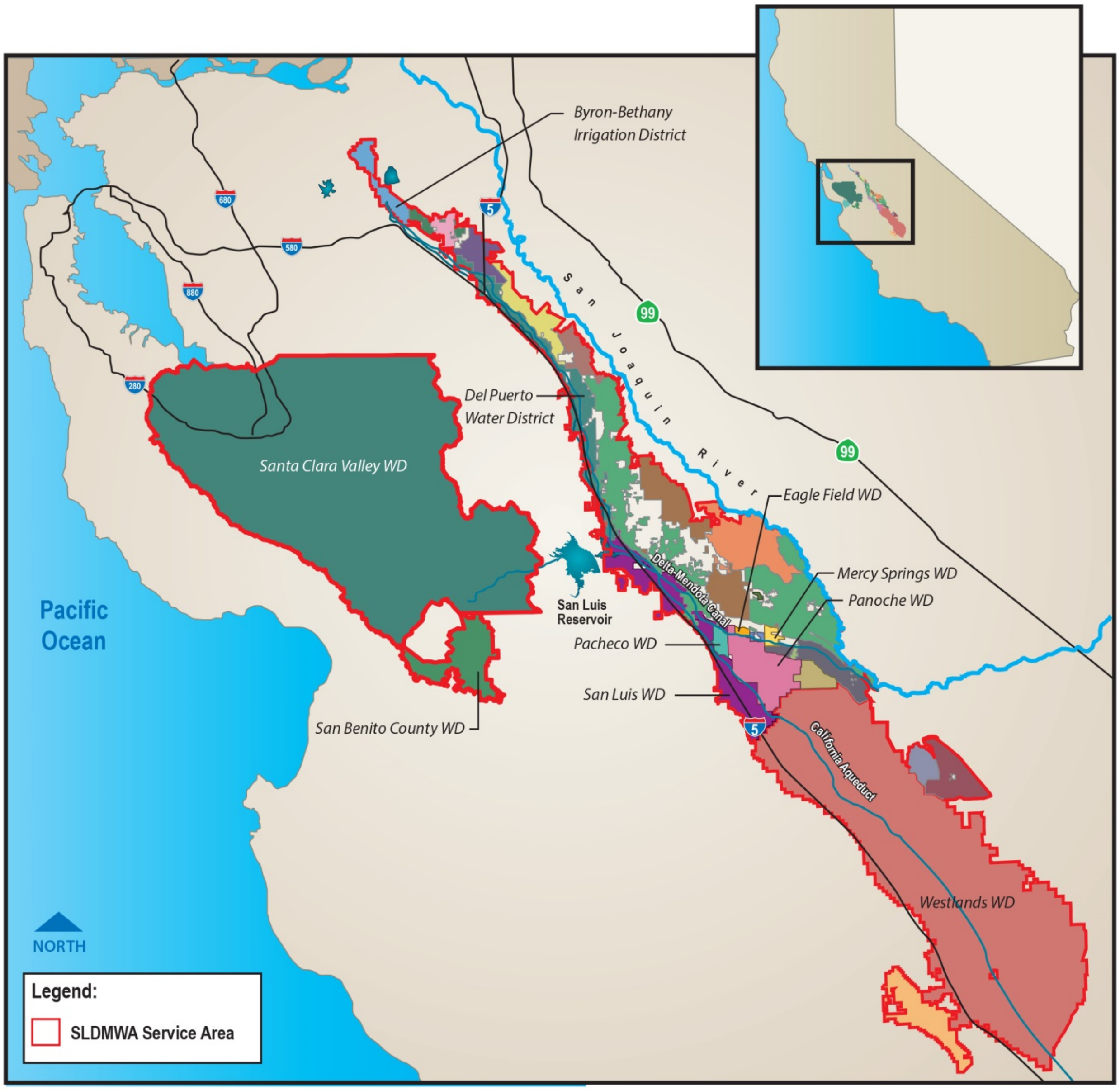

Figure 1-2. SLDWMA Service Area and Participating Member Agencies

The SLDMWA service area consists primarily of agricultural lands on the west side of the San Joaquin Valley. Agricultural water use occurs on approximately 850,000 irrigated acres. Water for habitat management occurs on approximately 120,000 acres of refuge lands, which receive approximately 250,000 to 300,000 acre-feet (AF) of water per year. Relative to agricultural uses, there is limited M&I water use in the San Joaquin Valley area. The majority of the M&I use in the SLDMWA service area occurs in the San Felipe Division, primarily the Santa Clara Valley Water District (WD). From 2001 to 2010, average annual M&I water use in the San Joaquin Valley area was about 22,000 AF and approximately 86,000 AF in the San Felipe Division.

As shown in Table 1-1, south-of-Delta agricultural contractors, many of which are members of the SLDMWA, experience severe cutbacks in CVP allocations in most years. In 2009, deliveries were cut back to ten percent of ~~CVP contract amounts~~Contract Total for agricultural water service contracts. In 2014, agricultural water service contractors received a zero percent allocation. Note that the Exchange Contractors are not included in these allocations. SLDMWA member agencies use water transfers as a method to supplement water supplies in years when CVP allocations are reduced.

1.2.2.2 Contra Costa WD

The Contra Costa WD was formed in 1936 to purchase and distribute CVP water for irrigation and industrial uses. Today, the Contra Costa WD encompasses more than 214 square miles, serves a population of approximately 500,000 people in Central and East Contra Costa County, and is Reclamation's largest urban CVP contractor in terms of ~~contract amount~~Contract Total. Figure 1-3 shows the Contra Costa WD service area.

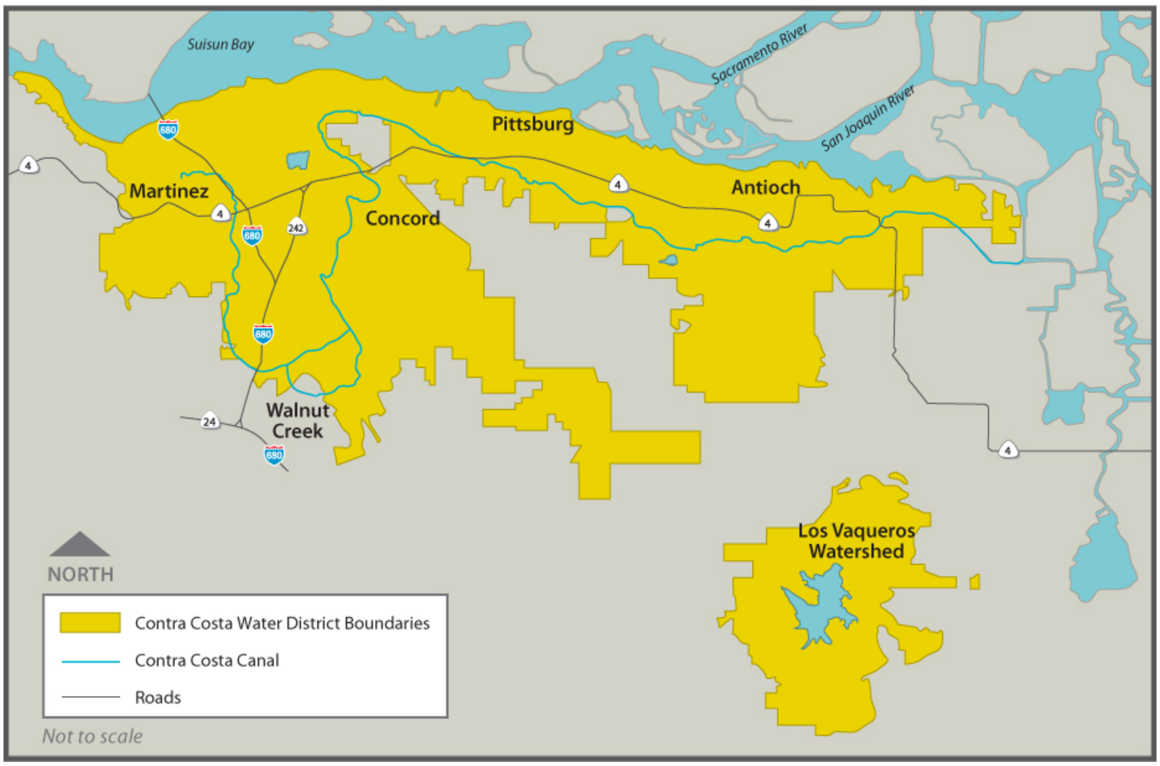

Figure 1-3. Contra Costa WD Service Area

Contra Costa WD is almost entirely dependent on ~~CVP~~ diversions from the Delta. Pursuant to its water service contract with Reclamation, for its water supply. The 48-mile Contra Costa Canal conveys water throughout the service area. Contra Costa WD's long-term CVP contract with Reclamation was renewed in May 2005 and has a term of 40 years. The contract with

Reclamation provides for a ~~maximum delivery~~Contract Total of 195,000 AF per year from the CVP for M&I purposes, with a reduction ~~in deliveries~~ during water shortages including regulatory restrictions and drought. Contra Costa WD also has limited water supply from groundwater, recycled water, and some long-term water purchase agreements.

Figure 1-4 shows ~~historic CVP water deliveries~~Water Delivered to Contra Costa WD for the contract years 2001 through 2010. The figure shows that deliveries are typically well below the ~~contract amount~~Contract Total of 195,000 AF.

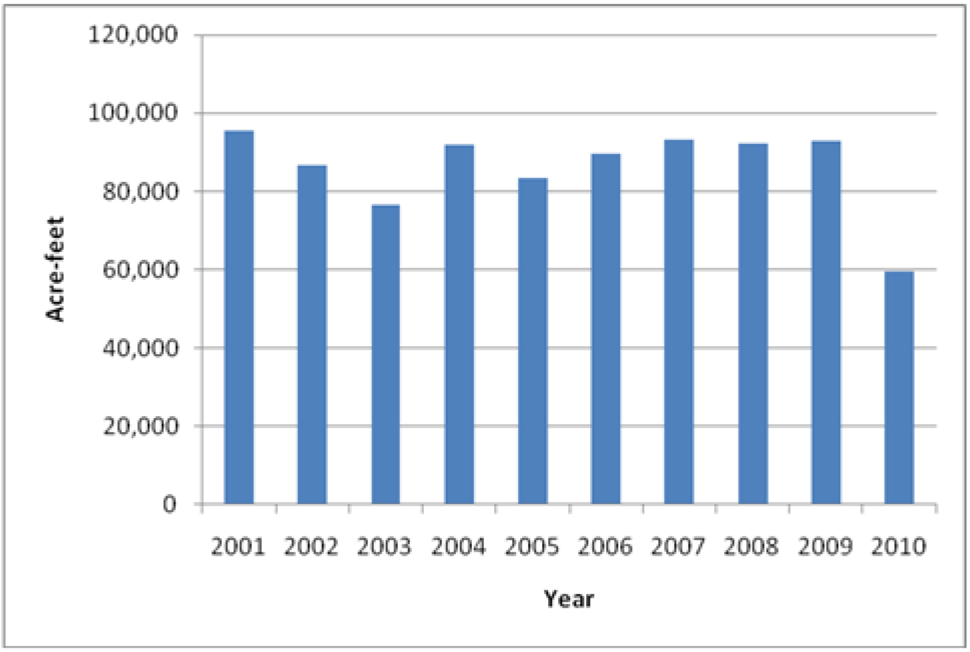

Figure 1-4. ~~Past CVP Deliveries~~Water Delivered to Contra Costa WD, Contract Years 2001-2010

State Water Resources Control Board (SWRCB) Decision 1629 provides that Contra Costa WD may divert water under Permit No. 20749 from Old River to Los Vaqueros Reservoir from November through June during excess conditions in the Delta. Decision 1629 also specifies the maximum diversion rates at 250 cfs and annual diversion to storage (95,800 AF annually at a rate of 200 cfs) by Contra Costa WD to Los Vaqueros Reservoir. These water rights are in addition to Contra Costa WD's CVP (195,000 AF) supply.

In the July 2011 Urban Water Management Plan (UWMP), Contra Costa WD estimates that CVP water supplies in the near term could be reduced from 170,000 AF in a normal year to 127,500 AF in a single year drought and 110,500 AF in the third year of a multi-year drought (Contra Costa WD 2011). The UWMP identifies use of water transfers to bridge the gap between supply and demand. Transfers would assist in meeting demands of existing customers during a drought and compensating them for possible reductions in the availability of CVP supplies (Contra Costa WD 2011).

1.2.2.3 East Bay Municipal Utility District (MUD)

East Bay MUD was ~~created~~ organized in 1923 to provide water service to the east San Francisco Bay Area. Today, East Bay MUD provides water and wastewater services to approximately 1.3 million people over a 332 square mile area in Alameda and parts of Contra Costa counties. Figure 1-5 shows the East Bay MUD service area.

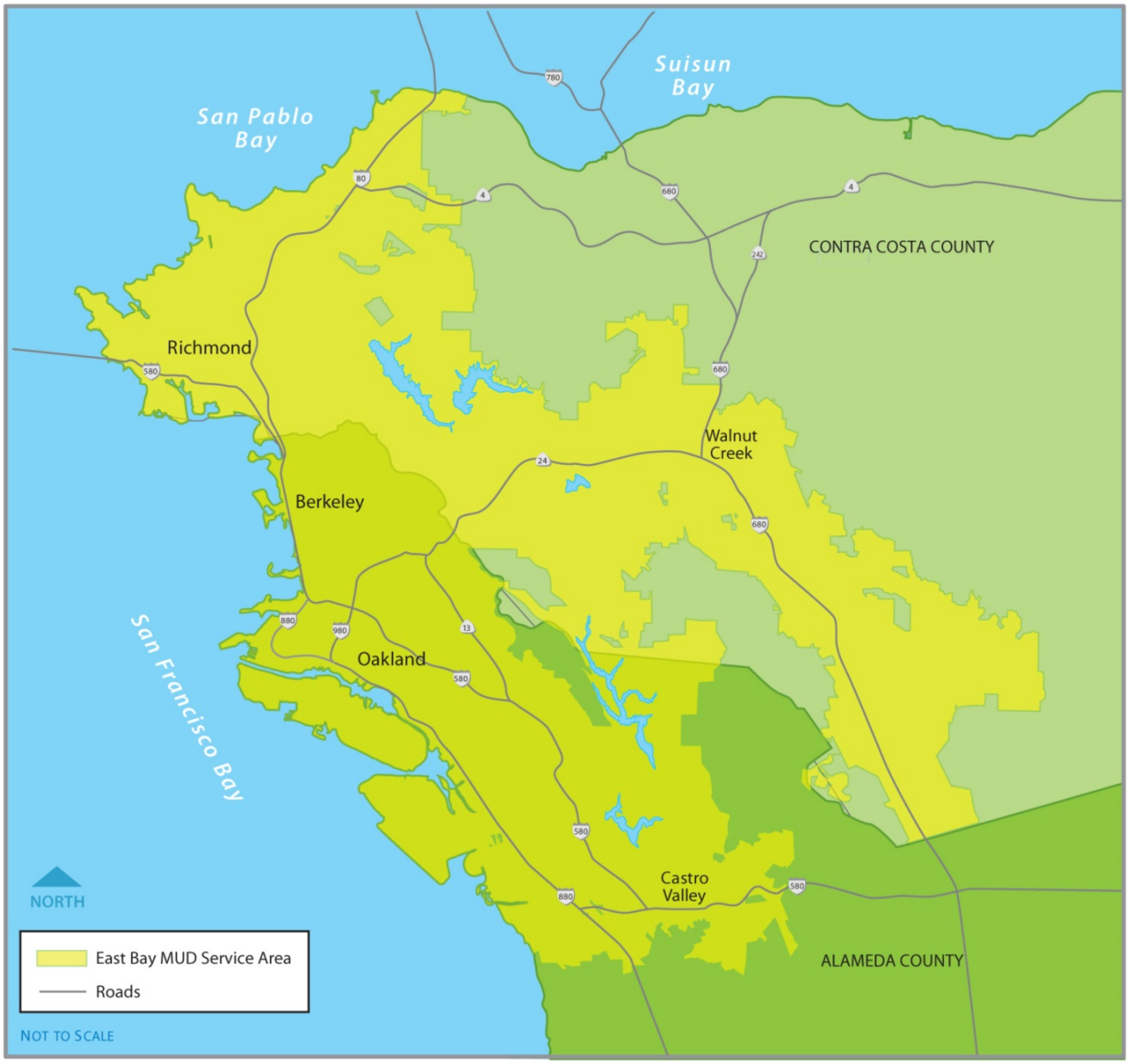

Figure 1-5. East Bay MUD Service Area

Ninety percent of East Bay MUD's water supply comes from the Mokelumne River watershed in the Sierra Nevada. East Bay MUD has a CVP water service contract with Reclamation to divert water from the Sacramento River for M&I purposes. East Bay MUD's long-term CVP contract with Reclamation was renewed in April 2006 and has a term of 40 years. The contract provides up to 133,000 AF in a single dry year, not to exceed a total of 165,000 AF in three consecutive dry years. CVP water is available to East Bay MUD only in dry years when certain storage conditions within the East Bay MUD system are met (East Bay MUD 2011). As a result East Bay MUD does not forecast frequent use of CVP water.

East Bay MUD's 2010 UWMP identifies short-term water transfers originating from northern California as a potential water supply source to meet dry year water supply needs in the future (East Bay MUD 2011).

1.3 Federal and State Regulations Governing Water Transfers

This section discusses federal and state regulations relevant to water transfers. Local ordinances have been adopted in the sellers' service areas that address groundwater-related transfers. These local ordinances are discussed in Section 3.3, Groundwater Resources.

1.3.1 Federal Regulations

1.3.1.1 Central Valley Project Improvement Act (CVPIA) of 1992

The CVPIA[1] is a federal statute passed in 1992 with the following purposes:

> *"To protect, restore, and enhance fish, wildlife, and associated habitats in the Central Valley and Trinity River basins of California; To address impacts of the Central Valley Project on fish, wildlife and associated habitats; To improve the operational flexibility of the Central Valley Project; To increase water-related benefits provided by the Central Valley Project to the State of California through expanded use of voluntary water transfers and improved water conservation; To contribute to the State of California's interim and long-term efforts to protect the San Francisco Bay/Sacramento-San Joaquin Delta Estuary; To achieve a reasonable balance among competing demands for use of Central Valley Project water, including the requirements of fish and wildlife, agricultural, municipal and industrial and power contractors."*

[1] Title 34 of Public Law 102-575, the Reclamation Projects Authorization and Adjustment Act of 1992, signed October 30, 1992.

The CVPIA granted the right to all individuals who receive CVP water (through contracts for water service, repayment contracts, water rights settlements, or exchange contracts) to sell this water to other parties for reasonable and beneficial purposes. According to the CVPIA Section 3405(a), the following principles must be satisfied for any transfer.

- Transfer may not violate the provisions of Federal or state law.
- Transfer may not cause significant adverse effects on Reclamation's ability to deliver CVP water to its contractors.
- Transfer will be limited to water that would be consumptively used or irretrievably lost to beneficial use.
- Transfer will not significantly adversely affect water supplies for fish and wildlife purposes.
- Transfers cannot exceed the average annual quantity of water under contract actually delivered to the contracting district or agency during the last three years of normal water delivery prior to the enactment of the CVPIA.

Reclamation must approve each transfer and will not approve a transfer if it will violate CVPIA principles and other state and federal laws. Reclamation issues its decision regarding potential CVP transfers in coordination with the U.S. Fish and Wildlife Service (USFWS), contingent upon the evaluation of impacts on fish and wildlife. A CVP transfer approval must be accompanied by appropriate documentation under NEPA.

1.3.1.2 Biological Opinions on the Coordinated Operations of the CVP and SWP

On December 15, 2008, USFWS released a biological opinion ~~describing delta smelt protections for the coordinated~~on the effects of coordinated long-term operations of the CVP and SWP on Delta smelt (USFWS 2008). The biological opinion concluded that continued long term operations of the CVP and SWP, as proposed, were "likely to jeopardize" the continued existence of delta smelt without further flow conditions in the Delta for their protection and the protection of designated delta smelt critical habitat. The USFWS developed a Reasonable and Prudent Alternative (RPA) aimed at protecting delta smelt, improving and restoring habitat, and monitoring and reporting results.

Similar to the USFWS biological opinion on delta smelt, National Oceanic Atmospheric Administration Fisheries Service (NOAA Fisheries) released a biological opinion on June 4, 2009 ~~describing the anadromous fish protections for the~~on the effects of continued long term coordinated operations of the CVP and SWP on listed andromous fish (NOAA Fisheries 2009). This biological opinion concluded that continued long term operations of the CVP and SWP, as proposed, were "likely to jeopardize" the continued existence of Sacramento River winter run Chinook salmon, Central Valley spring run Chinook salmon, Central Valley steelhead, and the southern Distinct Population Segment of North American green sturgeon and were "likely to destroy or adversely modify" designated or proposed critical habitat of these species. NOAA Fisheries also concluded that CVP and SWP operation both "directly altered the hydrodynamics of the Sacramento-San Joaquin River basins and have interacted with other activities affecting the Delta to create an altered environment that adversely influences salmonid and green sturgeon population dynamics." The biological opinion identified an RPA to address these issues and protect anadromous fish species.

The Opinions included the following operational parameters applicable to water transfers:

- A maximum amount of water transfers is 600,000 AF per year in ~~dry and~~ critical ~~dry~~ years and dry years (following dry or critical years). For all other year types, the maximum transfer amount is up to 360,000 AF.

- Transfer water will be conveyed through DWR's Harvey O. Banks (Banks) Pumping Plant or Jones Pumping Plant during July through September ~~unless Reclamation and/or DWR consult with the fisheries agencies~~.

Several lawsuits were filed challenging the validity of the 2008 USFWS and 2009 NOAA Fisheries Biological Opinions and Reclamation's acceptance of the RPA included with each (Consolidated Salmonid Cases, Delta Smelt Consolidated Cases). The District Court issued findings that concluded Reclamation had violated NEPA by failing to perform any NEPA analysis before provisionally adopting the 2008 USFWS RPA and 2009 NOAA Fisheries RPA. On December 14, 2010, the District Court found the 2008 USFWS Biological Opinion to be unlawful and remanded the Biological Opinion to USFWS. The District Court issued a similar ruling for the 2009 NOAA Fisheries Biological Opinion on September 20, 2011. On March 13, 2014, the United States Court of Appeals for the Ninth Circuit affirmed in part and reversed in part the finding from the District Court on the USFWS Biological Opinion. The Court of Appeals upheld the determination that Reclamation must complete NEPA analysis, but it reversed ~~the finding that the scientific basis for the Biological Opinion was arbitrary and capricious~~on all arguments related to the adequacy of the Biological Opinion. ~~The NOAA Fisheries Biological Opinion is the subject of a future review from the Court of Appeals~~. On December 22, 2014, the United States Court of Appeals for the Ninth Circuit released similar findings related to the Consolidated Salmonid Cases and reversed the arguments about the adequacy of the Biological Opinion. Reclamation is working to complete NEPA analysis on the Biological Opinions, but ~~Until the legal issues are resolved and new biological opinions are~~

~~completed (if necessary),~~ the 2008 USFWS and 2009 NOAA Fisheries biological opinions will guide operations of potential water transfers.

1.3.2 State Regulations

Several sections of the California Water Code provide the SWRCB with the authority to approve transfers of water involving post-1914 water rights. The Water Code defines processes for short- and long-term water transfers. The SWRCB is responsible for reviewing transfer proposals and issuing petitions for temporary transfers related to post-1914 water rights. The SWRCB generally considers transfers of water under CVP water service or repayment contracts, water rights settlement contracts, or exchange contracts within the CVP place of use authorized in Reclamation's water rights to be internal actions and not subject to SWRCB review. Transfers of CVP water outside of the CVP place of use require SWRCB review and approval. The Water Code includes protections for impacts related to water transfers for other legal users of water, as well as fish, wildlife, and other instream beneficial uses.

Pre-1914 water rights are not subject to SWRCB jurisdiction, but transfers of water involving pre-1914 water rights are subject to review under CEQA and accordingly are analyzed in this EIS/EIR. Transfers involving pre-1914 water rights are also subject to the same "no injury rule" as set forth in Water Code Section 1706. Pre-1914 water rights are not subject to the provisions of the Water Code discussed below unless specifically mentioned.

1.3.2.1 Short-Term Transfers

Short-term (i.e., temporary) transfers are those that take place over a period of one year or less. Water Code Section 1725 allows a permittee or licensee to temporarily change a point of diversion, place of use, or purpose of use of water due to a transfer of water. Short-term transfers under Section 1725 are limited to water that would have been used consumptively or stored absent the water transfer. Section 1725 defines consumptively used water as "the amount of water which has been consumed through use by evapotranspiration, has percolated underground, or has been otherwise removed from use in the downstream water supply as a result of direct diversion." Return flows (water that returns to a stream or a useable underground aquifer after being applied to land) are typically used by other users; therefore, they are generally not available for transfer because the transfer of this water could injure these downstream users. The most common ways to reduce consumptive use are to idle land, shift to less water-intensive crops, or substitute groundwater in-lieu of surface water.

Section 1725 allows expedited processing of short-term transfers of post-1914 water rights. Short-term transfers qualify for this expedited process because the action is limited to one year, minimizing the risk of potential impacts. Transfers qualified under Section 1725 are exempt from CEQA pursuant to Section 1729 of the Water Code; the Water Code relies on notice to the affected parties and findings made by the SWRCB rather than the development of environmental documents under CEQA.

Short-term transfers must not injure any legal user of water or unreasonably affect fish, wildlife, or instream uses. Petitions for transfer must document the identifying permit or license as the basis for the transfer and support the claims of no injury to any legal user of the water and no unreasonable effects to fish and wildlife or other instream beneficial uses. The petition is publicly noticed and persons may file with the SWRCB objections or comments to the petition. The SWRCB is required to act upon the petition in accordance with the procedures set forth in Water Code Section 1726.

Water Code Section 1728 specifies that the one-year transfer period does not include any time required for monitoring, reporting, or mitigation before or after the temporary change is carried out. If, within a period of one year or less, the water is transferred to off-stream storage outside of the watershed where it was originated, the water may be put to beneficial use in the place of use during or after that period.

1.3.2.2 Long-Term Transfers

Long-term transfers are those that take place over a period of more than one year. Long-term transfers of water under post-1914 water rights are governed under Section 1735 of the Water Code. Long-term transfers need not necessarily involve the amount of water consumptively used or stored, but the transfers are evaluated to assure that they will not cause substantial injury to any legal user of water and will not unreasonably affect fish, wildlife, or other instream beneficial uses. The Water Code does not provide for the expedited processing of long-term transfer petitions that is provided for short-term transfer petitions. Long-term transfers under Section 1735 are subject to the requirements of CEQA and must also comply with the standard SWRCB public noticing and protest process. If valid protests to the proposed change cannot be resolved through negotiation between the parties, a hearing must be held prior to the SWRCB’s decision on the requested transfer. Section 1745.07 specifically indicates that transfers approved pursuant to provisions of law are deemed to be a beneficial use of water and protect the water rights of the seller during the transfer period.

1.3.2.3 No Injury Rule

A change in water rights involving a transfer is subject to the no injury rule. The no injury rule requires that a transfer may not injure other legal users of water. This rule applies to modern water rights through sections 1725 and 1736 of the Water Code and applies to pre-1914 appropriative water rights through Section 1706 of the Water Code. The SWRCB has jurisdiction over changes to post-1914 water rights, and the courts have jurisdiction over any claimed violations of Section 1706.

1.3.2.4 Effects on Fish and Wildlife

Water Code Sections 1725 and 1736 require that the SWRCB make a finding that proposed transfers not result in unreasonable effects on fish and wildlife or other instream beneficial uses prior to approving a change in post-1914 water rights. California Code of Regulations Title 23 section 794 requires the petitioner to 1) provide information identifying any effects of the proposed changes on fish, wildlife, and other instream beneficial uses, and 2) request consultation with CDFW and the Regional Water Quality Control Board regarding potential effects of the proposed changes on water quality, fish, wildlife, and other instream beneficial uses. The petition for change will not be accepted by the SWRCB unless it contains the required information and consultation request. Early communication with CDFW would streamline the consultation process through "up front" coordination regarding assessment of the potential impact to fish and wildlife resources. The SWRCB will use this information in making their finding that proposed transfers do not result in unreasonable impacts on fish and wildlife or other instream beneficial uses.

1.3.2.5 Local Economic Effects

Cropland idling/crop shifting transfers have the potential to affect the overall economy of the county from which the water is being transferred. Parties that depend on farming-related activities can experience decreases in business if land idling becomes extensive. To minimize the socioeconomic effects on local areas, State agencies evaluate transfer proposals to ensure that the provisions of Water Code Section 1745.05(b) are implemented. Water Code Section 1745.05 (b) provides that if the amount of water made available by land fallowing (idling) exceeds 20 percent of the water that would have been applied absent the proposed water transfer, a public hearing by the water supply agency is required. Water supply agencies interested in participating in cropland idling/crop shifting transfers need to be aware of this Water Code section and conduct a public hearing if they propose a transfer in which cropland idling would exceed the 20 percent threshold.

1.4 History of Water Transfers

Water transfers have been a common water resources planning practice in the past decades. The Lead Agencies have participated in transfers through previous programs or agreements. Transfers have included both in-basin and out-of-basin transfers. Out-of-basin transfers often involve movement of water through the Delta. The following sections briefly describe past water transfer programs and their associated environmental documentation.

The water transfers history highlights the complexities of the water transfer approval process. Reclamation, buyers, and sellers spend significant resources to complete environmental documents that cover water transfers for a single year or a few years. Completing this EIS/EIR to cover ten years of transfers will streamline the environmental review process and make transfers more implementable relative to NEPA and CEQA requirements, especially when hydrologic conditions and available pumping capacity are unknown until right before the transfer season. A ten-year document will also help address requests from USFWS for a more comprehensive evaluation of water transfers on biological resources and listed species.

1.4.1 In-Basin Transfers and NEPA/CEQA

In-basin transfers are a routine practice for water agencies that are within the same region. In-basin transfers occur among agencies within both the Sacramento Valley and the San Joaquin Valley. In-basin transfers are generally one-year transfers used to meet irrigation requirements or existing M&I water needs. Water agencies have also transferred water to nearby refuges to meet refuge habitat requirements.

In-basin transfers among CVP contractors require NEPA documentation. Reclamation typically completes Environmental Assessments (EAs) to cover these transfers. In accordance with the CVPIA, Reclamation has evaluated in-basin transfers over a multi-year period to accelerate approval. Most recently in 2010, Reclamation signed two Finding of No Significant Impact (FONSI) statements for accelerated water transfers and exchanges from 2011 through 2015. One FONSI covered transfers between CVP South of Delta Contractors and the other covered transfers between Friant Division and Cross Valley CVP Contractors. Reclamation also issued a FONSI for accelerated water transfers among CVP contractors and wildlife refuges within the Sacramento Valley from April 2010 through February 2015.

Reclamation also worked with the Exchange Contractors to complete an EIS/EIR to examine the environmental impacts of the transfer and exchange of the Exchange Contractors' CVP water (up to 130,000 AF per year for ten years) from 2005 through 2014 (Reclamation 2004). In 2013, Reclamation released a Final EIS/EIR for the transfer of up to 150,000 AF of substitute water from the Exchange Contractors to potential water users over a 25-year timeframe, from 2014-2038 (Reclamation 2013a).

1.4.2 Out-of-Basin Transfers and NEPA/CEQA

Since the late-1980s, use of out-of-basin water transfers to meet water needs during dry years increased on a statewide level. In response to the drought in the early 1990s, Reclamation and DWR sponsored drought-related programs, including the DWR-run Drought Water Bank initiated in 1991 and 1992, to negotiate and facilitate the exchange of water. A series of wet years in the late 1990s reduced the need for transfers.

In 2000, CALFED Record of Decision (ROD) established the Environmental Water Account (EWA) as a management tool to protect Delta fisheries and maintain water supply reliability for the CVP and SWP. The EWA included purchase of water to help meet these objectives. The CALFED ROD defined the EWA as a four-year program. However, with efficient water purchase practices, the program was able to acquire all the required assets for the EWA each year and extend the allocated funding into a seven-year program implemented from 2001 through 2007. During this time, over two million AF of water assets were acquired for the EWA environmental purposes. To meet NEPA/CEQA requirements, Reclamation and DWR developed the 2004 EWA EIS/EIR, which was a comprehensive evaluation of environmental impacts of the EWA through 2007.

In responses to dry conditions in 2009, Reclamation and DWR cooperatively implemented the 2009 Drought Water Bank to support through-Delta transfers. Reclamation completed the 2009 Drought Water Bank EA and FONSI that evaluated CVP-related transfers that occurred under the 2009 Drought Water Bank. Total CVP-related transfers under the program totaled approximately 390,000 AF.

In 2010, Reclamation completed a 2010-2011 Water Transfer Program EA and FONSI that evaluated out-of-basin transfers for 2010 and 2011 contract years (Reclamation 2010). However, because of wetter hydrologic conditions, no CVP-related transfers occurred in 2010 and 2011.

In 2013, Reclamation developed an EA for one-year transfers from sellers in the Sacramento River basin to SLDMWA (Reclamation 2013b). The EA analyzed up to 37,715 AF of groundwater substitution transfers. Approximately 29,217 AF were transferred under actions and approvals addressed and cleared by this environmental document. As a separate action, Contra Costa WD purchased 2,000 AF from Woodbridge Irrigation District (ID) that was conveyed through East Bay MUD's Mokelumne Aqueduct to Contra Costa WD (Woodbridge ID 2013). Reclamation was not involved in this transfer because it did not involve CVP supplies or CVP facilities.

In 2014, Reclamation and SLDMWA completed an EA/Initial Study for one-year transfers from sellers in the Sacramento River Basin (Reclamation 2014b). The document analyzed transfers up to 175,226 AF made available from groundwater substitution or cropland idling. Transfers up to ~~55,000~~74,030 AF ~~have been~~was negotiated, but all of these transfers ~~may~~ were not ~~be~~ moved based on operational limitations. Reclamation also completed environmental documentation on transfers from Contra Costa WD to Alameda County WD (5,000 AF) and Byron-Bethany ID (4,000 AF) (Reclamation 2014c and Reclamation 2014d). Also in 2014, Reclamation completed NEPA documentation on a transfer Placer County Water Agency to East Bay MUD of about 5,000 AF (Reclamation 2014e).

SLDMWA is a common participant in most water transfers and has negotiated water transfers in past years on behalf of the member agencies. SLDMWA member agencies have been identified as a potential buyer in Reclamation's past transfer programs and many have purchased water in previous years. Table 1-3 shows previous quantities of water transfers purchased by SLDMWA member agencies from 2000 through 2014. Most recently, in 2009, SLDMWA member agencies purchased about 170,000 AF of water originating north of the Delta.

Table 1-3. North of Delta Water Transferred to SLDMWA Member Agencies (2000-2014)

Year	Water Transfer Quantity (AF)
2000	No Transfers
2001	No Transfers
2002	8,685
2003	No Transfers
2004	15,600
2005	3,100
2006	No Transfers
2007	3,100
2008	12,195
2009	106,322
2010	No Transfers
2011	No Transfers
2012	No Transfers
2013	66,500
2014	74,030[1]

Source: SLDMWA 2014
[1]SLDMWA 2015

~~Notes:~~
~~[1] 2014 information from SLDMWA 2014. This amount of transfers was negotiated, but all transfers may not be moved through the Delta because of operational restrictions.~~

1.5 Water Transfers Included in the EIS/EIR and Roles of Participating Agencies

The EIS/EIR evaluates out-of-basin water transfers from willing sellers upstream from the Delta to buyers south of the Delta and in the San Francisco Bay Area. Alternatives considered in this EIS/EIR only analyze transfers ~~of~~ to CVP contractors that require use of CVP or SWP facilities. SWP contractors located south of the Delta may also purchase transfer water originating north of the Delta ~~to areas south of the Delta~~. The cumulative analysis evaluates potential SWP transfers, but they are not part of the action alternatives for this EIS/EIR.

Transfers included in this EIS/EIR are not part of a “program.” More specifically, Reclamation is not initiating transfers or managing a bank or program to solicit or connect sellers and buyers. Buyers and sellers are responsible for identifying one another, initiating discussions, and negotiating the terms of the transfers, including amount of water for transfer, method to make water available, and price. Buyers and sellers must prepare transfer proposals for submission to Reclamation. The transfer proposals must identify whether the transfers are included in the selected alternative, as well as other required transfer information as defined by Reclamation and appropriate mitigation measures. Proposals must also be submitted to DWR if the transfers require use of DWR facilities or the transfers involve a seller with a settlement agreement with DWR.

Reclamation reviews transfer proposals to ensure they are in accordance with NEPA, CVPIA, and California State law. Reclamation also determines if a Warren Act Contract is appropriate (if non-CVP water would be stored or conveyed through CVP facilities). If a transfer is approved, Reclamation moves the water through CVP facilities at the specified time of transfer to the buyer's service area. DWR may also be involved in conveying water for transfers and is interested in verifying that water made available for transfers does not compromise SWP water supplies. For water conveyed through the SWP system, DWR must also determine if the transfer can be made without injuring any legal user of water and without unreasonably affecting fish, wildlife, or other instream beneficial uses and without unreasonably affecting the overall economy or environment of the county from which the water is being transferred. Because of DWR's role in water transfers, DWR is a Responsible Agency under CEQA for this EIS/EIR.

1.6 Decision to be Made and Uses of this Document

SLDMWA will use this document as the environmental analysis for a decision on whether to implement water transfers through 2024 that must be conveyed through the Delta using CVP or SWP facilities. Reclamation will use this document to decide whether to approve and facilitate water transfers of CVP water supplies or non-CVP supplies that require use of CVP facilities and ensure that water transfers are implemented with measures incorporated to minimize environmental effects. Appendix K provides the Mitigation Monitoring and Reporting Program for the proposed long-term water transfers. Appendix N contains an Index of key terms.

When proposing or approving a specific water transfer in the future, the Lead Agencies will consider whether it was analyzed in this document. If so, the Lead Agencies can rely on the analysis in this document. If it is not covered or there have been significant changes, the Lead Agencies may need to supplement this document.

1.7 Issues of Known Controversy

Federal, State, and local agencies, and other parties have participated in the NEPA and CEQA process leading to the development of the water transfer alternatives presented in this EIS/EIR. During January 2011, public scoping sessions on the development of the Long-Term Water Transfers EIS/EIR were held in Chico, Los Banos, and Sacramento. Key issues raised during the public scoping process that are applicable for inclusion in the EIS/EIR are listed below. The public in the Seller Service Area and not in the Buyer Service Area provided these comments.

- Water transfers could result in long-term impacts to groundwater, by decreasing groundwater levels and adversely affecting groundwater users that are not participating in transfers. The EIS/EIR must evaluate groundwater impacts over the ten-year transfer period.
- The cumulative effects analysis must include all water transfers and programs that result in additional groundwater pumping in the Sacramento Valley region.
- Water transfers could result in impacts to adjacent water users, local economies, and fish and wildlife. The EIS/EIR must evaluate and mitigate water transfer effects to non-transferring parties.

1.8 References

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Chapter 2 Proposed Action and Description of the Alternatives

This chapter includes an overview of the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) requirements for development of project alternatives. It also includes a description of the alternatives formulation process to select a reasonable range of alternatives and a description of the Proposed Action/Proposed Project (Proposed Action) and its alternatives.

2.1 NEPA and CEQA Requirements

2.1.1 NEPA Requirements

Federal law outlines the required components of the "alternatives" section of an Environmental Impact Statement (EIS) (40 Code of Federal Regulations [CFR] Part 1502.14), which include the following:

(a) Rigorous exploration and objective evaluation of all reasonable alternatives, and for alternatives which were eliminated from study, a brief discussion of the reasons for their having been eliminated.

(b) Substantial treatment of each alternative considered in detail, including the proposed action, so that reviewers may evaluate their comparative merits.

(c) Inclusion of reasonable alternatives that are not within the jurisdiction of the lead agency.

(d) Inclusion of the alternative of no action.

(e) Identification of the agency's preferred alternative or alternatives, if one or more exists, in the draft statement and identification of such an alternative in the final statement unless another law prohibits the expression of such a preference.

(f) Inclusion of appropriate mitigation measures that are not already included in the proposed action or alternatives.

2.1.2 CEQA Requirements

The CEQA Guidelines[1] developed by the California Natural Resources Agency include prescriptive requirements for the components of the "project description" section of an Environmental Impact Report (EIR). The required components from Section 15124 of the CEQA Guidelines are listed below.

(a) The precise location and boundaries of the proposed project shall be shown on a detailed map, preferably topographic. The location of the project shall also appear on a regional map.

(b) The document will include a statement of objectives sought by the proposed project. A clearly written statement of objectives will help the lead agency develop a reasonable range of alternatives to evaluate in the EIR and will aid the decision-makers in preparing findings or a statement of overriding considerations, if necessary. The statement of objectives should include the underlying purpose of the project.

(c) A general description of the project's technical, economic, and environmental characteristics, considering the principal engineering proposals, if any, and supporting public service facilities.

(d) A statement briefly describing the intended uses of the EIR.

  (1) This statement shall include the following, to the extent that the information is known to the lead agency:

  - A list of the agencies that are expected to use the EIR in their decision-making.
  - A list of permits and other approvals required to implement the project.
  - A list of related environmental review and consultation requirements required by federal, state, or local laws, regulations, or policies. To the fullest extent possible, the lead agency should integrate CEQA review with these related environmental review and consultation requirements.

  (2) If a public agency must make more than one decision on a project, all its decisions subject to CEQA should be listed, preferably in the order in which they occur.

[1] Title 14, California Code of Regulations, §§ 15000–15387.

2.2 Alternatives Development

NEPA and CEQA require an EIS and EIR, respectively, to identify a reasonable range of alternatives and provide guidance on the identification and screening of such alternatives. Both NEPA and CEQA include provisions that alternatives reasonably meet the purpose and need/project objectives, and be potentially feasible. For this EIS/EIR, the Lead Agencies followed a structured, documented process to identify and screen alternatives for inclusion in the EIS/EIR. Figure 2-1 illustrates the process that the Lead Agencies conducted to identify and screen alternatives.

Figure 2-1. Alternatives Development and Screening Process

2.2.1 Public Scoping and Screening Criteria Results

During public scoping, the public provided input regarding potential alternatives to the Proposed Action. The Lead Agencies reviewed the purpose and need/project objectives statement, public scoping comments, and previous studies in their initial effort to develop conceptual alternatives. This process identified an initial list of measures described in more detail in Appendix A, Alternatives Development Report and summarized in Table 2-1. The initial list included more than 27 measures. The Lead Agencies then developed and applied a set of screening considerations to determine which measures should move forward for further analysis and be considered as project alternatives.

The Lead Agencies determined that they would screen the alternatives based on their ability to meet key elements of the purpose and need/basic project objectives:

- Immediate: the term proposed for this EIS/EIR is 2015 through 2024. This period is relatively short, and measures need to be able to provide some measurable benefit within this time period.

- Flexible: project participants need water in some years, but not in others. They need measures that have the flexibility to be used only when needed.

- Provide Water: project participants need measures that have the capability of providing additional water to regions that are experiencing shortages.

Measures had to satisfy these key elements in order to move forward to the alternatives formulation phase. Table 2-1 provides an overview of the original measures developed during scoping and their screening results. Appendix A includes a detailed discussion of the screening process and results.

Table 2-1. Measures Screening Evaluation Results

Measures	Description	Immediate	Flexible	Provides Water
Agricultural conservation (Buyer Service Area)	Increase agricultural conservation in buyer service area to reduce agricultural water use, and improve agricultural systems to increase recapture and reuse of irrigation water	-	X	-
Agricultural conservation (Seller Service Area)	Increase agricultural conservation in seller service area to reduce agricultural water use, and improve agricultural systems to increase recapture and reuse of irrigation water	X	X	X
Conservation – municipal & industrial	Increase water conservation for municipal and industrial uses in Buyer Service Area to reduce water demands	X	X	-
Desalination - brackish	Desalinate brackish groundwater supplies and distribute to Buyer Service Area to develop new supply	-	X	X
Desalination - seawater	Desalinate seawater and distribute to the Buyer Service Area to develop new water supply	-	X	X
Reclamation - nonpotable reuse	Treat wastewater for agricultural water use in the buyer service area	-	X	X
Reclamation - indirect potable reuse	Advance treat wastewater and store in groundwater basins for future potable reuse	-	X	X
Cropland idling transfers- rice, field crops, grains	Idle croplands and transfer irrigation water to buyers	X	X	X
Cropland idling transfers-and alfalfa	Idle alfalfa fields and transfer irrigation water to buyers	X	X	X
Land retirement in San Joaquin Valley	Permanently retire lands in San Joaquin Valley and transfer irrigation water to other croplands	-	-	-
Groundwater substitution	Pump groundwater for irrigation rather than use of surface water supplies and transfer surface water to the buyers service area	X	X	X
New surface storage	Build new surface storage facilities to store water for the buyers	-	X	X
Groundwater storage	Build new facilities to recharge and extract groundwater for use in buyer service area or expand existing groundwater storage programs by increases recharge and extraction facilities	X	X	-
Water rights purchase	Purchase water rights for permanent transfer of water	-	X	-

Measures	Description	Immediate	Flexible	Provides Water
Delta conveyance	Build canal to increase CVP water deliveries south of Delta	-	X	X
Crop shifting in Seller Service Area	Shift from a higher water use crop to a lower water use crop and transfer incremental decrease in water to buyers	X	X	X
Rice decomposition water	Use alternate method to decompose rice straw and transfer rice decomposition water to the buyers	X	X	-
Reservoir release	Transfer available water stored in existing, non-CVP or -SWP reservoirs	X	X	X
Transfers within Buyer Service Area	Implement water transfers from buyers and sellers within the Buyer Service Area	X	X	-
Groundwater development	Develop new groundwater supplies by constructing new wells and pumps in the buyer service area	-	X	-
Modify CVP and SWP contracts	Change CVP and SWP contracts to limit water use in the buyer service area	-	-	-
Change cropping patterns in San Joaquin Valley	Plant lower water use crops or increase fallowed land in the Buyer Service Area	X	X	-
Limit dairies in San Joaquin Valley	Limit dairies in San Joaquin Valley to decrease water use	-	X	-
Enforce seniority system to manage deliveries	Deliver water supplies based on seniority of water rights	-	-	-
Implement policy of no net increase in water availability for urban or agricultural expansion	Prohibit use of CVP supplies for newly developed urban or agricultural lands	-	-	-
Pipe water from Canada and northern states	Purchase water and build distribution system to deliver water from northern states to the buyers	-	X	X
Fix Owens Valley	Increase water supply available from Owens Valley	-	-	-

Key:
CVP – Central Valley Project, SWP – State Water Project

2.2.2 Selected Alternatives

The measures that moved forward for more detailed analysis in this EIS/EIR are those that best meet the NEPA purpose and need and CEQA objectives, minimize negative effects, are potentially feasible, and represent a range of reasonable alternatives. Some alternatives do not fully meet the purpose and need/project objectives, but they have potential to minimize some types of environmental effects or help provide a reasonable range of alternatives for consideration by decision-makers.

Measures that were carried forward from scoping and the screening process for alternatives formulation include:

- Agricultural Conservation (Seller Service Area)
- Cropland Idling Transfers - rice, field crops, grains
- Cropland Idling Transfers - alfalfa

- Groundwater Substitution
- Crop Shifting
- Reservoir Release

The measures remaining after the initial screening were combined into three action alternatives that were selected to move forward for analysis in the EIS/EIR (in addition to the No Action/No Project Alternative). Table 2-2 presents the alternatives carried forward for analysis in the EIS/EIR. Analysis of these alternatives will provide the information needed to make a decision, and potentially to mix and match elements of the alternatives, if needed, to create an alternative that would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any significant environmental effects.

Table 2-2. Alternatives Selected for Analysis in the EIS/EIR

Alternative Number	Alternative Name	Description
Alternative 1	No Action/ No Project	The No Action/No Project Alternative represents the state of the environment without the Proposed Action or any of the alternatives. In the No Action/No Project Alternative, the Buyer Service Area would experience shortages and could increase groundwater pumping, idle cropland, or retire land to address those shortages.
Alternative 2	Full Range of Transfers (Proposed Action)	This alternative combines all potential transfer measures that met the purpose and need and were carried forward through the screening process.
Alternative 3	No Cropland Modifications	The No Cropland Modifications Alternative includes the following measures: • Agricultural conservation (Seller Service Area) • Groundwater substitution • Reservoir release
Alternative 4	No Groundwater Substitution	The No Groundwater Substitution Alternative includes the following measures: • Agricultural conservation (Seller Service Area) • Cropland idling transfers– rice, field, grains, alfalfa • Crop shifting • Reservoir release

2.3 Proposed Action and Alternatives

The following sections describe the alternatives under evaluation in this EIS/EIR.

2.3.1 Alternative 1: No Action/No Project Alternative

The Council on Environmental Quality regulations require an EIS to include a No Action Alternative (40 CFR Section 1502.14). The No Action Alternative may be described as the future circumstances without the proposed action and can also include predictable actions by persons or entities, other than the federal agency involved in a project action, acting in accordance with current management direction or level of management intensity.

CEQA requires an EIR to include a No Project Alternative. The No Project Alternative allows for a comparison between the impacts of the proposed project with future conditions of not approving the proposed project. The No Project Alternative may include some reasonably foreseeable changes in existing conditions and changes that would be reasonably expected to occur in the foreseeable future if the project were not approved.

Under the No Action/No Project Alternative, Central Valley Project (CVP) related water transfers through the Delta would not occur during the period 2015-2024. However, other transfers that do not involve CVP water or facilities could occur under the No Action/No Project Alternative. Additionally, CVP transfers within basins could continue and would still require Reclamation's approval. Some CVP entities may decide that they are interested in selling water to buyers in export areas under the No Action/No Project Alternative; however, they would need to complete individual environmental compliance for each transfer to allow Reclamation to complete the evaluation of the transfers for approval.

Under the No Action/No Project Alternative, some agricultural and urban water users may face potential shortages in the absence of water transfers. To the extent transfer water is not available, there would be demand that would be unmet by surface water. Demand may be met by increasing groundwater pumping, idling cropland, reducing landscape irrigation, land retirement, or rationing water.

2.3.2 Alternative 2: Full Range of Transfer Measures (Proposed Action)

This section describes potential transfer participants, potential transfer methods and operations for Alternative 2. Alternative 2 would involve transfers from potential sellers upstream from the Delta to buyers in the Central Valley or Bay Area (see Figure 2-2) when the Delta is in balanced conditions.

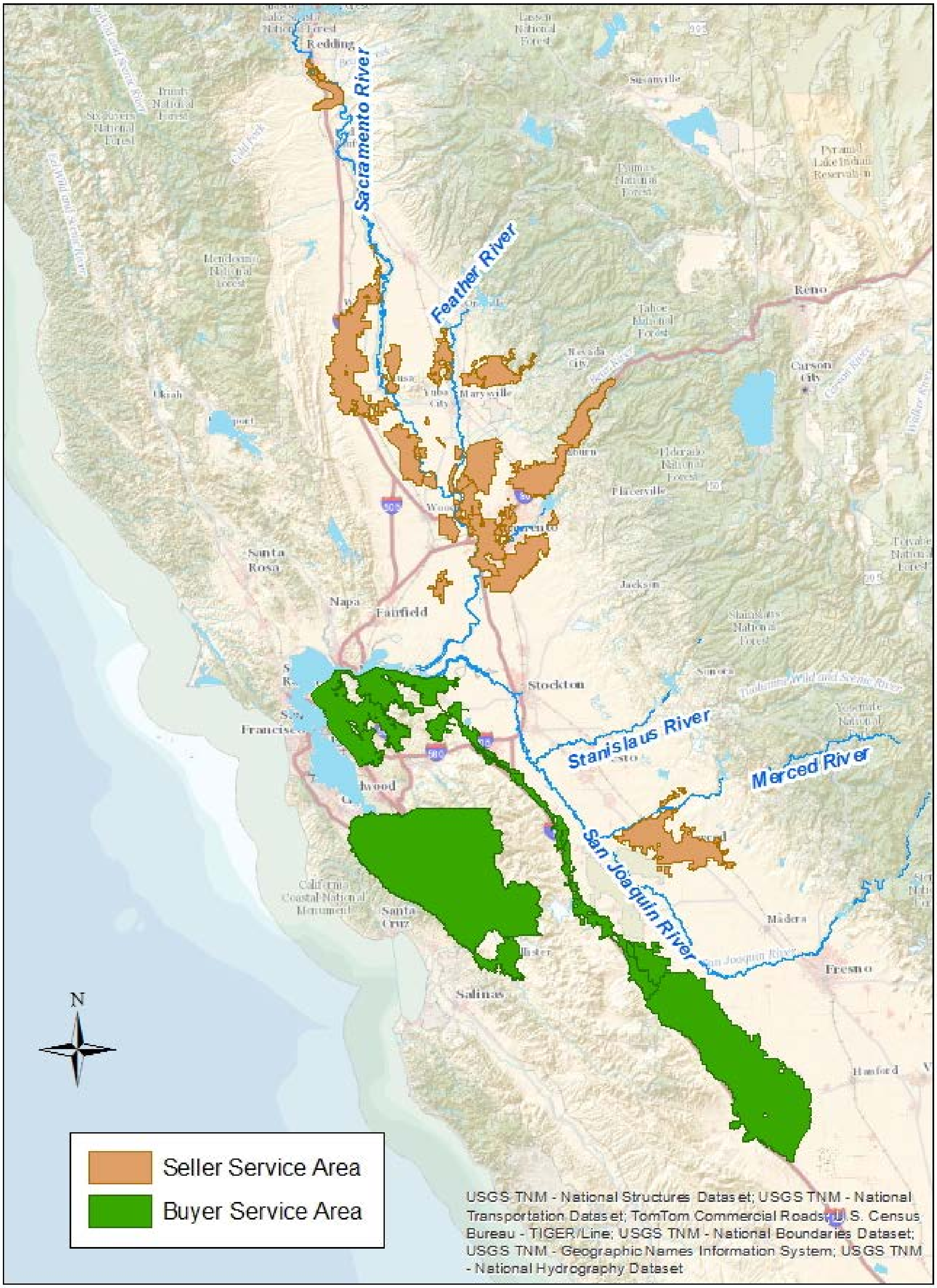

Figure 2-2. Potential sellers would transfer water to buyers in the Central Valley or Bay Area

2.3.2.1 Potential Water Transfer Methods

A water transfer temporarily moves water from a willing seller to a willing buyer. To make water available, the seller must take an action to reduce consumptive use or use water in storage. Water transfers must be consistent with State and Federal law, as discussed in Chapter 1. Transfers involving water diverted through the Delta are governed by existing water rights, applicable Delta pumping limitations, reservoir storage capacity and regulatory requirements.

The biological opinions on the Coordinated Operations of the CVP and State Water Project (SWP) (U.S. Fish and Wildlife Service [USFWS] 2008; National Oceanic and Atmospheric Administration Fisheries Service [NOAA Fisheries] 2009) analyze transfers through the Delta from July to September that are up to 600,000 acre-feet (AF) in critical years and dry ~~and critically dry~~ years (following dry or critical years). For all other year types, the maximum transfer amount is up to 360,000 AF. Through Delta transfers would be limited to the period when USFWS and NOAA Fisheries find transfers to be acceptable, typically July through September, unless a change is made in a particular water year based on concurrence from USFWS and NOAA Fisheries. Because this document only analyzes the environmental effects associated with a July through September transfer window, supplemental environmental documentation will be prepared to address the effects of moving the transfer window if such a shift were to occur.

In May 2011 and September 2011, U.S. District Judge Wanger ruled that USFWS and NOAA Fisheries, respectively, must submit new biological opinions on smelt and salmonids. Additionally, he found that Reclamation must complete NEPA before accepting the Reasonable and Prudent Alternatives within the biological opinions. In March 2013, the Ninth Circuit Court of Appeals upheld that Reclamation must complete NEPA, but reversed ~~the previous decision that the scientific basis for the USFWS was arbitrary and capricious. A similar case regarding the NOAA Fisheries biological opinion is before the court~~on all arguments related to the adequacy of the Biological Opinion. On December 22, 2014, the United States Court of Appeals for the Ninth Circuit released similar findings related to the Consolidated Salmonid Cases and reversed the arguments about the adequacy of the Biological Opinion. Reclamation is working to complete NEPA analysis on the Biological Opinions, but the 2008 USFWS and 2009 NOAA Fisheries biological opinions will guide operations of potential water transfers. ~~If new biological opinions are completed, the new biological opinions or the findings of the NEPA analysis could change the quantity or timing of transfers. If the biological opinions alter the timing and quantity of transfers, the Lead Agencies will determine if supplemental environmental documentation is necessary to address any changes in potential impacts.~~

This EIS/EIR analyzes transfers to CVP contractors. These transfers could be conveyed through the Delta using either CVP or SWP facilities, depending on availability. CVP sellers could transfer either Base Supply or Project Water under their CVP contracts. Some transfers may not involve CVP contractors as sellers, but they may use CVP facilities. Any non-CVP water that would use CVP facilities would need a Warren Act contract, which is subject to NEPA compliance. This document analyzes the impacts of conveying or storing non-CVP water in CVP facilities to address compliance needs for transfers facilitated by execution of a contract pursuant to the Warren Act of February 21, 1911 (36 Stat. 925).

Some transfers may be accomplished through forbearance agreements rather than transfers that involve the State Water Resources Control Board (SWRCB). Under such agreements, a CVP seller would forbear (i.e., temporarily suspend) the diversion of some of their Base Supply, which in the absence of forbearance, would have been diverted for use on lands within the CVP sellers' service areas. This forbearance would be undertaken in a manner that allows Reclamation to deliver the forborne water supply as Project water to a purchasing CVP water agency. A forbearance agreement would not change the way that water is made available for transfer, conveyed to buyers, or used by the buyers; therefore, it would not change the environmental effects of the transfer.

Groundwater Substitution

Groundwater substitution transfers occur when sellers choose to pump groundwater in lieu of diverting surface water supplies, thereby making the surface water available for transfer. Sellers making water available through groundwater substitution actions are agricultural and municipal and industrial users. Water could be made available for transfer by the agricultural users during the irrigation season of April through September. If there are issues related to water supply availability or conveyance capacity at the Delta, sellers could shorten the window when transfer water is available by switching between surface water sources and groundwater pumping for irrigation or municipal and industrial use.

Groundwater substitution would temporarily decrease levels in groundwater basins near the participating wells. Water produced from wells initially comes from groundwater storage. Groundwater storage would refill (or "recharge") over time, which affects surface water sources. Groundwater pumping captures some groundwater that would otherwise discharge to streams as baseflow and can also induce recharge from streams. Once pumping ceases, this stream depletion continues, replacing the pumped groundwater slowly over time until the depleted storage fully recharges.

Reservoir Release

Buyers could acquire water by purchasing surface water stored in reservoirs owned by non-Project entities (not part of the CVP or SWP). To ensure that purchasing this water would not affect downstream users, Reclamation would limit transferred water to what would not have otherwise been released downstream absent the transfer.

When the willing seller releases stored reservoir water for transfer, these reservoirs are drawn down to levels lower than without the water transfer (see Figure 2-3). To refill the reservoir, a seller must capture some flow that would otherwise have gone downstream. Sellers must refill the storage at a time when downstream users would not have otherwise captured the water, either in downstream reservoirs or at the CVP and SWP (collectively "the Projects") or non-Project pumps in the Delta. Typically, refill can only occur during Delta excess conditions as defined by the Coordinated Operations Agreement (COA) as "periods when it is agreed that releases from upstream reservoirs plus unregulated flow exceed Sacramento Valley in basin uses, plus exports," or when any downstream reservoirs are in flood control operations. Additionally, refill cannot occur at times when the water would have been used to meet downstream flow or water quality standards. Refill of the storage vacated for a transfer may take more than one season to refill if the above conditions are not met in the wet season following the transfer. Each reservoir release transfer would include a refill agreement between the seller and Reclamation (developed in coordination with Department of Water Resources [DWR]) to prevent impacts to downstream users following a transfer.

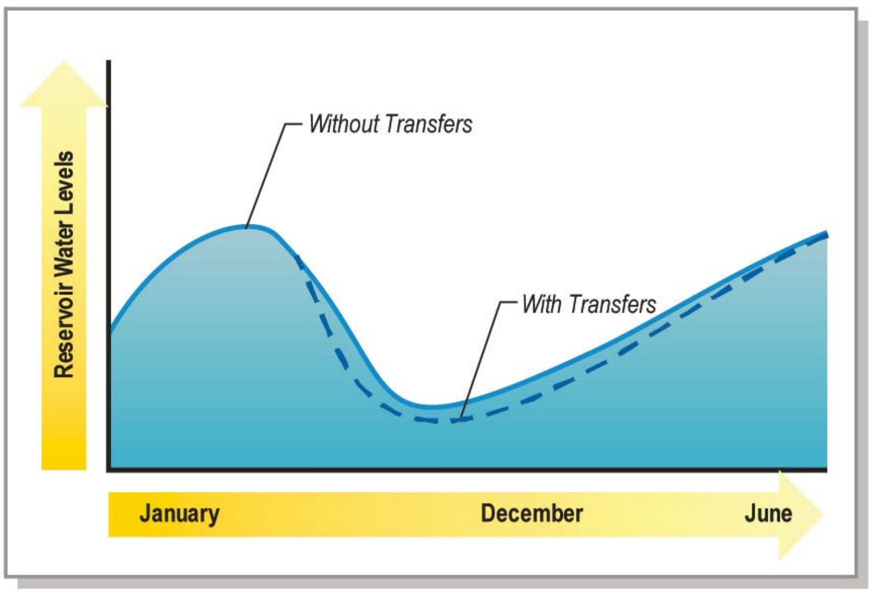

Figure 2-3. Reservoir levels would change because of reservoir release transfers

Some entities that could transfer water through reservoir release are upstream of CVP reservoirs and could request to store water temporarily in the CVP reservoirs. These entities may have restrictions on the patterns that they could release water from their reservoirs, and the patterns may not match the availability of export capacity in the Delta. The seller could request that Reclamation store the non-CVP water in the CVP reservoir until Delta capacity is available, which would require contractual approval in accordance with the Warren Act of 1911. Temporary storage would increase reservoir levels temporarily while water was stored. Reclamation would not release water for transfer from CVP reservoirs before the non-CVP water was available.

Cropland Idling

Cropland idling makes water available for transfer that would have been used for agricultural production. Water would be availab~~water~~le on the same pattern throughout the growing season as it would have been consumed had a crop been planted. The irrigation season generally lasts from April or May through September for most crops in the Sacramento Valley.

The quantity of water made available for transfer through cropland idling would be calculated based on the evapotranspiration of applied water (ETAW). ETAW is the portion of applied surface water that is used by the crop and evaporated from the soil and plant surfaces. Not all crops would be considered for participation in a transfer. Mixed grasses, orchard and vineyard, and alfalfa in the Delta region would not be considered due to factors that make it difficult to determine water savings, such as a lack of authoritative ETAW values and variability in cultural practices. Table 2-3 shows the ETAW of crops currently accepted by Reclamation and DWR that would be potentially involved in transfers. These values were developed using the conceptual model and data in DWR Bulletin 113-3 (DWR 1975).

Table 2-3. Estimated ETAW Values for Various Crops Suitable for Idling or Shifting Transfers

Crop	ETAW (AF/acre)
Alfalfa[1]	1.7 (July – Sept)
Bean	1.5
Corn	1.8
Cotton	2.3
Melon	1.1
Milo	1.6
Onion	1.1
Pumpkin	1.1
Rice	3.3
Sudan Grass	3.0
Sugar Beets	2.5
Sunflower	1.4
Tomato	1.8
Vine Seed/ Cucurbits	1.1
Wild Rice	2.0

Source: Department of Water Resources and Reclamation 2013

Notes:

[1] Only alfalfa grown in the Sacramento Valley floor north of the American River will be allowed for transfers. Fields must be disced on, or prior to, the start of the transfer period. Alfalfa acreage in the foothills or mountain areas is not eligible for transfer.

<u>Consistent with the provisions contained in Water Code Section 1018, potential sellers are encouraged to incorporate measures into their cropland idling transfer to protect habitat value in the area to be idled. Idled land cannot be irrigated</u>

during the transfer season, but vegetation that is supported only through precipitation or that has begun to senesce may remain on the idled fields. Excessive vegetation supported by seepage from irrigation supplies or shallow groundwater would result in a decrease in the amount of water available for cropland idling transfer.

Crop Shifting

For crop shifting transfers, water is made available when farmers shift from growing a higher water use crop to a lower water use crop. The difference in the accepted ETAW values between the two crops would be the amount of water that can be transferred. Transfer water generated by crop shifting is difficult to account for. Farmers generally rotate between several crops to maintain soil quality, so water agencies may not know what type of crop would have been planted in a given year absent a transfer. To calculate water available from crop shifting, agencies would estimate what would have happened absent a transfer using an average water use over a consecutive five-year baseline period. The change in consumptive use between this baseline water use and the lower water use crop determines the amount of water available for transfer.

Conservation

Conservation transfers must include actions to reduce the diversion of surface water by the transferring entity by reducing irrecoverable water losses. The amount of reduction in irrecoverable losses determines the amount of transferrable water. Conservation measures may be implemented on the water-district and individual user scale. These measures must reduce the irrecoverable losses at a site without reducing the amount of water that otherwise would have been available for downstream beneficial uses. Irrecoverable losses include water that would not be usable because it currently flows to a salt sink, to an inaccessible or degraded aquifer, or escapes to the atmosphere.

2.3.2.2 Potential Transfer Participants

The sections below identify potential transfer sellers and buyers that are analyzed in this EIS/EIR. Figure 2-4 shows the locations of sellers.

Sellers

Table 2-4 lists the agencies that have expressed interest in being a seller in the Long-Term Water Transfers EIS/EIR and the potential maximum quantities available for sale. Table 2-5 shows the potential upper limit of available water for transfer by each agency for each transfer type; however, actual purchases could be less, depending on hydrology, the amount of water the seller is interesting in selling in any particular year, the interest of buyers, and compliance with Central Valley Project Improvement Act transfer requirements, among other possible factors. Additionally, these transfers would not occur every year, but only years when there is demand from buyers and pumping capacity available to convey the transfers (generally dry and critical years). Modeling analysis indicates that using hydrology from 1970-2003, transfers could occur in 12 of the 33 years.

Because of the uncertainty of hydrologic and operating conditions in the future, it is likely that only a portion of the potential transfers identified in Table 2-4 would occur. Additionally, many agencies are uncertain about whether they would participate through groundwater substitution or cropland idling/crop shifting transfers. They have included their potential upper limit for both types of transfers, but they would not sell the maximum amount of both types in the same year. The maximum amount for each agency would not exceed the amount shown in Table 2-4. Table 2-5 shows the potential quantities of water that could be made available from April through June and July through September; the quantities available in April, May, and June would be able to be transferred if storage is available (see Section 2.3.2.3.1). Entities requiring Reclamation approval that are not listed in this table may decide that they are interested in selling water, but those transfers may require supplemental NEPA and Endangered Species Act analysis to allow Reclamation to complete the evaluation of the transfers.

Sellers that are not specifically listed in this document may be able to sell water to the buyers as long as: the water that is made available occurs in the same water shed or ground water basin analyzed in this EIS/EIR, the total quantity of water proposed for sale does not exceed the maximums listed for each region or type of transfer in any given transfer year, the transfer does not exceed the magnitude of the impacts assessed, and any potential mitigation required can be effectively implemented. On a case-by-case basis, Reclamation would evaluate proposals from sellers not included in this document to determine whether or not the impacts have been adequately assessed in this EIS/EIR.

Table 2-4. Alternative 2 Potential Sellers (Upper Limits)

Water Agency	Maximum Potential Transfer (acre-feet per year)
Sacramento River Area of Analysis	
Anderson-Cottonwood Irrigation District	5,225
Conaway Preservation Group	35,000
Cranmore Farms	8,000
Eastside Mutual Water Company	2,230
Glenn-Colusa Irrigation District	91,000
Natomas Central Mutual Water Company	30,000
Pelger Mutual Water Company	3,750
Pleasant Grove-Verona Mutual Water Company	18,000
Reclamation District 108	35,000
Reclamation District 1004	17,175
River Garden Farms	9,000
Sycamore Mutual Water Company	20,000
Te Velde Revocable Family Trust	7,094
American River Area of Analysis	
City of Sacramento	5,000

Water Agency	Maximum Potential Transfer (acre-feet per year)
Placer County Water Agency	47,000
Sacramento County Water Agency	15,000
Sacramento Suburban Water District	30,000
Yuba River Area of Analysis	
Browns Valley Irrigation District	8,100
Cordua Irrigation District	12,000
Feather River Area of Analysis	
Butte Water District	17,000
Garden Highway Mutual Water Company	14,000
Gilsizer Slough Ranch	3,900
Goose Club Farms and Teichert Aggregates	10,000
South Sutter Water District	15,000
Tule Basin Farms	7,320
Merced River Area of Analysis	
Merced Irrigation District	30,000
Delta Region Area of Analysis	
Reclamation District 2068	7,500
Pope Ranch	2,800
Total	**511,094**

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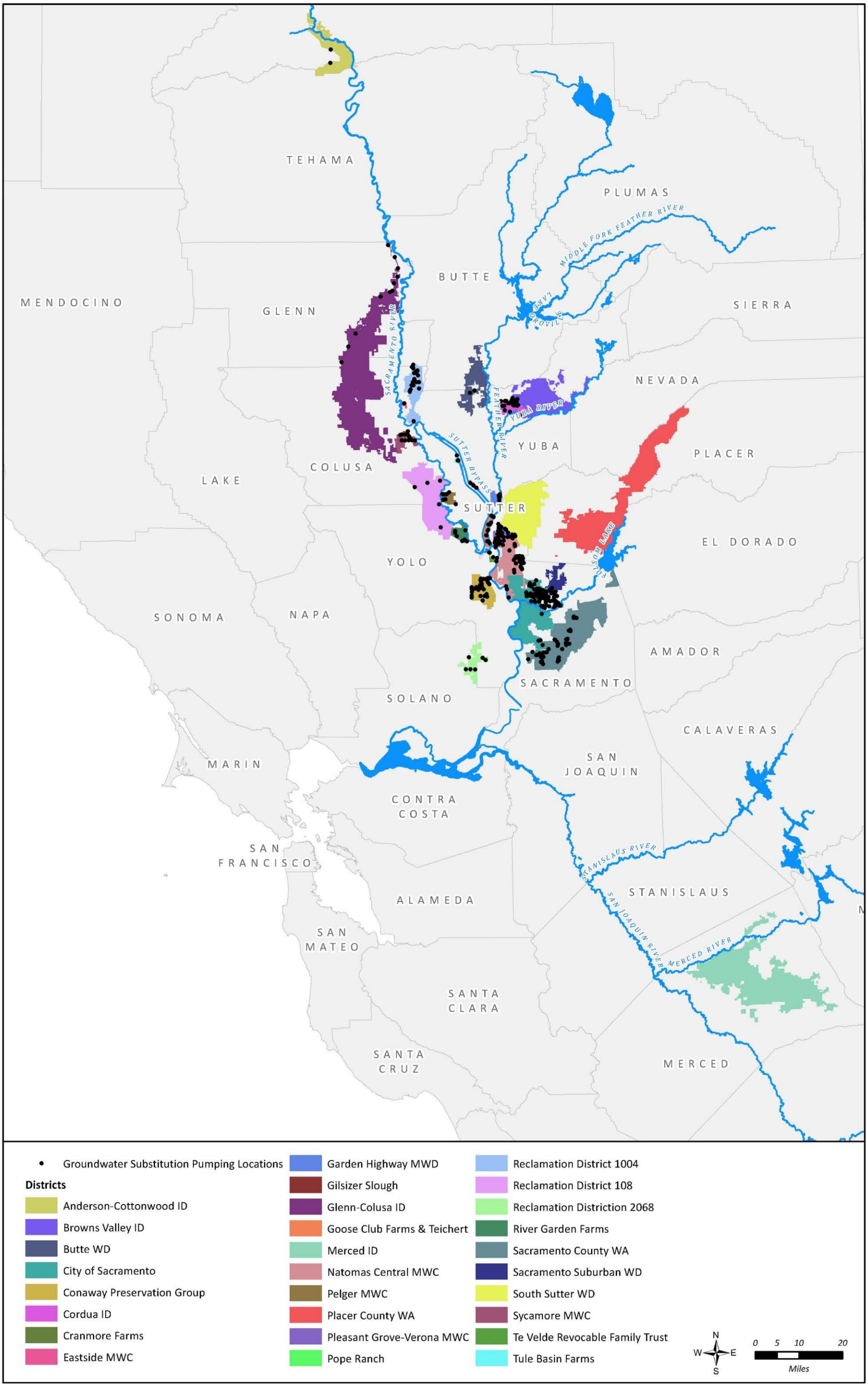

Figure 2-4. Locations of Potential Sellers

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Table 2-5. Alternative 2 Transfers Types (Upper Limits)

Water Agency	April-June Groundwater Substitution (acre-feet)	April-June Cropland Idling/ Crop Shifting (acre-feet)	April-June Stored Reservoir Release (acre-feet)	April-June Conservation (acre-feet)	July-Sep Groundwater Substitution (acre-feet)	July-Sep Cropland Idling/Crop Shifting (acre-feet)	July-Sep Stored Reservoir Release (acre-feet)	July-Sep Conservation (acre-feet)
Sacramento River Area of Analysis								
Anderson-Cottonwood Irrigation District	2,613				2,613			
Conaway Preservation Group	21,550	7,899			13,450	13,450		
Cranmore Farms	5,140	925			2,860	1,575		
Eastside Mutual Water Company	1,067				1,163			
Glenn-Colusa Irrigation District	12,500	24,420			12,500	41,580		
Natomas Central Mutual Water Company	15,000				15,000			
Pelger Mutual Water Company	2,151	939			1,599	1,599		
Pleasant Grove-Verona Mutual Water Company	8,000	3,330			10,000	5,670		
Reclamation District 108	7,500	7,400			7,500	12,600		
Reclamation District 1004		3,700			7,175	6,300		
River Garden Farms	4,000				5,000			
Sycamore Mutual Water Company	7,500	3,700			7,500	6,300		
Te Velde Revocable Family Trust	2,700	2,581			4,394	4,394		
American River Area of Analysis								
City of Sacramento					5,000			
Placer County Water Agency							47,000	
Sacramento County Water Agency					15,000			
Sacramento Suburban Water District	15,000				15,000			

Water Agency	April-June Groundwater Substitution (acre-feet)	April-June Cropland Idling/ Crop Shifting (acre-feet)	April-June Stored Reservoir Release (acre-feet)	April-June Conservation (acre-feet)	July-Sep Groundwater Substitution (acre-feet)	July-Sep Cropland Idling/Crop Shifting (acre-feet)	July-Sep Stored Reservoir Release (acre-feet)	July-Sep Conservation (acre-feet)
Yuba River Area of Analysis								
Browns Valley Irrigation District							5,000	3,100
Cordua Irrigation District					12,000			
Feather River Area of Analysis								
Butte Water District	2,750	5,750			2,750	5,750		
Garden Highway Mutual Water Company	6,500				7,500			
Gilsizer Slough Ranch	1,500				2,400			
Goose Club Farms and Teichert Aggregates	4,000	3,700			6,000	6,300		
South Sutter Water District							15,000	
Tule Basin Farms	3,800				3,520			
Merced River Area of Analysis								
Merced Irrigation District							30,000	
Delta Region Area of Analysis								
Reclamation District 2068	2,250	2,775			2,250	4,725		
Pope Ranch	1,400				1,400			
Total[1]	126,921	67,119	0	0	163,574	110,243	97,000	3,100

Note:

[1] These totals cannot be added together. Agencies could make water available through groundwater substitution, cropland idling, or a combination of the two; however, they will not make the full quantity available through both methods. Table 2-4 reflects the total upper limit for each agency.

Buyers

Table 2-6 identifies potential buyers who may be interested in participating in water transfers (similar to Table 1-2). Not all of these potential buyers may end up actually purchasing water. For some potential buyers, purchase decisions would depend on the ability to move the purchased water through the Delta to the buyer's service area.

Table 2-6. Alternative 2 Potential Buyers

San Luis & Delta-Mendota Water Authority Participating Members
Byron-Bethany Irrigation District
Del Puerto Water District
Eagle Field Water District
Mercy Springs Water District
Pacheco Water District
Panoche Water District
San Benito County Water District
San Luis Water District
Santa Clara Valley Water District
Westlands Water District
Contra Costa Water District
East Bay Municipal Utility District

2.3.2.3 Water Transfer Operations

Water transfer operations are discussed by geographic region. Transfer operations could affect river flows and timing of flows upstream or downstream from the point of diversion. The following sections describe how potential transfers would operate on rivers.

Sellers Service Area

As shown in Figure 2-2, both the Sacramento and San Joaquin Rivers flow into the Delta. The Sacramento River enters the Delta from the northeast and flows are regulated through releases from CVP-owned Shasta Reservoir and Folsom Reservoir, as well as the SWP-owned Lake Oroville. Major tributaries to the Sacramento River include the Yuba, Feather, and American Rivers. The South, North and Middle forks of the American River converge at the Folsom Reservoir. The San Joaquin River enters the Delta from the southeast; major tributaries include the Merced and Stanislaus Rivers.

Transfers that must be conveyed through the Delta are limited to periods when capacity at C.W. "Bill" Jones Pumping Plant (Jones Pumping Plant) and Harvey O. Banks Pumping Plant (Banks Pumping Plant) is available typically from July through September, and only after Project needs are met. Reclamation and DWR must also declare that the Delta is in "balanced conditions" under the terms of the COA (USFWS 2008). CVP transfer water conveyed at Banks Pumping Plant could occur upon the SWRCB's approval of Joint Points of

Diversion. The Delta pumping restrictions do not apply to East Bay Municipal Utility District (MUD) diversions at Freeport.

The timing of transfers from potential agricultural sellers upstream from the Delta by groundwater substitution, cropland idling, and crop shifting would be dictated by the irrigation season. While land owners may be able to postpone groundwater substitution until the adequate capacity is available at the Delta pumps, water from crop idling/shifting would be made available on the same pattern as it would have otherwise been used for irrigation. At the start of the irrigation season, the Delta pumps cannot pump water for transfer because the current biological opinions on CVP and SWP operations typically only allow for transfers from July through September. Transfer water made available prior to July would either bypass the pumps, or may be stored in upstream reservoirs if Project operations can account for the storage. However, as described in subsequent sections, Shasta Reservoir is operated to meet mandated temperature and flow requirements in the Sacramento River, which limits its ability to store water to support transfers.

Sacramento River

Potential sellers on the Sacramento River include Conaway Preservation Group, LLC, Cranmore Farms, LLC, Glenn-Colusa Irrigation District (ID), Pelger Mutual Water Company (MWC), Pleasant Grove-Verona MWC, Reclamation District 108, Reclamation District 1004, Sycamore MWC, and Te Velde Revocable Family Trust, which may provide water made available through groundwater substitution or crop idling/shifting actions. Anderson-Cottonwood ID, Eastside MWC, Natomas MWC, and River Garden Farms plan to transfer water made available through groundwater substitution only.

Potential sellers receive CVP water that is stored upstream from their service areas in Shasta Reservoir, a CVP facility. Releases from Shasta Reservoir may be routed through or around the Shasta Power Plant to the Sacramento River, where flows are re-regulated by Keswick Dam.

Delta conveyance capacity would be available when conditions for sensitive species are acceptable to NOAA Fisheries and USFWS, typically from July through September, but groundwater substitution and cropland idling/crop shifting transfers would be available from April through September. Storing water in Shasta Reservoir from April through June would help facilitate these types of transfers; however, Shasta Reservoir has a very limited capacity to store transfer water from April through June because of downstream temperature requirements. Reclamation is required by SWRCB Water Rights Orders 90-05/91-01 to meet average daily temperature requirements as far downstream as practical when temperatures could affect fish. To meet requirements, Reclamation must carefully manage the cold water pool in Shasta Reservoir by releasing larger quantities of water earlier in the season; larger flows maintain cooler temperatures for a longer distance downstream. Reducing releases to hold transfer water in storage could affect Reclamation’s ability to meet these downstream temperature requirements. Reclamation would only consider storing water for transfers if it would not affect releases for temperature, or if it could be “backed up” into another reservoir (by reducing releases from that reservoir). Backing up water may be possible if the Delta is in balanced conditions and instream standards are met. The decision to back up transfer water would be made on a case-by-case basis, but storage is analyzed in this EIS/EIR so that the analysis is complete in the event Reclamation determines that storage is possible in a specific year.

Because of the limitations associated with storing transfer water, crop idling transfers would be more difficult to implement. Cropland idling cannot be started partway through the irrigation season, so the water made available from April through June would bypass the pumps and become Delta outflow if it cannot be stored. Sacramento River sellers and buyers would generally prefer water transfer options that are more flexible, such as starting groundwater substitution pumping when Delta pumping capacity for transfers is available.

Proposed sellers divert water from various locations along the Sacramento River or the Sutter Bypass. If a seller shifts from using surface water to groundwater when a transfer is implemented, river flows would not decrease from Shasta Reservoir to the point of diversion absent transfers. River flow would then increase from the seller’s usual diversion point downstream to the buyer’s point of diversion because water is not diverted for use until it reaches the Delta.

If Reclamation determines that it can store water in Shasta Reservoir, the flows in the Sacramento River between Shasta Reservoir and the point of diversion absent transfers would decrease from April through June. Flows downstream of the point of diversion would not change during this period.

American River

The City of Sacramento, Sacramento County Water Agency and Sacramento Suburban Water District (WD) could sell water on the American River system through groundwater substitution. Placer County Water Agency could generate additional transfer water through the release of stored water from Hell Hole and French Meadows Reservoirs (see Figure 2-5). Folsom Reservoir is the primary storage and flood control reservoir on the American River. Releases from Folsom Reservoir are re-regulated at Nimbus Dam, which is about seven miles downstream from Folsom Dam.

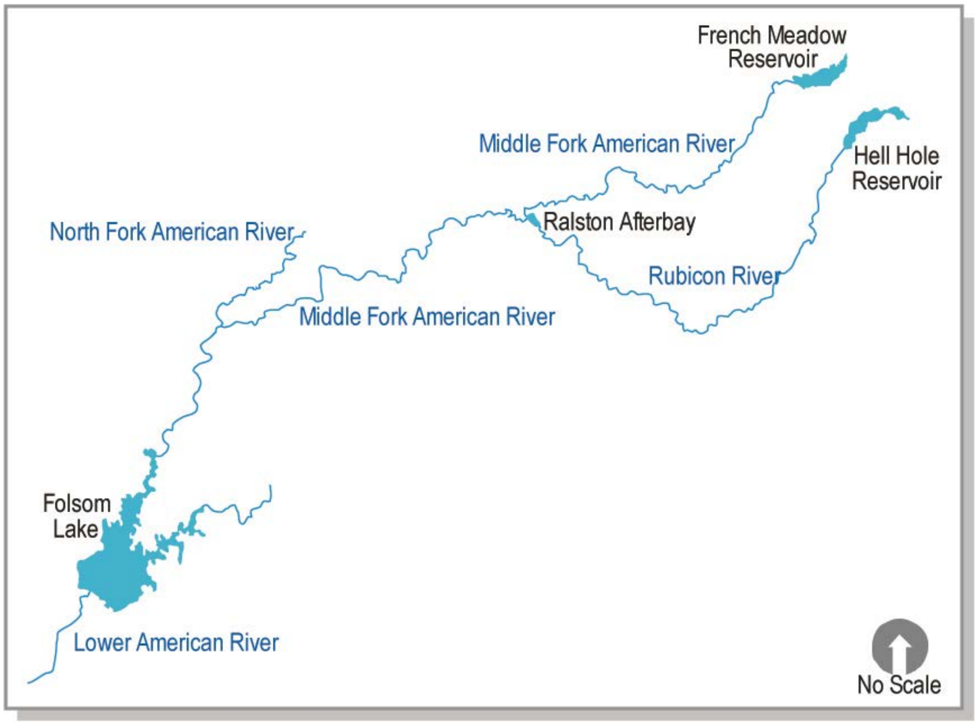

Figure 2-5. American River Facilities

Storage in Folsom Reservoir is not as restricted as Shasta Reservoir, but Reclamation generally cannot guarantee storage in Folsom Reservoir prior to the transfer season because operational complexities may require water releases.

The Sacramento Suburban WD would use groundwater to offset surface water supplies from the American River. The Sacramento Suburban WD receives surface water from the City of Sacramento or Placer County Water Agency out of Folsom Reservoir. When transferring water through groundwater substitution, the Sacramento Suburban WD would take less surface water, leaving the water in storage in Folsom Reservoir. This water may be able to be stored in Folsom Reservoir before being conveyed south-of-Delta, depending on year-to-year operational restrictions on the export pumps. Storing water in Folsom Reservoir would likely be possible because this water would not otherwise have been released to the river absent the transfer.

Placer County Water Agency would release stored surface water from Hell Hole and French Meadows Reservoirs. It would time release of water to coincide with the availability of Delta export capacity, generally starting in July. Placer County Water Agency's release schedule would be influenced by power generation, so it may wish to release water before July continuing through September to generate power and reregulate that water in Folsom Reservoir until the water can be conveyed through the Delta export pumps. Non-Project water in Folsom Reservoir for greater than 30 days requires a Warren Act

Contract[2] for storage. Placer County Water Agency would release water that would otherwise have remained in storage; therefore, this water would increase flows downstream along the Middle Fork of the American River to Folsom Reservoir, and downstream of Folsom Reservoir from July through September. The water releases would leave additional storage capacity in the reservoirs that would be refilled during the following wet seasons (at times that it would not affect downstream users, see Section 2.1.1.3 for more information). Refilling the empty storage would decrease flows downstream of the reservoirs; therefore, a refill agreement would be required as part of any transfer.

Yuba River

Browns Valley ID and Cordua ID are the potential sellers on the Yuba River. Browns Valley ID generates water for transfer through conservation efforts or stored reservoir release. Browns Valley ID water for transfer from conservation may be generated through the Upper Main Water Conservation Project. This project was initiated in 1990 to terminate use of the Upper Main Canal, a Gold Rush Era water conveyance facility that served facilities downstream of Collins Lake. The Canal experienced substantial losses during conveyance to vegetation along the Canal system. The conservation project replaced the Canal with a pipeline and reduced associated losses to vegetation, thereby creating water for transfers.

Browns Valley ID could also make water available by releasing water from Merle Collins Reservoir that otherwise would have remained in storage. Release of this water would increase flows downstream in Dry Creek and in the Yuba River downstream of the confluence with Dry Creek. Similar to stored reservoir release transfers from Placer County Water Agency, refilling the reservoir would decrease flows downstream of the reservoir; therefore, a refill agreement would be required for the transfer.

Cordua ID would transfer water made available through groundwater substitution actions. This transfer would increase flows on the Yuba River downstream of Cordua ID's point of diversion (absent the transfer) during the transfer period.

Feather River

Potential sellers on the Feather River include Butte WD (groundwater substitution and crop idling/shifting), Garden Highway MWC (groundwater substitution), Gilsizer Slough Ranch (groundwater substitution), Goose Club Farms and Teichert Aggregates (groundwater substitution and crop idling/shifting), South Sutter WD (stored reservoir release), and Tule Basin Farms (groundwater substitution).

[2] The Warren Act of February 21, 1911 authorized the United States to execute contracts for the conveyance and storage of non-project water in Federal facilities when excess capacity exists.

Butte WD is a member agency of the Joint Water Districts Board (Joint Board). The Joint Board has a settlement agreement with DWR and the water supply under that agreement is distributed among the four member agencies of the Joint Board. DWR approval would be required for a transfer from Butte WD. DWR makes releases from Lake Oroville to Thermalito Afterbay for diversion by Butte WD. Changes in diversion from Thermalito Afterbay would result in changes in DWR's releases to the Afterbay but would not change Feather River flows. An increase in flows in the Feather River would result when the transfer water was released by DWR to the Feather River. The timing of releases could change from the timing of diversions by Butte WD from Thermalito Afterbay absent the transfer.

Garden Highway MWC has a settlement agreement with DWR to divert water from the Feather River for irrigation use. A transfer from Garden Highway MWC must be approved by DWR. A reduction in diversions from Garden Highway MWC would result in higher flows in the Feather River downstream of the existing point of diversion.

Goose Club Farms and Teichert Aggregates divert water from the Feather River and Sacramento Slough for irrigation. For a transfer from either of these entities, surface water would not be diverted, which would result in higher flows in the Feather River downstream of the points of diversion during the transfer period.

Gilsizer Slough Ranch diverts water from the East Canal of the Sutter Bypass, Gilsizer Slough, and a drainage canal. Tule Basin Farms diverts water from the West Canal of the Sutter Bypass. Transfers from these entities would increase flows downstream of their points of diversion absent the transfer, which would increase flows in the Sutter Bypass canals and downstream in the Sacramento River.

DWR operates Lake Oroville on the Feather River, which is upstream from the diversion locations for these entities. At times, DWR has the ability to retain water in Lake Oroville that would have been released for diversion by Butte WD and Garden Highway MWC during April through June until the Delta export pumps have capacity to convey the water. Any transfer agreement with DWR for Butte WD or Garden Highway MWC would need to include approval to store water in Lake Oroville before DWR could provide storage for the transfer. DWR cannot approve storage in Lake Oroville if it would affect SWP operations. The transfer water would be the first water to be spilled if Lake Oroville reaches flood capacity. River flows would increase downstream of the sellers' points of diversion (absent the transfer) when the stored transfer water is released.

South Sutter WD could provide water through stored reservoir release. Stored reservoir releases would be from Camp Far West Reservoir (see Figure 2-6). During the transfer period, Camp Far West Reservoir would be slightly lower than conditions without the transfer until the reservoir is refilled. River flows downstream of the reservoir on the Bear River, Feather River, and Sacramento River would increase during the release period. Camp Far West Reservoir would refill as water was available in the Bear River and when the Delta is in excess conditions, which would decrease flows downstream from the reservoir relative to non-transfer conditions. A refill agreement would be required for this transfer to avoid affects to downstream water users.

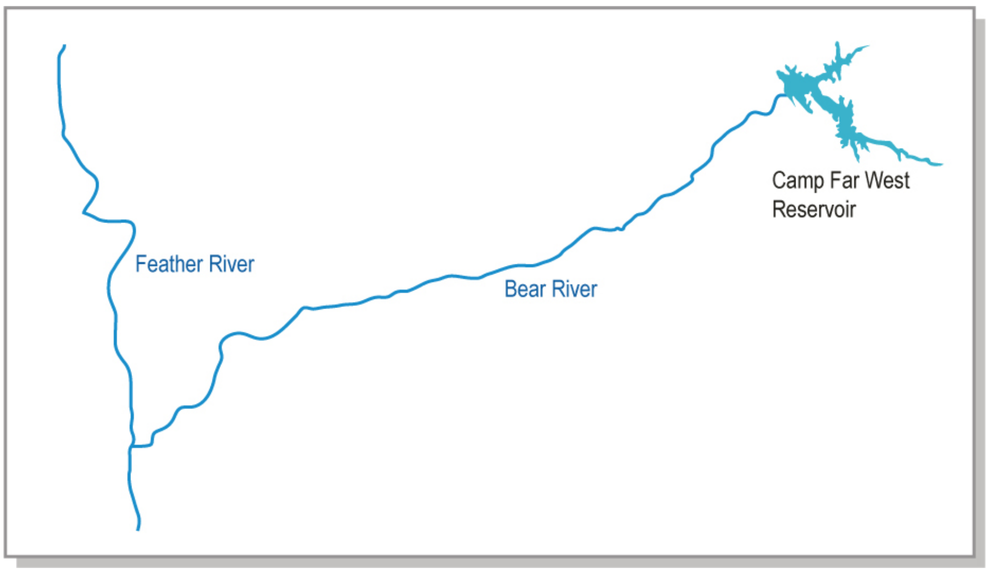

Figure 2-6. Bear River Facilities

Merced River

Merced ID could provide water through stored reservoir release. Stored reservoir releases would be from Lake McClure (see Figure 2-7). During the transfer period, water elevations in Lake McClure would be slightly lower than conditions without the transfer until the reservoir is refilled. Lake McClure would refill as water was available in the Merced River and when the Delta is in excess conditions, which would decrease flows downstream from the reservoir relative to non-transfer conditions.

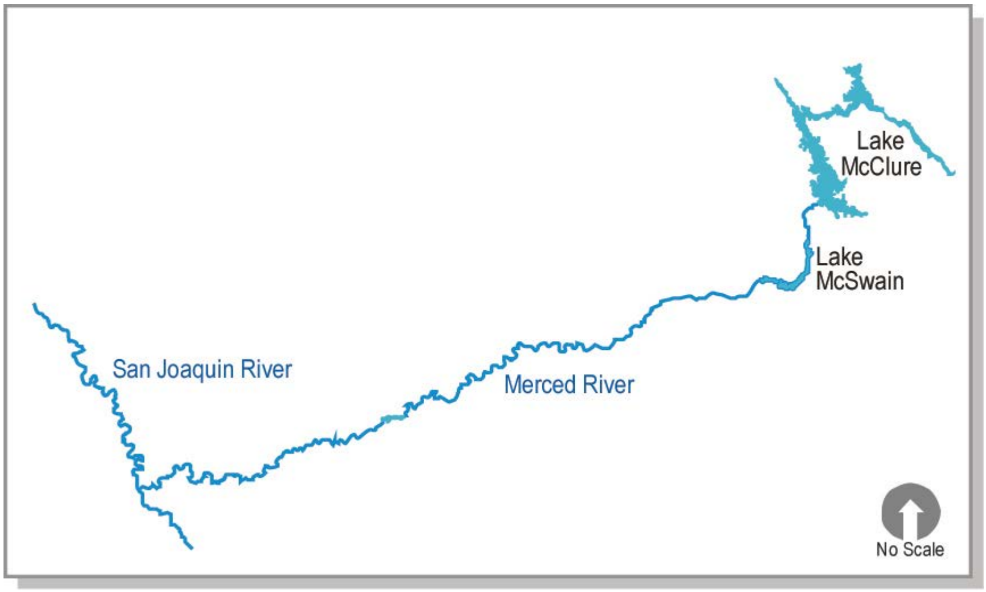

Figure 2-7. Merced River Facilities

Merced ID's transferred water could be conveyed to the Buyers Service Area in several ways:

- Water could flow down the Merced River, through the San Joaquin River, and be diverted through the Jones or Banks Pumping Plants in the Delta.
- Water could flow down the Merced River into the San Joaquin River and be diverted through existing facilities within Banta Carbona ID, West Stanislaus ID, or Patterson ID (see Figure 2-8). These agencies would either convey the water through their districts to the Delta-Mendota Canal, or they would use the water diverted from the San Joaquin River in exchange for their CVP water from the Delta-Mendota Canal.
- Water would enter the Merced River and be diverted into the Eastside Canal before reaching the San Joaquin River confluence. Water could be delivered for exchange to San Luis Canal Company, which would reduce its use of water from the Delta-Mendota Canal.
- Water would be diverted from Lake McClure for delivery through Merced ID's internal conveyance facilities to one of the refuges in the San Luis unit for exchange. The refuge would reduce its use of water from the Delta-Mendota Canal. This delivery mechanism would not change flows in any surface water body and could therefore be used year-round.

The timing of these transfers would depend on the limitations at the diversion point. Transfers through Jones and Banks Pumping Plants would be during periods acceptable to NOAA Fisheries and USFWS, typically from July through September, but the remaining delivery methods could be used throughout the irrigation season (April through September). A stored reservoir release transfer from Merced ID would require a refill agreement to clarify how the reservoir would be refilled after the transfer. Additionally, buyers would require a Warren Act Contract with Reclamation to provide for conveyance of non-CVP water through CVP facilities.

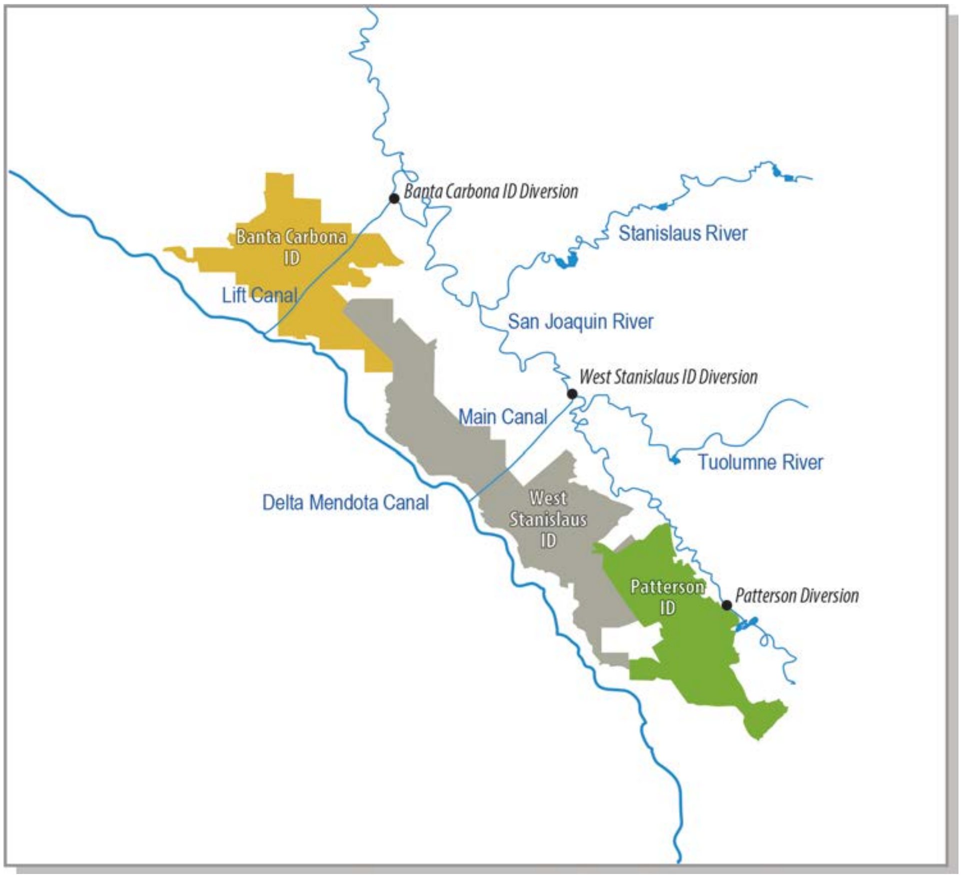

Figure 2-8. Diversion Facilities for Banta Carbona ID, West Stanislaus ID, and Patterson ID

Delta Region

The Sacramento and San Joaquin rivers join at the Sacramento-San Joaquin Delta. Pope Ranch could transfer water through groundwater substitution, and Reclamation District 2068 could transfer water through groundwater substitution and crop idling/shifting.

Transfers from potential sellers in the Delta have several challenges, including:

- Variability in ETAW values make calculating water savings from crop idling/shifting difficult;
- High groundwater table results in high evapotranspiration rates and excessive weed growth in idle fields;
- Hydraulic connectivity must be maintained at all times during the transfer period;
- The locations used in determining compliance with the Delta outflow-based objectives in D-1641 are upstream from the majority of the Delta diversions;
- Water made available outside the transfer window cannot be exported or stored in Delta; and,
- The status of many underlying water rights can be difficult to verify.

These challenges make it difficult to determine consumptive use and export transfer water. More extensive monitoring may be required throughout the transfer season compared to transfers from other locations to account for potential weed growth and evaporation from bare fields, which affects the amount of transfer water made available. Additionally, transfer proponents must obtain concurrence from the SWRCB that the estimated reduction in consumptive use can be accounted for separately in meeting flow related compliance objectives.

Buyers Service Area

Multiple buyers could purchase water made available for transfer; this EIS/EIR addresses transfers to the San Luis & Delta-Mendota Water Authority (SLDMWA), Contra Costa WD, and East Bay MUD. These entities receive water diverted in the Delta or its tributaries. The points of diversion in the Delta are shown on Figure 2-9. Diversions could also be made along the San Joaquin River (as shown in Figure 2-8), from the Merced River, or from Lake McClure.

SLDMWA

As discussed in Section 1, SLDMWA consists of ~~29~~ 28 member agencies representing water service contractors and San Joaquin River Exchange Contractors. The SLDMWA operates some CVP facilities and represents its member agencies' interests related to water supply issues. The SLDMWA does not directly supply water, but it would participate in negotiations to assist its participating members to secure transfers when needed and would assist with scheduling and managing the transferred water. Transfers to agencies within the SLDMWA would be pumped through the Jones or Banks pumping plants, or would be delivered through local facilities as described above. This water would then be conveyed through SWP or CVP canals and aqueducts and local irrigation canals to the purchasing agencies.

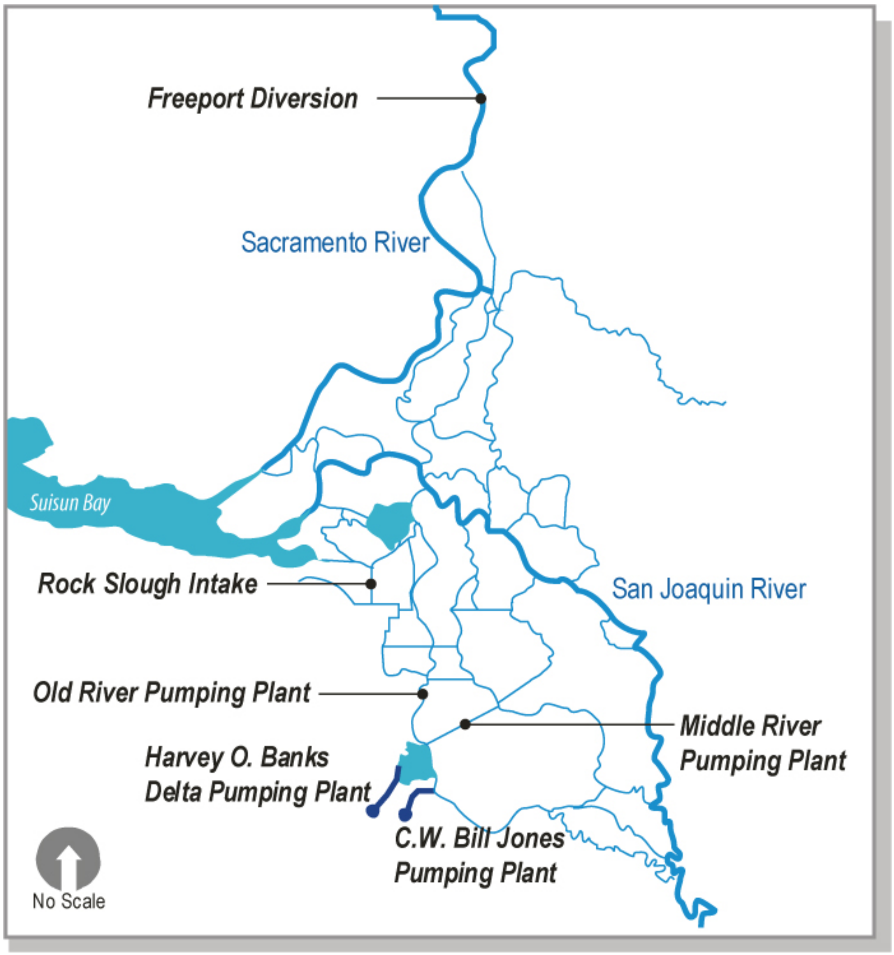

Figure 2-9. Delta Transfer Diversion Locations

Contra Costa WD

Contra Costa WD is an in-Delta water user and diverts both CVP water and water under its own water rights from Delta drinking water intakes located at Rock Slough, Old River near Highway 4, Middle River at Victoria Canal, and Mallard Slough. Contra Costa WD is interested in purchasing transfer water to augment dry year supplies.

East Bay MUD

Water transfers to the East Bay MUD would be diverted at the Freeport Regional Water Authority's intake on the Sacramento River near Freeport, at the northern end of the Delta. These transfers would not pass through the Delta and therefore would not be subject to constraints on through Delta pumping. Once diverted from the Sacramento River, water transferred to East Bay MUD would travel eastward through 16 miles of underground pipeline to the Folsom

South Canal. After flowing 14 miles to the southern end of the canal, the water would be pumped via 18 miles of pipeline to East Bay MUD's Mokelumne Aqueducts, which cross the Delta and deliver the water to East Bay MUD's service district in the East Bay.

2.3.2.4 Environmental Commitments

Several environmental commitments are included in the Proposed Action to avoid potential environmental impacts from water transfers.

Groundwater Substitution Transfers

- In groundwater basins where sellers are in the same groundwater subbasin as protected aquatic habitats, such as giant garter snake preserves and conservation banks, groundwater substitution will be allowed as part of the long term water transfers if the seller can demonstrate that any impacts to water resources needed for special-status species protection have been addressed. In these areas, sellers will be required to address these impacts as part of their mitigation plan.

All Transfer Methods

- Carriage water (a portion of the transfer that is not diverted in the Delta and becomes Delta outflow) will be used to maintain water quality in the Delta. Carriage water calculations will also reflect conveyance losses as the water moves from its source to the Delta export pumps, and is conveyed from the Delta to buyers. Carriage water is represented as a percent of the transfer that does not reach the buyer, and this percent is calculated during the transfer based on real-time monitoring information in the Delta. Typical carriage water amounts range from 20 to 30 percent for transfers from the Sacramento Valley, and about 10 percent for transfers from the San Joaquin Valley.

Cropland Idling Transfers

- As part of the approval process for long-term water transfers, Reclamation will have access to the land to verify how the water transfer is being made available and to verify that actions to protect the giant garter snake are being implemented. At the end of each water transfer year, Reclamation will prepare a monitoring report that contains the following:

  - Maps of all cropland idling actions that occurred within the range of potential transfer activities analyzed in this EIS/EIR,
  - Results of any newly available scientific research and monitoring results pertinent to water transfer actions, and
  - A discussion of conservation measure effectiveness.

The report will be submitted to USFWS and shared with California Department of Fish and Wildlife (CDFW) in February, prior to the next year of potential transfers. Reclamation will coordinate with USFWS and CDFW on the contents and findings of the annual report prior to additional transfers.

- Reclamation will establish annual meetings with the USFWS to discuss the contents and findings of the annual report. These meetings will be scheduled following the distribution of the monitoring report and prior to the next transfer season.
- Reclamation will provide a map(s) to the USFWS in June of each year showing the parcels of riceland that are ~~idled~~ proposed for the purpose of transferring water for that year. These maps will be prepared to comport to Reclamation's geographic information system (GIS) standards.
- Movement corridors for aquatic species (including pond turtle and giant garter snake) include major irrigation and drainage canals. The water seller will keep adequate water in major irrigation and drainage canals. Canal water depths should be similar to years when transfers do not occur or, where information on existing water depths is limited, at least two feet of water will be considered sufficient.
- Districts proposing water transfers made available from idled rice fields will ensure that adequate water is available for priority habitat with a high likelihood of giant garter snake occurrence. The determination of priority habitat will be made through coordination with giant garter snake experts, GIS analysis of proximity to historic tule marsh, and GIS analysis of suitable habitat. The priority habitat areas are indicated on the priority habitat maps for participating water agencies and will be maintained by Reclamation. As new information becomes available, these maps will be updated in coordination with USFWS and CDFW. In addition to mapped priority habitat, fields abutting or immediately adjacent to federal wildlife refuges will be considered priority habitat.
- Maintaining water in smaller drains and conveyance infrastructure supports key habitat attributes such as emergent vegetation for giant garter snake for escape cover and foraging habitat. If crop idling/shifting occurs in priority habitat areas, Reclamation will work with contractors to document that adequate water remains in drains and canals in those priority areas. Documentation may include flow records, photo documentation, or other means of documentation agreed to by Reclamation and USFWS.

- Mapped priority habitat known to be occupied by giant garter snake and priority habitats with a high likelihood for giant garter snake occurrence (60 percent or greater probability) Areas with known priority giant garter snake populations will not be permitted to participate in cropland idling/shifting transfers. Water sellers can request a case-by-case evaluation of whether a specific field would be precluded from participating in long-term water transfers. These areas include lands adjacent to naturalized lands and refuges and corridors between these areas, such as:

  - Fields abutting or immediately adjacent to Little Butte Creek between Llano Seco and Upper Butte Basin Wildlife Area, Butte Creek between Upper Butte Basin and Gray Lodge Wildlife areas, Colusa Basin drainage canal between Delevan and Colusa National Wildlife Refuges, Gilsizer Slough, Colusa Drainage Canal, the land side of the Toe Drain along the Sutter Bypass, Willow Slough and Willow Slough Bypass in Yolo County, Hunters and Logan Creeks between Sacramento and Delevan National Wildlife Refuges; and

  - Lands in the Natomas Basin.

- Sellers will continue to voluntarily perform giant garter snake best management practices, including educating maintenance personnel to recognize and avoid contact with giant garter snake, dredgingcleaning only one side of a conveyance channel per year, and implementing other measures to enhance habitat for giant garter snake. Implementation of best management practices will be documented by the sellers and verified by Reclamation and will be included in the annual monitoring report.

- In order to limit reduction in the amount of over-winter forage for migratory birds, including greater sandhill crane, cropland idling transfers will be minimized near known wintering areas that support high concentrations of waterfowl and shorebirds, such as wildlife refuges and established wildlife areas. in the Butte Sink.

2.3.2.5 Transfer Quantities

Table 2-4 provides a list of entities that could potentially sell water for transfers in the future. The table also includes maximum quantities that each agency could make available through different transfer mechanisms. Adding these maximum quantities produces a total of a little over 500,000 AF, but multiple other factors may limit the transfers to a number that is likely less than this total. Transfers to East Bay MUD and Contra Costa WD are limited by available pumping capacity at the Freeport intake and Contra Costa WD's Delta intakes, respectively, as well as other system constraints such as service area demand and available storage. Transfers to south-of-Delta water districts, which account for the majority of proposed transfers, are typically pumped through the

CVP and SWP south Delta export facilities. The capacity to pump the water at Banks and Jones Pumping Plants would limit the overall volume of transfers to south-of-Delta water districts. Factors that affect capacity available for transfers to south-of-Delta water districts include:

- Water availability: many potential sellers are listed for both cropland idling and groundwater substitution; however, they would not transfer the full amount under both mechanisms or the same amount in all years. The decision to transfer water is often a complex business decision made by individual landowners in a district. Each landowner weighs the economic value of irrigating land with surface water, selling the surface water and idling a field, or selling the surface water and irrigating with pumped groundwater. The economic value of any of these decisions is highly variable and depends on unpredictable trends in agricultural and water markets.

- Biological opinions: the biological opinions on the long-term operations of the CVP and SWP ~~restrict~~ may reduce exports from December through June and potentially in some fall seasons for the protection of special-status species. Historically, the CVP and SWP pumped significant amounts of water during these months for Project purposes because flows are usually high. Project water pumped during this period is typically stored in San Luis Reservoir or DWR's southern California reservoirs for use during the following summer. With current Delta pumping restrictions, the CVP and SWP pump more water during the late summer period for Project purposes than they did historically, which is the same period when the biological opinions allow transfer water to be pumped (typically July through September). The increased CVP and SWP pumping leaves less remaining pumping capacity for transfer water.

- September: During certain years, much of the capacity to pump transfer water from the Delta is available in September. In some years, the Delta pumps have no capacity available until September. September capacity would be more challenging to use because increasing streamflows in the Sacramento, Feather, American, and San Joaquin rivers downstream of Project reservoirs during September could create a requirement for higher flows in October so that fish do not experience a dramatic flow change. Higher flows in October would correspond to higher reservoir releases at a time when the Delta pumping would be restricted. Reclamation and DWR may not be able to capture the additional releases at the Delta pumps.

- SWRCB's Water Rights Decision 1641: The decision requires Response Plans for water quality and water levels to protect diverters in the south Delta that may affect the opportunity to export transfers.

- Outages: Any planned or unplanned outages could reduce available capacity for transfers.

- Competition: Most of the pumping capacity available would be at the Banks Pumping Plant except for very dry years. Banks is an SWP facility, so SWP-related transfers would have priority. Agreements with DWR would be required for any transfers using SWP facilities.

Figure 2-10 shows an exceedance plot of the available export pumping capacity in the Projects' south Delta pumping facilities during periods when buyers may want to transfer water (when SWP allocations are less than 60 percent). An exceedance plot shows how often capacities are exceeded. For example, the July and August capacity curve shows that the capacity is above zero only about 35 percent of the time. In other words, the pumps have no capacity for transfer water in 65 percent of years studied. The figure includes July and August capacity separately from the capacity of all three months (July through September) because September pumping capacity may be more difficult to use and including that capacity makes the available capacity look much larger. This figure is from the CalSim modeling of the future conditions without transfers. Figure 2-10 shows that available capacity will limit the amount of transfers in most years to less than the quantities shown in Table 2-4.

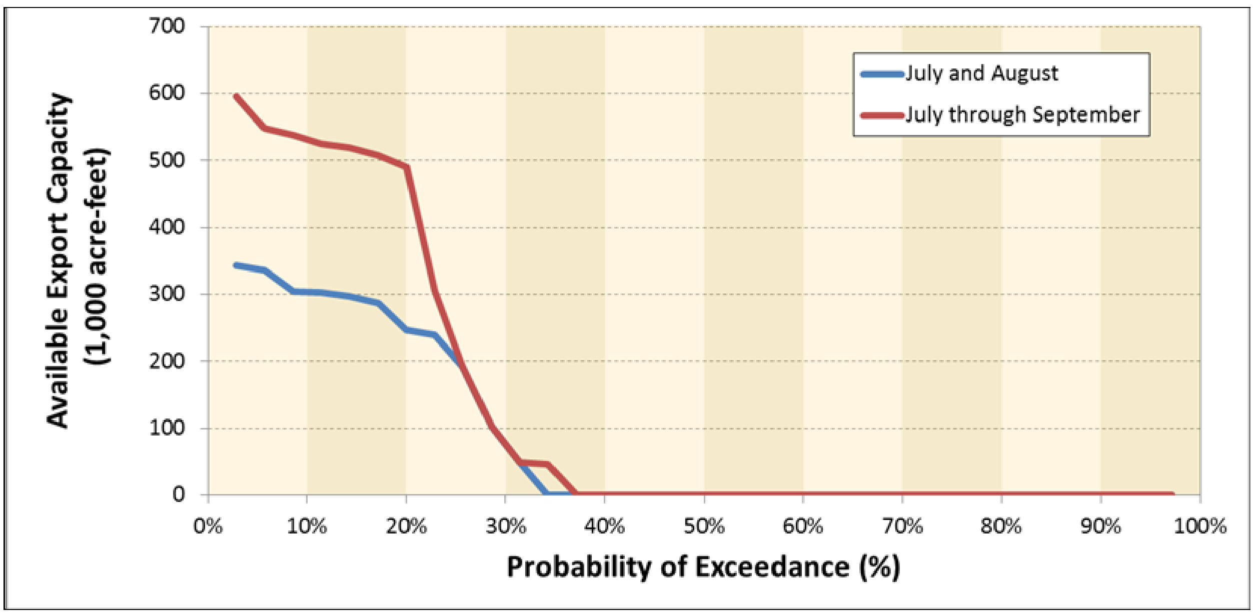

Figure 2-10. Available Delta Pumping Capacity for Transfers

2.3.2.6 Risk and Uncertainty

Transferring water from north of the Delta to south of the Delta would involve uncertainty and risk. The CVP and SWP would convey this water using the Jones and Banks Pumping Plants, but the CVP and SWP must first meet regulatory requirements and the needs of their users. CVP and SWP operations are governed by the criteria contained in SWRCB Decision 1641 (D-1641), the 2008 USFWS and 2009 NOAA Fisheries biological opinions, and all other regulatory restrictions governing operations.

Buyers and sellers often negotiate transfers during the wet season before hydrologic conditions are clear. Late season precipitation could increase the amount of available water for the CVP and SWP and reduce or eliminate available capacity for transfers. The CVP and SWP may not know the capacity in advance and would not guarantee available capacity; any uncertainty regarding capacity would rest with the buyers and sellers.

Transfers, particularly cropland idling, could be heavily affected by this uncertainty. Growers would need to idle crops at the beginning of the growing season, which typically occurs in April or May. The possibility exists that buyers and sellers would negotiate a crop idling transfer at the beginning of April, the seller would leave fields idle, and late-season rains could reduce excess capacity at the Delta pumps and prevent this water from being exported. This risk would typically fall on the buyers after the water purchase agreements are negotiated.

2.3.2.7 Transfer Length

Buyers and sellers may negotiate transfers that last one year or multiple years. Sellers and buyers would typically negotiate the terms of a single year transfer during the wet season and could finalize an agreement after the hydrologic conditions are understood well enough to establish available pumping capacity.

Sellers and buyers could also negotiate multi-year transfers. In this type of transfer, a long-term agreement would generally give the buyer the first right of refusal for water that a seller makes available. The buyer could pay the seller a fee every year to reserve the water, whether the buyer purchases it or not in any one year. In years where adequate capacity exists to convey water through the Delta, the buyer would have priority to buy the water at an established price. If the buyer does not want the water in a year when capacity is available, the seller could potentially negotiate a one-year transfer with another buyer.

2.3.2.8 CEQA Coverage Under Alternative 2

All transfers in this document are analyzed under NEPA, but not all transfers are included in the CEQA Proposed Project. Several transfers already have CEQA coverage, are obtaining CEQA coverage through a parallel effort or CEQA coverage will be prepared at the time a specific transfer is planned. These transfers include transfers from Browns Valley ID, transfers to East Bay MUD, and transfers to Contra Costa WD.

The Browns Valley ID, East Bay MUD, and Contra Costa WD transfers are not part of the Proposed Project (CEQA) but are part of the Proposed Action (NEPA). As a result, the effects of the Proposed Project are considered in context with these transfers, but these transfers are part of the Proposed Action and their effects are included in the analysis.

2.3.3 Alternative 3: No Cropland Modifications

Alternative 3 would include transfers through groundwater substitution, stored reservoir release, and conservation. It would not include any cropland idling or crop shifting transfers. Table 2-7 shows the potential sellers under Alternative 3. Buyers would be the same as those shown in Table 2-6, and transfers not included in the Proposed Project for CEQA would be the same as those described for Alternative 2. Environmental commitments would be the same as those described in Section 2.3.2.4 for the relevant transfer types.

2.3.4 Alternative 4: No Groundwater Substitution

Alternative 4 would include transfers through cropland idling, crop shifting, stored reservoir release, and conservation. It would not include any groundwater substitution transfers. Table 2-8 shows the potential sellers under Alternative 4. Buyers would be the same as those shown in Table 2-6, and transfers not included in the Proposed Project for CEQA would be the same as those described for Alternative 2. Environmental commitments would be the same as those described in Section 2.3.2.4 for the relevant transfer types.

Table 2-7. Alternative 3 Transfers Types (Upper Limits)

Water Agency	April – June			July - September		
	Groundwater Substitution (acre-feet)	Stored Reservoir Release (acre-feet)	Conservation (acre-feet)	Groundwater Substitution (acre-feet)	Stored Reservoir Release (acre-feet)	Conservation (acre-feet)
Sacramento River Area of Analysis						
Anderson-Cottonwood Irrigation District	2,613			2,613		
Conaway Preservation Group	21,550			13,450		
Cranmore Farms	5,140			2,860		
Eastside Mutual Water Company	1,067			1,163		
Glenn-Colusa Irrigation District	12,500			12,500		
Natomas Central Mutual Water Company	15,000			15,000		
Pelger Mutual Water Company	2,151			1,599		
Pleasant Grove-Verona Mutual Water Company	8,000			10,000		
Reclamation District 108	7,500			7,500		
Reclamation District 1004				7,175		
River Garden Farms	4,000			5,000		
Sycamore Mutual Water Company	7,500			7,500		
Te Velde Revocable Family Trust	2,700			4,394		
American River Area of Analysis						
City of Sacramento				5,000		
Placer County Water Agency					47,000	
Sacramento County Water Agency				15,000		
Sacramento Suburban Water District	15,000			15,000		
Yuba River Area of Analysis						
Browns Valley Irrigation District					5,000	3,100
Cordua Irrigation District				12,000		
Feather River Area of Analysis						
Butte Water District	2,750			2,750		
Garden Highway Mutual Water Company	6,500			7,500		
Gilsizer Slough Ranch	1,500			2,400		

Water Agency	April – June			July - September		
	Groundwater Substitution (acre-feet)	Stored Reservoir Release (acre-feet)	Conservation (acre-feet)	Groundwater Substitution (acre-feet)	Stored Reservoir Release (acre-feet)	Conservation (acre-feet)
Goose Club Farms and Teichert Aggregates	4,000			6,000		
South Sutter Water District					15,000	
Tule Basin Farms	3,800			3,520		
Merced River Area of Analysis						
Merced Irrigation District					30,000	
Delta Region Area of Analysis						
Reclamation District 2068	2,250			2,250		
Pope Ranch	1,400			1,400		
Total	126,921	0	0	163,574	97,000	3,100

Table 2-8. Alternative 4 Transfers Types (Upper Limits)

Water Agency	April – June			July - September		
	Cropland Idling/Crop Shifting (acre-feet)	Stored Reservoir Release (acre-feet)	Conservation (acre-feet)	Cropland Idling/Crop Shifting (acre-feet)	Stored Reservoir Release (acre-feet)	Conservation (acre-feet)
Sacramento River Area of Analysis						
Anderson-Cottonwood Irrigation District						
Conaway Preservation Group	7,899			13,450		
Cranmore Farms	925			1,575		
Eastside Mutual Water Company						
Glenn-Colusa Irrigation District	24,420			41,580		
Natomas Central Mutual Water Company						
Pelger Mutual Water Company	939			1,599		
Pleasant Grove-Verona Mutual Water Company	3,330			5,670		
Reclamation District 108	7,400			12,600		
Reclamation District 1004	3,700			6,300		
River Garden Farms						
Sycamore Mutual Water Company	3,700			6,300		
Te Velde Revocable Family Trust	2,581			4,394		
American River Area of Analysis						
City of Sacramento						
Placer County Water Agency					47,000	
Sacramento County Water Agency						
Sacramento Suburban Water District						
Yuba River Area of Analysis						
Browns Valley Irrigation District					5,000	3,100
Cordua Irrigation District						
Feather River Area of Analysis						
Butte Water District	5,750			5,750		
Garden Highway Mutual Water Company						
Gilsizer Slough Ranch						
Goose Club Farms and Teichert Aggregates	3,700			6,300		

Water Agency	April – June			July - September		
	Cropland Idling/Crop Shifting (acre-feet)	Stored Reservoir Release (acre-feet)	Conservation (acre-feet)	Cropland Idling/Crop Shifting (acre-feet)	Stored Reservoir Release (acre-feet)	Conservation (acre-feet)
South Sutter Water District					15,000	
Tule Basin Farms						
Merced River Area of Analysis						
Merced Irrigation District					30,000	
Delta Region Area of Analysis						
Reclamation District 2068	2,775			4,725		
Pope Ranch						
Total	67,119	0	0	110,243	97,000	3,100

2.4 Summary Comparison of Alternative Impacts

Tables 2-9 and 2-10 summarize the potential environmental impacts associated with each action alternative. The No Action/No Project Alternative considers the potential for changed conditions during the 2015-2024 period when transfers could occur, but because this period is relatively short, the analysis did not identify changes from existing conditions. Alternative 1 is therefore not included in the tables.

2.5 Environmentally Superior Alternative

As shown in Tables 2-9 and 2-10, the Proposed Action would not have any significant, unavoidable adverse impacts. Similarly, none of the alternatives have unavoidable significant impacts, although some of the alternatives could have less of an impact on some resources, as follows:

- Alternative 3, No Cropland Modifications, would reduce the environmental effects associated with cropland idling. Alternative 3 would not have the potential to affect ~~terrestrial resources~~vegetation and wildlife, particularly the giant garter snake, by idling rice fields and reducing habitat. It would also reduce effects to agricultural land use and economic effects to non-transferring parties.

- Alternative 4, No Groundwater Substitution, would reduce the environmental effects associated with groundwater substitution transfers. Alternative 4 would reduce effects to groundwater levels, quality, and land subsidence. It would also reduce effects associated with streamflow depletion, including potential effects to ~~aquatic resources~~fisheries, ~~terrestrial resources~~vegetation and wildlife, and water supply.

While the alternatives would affect different resources in different ways, none of the alternatives are considered to be the environmentally superior alternative. There are no unavoidable significant impacts associated with the Proposed Action that would otherwise be avoided or substantially reduced by an alternative, and each of the alternatives has its own unique set of environmental impacts which, on balance, would be a “trade-off” of environmental impacts in selecting any one alternative over another.

Table 2-9. Potential Impacts Summary

Potential Impact	Alternative	Significance to CEQA	Proposed Mitigation	Significance After Mitigation Pursuant to CEQA
3.1 Water Supply				
Groundwater substitution transfers could decrease flows in surface water bodies following a transfer while groundwater basins recharge, which could decrease pumping at Jones and Banks Pumping Plants and/or require additional water releases from upstream CVP reservoirs.	2, 3	S	WS-1: Streamflow Depletion Factor	LTS
Water supplies on the rivers downstream of reservoirs could decrease following stored reservoir water transfers, but would be limited by the refill agreements	2, 3, 4	LTS	None	LTS
Changes in Delta diversions could affect Delta water levels ~~and cause local users' diversion pumps to be above the water surface.~~	2, 3, 4	LTS	None	LTS
Transfers would increase water supplies in the Buyers Service Area	2, 3, 4	B	None	B
3.2 Water Quality				
Cropland idling transfers could result in increased deposition of sediment on water bodies.	2, 4	LTS	None	LTS
Cropland idling/shifting transfers could change the water quality constituents associated with leaching and runoff.	2, 4	LTS	None	LTS
Cropland idling/shifting transfers could change the quantity of organic carbon in waterways.	2, 4	LTS	None	LTS
Groundwater substitution transfers could introduce contaminants that could enter surface waters from irrigation return flows.	2, 3	LTS	None	LTS

Potential Impact	Alternative	Significance to CEQA	Proposed Mitigation	Significance After Mitigation Pursuant to CEQA
Water transfers could change reservoir storage in CVP and SWP reservoirs and could result in water quality impacts.	2, 3, 4	LTS	None	LTS
Water transfers could change reservoir storage non-Project reservoirs participating in reservoir release transfers, which could result in water quality impacts.	2, 3, 4	LTS	None	LTS
Water transfers could change river flow rates in the Seller Service Area and could affect water quality.	2, 3, 4	LTS	None	LTS
Water transfers could change Delta inflows and could result in water quality impacts.	2, 3, 4	LTS	None	LTS
Water transfers could change Delta outflows and could result in water quality impacts.	2, 3, 4	LTS	None	LTS
Water transfers could change Delta salinity and could result in water quality impacts.	2, 3, 4	LTS	None	LTS
Diversion of transfer water at Banta Carbona ID, West Stanislaus ID, and Patterson ID could affect water quality in the Delta-Mendota Canal.	2, 3, 4	LTS	None	LTS
Use of transfer water in the Buyer Service Area could result in increased irrigation on drainage impaired lands in the Buyer Service Area which could affect water quality.	2, 3, 4	LTS	None	LTS
Water transfers could change reservoir storage in San Luis Reservoir and could result in water quality impacts.	2, 3, 4	LTS	None	LTS
3.3 Groundwater Resources				
Groundwater substitution transfers could cause a reduction in groundwater levels in the Seller Service Area.	2, 3	S	GW-1: Mitigation and Monitoring Plans	LTS

Potential Impact	Alternative	Significance to CEQA	Proposed Mitigation	Significance After Mitigation Pursuant to CEQA
Groundwater substitution transfers could cause subsidence in the Seller Service Area.	2, 3	S	GW-1: Mitigation and Monitoring Plans	LTS
Groundwater substitution transfers could cause changes to groundwater quality in the Seller Service Area.	2, 3	LTS	None	LTS
Cropland idling transfers could cause reduction in groundwater levels in the Seller Service Area due to decreased applied water recharge.	2, 4	LTS	None	LTS
Water transfers via cropland idling could cause groundwater level declines in the Seller Service Area that lead to permanent land subsidence or changes in groundwater quality.	2,4	LTS	None	LTS
Water transfers could reduce groundwater pumping during shortages in the Buyer Service Area, which could increase groundwater levels, decrease subsidence, and improve groundwater quality.	2, 3, 4	B	None	B
3.4 Geology and Soils				
Cropland idling transfers in the Seller Service Area that temporarily convert cropland to bare fields could increase soil erosion.	2, 4	LTS	None	LTS
Cropland idling water transfers could cause expansive soils in the Seller Service Area to shrink due to the reduction in applied irrigation water.	2, 4	LTS	None	LTS
Use of transfer water on agricultural fields in the Buyer Service Area could increase soil erosion.	2, 3, 4	LTS	None	LTS
Use of transfer water on agricultural fields in the Buyer Service Area could increase soil movement.	2, 3, 4	LTS	None	LTS

Potential Impact	Alternative	Significance to CEQA	Proposed Mitigation	Significance After Mitigation Pursuant to CEQA
Changes in streamflows in the Sacramento and San Joaquin Rivers and their tributaries as a result of water transfers could result in increased soil erosion.	2, 3, 4	LTS	None	LTS
3.5 Air Quality				
Increased groundwater pumping for groundwater substitution transfers would increase emissions of air pollutants in the Sellers Service Area.	2, 3	S	AQ-1: Reducing pumping to reduce emissions, AQ-2: Operate electric engines	LTS
Water transfers via cropland idling could reduce vehicle exhaust emissions from reduced operations in the Sellers Service Area.	2, 4	B	None	B
Water transfers via cropland idling would increase fugitive dust emissions from wind erosion of bare fields and decrease fugitive dust emissions associated with land preparation and harvesting in the Sellers Service Area.	2, 4	B	None	B
Use of water from transfers on agricultural fields in the Buyer Service Area could reduce windblown dust.	2, 3, 4	B	None	B
Water transfers via groundwater substitution and cropland idling could exceed the general conformity de minimis thresholds.	2, 3, 4	LTS	None	LTS
3.6 Climate Change				
Increased groundwater pumping for groundwater substitution transfers could increase emissions of greenhouse gases.	2, 3	LTS	None	LTS
Water transfers via cropland idling could reduce vehicle exhaust emissions from reduced operations in the study area.	2, 4	LTS	None	LTS
Changes to the environment from climate change could affect the action alternatives.	2, 3, 4	LTS	None	LTS

Potential Impact	Alternative	Significance to CEQA	Proposed Mitigation	Significance After Mitigation Pursuant to CEQA
Use of water from transfers on agricultural fields in the Buyer Service Area could affect emissions.	2, 3, 4	LTS	None	LTS
3.7 ~~Aquatic Resources~~Fisheries				
Transfer actions could affect reservoir storage and reservoir surface area in reservoirs supporting fisheries resources	2, 3, 4	LTS	None	LTS
Groundwater substitution could reduce stream flows supporting fisheries resources in small streams	2, 3	LTS	None	LTS
Transfer actions could ~~decrease~~ alter flows of rivers and creeks supporting fisheries resources in the Sacramento and San Joaquin river watersheds	2, 3, 4	LTS	None	LTS
Transfer actions could alter hydrologic conditions in the Delta, altering associated habitat availability and suitability	2, 3, 4	LTS	None	LTS
Transfer actions could affect the habitat of special-status species associated with mainstem rivers, tributaries, and the Delta.	2, 3, 4	not applicable	LTS	LTS
3.8 Vegetation and Wildlife				
Groundwater substitution could reduce groundwater levels supporting natural communities	2, 3	LTS	None	LTS
Groundwater substitution could reduce stream flows supporting natural communities in small streams	2, 3	S	GW-1	LTS
Cropland Idling/Shifting could alter habitat availability and suitability for upland species	2, 4	LTS	None	LTS
Transfer actions could impact reservoir storage and reservoir surface area and alter habitat availability and suitability associated with those reservoirs	2, 3, 4	LTS	None	LTS

Potential Impact	Alternative	Significance to CEQA	Proposed Mitigation	Significance After Mitigation Pursuant to CEQA
Transfers could reduce flows in large rivers in the Sacramento and San Joaquin River watersheds, altering habitat availability and suitability associated with these rivers	2, 3, 4	LTS	None	LTS
Transfer actions could alter hydrologic conditions in the Delta, altering associated habitat availability and suitability	2, 3, 4	LTS	None	LTS
Transfer actions could impact San Luis Reservoir storage and surface area.	2, 3, 4	LTS	None	LTS
Cropland idling/shifting under could alter the amount of suitable habitat for natural communities ~~and~~ , special-status wildlife species, and migratory birds associated with seasonally flooded agriculture and associated irrigation waterways	2, 4	LTS	None	LTS
Transfer actions could alter planting patterns and urban water use in the Buyer Service Area	2, 3, 4	LTS	Non	LTS
Transfers could affect wetlands that provide habitat for special status plant species.	2, 3, 4	LTS	None	LTS
Transfers could affect giant garter snake and Pacific pond turtle by reducing aquatic habitat.	2, 3, 4	LTS	None	LTS
Transfers could affect the San Joaquin kit fox by reducing available habitat.	2, 3, 4	LTS	None	LTS
Transfers could impact special status bird species and migratory birds.	2, 3, 4	LTS	None	LTS
3.9 Agricultural Land Use				
Cropland idling water transfers could ~~permanently or substantially~~ decrease the amount of lands categorized as Prime Farmland, Farmland of Statewide Importance, or Unique Farmland under the FMMP.	2	LTS	None	LTS

Potential Impact	Alternative	Significance to CEQA	Proposed Mitigation	Significance After Mitigation Pursuant to CEQA
	4	S	Mitigation Measure LU-1: Avoiding changes in FMMP land use classifications	LTS
Cropland idling water transfers could convert agricultural lands under the Williamson Act and other land resource programs to an incompatible use.	2, 4	LTS	None	LTS
Cropland idling water transfers could conflict with local land use policies.	2, 4	NI	None	NI
Water transfers could provide water to irrigators in the Buyer Service Area to irrigate existing crop fields and maintain agricultural land uses.	2, 3, 4	B	B	B
3.13 Cultural Resources				
Transfers that draw down reservoir surface elevations beyond historically low levels could result in a potentially significant effect on cultural resources.	2, 3, 4	LTS	None	LTS
Stored reservoir release transfers that draw down reservoir surface elevations at local reservoirs beyond historically low levels could affect cultural resources.	2, 3, 4	LTS	None	LTS
3.14 Visual Resources				
Water transfers could degrade the existing landscape character or scenic attractiveness of Class A and B visual resources at CVP and SWP reservoirs	2, 3, 4	LTS	None	LTS
Water transfers could degrade the existing landscape character or scenic quality of Class A and B visual resources along surface water bodies	2, 3, 4	LTS	None	LTS
Stored reservoir release transfers could substantially degrade the existing landscape character or scenic attractiveness of Class A and B visual resources participating reservoirs	2, 3, 4	LTS	None	LTS

Potential Impact	Alternative	Significance to CEQA	Proposed Mitigation	Significance After Mitigation Pursuant to CEQA
Cropland idling transfers could substantially degrade the existing landscape character and scenic attractiveness of Class A and B visual resources	2, 4	LTS	None	LTS
Water transfers could substantially degrade the existing landscape character and quality in the Buyer's Service Area	2, 3, 4	LTS	None	LTS
3.15 Recreation				
Changes in surface water elevation at Shasta, Folsom, Merle Collins, Oroville, Camp Far West, and Lake McClure reservoirs as a result of water transfers could affect reservoir-based recreation.	2, 3, 4	LTS	None	LTS
Changes in surface water elevations at Hell Hole and French Meadows Reservoirs as a result of water transfers could affect reservoir-based recreation.	2, 3, 4	LTS	None	LTS
Changes in river flows from water transfers could affect river-based recreation on the Sacramento, Yuba, Feather, American, San Joaquin, and Merced rivers.	2, 3, 4	LTS	None	LTS
Changes in average flow into the Delta from the San Joaquin River from water transfers could affect river-based recreation.	2, 3, 4	NI	None	NI
Changes in surface water elevation at San Luis Reservoir as a result of water transfers could affect reservoir-based recreation	2, 3, 4	NI	None	NI
3.16 Power				
Acquisition of water via groundwater substitution or crop idling may cause changes in power generation from CVP and SWP reservoirs	2, 3, 4	LTS	None	LTS

Potential Impact	Alternative	Significance to CEQA	Proposed Mitigation	Significance After Mitigation Pursuant to CEQA
Acquisition of water via stored reservoir water may cause changes in power generation from the facilities that ~~sell~~ provide water	2, 3, 4	LTS	None	LTS
3.17 Flood Control				
Water transfers would change storage levels in CVP and SWP reservoirs, potentially affecting flood control	2, 3, 4	LTS	None	LTS
Water transfers ~~could~~ would ~~decrease~~ change storage levels in non-Project reservoirs and potentially affecting flood control	2, 3, 4	B	None	B
Water transfers could ~~change~~ increase river flows, potentially affecting flood capacity or levee stability	2, 3, 4	LTS	None	LTS
Water transfers would change storage at San Luis Reservoir, potentially affecting flood control	2, 3, 4	LTS	None	LTS

Key:
B = beneficial
LTS = less than significant
NCFEC = no change from existing conditions
NI = no impact
None = no feasible mitigation identified and/or required
S = significant

Table 2-10. Impacts for NEPA-Only Resources

Potential Impact	Alternative	Impact
3.10 Regional Economics		
Seller Service Area		
Revenues from cropland idling water transfers could increase incomes for farmers or landowners selling water.	2, 4	Beneficial
Cropland idling transfers in Glenn, Colusa, and Yolo counties could reduce employment, labor income, and economic output for businesses and households linked to agricultural activities.	2, 4	Employment: -492 Labor Income: -$19.38 Million Output: -$90.43 Million
Cropland idling transfers in Sutter and Butte counties could reduce economic output, value added, and employment for businesses and households linked to agricultural activities.	2, 4	Employment: -163 Labor Income: -$5.50 Million Output: -$26.76 Million
Cropland idling transfers in Solano County could reduce economic output, labor income, and employment for businesses and households linked to agricultural activities.	2, 4	Employment: -32 Labor Income: -$1.13 Million Output: -$4.58 Million
Cropland idling transfers could have adverse local economic effects.	2, 4	Adverse
Water transfers from idling alfalfa could increase costs for dairy and other livestock feed.	2, 4	Adverse, but minimal
Cropland idling transfers could decrease net revenues to tenant farmers whose landowners choose to participate in transfers.	2, 4	Adverse
Crop shifting transfers could change economic output, value added, and employment for businesses and households linked to agricultural activities.	2, 4	Adverse, but minimal
Crop shifting transfers could change economic output, value added, and employment for businesses and households linked to agricultural activities.	2, 4	Adverse, but minimal
Economic effects associated with cropland idling could conflict with economic policies and objectives set forth in local plans.	2, 4	Adverse
Economic effects associated with cropland idling could conflict with economic policies and objectives set forth in local plans.	2, 4	Adverse
Reductions in local sales associated with cropland idling transfer effects could reduce tax revenues and increase costs to county governments.	2, 4	Adverse, but minimal
Groundwater substitution transfers could increase groundwater pumping costs for water users in areas where groundwater levels decline as a result of the transfer.	2, 3	Adverse
Revenues from groundwater substitution water transfers could increase incomes for farmers or landowners selling water.	2, 3	Beneficial

Potential Impact	Alternative	Impact
Groundwater substitution water transfers could increase management costs for local water districts.	2, 3	Adverse
Revenues received from stored reservoir and conservation transfers could increase operating incomes for sellers.	2, 3, 4	Beneficial, but minimal
Buyer Service Area		
Water transfers would provide water for agricultural uses that could support revenues, economic output, and employment.	2, 3, 4	Beneficial
Water transfers would provide water for M&I uses that could support revenues, economic output, and employment.	2, 3, 4	Beneficial
3.11 Environmental Justice		
Cropland idling transfers could adversely and disproportionately affect minority and low-income farm workers in the Seller Service Area.	2, 4	No disproportionately high or adverse effect
Crop shifting transfers could adversely and disproportionately affect minority and low-income farm workers in the Seller Service Area.	2, 3	No disproportionately high or adverse effect
Use of cropland modification transfers could adversely and disproportionately affect minority and low-income farm workers in the Buyer Service Area.	2, 3, 4	Beneficial
3.12 Indian Trust Assets		
Groundwater substitution transfers could adversely affect ITAs by decreasing groundwater levels, which would potentially interfere with the exercise of a federally-reserved water right use, occupancy, and or character	2, 3	No effect
Groundwater substitution transfers could adversely affect ITAs by reducing the health of tribal members by decreasing water supplies	2, 3	No effect
Groundwater substitution transfers could affect ITAs by affecting fish and wildlife where there is a federally-reserved hunting, gathering, or fishing right.	2, 3	No effect
Groundwater substitution transfers could adversely affect ITAs by causing changes in stream flow temperatures or stream depletion, which would potentially interfere with the exercise of a federally-reserved Indian right	2, 3	No effect
Use of groundwater substitution transfers could affect reservations or Rancherias in the Buyer Service Area to reduce CVP shortages.	2, 3, 4	Beneficial

2.6 References

Department of Water Resources (DWR). 1975. Bulletin 113-3, Vegetative Water Use in California, 1974. Table 23. April 1975. Accessed: September 9, 2014. Available at: http://www.water.ca.gov/pubs/use/land_and_water_use/vegetative_water_use_in_california__bulletin_113-3__1974/bulletin_113-3.pdf

Department of Water Resources (DWR) and Bureau of Reclamation. 2013. DRAFT Technical Information for Preparing Water Transfer Proposals. October 2013. Accessed: April 21, 2014. Available at: http://www.water.ca.gov/watertransfers/docs/DTIWT_2014_Final_Draft.pdf

National Oceanic and Atmospheric Association Fisheries Service (NOAA Fisheries). 2009. Biological Opinion and Conference Opinion on the Long-Term Operations of the Central Valley Project and State Water Project. 4 June 2009.

U.S. Fish and Wildlife Service (USFWS). 2008. Formal Endangered Species Act Consultation on the Proposed Coordinated Operations of the Central Valley Project (CVP) and State Water Project (SWP). 15 December 2008. Accessed on January 2, 2014. Available from http://www.fws.gov/sfbaydelta/documents/swp-cvp_ops_bo_12-15_final_ocr.pdf

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Chapter 3 Affected Environment/Environmental Consequences

This chapter describes, for each resource area, the affected environment/environmental setting for the project area potentially affected by the action alternatives. This chapter also presents the analyses of the impacts that would result from the No Action/No Project Alternative or implementation of the action alternatives described in Chapter 2, and considers how the environmental commitments could reduce or eliminate these impacts. The sections of this chapter, by resource area, are as follows:

3.1 Water Supply
3.2 Water Quality
3.3 Groundwater Resources
3.4 Geology and Soils
3.5 Air Quality
3.6 Climate Change
3.7 Fisheries
3.8 Vegetation and Wildlife
3.9 Agricultural Land Use
3.10 Regional Economics
3.11 Environmental Justice
3.12 Indian Trust Assets
3.13 Cultural Resources
3.14 Visual Resources
3.15 Socioeconomics
3.16 Power
3.17 Flood Control

Resource areas that are not analyzed in this document include:

- Hazards & Hazardous Materials
- Mineral Resources
- Noise
- Public Services and Utilities
- Transportation/Traffic

The action alternatives would not require any construction activities; therefore, short- and long-term impacts to transportation/traffic, noise, and public services and utilities would not occur. Because water transfers would not result in the disturbance of land, there would be no impacts to hazardous materials and mineral resources.

Because this document addresses both the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA), the terms used in this document reflect both NEPA and CEQA. Table 3-1 presents a list of

NEPA terms that are synonymous with CEQA terms and are used throughout this document.

Table 3-1. NEPA and CEQA Terms

NEPA	CEQA
Proposed Action	Proposed Project
No Action Alternative	No Project Alternative
Environmentally Preferred Alternative	Environmentally Superior Alternative
Purpose and Need	Project Objectives
Affected Environment	Environmental Setting
Environmental Consequences	Environmental Impacts
Environmental Commitments	Mitigation Measures
Environmental Impact Statement (EIS)	Environmental Impact Report (EIR)

The impacts of each alternative are discussed by resource area and alternative. Each resource area section is structured so that an *italicized* impact statement introduces potential changes that could occur from implementation of each alternative. A discussion of how the resource area would be affected by the impact then follows this initial statement. The impact discussion is concluded with a determination that indicates if there is no impact to a resource area or if the impact to a resource area is beneficial, less than significant, or significant. Pursuant to NEPA, significance is used to determine whether an EIS or some other level of documentation is required, and once the decision to prepare an EIS is made, the magnitude of the impact is evaluated and no further judgment of significance is required. Therefore, any determinations of significance are for CEQA purposes only.

Section 3.1
Water Supply

This section discusses how and when surface water supplies are delivered to water users, the management of surface water, and how long-term water transfers could benefit or adversely affect water supplies.

3.1.1 Affected Environment/Environmental Setting

This section describes existing water supplies, including source and management, for agencies that could take part in the transfers.

3.1.1.1 Area of Analysis

The evaluation of potential effects on surface water supply and management from the implementation of long-term transfers includes the waterways that provide water to the buyers or sellers. Sellers include water rights holders on the Sacramento and San Joaquin rivers or their tributaries, including the Feather, Yuba, American, and Merced rivers. Some sellers are also within the Delta, and most transfers would need to move through the Delta to be delivered to buyers.

Potential buyers are located south and west of the Delta, and include the Contra Costa Water District (WD), the East Bay Municipal Utility District (MUD), and ten member agencies of the San Luis & Delta-Mendota Water Authority (SLDMWA). Not all potential buyers will purchase water from transfers. For some potential buyers, the ability to purchase water would depend on whether purchased water could be moved to the buyer's service area. Contra Costa WD would divert water from one of its diversion facilities in the Delta, East Bay MUD would divert water at the Freeport facility on the Sacramento River, and SLDMWA would receive water from Jones or Banks Pumping Plants in the Delta. SLDMWA could also receive water from Merced Irrigation District (ID) through San Joaquin River diversion facilities belonging to Banta Carbona ID, West Stanislaus ID, and Patterson ID.

Figure 3.1-1 shows the various potential sellers and buyers and key waterways in the area of analysis.

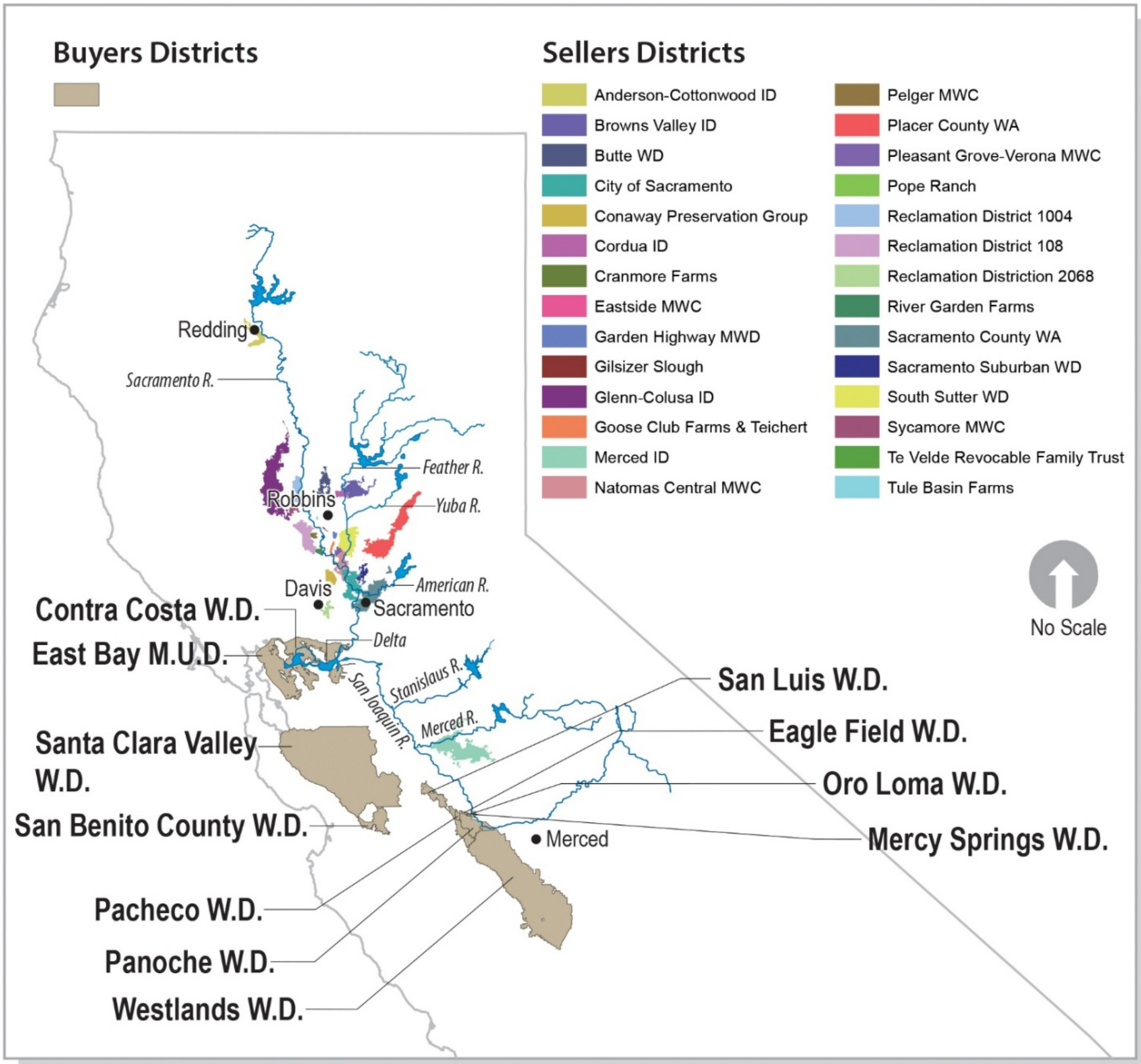

Figure 3.1-1. Location of Potential Buyer and Sellers

3.1.1.2 Regulatory Setting

The following section describes the applicable laws, rules, regulations and policies governing the transfer of surface and groundwater water in the area of analysis.

3.1.1.2.1 Federal

Reclamation approves water transfers consistent with provisions of the Central Valley Project Improvement Act (CVPIA) and State law that protect against injury to other legal users of water. According to the CVPIA Section 3405(a), the following principles must be satisfied for any transfer:

- Transfer may not violate the provisions of Federal or state law;
- Transfer may not cause significant adverse effects on Reclamation's ability to deliver Central Valley Project (CVP) water to its contractors or other legal user;
- Transfer will be limited to water that would be consumptively used or irretrievably lost to beneficial use;
- Transfer will not have significant long-term adverse impact on groundwater conditions; and
- Transfer will not adversely affect water supplies for fish and wildlife purposes.

Reclamation will not approve a water transfer if these basic principles are not satisfied and will issue its decision regarding potential CVP transfers in coordination with the U.S. Fish and Wildlife Service (USFWS), contingent upon the evaluation of impacts on fish and wildlife.

In addition, the biological opinions[1] on the Coordinated Operations of the CVP and State Water Project (SWP) (USFWS 2008; National Oceanic Atmospheric Administration Fisheries Service [NOAA Fisheries] 2009) analyze transfers through the SWP Banks and CVP Jones Pumping Plants from July to September that are up to 600,000 acre-feet (AF) in critical and dry years. For all other year types, the maximum transfer amount is up to 360,000 AF. For this Environmental Impact Statement/Environmental Impact Report (EIS/EIR), annual transfers would not exceed the above capacities and would be pumped through Banks or Jones Pumping Plants between July and September~~ unless it shifts based on consultation with USFWS and NOAA Fisheries~~.

3.1.1.2.2 State

The State Water Resources Control Board (SWRCB) is responsible for reviewing transfer proposals and issuing petitions for temporary and long-term transfers related to post-1914 water rights. Transfers of CVP water outside of the CVP service area require SWRCB review and approval. Several sections of the California Water Code (WC) provide authority to the SWRCB to carry out transfers as presented below.

[1] A written statement setting forth the opinion of the USFWS or the NOAA Fisheries as to whether a federal action is likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of a critical habitat. See 16 USCA 1536(b).

- Short-Term Transfers: Section 1725 allows a water rights permittee or licensee to temporarily change a point of diversion, place, or purpose of use for short-term water transfers (limited to one year). Short-term transfers under Section 1725 are limited to water that would have been consumptively used or stored absent the water transfer. Petitioners for transfers must provide the SWRCB notification in writing of the proposed change, providing information outlining the buyer's consumptive use and documentation that no injury to other legal users and no unreasonable effects to fish, wildlife, or other instream beneficial uses would occur. The petition is publicly noticed, and parties can file objections to the transfer. The SWRCB must evaluate and respond to the notification within 55 days if objections are filed.

- Long-Term Transfers: Section 1735 addresses long-term transfers that take place over a period of more than one year. Long-term transfers of water under post-1914 water rights must not cause substantial injury to any legal user of water and must not unreasonably affect fish, wildlife, or other instream beneficial uses. Long-term transfers are subject to the requirements of California Environmental Quality Act (CEQA) and must also comply with the SWRCB public noticing and protest process.

- No Injury Rule: Numerous sections of the WC (including Sections 1702, 1706, 1725, 1735 and 1810, among others) protect legal users of water from impacts that might result due to transfers, referred to as the "no injury rule." The no injury rule applies to both Pre-1914 water rights (WC Section 1706) and post-1914 water rights. The SWRCB has jurisdiction over changes to post-1914 water rights, and the courts typically have jurisdiction over changes in pre-1914 water rights.

- Effects on Fish and Wildlife: Sections 1725 and 1736 require that the SWRCB make a finding that post-1914 water rights water transfers will not result in unreasonable effects on fish and wildlife or other instream beneficial uses.

- Third-Party Impacts: Sections 386 and 1810 require the proposed transfer not result in unreasonable effects to the overall economy of the area from which the water is being transferred where the use of a state, regional or local public agency's conveyance capacity is required.

3.1.1.2.3 Regional/Local

County governments also have requirements related to transferring water outside of the county, primarily related to groundwater extraction. Reclamation requires transfer participants to comply with local requirements (including ordinances relating to well drilling, well spacing, and groundwater extraction) and local groundwater management plans, as well as compliance with adjudications and with the overdraft protections in WC Section 1745 et seq.

Many of the counties in the Seller Service Area have ordinances addressing groundwater transfers to users outside of the particular county. Chapter 3.3, Groundwater Resources, has more information on these county ordinances.

3.1.1.3 Existing Conditions

Water supplies available for transfer come from either groundwater or surface water. This section will focus on the availability of surface water supplies to their users as a result of the alternatives. This section does not address potential groundwater impacts (see Section 3.3) or flood risk (see Section 3.17).

The following sections describe the existing water supply conditions within the area of analysis.

3.1.1.3.1 Sellers Service Area

Sellers making water available for transfer are generally north of the Delta, but also include Merced ID (Figure 3.1-1).

Sacramento River Area

The Sacramento River flows south for 447 miles through the northern Central Valley of California, between the Pacific Coast Range and the Sierra Nevada, and enters the Delta from the north. The major tributaries to the Sacramento River are the Feather and the American rivers.

Some of the potential sellers on the Sacramento River receive CVP water that is stored upstream from their service areas in Shasta Reservoir on the Sacramento River. Shasta Reservoir is managed for flood control, water supply, recreation, fish and wildlife enhancement, power, and salinity control in the lower Sacramento River and the Delta.

Several CVP sellers hold Sacramento River Settlement Contracts[2] (Settlement Contracts). Reclamation entered into settlement negotiations with water users on the Sacramento River beginning in 1944, and most contracts were completed by 1964. These contracts expired on March 31, 2004 and were renewed as the 2005 Executed Sacramento River Settlement Contracts. The negotiations focused on the natural flow of the Sacramento River, stored CVP water, diversions, and pre-CVP water rights held by the Sacramento River Settlement Contractors. The term of the Settlement Contracts for municipal and industrial (M&I) water is 40 years, and for irrigation water it is 40 years with an option to extend the contract for another 40 years (Reclamation 2004b).

As part of the original contract negotiations, a quantitative study of pre-CVP water use by the Sacramento River Settlement Contractors was conducted. This resulted in a determination of Base Supply and Project Water volumes. Base Supply is water that the Sacramento River Settlement Contractors divert,

[2] The Settlement Contracts are currently the subject of litigation. The court of appeals en banc panel remanded the matter to district court. The Sacramento River Settlement Contractors have petitioned the ~~supreme court~~Supreme Court and that petition is pending.

without payment, from April through October, based on their water rights. Project Water is water that the Sacramento River Settlement Contractors purchase from Reclamation, primarily in the months of July, August, and September. Project Water is subject to all federal regulations.

The Sacramento River Settlement Contractors can divert up to 1.8 million AF of Base Supply from the Sacramento River, and can purchase up to 380,000 AF of Project Water each year (Reclamation 2004a).

Anderson-Cottonwood ID

The Anderson-Cottonwood ID is located near Redding, California (Figure 3.1-1). Anderson-Cottonwood ID has a Sacramento River Settlement Contract for 121,000 AF of Base Supply and 4,000 AF of Project Water per year.

Anderson-Cottonwood ID, through either multiple year or single year agreements, could transfer a maximum of 5,225 AF of water annually through groundwater substitution.

Conaway Preservation Group, LLC

The Conaway Preservation Group, LLC operates the 16,088 acre Conaway Ranch located east of the cities of Davis and Woodland in Yolo County (Figure 3.1-1). The Conaway Ranch is managed for agriculture, wildlife habitat, and flood control in the Yolo Bypass. Conaway Preservation Group has a Sacramento River Settlement Contract with Reclamation for up to 50,190 AF[3] of Base Supply and 672 AF of Project Water from the Sacramento River. Conaway Ranch uses groundwater resources to supplement surface water supplies.

Conaway Preservation Group, LLC, through either multiple year or single year agreements, could transfer a maximum of 35,000 AF annually through groundwater substitution~~,~~ and/or ~~9,239 AF per year~~ by cropland idling or crop shifting.

Cranmore Farms, LLC

Cranmore Farms, LLC (Pinnacle Land Ventures, LLC or Broomieside Farms) is on the east side of the Sacramento River. It diverts water for agricultural and habitat use from the Sacramento River through a Sacramento River Settlement Contract with Reclamation for 8,070 AF of Base Supply and 2,000 AF of Project Water annually.

[3] ~~After January, 2016, the contract amount will decrease to 40,290 AF. Conaway Preservation Group's water right was split, selling 10,000 AF to the Woodland-Davis Clean Water Agency.~~Conway Preservation Group has assigned portions of its water rights and Sacramento River Settlement Contract to the Woodland Davis Clean Water Agency. Amendment No. 1 to the Conway Preservation Group's Settlement Contract, which identifies the assignment of 10,000 AF to the Woodland Davis Clean Water Agency, is effective upon the earlier of the Woodland Davis Clean Water Agency diverting water or January 15, 2016. After that time, Conway Preservation Group may receive surface water under the portion assigned to the Woodland Davis Clean Water Agency.

Cranmore Farms, LLC, through either multiple year or single year agreements, could transfer a maximum of 8,000 AF annually through groundwater substitution~~,~~ and/or ~~2,500 AF per year~~ by crop idling or crop shifting.

Eastside Mutual Water Company (MWC)

The Eastside MWC is in the northern part of the Sacramento Basin on the Sacramento River (Figure 3.1-1). The Eastside MWC has a Sacramento River Settlement Contract with Reclamation for 2,170 AF of Base Supply and 634 AF of Project Water.

Eastside MWC, through either single or multi-year agreements, could transfer up to 2,230 AF per year through groundwater substitution.

Glenn-Colusa ID

Glenn-Colusa ID holds pre- and post-1914 appropriative water rights to divert water from the Sacramento River, Stony Creek, and their tributaries which is used to irrigate 141,000 acres. Glenn-Colusa ID also conveys water to 20,000 acres of wildlife habitat comprising the Sacramento, Delevan, and Colusa National Wildlife refuges. Glenn-Colusa ID has a Sacramento River Settlement Contract for 720,000 AF of Base Supply and 105,000 AF of Project Water. In addition to surface water, Glenn-Colusa ID relies on groundwater for a portion of its supply.

Glenn-Colusa ID, through either single or multi-year transfers, agreements, could transfer up to 66,000 AF per year through crop idling and shifting and/or 25,000 AF per year through groundwater substitution.

Natomas Central MWC

The Natomas Central MWC is along the Sacramento River on the border of northern Sacramento County and southern Sutter County. The Natomas Central MWC has a Sacramento River Settlement Contract with Reclamation for 98,200 AF of Base Supply and 22,000 AF of Project Water.

Natomas Central MWC, through either multiple year or single year agreements, could transfer a maximum of 30,000 AF annually thorough groundwater substitution.

Pelger MWC

The Pelger MWC is located on the east side of the Sacramento River near Robbins (Figure 3.1-1). The Pelger MWC has a Sacramento River Settlement Contract with Reclamation for 7,110 AF of Base Supply and 1,750 AF of Project Water.

The Pelger MWC, through either multiple year or single year agreements, could transfer a maximum of 3,750 AF annually through groundwater substitution, and/or ~~2,538 AF per year~~ by crop idling or crop shifting.

Pleasant Grove-Verona MWC

The Pleasant Grove-Verona MWC is just northeast of the confluence with the Sacramento and Feather rivers (Figure 3.1-1). The Pleasant Grove-Verona MWC provides irrigation water to 6,857 acres of farmland through a Sacramento River Settlement Contract with Reclamation for 23,790 AF of Base Supply and 2,500 AF of Project Water.

Pleasant Grove-Verona MWC, through either multiple year or single year agreements, could transfer a maximum of ~~10~~18,000 AF annually through groundwater substitution~~,~~ and/or ~~10,000 AF per year~~ by crop idling or crop shifting.

Reclamation District (RD) 108

RD 108 is on the west side of the Sacramento River, just north of the confluence with the Feather River. RD 108 has a Sacramento River Settlement Contract for 199,000 AF of Base Supply and 33,000 AF of Project Water.

RD 108, through either multiple year or single year agreements, could transfer a maximum of 15,000 AF annually through groundwater substitution, and/or up to 20,000 AF per year by crop idling or crop shifting.

RD 1004

RD 1004 is in the northern portion of the Sacramento Valley, and has a Sacramento River Settlement Contract for 56,400 AF of Base Supply and 15,000 AF of Project Water.

RD 1004, through either single year or multiyear agreements, could transfer a maximum of 10,000 AF through crop idling and/or crop shifting, or up to 7,175 AF through groundwater substitution.

River Garden Farms

River Garden Farms is on the west side of the Sacramento River. River Garden Farms has a Sacramento River Settlement Contract with Reclamation for 29,300 AF of Base Supply and 500 AF of Project Water. River Garden Farms supplements its surface water supply with ~~three~~ groundwater wells.

River Garden Farms, through either multiple year or single year agreements, could transfer a maximum of 9,000 AF annually through groundwater substitution.

Sycamore MWC

The Sycamore MWC farm is in the northern Sacramento Valley (Figure 3.1-1). Most of the farm is located in Sutter County, with a small northern portion in Colusa County. The Glenn-Colusa Canal and the Colusa Trough run through the parcel on the south and east side, respectively. Sycamore MWC has a Sacramento River Settlement Contract for 22,000 AF of Base Supply and 9,800 AF of Project Water.

Sycamore MWC, through either multiple year or single year agreements, could transfer up to ~~15~~20,000 AF through crop idling or crop shifting~~,~~ and/or ~~up to 10,000 AF~~ through groundwater substitution.

Te Velde Revocable Family Trust

The Te Velde Revocable Family Trust is on the west side of the Sacramento River in unincorporated Yolo County, just downstream of the confluence of the Feather and Sacramento rivers. Te Velde has a Sacramento River Settlement Contract of a Base Supply of 4,000 AF and its own water right of 7,094 AF diverting water out of the Sacramento River.

Te Velde, through multiple year agreements, could transfer a maximum of 7,094 AF annually through groundwater substitution~~,~~ and/or ~~7,094 AF per year~~ by crop idling or crop shifting.

Feather River Area

Lake Oroville is on the Feather River. Operated by the California Department of Water Resources (DWR), it is the largest reservoir in the SWP and provides water to downstream contractors. Water from Lake Oroville is released to meet export demands, generate power at the Hyatt Powerplant beneath Oroville Dam and at the Thermalito Powerplant and to support downstream fisheries and water quality objectives.

Butte WD

Butte WD is in southern Butte County and northern Sutter County (Figure 3.1-1). The Butte WD receives water from the Thermalito Afterbay through a Feather River Settlement Contract between the Joint Water District Board (Joint Board), of which Butte WD is a member and DWR. Butte WD's share of the Feather River Settlement supply is for 133,200 AF per year under an agreement allocating the Settlement supply among all the member units of the Joint Board.

The Butte WD, through either single or multiple year agreements, could transfer a maximum of 11,500 AF per year by crop idling or crop shifting, and/or 5,500 AF per year from groundwater substitution. An agreement with DWR would be required for Butte WD to implement a transfer.

Garden Highway MWC

The Garden Highway MWC is on the west side of the Feather River approximately midway between its confluence with the Yuba River and the confluence with the Sacramento River (Figure 3.1-1). The Garden Highway MWC may divert up to 18,000 AF per year from the Feather River for agriculture under its water rights permit and Feather River Settlement Agreement with DWR.

Garden Highway MWC, through either multiple year or single year agreements, could transfer a maximum of 1~~2,287~~4,000 AF annually through groundwater substitution. An agreement with DWR would be required for Garden Highway to implement a transfer.

Gilsizer Slough Ranch

The Gilsizer Slough Ranch is between the Feather and Sacramento rivers. Gilsizer Slough Ranch has a water right to the Feather River for 5,386 AF per year from the Sacramento River.

Gilsizer Slough Ranch, through either multiple year or single year agreements, could transfer a maximum amount of 3,900 AF through groundwater substitution.

Goose Club Farms and Teichert Aggregates

Goose Club Farms and Teichert Aggregates are on the west bank of the Feather River, just north of the confluence with the Sacramento River (Figure 3.1-1). Goose Club Farms and Teichert Aggregates have a water right on the Feather River for 15,000 AF per year.

Goose Club Farms and Teichert Aggregates, through either multiple year or single year agreements, could transfer a maximum of 10,000 AF annually through groundwater substitution~~,~~ or ~~10,000 AF per year~~ by crop idling or crop shifting.

South Sutter WD

South Sutter WD is just northeast of the confluence of the Feather and Sacramento rivers (Figure 3.1-1). South Sutter WD owns and operates Camp Far West Reservoir on the Bear River approximately 6.5 miles northeast of Wheatland. South Sutter WD holds water right Licenses 11118 and 11120 (Applications 14804 and 10221, respectively) for diversions from the Bear River. The maximum combined direct diversion plus collection to storage under these licenses is 180,550 AF per year; and the maximum combined direct diversion plus withdrawal from storage under these licenses is 138,300 AF per year.

South Sutter WD, through either multiple year or single year agreements, could transfer a maximum of 15,000 AF annually through stored reservoir release from Camp Far West Reservoir.

Tule Basin Farms

Tule Basin Farms is on the east side of the Sacramento River in the center of the Sacramento Valley (Figure 3.1-1). The Farm has a water right to 8,980 AF per year for agriculture and habitat needs out of the ~~Feather River.~~ West Borrow Pit of the Sutter Bypass.

Tule Basin Farms, through either multiple year or single year agreements, could transfer up to 7,320 AF per year through groundwater substitution.

Yuba River Area

Browns Valley ID

The Browns Valley ID is on the Yuba River, just upstream of the confluence with the Feather River. Browns Valley ID has pre-1914 water rights for 34,171 AF per year on the Yuba River. Browns Valley ID completed an EIR for water transfers to willing buyers in 2009 based on water conservation measures that reduced consumptive use in the conveyance system.

Browns Valley ID, through either multiple year or single year agreements, could transfer a maximum amount of 3,100 AF through conservation measures, and/or 5,000 AF per year by stored reservoir release from Merle Collins Reservoir.

Cordua ID

Cordua ID is in Yuba County, near the confluence of the Yuba and Feather rivers. Cordua ID may divert up to 60,000 AF per year from the Yuba River under its water rights and an agreement with the Yuba County Water Agency.

Cordua ID, through either multiple year or single year agreements, could transfer a maximum amount of 12,000 AF per year through groundwater substitution.

American River

On the American River, Reclamation's Folsom Reservoir captures and holds up to 1,010,000 AF of CVP water. The reservoir provides flood control for downstream areas, water supply, hydropower, flows for American River fisheries and helps to meet water quality needs in the Delta.

City of Sacramento

The City of Sacramento is on both sides of the American River at its confluence with the Sacramento River (Figure 3.1-1), and has water rights to the American River for 245,000 AF per year and to the Sacramento River for 81,000 AF per year[4]. The City also has a network of groundwater supply wells in its service area. The City provides water for M&I purposes.

City of Sacramento, through either multiple year or single year agreements, could transfer a maximum of 5,000 AF annually through groundwater substitution.

Placer County Water Agency

The Placer County Water Agency is in the upper reaches of the American River, upstream of the Folsom Reservoir. Placer County Water Agency operates the Middle Fork Project reservoir on the American River, diverting up to 120,000 AF of water under its own water rights.

[4] The full amount of this contract will not be made available until 2030.

Placer County Water Agency could make up to 47,000 AF of water available each year for transfer through reoperation of the Middle Fork Project Reservoir, from Hell Hole and French Meadows reservoirs. Placer County Water Agency would prefer to use long term agreements to transfer water rather than individual single year contracts.

Sacramento County Water Agency

The Sacramento County Water Agency, located south of the City of Sacramento service area, provides M&I water to residents outside of the City of Sacramento boundaries (Figure 3.1-1). The Sacramento County Water Agency has a water right to 71,000 AF per year of surface water from the Sacramento River and 52,000 AF per year through two contracts with Reclamation. They also obtain up to 8,900 AF per year from groundwater.

The Sacramento County Water Agency, through either multiple year or single year agreements, could transfer a maximum of 15,000 AF annually through groundwater substitution.

Sacramento Suburban WD

Sacramento Suburban WD is downstream of the Folsom Reservoir on the American River (Figure 3.1-1). Through water rights and agreements with the Placer County Water Agency, Sacramento Suburban WD provides water to approximately 172,000 people in the greater Sacramento region. Sacramento Suburban WD also has a network of groundwater supply wells in its service area.

The Sacramento Suburban WD, through either multiple year or single year agreements, could transfer a maximum of 30,000 AF annually through groundwater substitution.

Delta Region

Pope Ranch

Pope Ranch is just east of RD 2068, in the southern Sacramento Valley on the north side of the Delta (Figure 3.1-1). Pope Ranch can divert a total of 2,800 AF.

Pope Ranch, through either multiple year or single year agreements, could transfer a maximum amount of 2,800 AF through groundwater substitution.

RD 2068

RD 2068 is in the southern Sacramento River Valley on the north side of the Delta (Figure 3.1-1). RD 2068 has a water right for a total of 80,000 AF.

RD 2068, through either multiple year or single year agreements, could transfer a maximum amount of ~~4~~7,500 AF through groundwater substitution or ~~7,500 AF~~ through crop-idling and/or crop shifting.

Merced River

Merced ID
Merced ID is on the Merced River upstream of the confluence with the San Joaquin River. Merced ID has water rights on the Merced River and stores water in McClure and McSwain lakes. Merced ID supplies water primarily for agriculture~~, and M&I~~ purposes.

Merced ID, through either multiple year or single year agreements, could transfer a maximum of 30,000 AF annually through stored reservoir releases.

3.1.1.3.2 Buyers Service Area

Transfer buyers are in the Central Valley or the San Francisco Bay Area. These buyers include the participating members of the SLDMWA (Figure 3.1-1), the Contra Costa WD, and the East Bay MUD. These areas receive water from multiple sources, including the SWP, the CVP, local surface water sources, and groundwater. With the exception of East Bay MUD, these potential buyers would require any transferred water to be moved through the Delta.

SLDMWA
The SLDMWA is made up of ~~29~~ 28 federal and exchange water service contractors that manage approximately 2,100,000 acres in western San Joaquin Valley, and San Benito and Santa Clara counties. The SLDMWA was established in 1992 and entered into a cooperative agreement and subsequently in 1998 entered into a transfer agreement with Reclamation to operate and maintain CVP facilities in the San Joaquin Valley, including the Delta-Mendota Canal.

Of the ~~29~~ 28 members of the SLDMWA, there are ten that would receive water transfers through the program (see Table 2-6). Deliveries to these districts would be diverted through the Delta through the CVP’s Jones Pumping Plant or the SWP’s Banks Pumping Plant. After diversion, the transfers would be delivered via the Delta-Mendota Canal, California Aqueduct and San Luis Canal. Deliveries of transfers from Merced ID could also be routed from the San Joaquin River through Banta Carbona ID, West Stanislaus ID, or Patterson ID.

Contra Costa WD
The Contra Costa WD is in Contra Costa County and principally relies on four Delta intakes for its water supplies. Contra Costa WD is a potential buyer of water. Contra Costa WD receives CVP water and has its own water rights to Delta water supplies.

East Bay MUD
East Bay MUD provides M&I water supplies to portions of Alameda and Contra Costa counties in the east San Francisco Bay area. East Bay MUD would receive transfer water through the Freeport Regional Water Authority’s

intake on the Sacramento River near Freeport. Due to the intake's northern location, the transfers would not be subject to the constraints on Delta pumping. East Bay MUD receives water from a variety of sources, including the Mokelumne River, a CVP contract with Reclamation for dry year supplies from the American River, and local supplies.

3.1.2 Environmental Consequences/Environmental Impacts

These sections describe the environmental consequences/environmental impacts associated with each alternative.

3.1.2.1 Assessment Methods

Impacts to surface water supplies are analyzed by comparing the conditions in water bodies and surface supplies without implementing transfers to the expected conditions of supplies with implementation. The No Action/No Project Alternative operations were simulated in CalSim, while water transfers and exports from the Delta were simulated using a post-processing tool (as described in Appendix B, Water Operations Assessment).

The post-processing tool also includes changes in flows in waterways caused by streamflow depletion from groundwater substitution. Data for the post-processing tool was provided by the SACFEM 2013 model, which includes highly variable hydrology (from very wet periods to very dry periods) that was used as a basis for simulating groundwater substitution pumping. The model simulated the potential to export groundwater substitution pumping transfers through the Delta during 12 of the 33 years from water year (WY) 1970 through WY 2003 (the SACFEM 2013 model simulation period). Each of the 12 annual transfer volumes was included in a single model simulation. Including each of the 12 years of transfer pumping in one simulation rather than 12 individual simulations allows for the potential cumulative effects from pumping from prior years. For example, transfer pumping in 1976 simulated pumping in a critical year followed by a critical year, while transfer pumping in 1987 simulated substitution pumping in a dry year followed by a critical year and a long term drought. Appendix D, Groundwater Model Documentation, includes more information about the use of SACFEM 2013 in this analysis.

3.1.2.2 Significance Criteria

Impacts on surface water supplies would be considered potentially significant if the long-term water transfers would:

- Result in substantial long-term adverse effects to water supply for beneficial uses.

The significance criteria described above apply to all surface water bodies that could be affected by transfers. Changes in surface water supplies are determined relative to existing conditions (for CEQA) and the No Action/No Project Alternative (for the National Environmental Policy Act [NEPA]).

3.1.2.3 Alternative 1: No Action/No Project

Surface water supplies would not change relative to existing conditions. Water users would continue to experience shortages under certain hydrologic conditions, requiring them to use supplemental water supplies. Under the No Action/No Project Alternative, some agricultural and urban water users may face potential shortages under dry and critical hydrologic conditions. These users may take alternative water supply actions in response to potential shortages, including increased groundwater pumping, cropland idling, reduction of landscape irrigation, water rationing, or pursuing supplemental water supplies. Impacts to surface water supplies would be the same as the existing conditions.

3.1.2.4 Alternative 2: Full Range of Transfers (Proposed Action)

3.1.2.4.1 Seller Service Area

Groundwater substitution transfers could decrease flows in neighboring surface water bodies following a transfer while groundwater basins recharge, which could decrease pumping at Jones and Banks Pumping Plants and/or require additional water releases from upstream CVP reservoirs. Groundwater substitution transfers make surface water available for transfer by reducing surface water diversions and replacing that water with groundwater pumping. The resulting increase in surface water supplies can then be transferred downstream to other users that do not have access to groundwater.

However, groundwater basins are naturally recharged after drawdown by both rainfall and through surface water and groundwater interactions. Streams that overlie an aquifer can lose water through the streambed to the aquifer (a “losing” stream), decreasing the amount of water available in the stream for other beneficial uses (Figure 3.1-2). Additional recharge to the groundwater basin can also intercept groundwater flow that would have entered a stream.

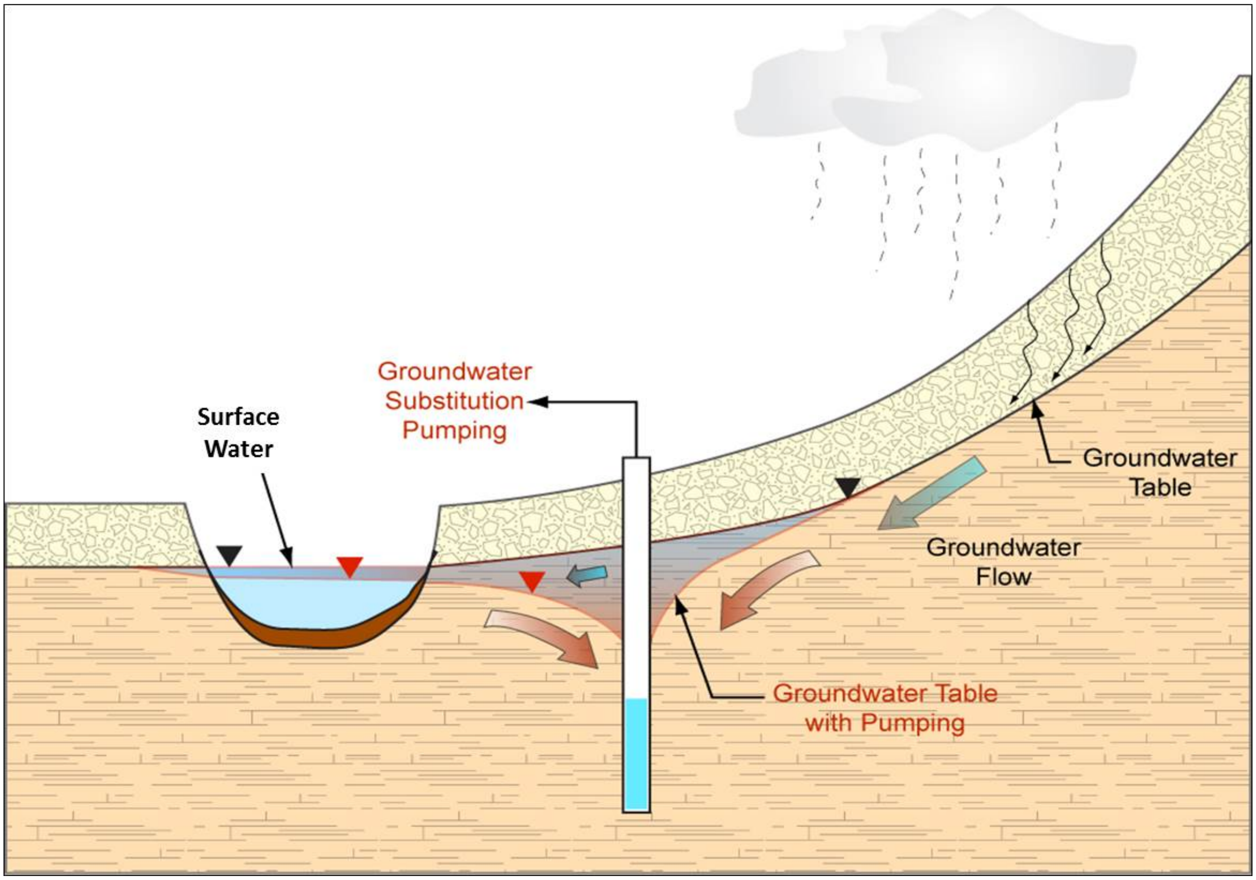

Figure 3.1-2. Groundwater and Surface Water Interactions Related to Groundwater Substitution Pumping

A portion of the groundwater recharge would occur during periods when there is higher flow in waterways. During these times, although the recharge would decrease flows in the waterways, the decreased flows would not affect water supplies or the ability to meet flow or quality standards. However, if the recharge occurs during dry periods, then the recharge would decrease river flows at times when it would affect Reclamation and DWR. Reclamation and DWR are responsible for meeting river flow and water quality standards on the Sacramento River, its tributaries, and within the Delta. If decreased river flows affect the ability to meet these standards, Reclamation and DWR would need to either decrease Delta exports or release additional flow from upstream reservoirs to meet flow or water quality standards. Transfers would not affect whether the water flow and quality standards are met, however, the actions taken by Reclamation and DWR to meet these standards because of instream flow reductions due to the groundwater recharge could affect CVP and SWP water supplies.

Decreased streamflows during dry periods could affect CVP and SWP supplies in the near term or longer term. Under dry or critical water years, streamflows are expected to decrease during the months of October through June. When faced with decreased streamflows, the CVP and SWP could choose to decrease Delta exports (affecting supplies to users south of the Delta) or increase releases from storage. Increased releases from storage would vacate storage that could be filled during wet periods, but would affect water supplies in subsequent years if the storage is not refilled.

Figure 3.1-3 shows the modeled potential changes (both in total volume and percent reductions) in total exports at both Jones and Banks pumping plants as a result of surface water and groundwater interactions over the modeled period of record. This figure only shows reductions to exports associated with streamflow depletion, and does not include increases in exports to convey water transfers to the buyers. The reductions in CVP and SWP supplies are not complete within one year, but can extend over multiple years as the groundwater aquifer refills. During periods where transfers occur in back-to-back years (such as 1987-1992), the water supply effects increase because effects compound over time.

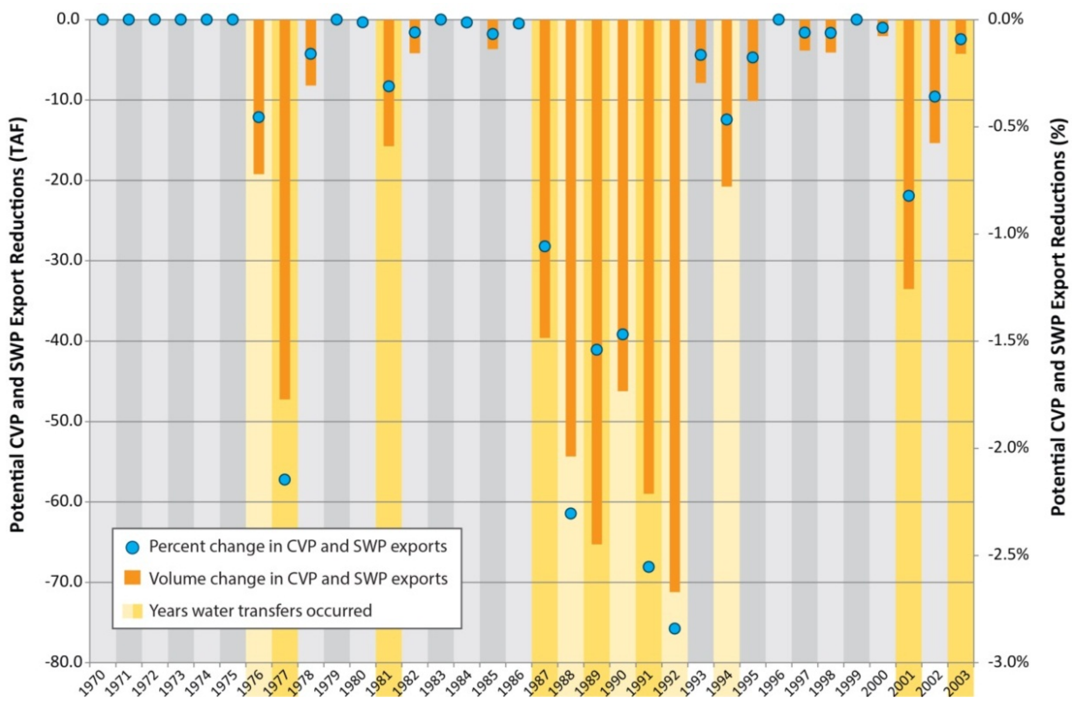

Figure 3.1-3. Potential Changes in Total Exports at the Delta Pumping Station as a Result of Surface Water and Groundwater Interaction

As a result of the groundwater and surface water interaction, the losses to surface flow from groundwater basin recharge shown in Figure 3.1-3, above, would reduce the water available to the CVP and SWP. Overall, the increased supplies delivered from water transfers would be greater than the decrease in supply because of streamflow depletion; however, the impacts from streamflow depletion may affect water users that are not parties to water transfers. On average[5], the losses due to groundwater and surface water interaction would result in approximately 15,800 AF of water annually compared to the No Action/No Project Alternative, or approximately a loss of 0.3 percent of the supply. This change in water supply is small, but the impacts in a single year could be greater. In a period of multiple dry years (such as 1987-1992), the streamflow depletion causes a 2.8 percent reduction in CVP and SWP supplies, or 71,200 AF. While the impacts to water supplies in the Buyer Service Area as a result of streamflow depletion would be small on average, the greater depletion in some years could have a potentially significant effect on water supply. To reduce these effects, Mitigation Measure WS-1 includes a streamflow depletion factor to be incorporated into transfers to account for the potential water supply impacts to the CVP and SWP. Mitigation Measure WS-1 would reduce the impacts to less than significant.

Water supplies available to users on the rivers downstream of reservoirs could decrease following stored reservoir release transfers. Stored reservoir release transfers would allow buyers to acquire transfer water from reservoirs owned by non-Project entities, such as Hell Hole and French Meadows reservoirs. Sellers would release water from these reservoirs, resulting in lower reservoir storage levels following the transfer. A reduction in downstream water supplies could occur when the reservoirs began to refill. In order to refill the reservoir storage vacated for the transfer, water would have to be held in the reservoirs that would otherwise have flowed downstream. To avoid impacting downstream users, the refill can only occur when all water needs downstream have been met and excess water remains in the system, referred to as Delta excess conditions. Additionally, this refill can only occur when downstream reservoirs cannot capture the water due to flood storage requirements. As demonstrated in Figure 3.1-4, reservoir levels are lower with the transfers than without until refilling to normal levels.

[5] The model used in the analysis assumes the maximum quantity of groundwater substitutions. In general, this maximum amount of water transferred is not likely in any given year, and therefore the impacts described here are the worst-case scenario. In practice, it is likely that the impacts will be less than what is modeled.

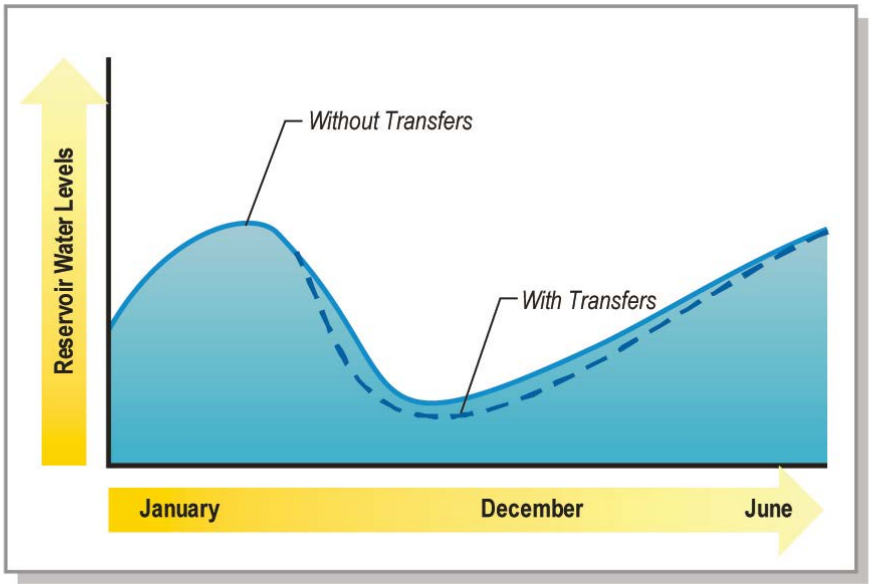

Figure 3.1-4. Reservoir Level Changes Under Stored Reservoir Release Transfers

Supplies in the seller's reservoirs would be decreased due to the transfer until the vacated storage was refilled during high flow periods. Figure 3.1-4 shows the refill occurring within one year, however, if one or more dry years follow the transfer year, or if a downstream reservoir does not enter flood control conditions for multiple years, the refill may not be able to occur for multiple years. As described in Chapter 2, each stored reservoir release transfer would include a refill agreement which specifies that the reservoir could only be refilled when it would not adversely affect downstream water users. Therefore, the impact of reservoir release transfers on downstream water users would be less than significant.

Changes in Delta diversions could affect Delta water levels. During July through September when transfer water can be pumped through the Delta, the Banks and Jones pumping plants would pump more water than they would under the No Action/No Project conditions. Increased pumping could affect water levels in the south Delta around the pumping facilities. Decreased Delta water levels could have the potential to affect water supplies in this area because the local users' diversion pumps may not remain underwater.

Reclamation and DWR operate a series of temporary barriers during this period to minimize potential water level impacts to south Delta water users. These barriers would help maintain water levels under Alternative 2. Table 3.1-1 shows water levels downstream of the barrier at Old River compared to the No Action/No Project Alternative. Water levels are generally the same under both alternatives, with only very minor changes to water levels. Appendix C contains water levels at other points, both upstream of barriers and in other waterways.

These other areas show impacts to water levels that are similar or less than those shown in Table 3.1-1. Therefore, the impacts to south Delta water supplies would be less than significant.

Table 3.1-1. Difference in Minimum Stage (ft) at Old River Downstream of Barrier for Alternative 2 minus the No Action/No Project Alternative

WY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1970	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1971	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1972	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1973	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1974	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1975	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1976	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.1
1977	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	0.0
1978	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1979	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1980	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1981	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0
1982	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1983	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1984	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1985	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1987	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.1
1988	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	-0.1	0.0
1989	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0
1990	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	-0.1	0.0
1991	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	-0.1	0.0
1992	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.0
1993	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1994	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
1995	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1999	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1
2002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0
Average	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Critical	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.0
Dry	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wet	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

3.1.2.4.2 Buyers Service Area

Transfers would increase water supplies in the Buyer Service Area. Under the No Action Alternative, water users would be subject to reductions in their water supply due to dry hydrologic conditions. Under the Proposed Action, additional water supply would benefit water users who receive the transferred water. The transfer water would help provide supplemental water to lands that are experiencing substantial shortages. For transfers to agricultural users, water would only be delivered to lands that were previously irrigated. Water transfers to M&I users would also help relieve shortages. Any water transferred to buyers would need to be used for beneficial uses. The increased water supply to buyers would be a beneficial effect.

3.1.2.5 Alternative 3: No Cropland Modifications

The No Cropland Modification Alternative does not include cropland idling. Potential water supply effects of the Proposed Action are caused by groundwater substitution and stored reservoir release transfers, which are the same in Proposed Action and Alternative 3. The effects in the Seller and Buyer Service Areas and the Delta would be the same as the Proposed Action.

3.1.2.6 Alternative 4: No Groundwater Substitutions

With the No Groundwater Substitution Alternative there would not be any groundwater substitution pumping. The potential water supply impacts associated with streamflow depletion would not occur. However, the potential impacts associated with stored reservoir release transfers would be the same as the Proposed Action. Effects in the Buyer Service Area and the Delta would be the same as the Proposed Action.

3.1.3 Comparative Analysis of Alternatives

Table 3.1-~~1~~ 2 lists the effects of each of the action alternatives and compares them to the existing conditions and No Action/No Project Alternative.

Table 3.1-~~1~~2. Comparative Analysis of Alternatives

Potential Impact	Alternatives	Significance	Proposed Mitigation	Significance after Mitigation
Surface water supplies would not change relative to existing conditions	1	NCFEC	None	NCFEC
Groundwater substitution transfers could decrease flows in surface water bodies following a transfer while groundwater basins recharge, which could decrease pumping at Jones and Banks Pumping Plants and/or require additional water releases from upstream CVP~~/SWP~~ reservoirs.	2, 3	S	WS-1: Streamflow Depletion Factor	LTS
Water supplies on the rivers downstream of reservoirs could decrease following reservoir release water transfers	2, 3, 4	LTS	None	LTS
Changes in Delta diversions could affect Delta water levels~~ and supplies to in-Delta users~~	2, 3, 4	LTS	None	LTS
Transfers would increase water supplies in the Buyers Service Area	2, 3, 4	B	None	B

Notes:
B = Beneficial
LTS = Less than significant
NCFEC = No change from existing conditions
S = Significant

3.1.3.1 Alternative 1: No Action/No Project Alternative

There would be no impacts on water supplies.

3.1.3.2 Alternative 2: Full Range of Transfers (Proposed Action)

Streamflow depletion from groundwater substitution transfers could result in small decreases in water supplies to CVP and SWP users. Stored reservoir release transfers could decrease carryover storage in participating reservoirs, but refill criteria would prevent water supply impacts to downstream users from refilling that storage. The effects on water supply would be less than significant.

3.1.3.3 Alternative 3: No Cropland Modifications

This alternative would have similar effects on water supply as the Proposed Action. The effects to water supply would be less than significant.

3.1.3.4 Alternative 4: No Groundwater Substitution

Alternative 4 would not include groundwater substitution transfers, so the streamflow depletion effects on CVP and SWP supplies in the other two action alternatives would not occur. Effects from refilling surface water storage from stored reservoir release transfers could still occur, but they would be avoided with the inclusion of the refill criteria. The effects on water supply would be less than significant.

3.1.4 Environmental Commitments/Mitigation Measures

3.1.4.1 Mitigation Measure WS-1: Streamflow Depletion Factor

The purpose of Mitigation Measure WS-1 is to address potential streamflow depletion effects to CVP and SWP water supply. Reclamation will apply a streamflow depletion factor to mitigate potential water supply impacts from the additional groundwater pumping due to groundwater substitution transfers. The streamflow depletion factor equates to a percentage of the total groundwater substitution transfer that will not be credited to the transferor and is intended to offset the streamflow effects of the added groundwater pumping due to transfer.

As described in the impact analysis, the magnitude of the potential water supply impact depends on hydrologic conditions surrounding the transfer period (both before and after). The exact percentage of the streamflow depletion factor will be assessed and determined on a regular basis by Reclamation and DWR, in consultation with buyers and sellers, based on the best technical information available at that time. The percentage will be determined based on hydrologic conditions, groundwater and surface water modeling, monitoring information, and past transfer data. Application of the streamflow depletion factor will offset potential water supply effects and reduce them to a less than significant level. The streamflow depletion factor may not change every year, but will be refined as new information becomes available and may become more site specific as better data and groundwater modeling becomes available. The minimum streamflow depletion factor (based on modeling completed for this EIS/EIR) will be 13 percent, but this factor may be adjusted based on additional information on local conditions.

Reclamation and DWR require the imposition of a streamflow depletion factor because they will not move transfer water if doing so will violate the no injury rule. This process to evaluate and determine the streamflow depletion factor will help verify that the factor reduces potential impacts to avoid legal injury to CVP or SWP water supplies and a substantial impact or injury.

3.1.5 Potentially Significant Unavoidable Impacts

None of the action alternatives would result in potentially significant unavoidable impacts on water supply.

3.1.6 Cumulative Effects

The timeframe for the Long-Term Water Transfers cumulative analysis extends from 2015 through 2024, a ten year period. The cumulative effects analysis for water supply considers SWP water transfers, the Lower Yuba River Accord (Yuba Accord), CVP M&I Water Shortage Policy (WSP), ~~and~~ the San Joaquin River Restoration Program (SJRRP), and refuge transfers. Chapter 4 further describes these projects and policies.

3.1.6.1 Alternative 2: Full Range of Transfers (Proposed Action)

3.1.6.1.1 Seller Service Area

Groundwater substitution transfers in combination with other cumulative projects could decrease flows in surface water channels following a transfer while groundwater basins recharge, and could decrease pumping at the Jones and Banks Pumping Plants or require additional releases from upstream Project storage. The SWP transfers include groundwater substitution up to a maximum of 6,800 AF. As described in Section 3.1.2.4.1, increased groundwater pumping could result in decreased surface water supplies as a result of surface water and groundwater interactions, resulting in decreased water available for exports at the Delta pumping plants or the need to release additional water from upstream Project reservoirs. Mitigation Measure WS-1 would reduce the impacts of the Proposed Action to less-than-significant levels.

Mitigation Measure WS-1 includes a streamflow depletion factor determined and applied by Reclamation and DWR; both CVP and SWP transfers would be held to this standard to avoid any significant incremental effects. Therefore, the Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact related to changes in surface water flows.

The Proposed Action in combination with other cumulative projects could increase Delta diversions, which could decrease Delta water levels and affect in-Delta water users. SWP transfers, the Yuba Accord, and refuge transfers could affect Delta operations during the same period (July through September) as the Proposed Action. These efforts could increase Delta diversions during dry years. Reclamation and DWR install temporary barriers each year during this time period to reduce effects to Delta water levels; therefore, the effects of the Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact.

3.1.6.1.2 Buyer Service Area

The Proposed Action in combination with other cumulative past, present, and future projects could affect water supply in the Buyer Service Area. As described in Table 1-1 in Section 1.2.1, existing CVP water supply allocations for water users south of the Delta are frequently not fully met. In any given WY, the volume of water delivered is dependent on forecasted reservoir inflows and Central Valley hydrologic conditions, amounts of storage in CVP reservoirs, regulatory requirements, and management of Section 3406(b)(2) water resources and Sections 3406 (b)(3) and (d) concerning refuge water supplies (including refuge transfers) in accordance with implementation of the CVPIA. These conditions have had a significant cumulative impact on water supplies in the region.

Other cumulative projects could also affect water supplies. The M&I WSP could change water supplies to CVP users. The SJRRP could affect supplies within the Buyer Service Area as a result of reduced flood flows from the San Joaquin River that could supplement water supply to buyers in wet years. SWP transfers and the ~~Lower~~ Yuba ~~River~~ Accord could also increase supplies to the Buyer Service Area.

Cumulatively, past, present, and future physical and regulatory limitations have reduced water supplies to the Buyer Service Area, which would be a significant cumulative effect on water supply. The Proposed Action would increase water supplies to buyers who may be affected by reduced allocations, which would help offset adverse impacts. Therefore, the Proposed Action's incremental contribution to potentially significant cumulative water supply impacts would not be cumulatively considerable.

3.1.6.2 Alternative 3: No Cropland Modification

Cumulative effects would be the same or less than those described for the Proposed Action in the Seller and Buyer Service Areas.

3.1.6.3 Alternative 4: No Groundwater Substitution

Cumulative effects would be the same or less than those described for the Proposed Action in the Seller and Buyer Service Areas.

3.1.7 References

Bureau of Reclamation. 2004a. *Federal Register December 16, 2004 Volume 69 Number 241, Sacramento River Settlement Contractors. Page 75341-75342*. Accessed on: September 02, 2014. Available at: http://www.gpo.gov/fdsys/pkg/FR-2004-12-16/pdf/04-27479.pdf

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National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries). 2009. Biological Opinion on the Long-Term Central Valley Project and State Water Project Operations Criteria and Plan. National Marine Fisheries Service, Southwest Region, Long Beach, CA. June 4, 2009. 844 pp.

U.S. Fish and Wildlife Service. 2008. *Biological Opinion on the Coordinated Operations of the Central Valley Project (CVP) and State Water Project (SWP). Final*. December 15, 2008.

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Section 3.2
Water Quality

Maintaining surface water quality in California’s water bodies is important to ensure safe drinking water and to maintain environmental, recreational, industrial, and agricultural beneficial uses. This section describes the existing water quality of the water bodies within the area of analysis, and discusses potential effects on surface water quality from implementation of the proposed alternatives. Section 3.3 addresses potential water quality effects to groundwater.

Surface water quality effects could occur from all types of transfer methods including cropland idling, crop shifting, groundwater substitution, stored reservoir water, and conservation.

3.2.1 Affected Environment/Environmental Setting

This section identifies the area of analysis, describes applicable laws and policies relevant to water quality, and provides a description of existing water quality for each of the water bodies with the potential to be affected by long-term water transfers.

3.2.1.1 Area of Analysis

The area of analysis for water quality is divided into two regions: the Seller Service Area and the Buyer Service Area. Figure 3.2-1 shows the area of analysis for water quality.

3.2.1.1.1 Seller Service Area

The alternatives have the potential to affect water bodies within the Sacramento River Basin, including:

- Shasta Reservoir and the Sacramento River downstream of Shasta Reservoir to the Sacramento-San Joaquin Delta (Delta);

- Lake Oroville and the Feather River downstream of Lake Oroville; Camp Far West Reservoir, the Bear River downstream of Camp Far West Reservoir, and the Yuba River downstream of the confluence with the Bear River; and Collins Lake and Dry Creek downstream of Collins Lake;

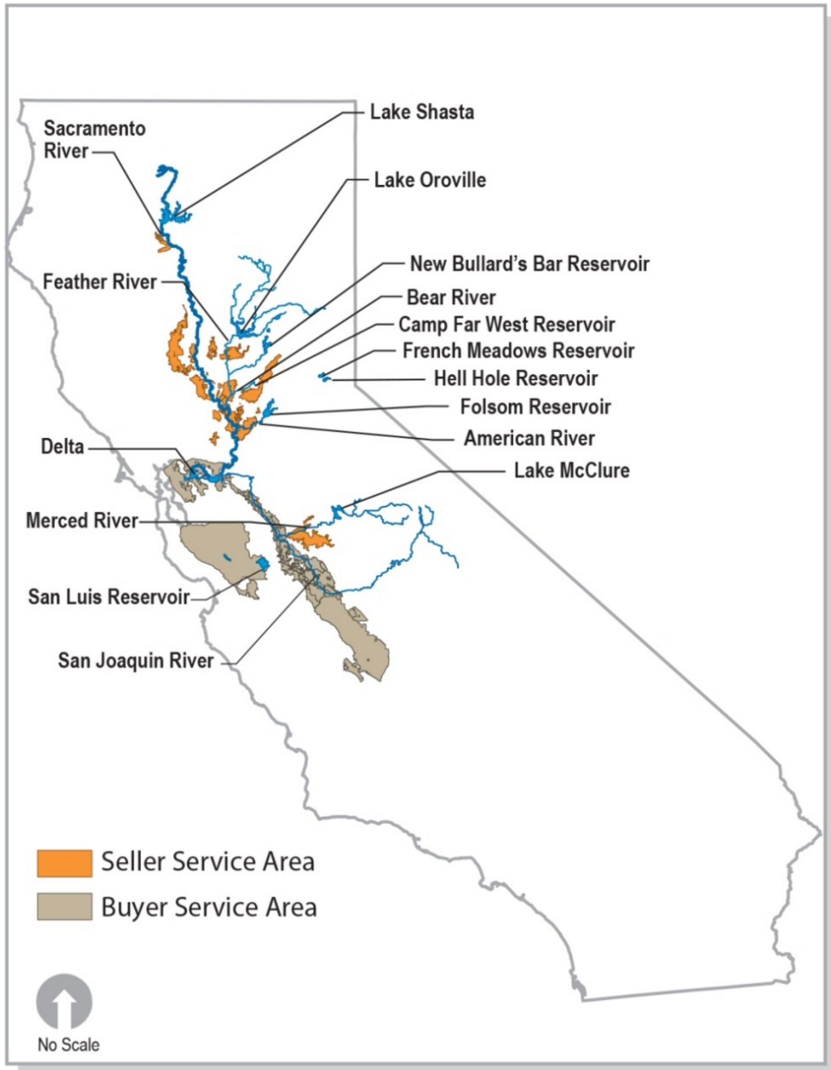


Figure 3.2-1. Water Quality Area of Analysis

- Folsom Reservoir and the American River downstream of Folsom Reservoir to its confluence with the Sacramento River, and Hell Hole and French Meadows reservoirs and the Middle Fork American River downstream of Hell Hole and French Meadows reservoirs; and
- Delta Region, including the river channels and sloughs at the confluence of the Sacramento and San Joaquin rivers.

Within the San Joaquin River Basin, potentially affected water bodies in the Seller Service Area include:

- Lake McClure and the Merced River downstream of Lake McClure; and
- San Joaquin River from the Merced River to the Delta.

3.2.1.1.2 Buyer Service Area

Potentially affected water bodies in the Buyer Service Area include:

- San Luis Reservoir in Merced County.

3.2.1.2 Regulatory Setting

There are numerous Federal and State laws and policies that protect water quality.

3.2.1.2.1 Federal

Safe Drinking Water Act (SDWA)

The Federal SDWA was enacted in 1974 and authorized the U.S. Environmental Protection Agency (USEPA) to establish safe standards of purity for naturally-occurring and man-made contaminants. It requires all owners or operators of public water systems to comply with primary (health-related) standards and encourages attainment of secondary standards (nuisance-related). Contaminants of concern in a domestic water supply are those that either pose a health threat or in some way alter the aesthetic acceptability of the water. These types of contaminants are currently regulated by the USEPA through primary and secondary maximum contaminant levels (MCLs). As directed by the SDWA amendments of 1986, the USEPA has been expanding its list of primary MCLs. MCLs have been proposed or established for approximately 100 contaminants. In California, the USEPA has delegated SDWA powers to the state government.

Clean Water Act (CWA)

The Federal Water Pollution Control Act of 1948 was the first major law addressing water pollution in the United States. When it was amended in 1972, this law became commonly known as the CWA. The CWA established the basic structure for regulating discharges of pollutants into the waters of the U.S. It gave the USEPA the authority to implement pollution control programs and to set water quality standards for known contaminants in surface waters. The CWA also made it unlawful for any person to discharge any pollutant from a point source into navigable waters, unless a permit was obtained under its provisions (USEPA 2002). In California, the USEPA has delegated authority to the state government.

Section 303(d) of the CWA requires states, territories and authorized tribes to develop a list of water quality-impaired segments of waterways. The 303(d) list includes water bodies that do not meet water quality standards for their beneficial uses. The CWA requires that these jurisdictions establish priority rankings for water on the lists and develop action plans, called Total Maximum Daily Loads (TMDLs), to improve water quality (USEPA 2012a). A TMDL is the sum of the allowable loads within an individual waterbody of a single pollutant from all contributing point and nonpoint sources (USEPA 2012a). TMDLs are tools for implementing water quality standards and establish the allowable daily pollutant loadings or other quantifiable parameters (e.g., pH or temperature) for a waterbody.

Several water bodies within the area of analysis have been identified as impaired by certain constituents of concern and appear on the most recent 303(d) list. Table 3.2-1 presents the 2010 303(d) listed water bodies within the area of analysis.

Table 3.2-1. 303(d) Listed Water Bodies Within the Area of Analysis and Associated Constituents of Concern

Water Body Name	Constituent	Estimated Area Affected [2]	Proposed TMDL Completion Year
Shasta Reservoir	Cadmium Copper Zinc Mercury	20 acres 20 acres 20 acres 27,335 acres	2020 2020 2020 2021
Sacramento River (Keswick Dam to Delta)	Chlordane DDT Dieldrin Mercury PCBs Unknown toxicity	16 miles 98 miles 98 miles 16 miles 98 miles 129 miles	2021 2021 2021 2021 2021 2019
Lake Oroville	Mercury PCBs	15,400 acres 15,400 acres	2021 2021
Lower Feather River	Chlorpyrifos Group A Pesticides [1] Mercury PCBs Unknown Toxicity	42 miles 42 miles 42 miles 42 miles 42 miles	2019 2011 2012 2021 2019
Camp Far West Reservoir	Chlorpyrifos Copper Diazinon Mercury	21 miles 21 miles 21 miles 21 miles	2021 2021 2010 2015
Lower Bear River (Below Camp Far West Reservoir)	Mercury	1,945 acres	2015
Dry Creek	Chlorpyrifos Diazinon E.Coli Unknown Toxicity	34 Miles	2021
Hell Hole Reservoir	Mercury	1,370 acres	2021
Folsom Reservoir	Mercury	11,064 acres	2019
Lower American River	Mercury Unknown Toxicity PCBs	27 miles 27 miles 27 miles	2010 2021 2021
Lake McClure	Mercury	5,605 acres	2021

Water Body Name	Constituent	Estimated Area Affected [2]	Proposed TMDL Completion Year
Merced River	Chlorpyrifos	50 miles	2008
	Diazinon	50 miles	2008
	Group A Pesticides [1]	50 miles	2011
	Mercury	50 miles	2019
	Unknown Toxicity	50 miles	2021
	Water Temperature	50 miles	2021
	E.Coli	50 miles	2021
San Joaquin River (Merced River to Delta)	Alpha-BHC	29 miles	2022
	Boron	29 miles	2007
	Chlorpyrifos	40 miles	2007
	DDE	32 miles	2011
	DDT	40 miles	2011
	Diazinon	8.4 miles	2007
	Group A Pesticides [1]	40 miles	2011
	Electrical Conductivity	40 miles	2021
	Mercury	40 miles	2012
	Water Temperature	40 miles	2021
	Toxaphene	3 miles	2019
	Diuron	3 miles	2021
	Unknown Toxicity	40 miles	2019
Sacramento-San Joaquin Delta	Chlordane	6,795 acres	2007
	Chlorpyrifos	43,614 acres	2011
	DDT	43,614 acres	2011
	Diazinon	43,614 acres	2007
	Dieldrin	6,795 acres	2011
	Dioxin	1,603 acres	2019
	Electrical Conductivity	20,819 acres	2019
	Furan Compounds	1,603 acres	2019
	Group A Pesticides	43,614 acres	2011
	Invasive Species	43,614 acres	2019
	Mercury	43,614 acres	2009
	Organic Enrichment/ Low Dissolved Oxygen	1,603 acres	2007
	Pathogens	1,603 acres	2008
	PCBs	8,398 acres	2019
	Unknown Toxicity	43,614 acres	2019

Source: SWRCB 2011.

Key:

alpha-BHC = Benzenehexachloride or alpha-HCH

DDE = Dichlorodiphenyldichloroethylene

DDT =Dichlorodiphenyltrichloroethane

PCBs = Polychlorinated biphenyls

Notes:

[1] Group A Pesticides: aldrin, dieldrin, endrin, chlordane, heptachlor, heptachlor expoxid, hexachlorocyclohexane, endosulfan, and toxaphehe

[2] Estimated area affected is given as the surface area (acres) of lakes or estuaries or length (river miles) for river systems.

The National Pollutant Discharge Elimination System is a permit program authorized by the CWA that controls water pollution by regulating point source discharges into waters of the United States. In California, the USEPA has delegated authority of this program to the State Water Resources Control Board (SWRCB). The SWRCB ensures that all point source discharges to surface waters will not conflict with existing water quality laws and the water quality standards established for that specific water body.

3.2.1.2.2 State

Porter-Cologne Water Quality Control Act

The California Porter-Cologne Water Quality Act (Porter-Cologne Act) was enacted in 1969 and established the SWRCB and nine Regional Water Quality Control Boards (RWQCBs). These boards are the primary agencies responsible for protecting California water quality to meet present and future beneficial uses. They are also responsible for regulating appropriative surface rights allocations.

According to the Porter-Cologne Act, the RWQCBs must establish water quality objectives for water bodies within their regions. The Porter-Cologne Act defines water quality objectives as "… the limits or levels of water quality constituents or characteristics which are established for the reasonable protections of the beneficial uses of water or the preventions of nuisance within a specified area" [Water Code 13050(H)]. The RWQCBs do this through the adoption of water quality control plans, or Basin Plans.

Regional Water Quality Control Plans

California Water Code (Section 13240) requires the preparation and adoption of water quality control plans (Basin Plans), and the Federal CWA (Section 303) supports this requirement. According to Section 13050 of the California Water Code, Basin Plans consist of a designation or establishment of beneficial uses to be protected, water quality objectives to protect those uses, and an implementation program for achieving the objectives. Because beneficial uses, together with their corresponding water quality objectives, can be defined per Federal regulations as water quality standards, the Basin Plans are regulatory references for meeting the State and Federal requirements for water quality control (40 Code of Federal Regulations 131.20).

Basin Plans present water quality objectives in numerical or narrative format for specified water bodies or for protection of specified beneficial uses throughout a specific basin or region. State law defines beneficial uses to include (but not be limited to) "...domestic; municipal; agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves" (Water Code Section 13050(f)). The beneficial uses designated for water bodies within the area of analysis are presented in Table 3.2-2 (Seller Service Area), and Table 3.2-3 (Buyer Service Area).

Table 3.2-2. Beneficial Uses of Water Bodies in the Seller Service Area

Beneficial Use Designation	Shasta Reservoir	Sacramento River	Lake Oroville	Lower Feather River	Bear River	Camp Far West Reservoir	Lower Yuba River	Hell Hole and French Meadows Reservoirs	Middle Fork American River	Folsom Reservoir	Lower American River	Lake McClure	Merced River	San Joaquin River	Sacramento-San Joaquin Delta
Municipal and Domestic Supply	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓
Agricultural Irrigation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Stock Watering		✓			✓	✓	✓	✓	✓				✓	✓	✓
Industrial Process Supply													✓	✓	✓
Industrial Service Supply		✓									✓		✓		✓
Power Generation	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	
Water Contact Recreation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Canoeing and Rafting		✓		✓	✓		✓		✓		✓		✓	✓	
Non-contact Water Recreation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Warm Freshwater Habitat	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓
Cold Freshwater Habitat	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Beneficial Use Designation	Shasta Reservoir	Sacramento River	Lake Oroville	Lower Feather River	Bear River	Camp Far West Reservoir	Lower Yuba River	Hell Hole and French Meadows Reservoirs	Middle Fork American River	Folsom Reservoir	Lower American River	Lake McClure	Merced River	San Joaquin River	Sacramento-San Joaquin Delta
Warm and Cold Water Migration Areas		✓		✓			✓						✓	✓	✓
Warm Water Spawning Habitat	✓	✓	✓	✓			✓			✓			✓	✓	✓
Cold Water Spawning Habitat	✓	✓	✓	✓			✓	✓	✓		✓		✓		
Navigation		✓													✓
Wildlife Habitat	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Source: RWQCBCV 2011

Table 3.2-3. Beneficial Uses of Water Bodies in the Buyer Service Area

Beneficial Use Designation	California Aqueduct	Delta-Mendota Canal	San Luis Reservoir
Municipal and Domestic Supply	✓	✓	✓
Agricultural Irrigation	✓	✓	✓
Stock Watering	✓	✓	✓
Industrial Process	✓	✓	
Service Supply	✓		✓
Power Generation	✓		✓
Water Contact Recreation	✓	✓	✓
Non-contact Water Recreation	✓	✓	✓
Warm Freshwater Habitat		✓	✓
Wildlife Habitat	✓	✓	✓

Source: RWQCBCV 2011

The current Basin Plan that covers the water bodies in the Seller Service Area and Buyer Service Area (with the exception of the Delta) is the *Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins* (RWQCB, Central Valley [RWQCBCV] 2011). The current plan that covers the Delta is the *Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary* (SWRCB 2006), which was originally adopted in 1996 and revised in 2006. This plan is referred to as the Bay-Delta Plan.

SWRCB Decision 1641

SWRCB Decision-1641 and Water Right Order 2001-05 describe the current water right requirements to implement the flow-dependent objectives outlined in the Bay-Delta Plan. In SWRCB Decision-1641, the SWRCB assigned responsibilities to Reclamation and Department of Water Resources (DWR) for meeting these requirements. These responsibilities require that the Central Valley Project (CVP) and State Water Project (SWP) be operated to protect water quality, and that DWR and/or Reclamation ensure that the flow dependent water quality objectives are met in the Delta (SWRCB 2000).

Reclamation Non-Project Water Acceptance Criteria

Reclamation has developed water quality criteria that must be met to add non-CVP water into the Delta-Mendota Canal (Reclamation 2014). Reclamation has developed these criteria to measure constituents of concern that would affect downstream users. The concentration for selenium must not exceed 2 μg/L, the limit for the Grasslands wetlands water supply channels specified in the 1988 Basin Plan. The salinity of any source shall not exceed 1,500 mg/L TDS. The other constituents are mainly agricultural chemicals listed in the California Drinking Water Standards.

DWR Non-Project Water Acceptance Criteria
DWR has developed acceptance criteria to govern the water quality of non-Project water that may be conveyed through the California Aqueduct. These criteria dictate that a pump-in entity of any non-project water program must demonstrate that the water is of consistent, predictable, and acceptable quality prior to pumping the local groundwater into the SWP. Since there cannot be any adverse impacts to SWP water deliveries, operations or facilities, the water quality criteria cannot constrain DWR's ability to operate the SWP for its intended purposes or to protect its integrity during emergencies (DWR 2014).

The Sustainable Groundwater Management Act (SGMA)
The Sustainable Groundwater Management Acts (SGMA) [California State Assembly Bill 1739 and Senate Bills 1168 and Senate Bill 1319] were signed into law in September, 2014. See section 3.3.1.2 for the effect on proposed buyer and seller regions in regard to their groundwater management, land use, water demands, and water availability due to the implementation of the SGMA.

3.2.1.3 Existing Conditions

The following sections describe the general water quality for each of the water bodies in the area of analysis. The water quality information varies by geographic area due to availability of water quality data and the specific water quality concerns for each water body.

3.2.1.3.1 Seller Service Area

Sacramento River Area of Analysis

Shasta Reservoir
Shasta Reservoir receives water from the Sacramento River, McCloud River, and Pit River drainages and generally has good water quality. Shasta Reservoir is listed on the 2010 303(d) list as impaired due to heavy metal accumulations (mercury, cadmium, copper and zinc) from natural resource extraction. Streams that drain into Shasta Reservoir come in contact with areas disturbed by mining and become acidic and can contain concentrations of dissolved metals that violate existing water quality standards. The sources of the include West Squaw Creek below Balakala Mine, lower Little Backbone Creek, lower Horse Creek, and Town Creek, which are listed as impaired on the 2010 303(d) list (Reclamation 2013a).

Turbidity in Shasta Reservoir occurs from sediment discharge from tributaries, as well as wave erosion and shoreline erosion from changing surface water levels. Turbidity can decrease the clarity of the lake along the shoreline and can affect water-based recreation (Reclamation 2013a).

Table 3.2-4 summarizes general water quality in Shasta Reservoir.

Table 3.2-4. Water Quality in Shasta Reservoir

Water Quality Parameter	Minimum	Maximum	Average
pH[1] (standard units)	7.3	8.3	7.8
Turbidity[2] (NTU)	0.1	6553	27.5
Dissolved Oxygen[2] (mg/L)	0.1	24.2	10.7
Total Nitrogen[1](mg/L)	0.2	0.2	0.2
Total Phosphorus[1](mg/L)	0.01	0.03	0.02
Electrical Conductivity[1] (μS/cm)	68.0	109	95.3

Sources: [1] Storet 1975; [2] California DWR 2013. Water quality data from the California Data Exchange Center is from continuously hourly data from 2006 through 2011.

Key: NTU = Nephelometric Turbidity Units , mg/L = milligrams per liter; μS/cm = micro siemens per centimeter

Sacramento River

The 303(d) list indicates that certain segments of the Sacramento River contain several constituents of concern, including Chlordane, dichlorodiphenyltrichloroethane, Dieldrin, mercury, polychlorinated biphenyls (PCBs), and unknown toxicity (see Table 3.2-1); however, the water quality in the Sacramento River is generally of high quality and concentrations of undesirable constituents are generally low. The following sections report general water quality data for two locations along the Sacramento River.

Sacramento River at Balls Ferry

The Sacramento River sampling site at Balls Ferry is downstream of Shasta Dam approximately 21 miles south of Redding. Stream flow at this site is greatly influenced by managed releases from Shasta Reservoir and, during the rainy season, by storm water runoff. Water quality in this region is also influenced by human activities along the Sacramento River including agricultural, historical mining, and municipal and industrial (M&I) inputs (Reclamation 2013a). Land cover in the area is mainly forestland; cropland, pasture, and rangeland cover most of the remaining land area (U.S. Geological Survey [USGS] 2002).

Water quality within this portion of the Sacramento River is generally good. Water quality issues include the presence of mercury, pesticides, and trace metals.

Table 3.2-5 presents data for the general water quality parameters.

Table 3.2-5. Water Quality Parameters Sampled[1]on the Sacramento River at Balls Ferry

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	6.69	8.32	7.5
Turbidity (NTU)	0.54	64.3	7.5
Dissolved Oxygen (mg/L)	8.1	14	10.9
Total Organic Carbon (mg/L)	0.5	3.5	1.65
Total Nitrogen (mg/L)	0	1.3	0.14
Total Phosphorus (mg/L)	0.01	0.16	0.03
Electrical Conductivity (µS/cm)	79	136	113

Sources: DWR 2013
[1] Samples Collected 12/2000 – 08/2010

Sacramento River at Hood

The Sacramento River sampling site at Hood is located on the Lower Sacramento River south of Sacramento. Therefore, water quality samples at this site reflect the impacts of land use upstream. Impacts to water quality in this region include agricultural runoff, acid mine drainage, stormwater runoff, water releases from dams, diversions, and urban runoff (Reclamation 2013a). Table 3.2-6 presents the general water quality data for samples collected at Hood.

Table 3.2-6. Water Quality Parameters Sampled[1] at Sacramento River at Hood

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	6.4	8.4	7.5
Turbidity (NTU)	1.2	240	18.7
Dissolved Oxygen (mg/L)	5.2	12.4	8.8
Total Organic Carbon (mg/L)	0.6	11	2.4
Total Nitrogen (mg/L)	0.01	0.4	0.1
Total Phosphorus (mg/L)	0.02	1.0	0.09
Electrical Conductivity (µS/cm)	73	234	154

Sources: DWR 2013
[1] Samples Collected 01/2006 - 01/2013.

Feather River Area of Analysis

Lake Oroville

Lake Oroville generally has good water quality. The following water quality information was obtained from the 2007 Draft Environmental Impact Report (EIR) Oroville Facilities Relicensing (DWR 2007), which described water quality monitoring results for 2002 through 2004. Water temperatures from Lake Oroville releases generally met the Feather River temperature requirements established for the downstream hatchery. When temperature exceedances did occur, they were usually minor. In Lake Oroville, dissolved oxygen and pH levels at the monitoring stations generally met the objectives in the Basin Plan for the Sacramento River and San Joaquin River Basins.

Occasionally, when Lake Oroville is thermally stratified during the summer, dissolved oxygen measured near the surface and bottom of the reservoir did not meet the Basin Plan objective. Mineral and electrical conductivity (EC) met all Basin Plan objectives (DWR 2007).

Lake Oroville retains most sediment that flows into the reservoir from the upper watershed, and only suspended material is released into the lower Feather River. Wave and wind action at the reservoir can result in some shoreline erosion (DWR 2007). Recreation activities can introduced contaminants into Lake Oroville, including sediment, petroleum hydrocarbons, bacteria/organic sewage, metals, pesticides, and garbage (California Department of Parks and Recreation [CDPR] 2004). Lake Oroville is not a significant source of metals but does trap sediments from upstream historic mining. Lake Oroville is listed as impaired on the 2010 303(d) list for mercury and PCBs. The source of the mercury is listed as resource extraction and likely attributed to upstream historic mining activities; the source of the PCBs is unknown.

Lower Feather River

The Lower Feather River extends from Lake Oroville down to its confluence with the Sacramento River. Water quality in the lower Feather River is substantially affected by agriculture and urbanization (Sacramento River Watershed Program 2010). The lower Feather River appears on the 2010 303(d) list of impaired water bodies for chlorpyrifos, Group A pesticides, mercury, PCBs and unknown toxicity. The source of the chlorpyrifos and Group A pesticides is listed as agriculture while the source of the mercury is listed as abandoned mines. The source of the PCBs and unknown toxicity remains unknown.

A major constituent of concern on the lower Feather River is diazinon, a pesticide applied to orchards growing plums, peaches and almonds. In 2002, the lower Feather River was listed on the 303(d) list of impaired water bodies for diazinon. In 2003, the RWQCBCV implemented TMDLs for this pesticide and worked with stakeholders to implement methods to reduce diazinon loading. As a result, 79 miles of river, including the lower Feather River, were removed from the 303(d) list in 2010 (USEPA 2012b) for impairment by diazinon.

Table 3.2-7. Water Quality Parameters Sampled[1] at the Feather River near Verona

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	6.8	8.5	7.6
Turbidity (NTU)	2.77	46.8	13.3
Dissolved Oxygen (mg/L)	7.5	10.7	9.1
Total Organic Carbon (mg/L)	0.8	4.6	1.8
Total Nitrogen (mg/L)	0.02	0.16	0.06
Total Phosphorus (mg/L)	0.01	0.08	0.03
Electrical Conductivity (μS/cm)	65	131	97

Sources: DWR 2013
[1] Samples Collected 01/2006 - 01/2013.

Yuba River Area of Analysis

Collins Lake

Collins Lake is a reservoir created to provide additional irrigation water for Browns Valley Irrigation District (ID). The reservoir has a total storage capacity of 49,500 acre-feet (AF) (Browns Valley ID 2014). Dry Creek is located downstream of the lake, which eventually joins the Yuba River. Collins Lake is not currently listed for any 303(d) water quality impairments.

Dry Creek

Dry Creek is currently listed as impaired by chlorpyrifos, diazinon, E.Coli, and unknown toxicity. Chlorpyrifos and diazinon are pesticides with agriculture listed as potential sources. Potential sources of E.Coli and unknown toxicity are listed as unknown.

Lower Yuba River

The water quality of the lower Yuba River is generally good and has improved in recent decades due to controls on hydraulic and other destructive mining techniques, changes in pesticide regulations, and the establishment of minimum instream flows (HDR and SWRI 2007). Dissolved oxygen concentrations, total dissolved solids (TDS), pH, hardness, alkalinity, and turbidity are well within acceptable or preferred ranges for salmonids and other key freshwater biota. The surface water monitoring performed by the Sacramento River Watershed Program over the past decade generally indicates that water quality supports the beneficial uses (e.g., irrigation, fisheries habitat) designated for the water bodies in the Yuba River Basin (Sacramento River Watershed Program 2010). To date, no TMDLs have been established for the Yuba River.

Table 3.2-8 presents general water quality data for the lower Yuba River near the Feather River confluence.

Table 3.2-8. Water Quality Parameters Sampled[1] on the Yuba River Upstream of Feather River Confluence (Yuba R A MO)

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	6.9	8.3	7.5
Turbidity (NTU)	1.17	46.8	9.18
Dissolved Oxygen (mg/L)	7.72	12.2	10.3
Total Organic Carbon (mg/L)	0.9	2.3	1.6
Total Nitrogen (mg/L)	0.01	0.07	0.04
Total Phosphorus (mg/L)	0.01	0.03	0.01
Electrical Conductivity (µS/cm)	66	100	85.7

Sources: DWR 2013
[1] Samples collected 11/2008 – 2/2011

Bear River Area of Analysis

Camp Far West Reservoir

Camp Far West Reservoir is listed as impaired by mercury on the 2010 303(d) list. Historic gold mining has led to elevated mercury concentrations in fish, especially spotted bass. The California Office of Environmental Health Hazard Assessment (OEHHA) has issued a public advisory recommending no consumption of largemouth, smallmouth, or spotted bass from Camp Far West Reservoir by women of childbearing age and children (California OEHHA 2009).

Bear River

Flows within the Bear River are continuous and dependent on releases from Camp Far West Reservoir. The lower Bear River is listed as impaired by chlorpyrifos, copper, diazinon, and mercury. The source of the chlorpyrifos and diazinon is agriculture. The source of the copper is unknown. The mercury is from historic mining, as noted above for Camp Far West Reservoir (SWRCB 2011).

Table 3.2-9 presents general water quality data for the lower Bear River.

Table 3.2-9. Water Quality Parameters Sampled[1] on the Lower Bear River (Bear R NR MO)

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	6.8	7.9	7.4
Turbidity (NTU)	0.8	101	23.3
Dissolved Oxygen (mg/L)	5.5	12.1	8.7
Total Organic Carbon (mg/L)	1.1	10.5	4.3
Total Nitrogen (mg/L)	0.02	0.26	0.97
Total Phosphorus (mg/L)	0.02	0.19	0.07
Electrical Conductivity (µS/cm)	85	208	140

Sources: DWR 2013
[1] Samples collected 11/2008 – 8/2012

American River Area of Analysis

French Meadows Reservoir

Water in French Meadows Reservoir is generally considered to be of good quality with a strong trout population. There are currently no TMDLs developed for French Meadows Reservoir. Limited water quality data is available for French Meadows Reservoir, as shown in Table 3.2-10.

Table 3.2-10. Water Quality Parameters Sampled[1] at French Meadows Reservoir

Water Quality Parameter	Value
pH (standard units)	7.3
Turbidity (NTU)	0.4
Total Organic Carbon (mg/L)	1.2
Total Phosphorus (mg/L)	1.1
Electrical Conductivity (μS/cm)	26

Source: Storet 1985

Hell Hole Reservoir

Water in Hell Hole Reservoir is generally considered to be of good quality. In 2010 the Commercial and Sport Fishing designated use was listed as impaired due to mercury impairment. A TMDL has not yet been developed for this impairment. The source of the mercury exceedance is listed as unknown (USEPA 2013). Limited water quality data is available for Hell Hole Reservoir, as shown in Table 3.2-11.

Table 3.2-11. Water Quality Parameters Sampled[1] at Hell Hole Reservoir

Water Quality Parameter	Value
pH (standard units)	7.1
Electrical Conductivity (μS/cm) a	26

Source: Storet 1969

Middle Fork American River

Water in the Middle Fork American River is generally considered to be of good quality. Table 3.2-12 presents the results of a region-wide RWQCBCV Recreation Beneficial Use Study in 2008 for the Middle Fork American River.

Table 3.2-12. Water Quality Parameters Sampled on the Middle Fork American River at Mammoth Bar

Water Quality Parameter	08/27/2008	08/31/2008	09/03/2008
pH (standard units)	9.08	7.11	5.41
Temperature (º C)	20.8	18.8	18.4
Specific Conductivity (umhos/cm)	40	40	37
E Coli (MPN/100mL)	2	2	1

Sources: SWRCB 2008

Folsom Reservoir

Snowmelt and precipitation from the upper American River Watershed discharges water into Folsom Reservoir and Lake Natoma. In general, runoff from the relatively undeveloped watershed is of very high quality, rarely exceeding California's water quality objectives (Wallace, Roberts, & Todd et al. 2003). Due to changes in the operation of Shasta Dam, releases from Folsom Reservoir are used to fulfill water delivery obligations and downstream water quality standards that would normally be met by releases from Shasta (Reclamation 2013b). The reservoir is listed on the 2010 303(d) list as impaired by mercury. The source of the mercury is historic mining. Table 3.3-13 presents general water quality data for Folsom Reservoir.

Table 3.2-13. Water Quality Parameters Sampled at Folsom Reservoir

Water Quality Parameter	Minimum	Maximum	Average
PH (standard units)	5.8	8.5	7.1
Turbidity (NTU)	1	68	1.2
Dissolved Oxygen (mg/L)	7.0	14	10.3
Total Organic Carbon (mg/L)	2	3.5	N/A
Total Nitrogen (mg/L)	N/A	N/A	N/A
Total Phosphorus (mg/L)	N/A	N/A	N/A
Electric Conductivity (μS/cm)	19	123	52

Source: Larry Walker Associates 1999

Lower American River

Gold mining has occurred within the American River basin since the Gold Rush in 1848. The lower American River is listed as an impaired water body because of mercury lost during gold recovery. The urbanized portions of the lower American River are also listed for unknown toxicity. This is believed to be a result of use of herbicides and pesticides on landscaped residential and commercial areas.

Table 3.2-14. Water Quality Parameters Sampled[1] on the Lower Fork American River (American River at Water Treatment Plant)

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	5.9	9.3	7.4
Turbidity (NTU)	0.7	146	4.5
Dissolved Oxygen (mg/L)	5.2	12.95	9.5
Total Organic Carbon (mg/L)	0.7	3.0	1.7
Total Nitrogen (mg/L)	0.01	0.19	0.05
Total Phosphorus (mg/L)	0.01	0.1	0.02
Electrical Conductivity (μS/cm)	40	95	60

Sources: DWR 2013

[1] *Samples collected 01/2006 – 12/2012*

Table 3.2-15 summarizes water quality data measured downstream of Folsom Dam in Lake Natoma at Negro Bar from April to September 2008. In general, water quality in Lake Natoma meets standards in the Basin Plan for the Sacramento River and San Joaquin River Basins.

Table 3.2-15. Water Quality at Lake Natoma (at Negro Bar) - April to September 2008

Water Quality Parameter	Units	Minimum	Maximum	Average	RL
Arsenic (Dissolved)	µg/l	<0.5	<0.5	0.5	0.5
Barium (Dissolved)	µg/l	11	17	13.5	0.5
Calcium (Dissolved)	mg/l	5	9	7	1
Chromium (Dissolved)	µg/l	<0.5	1	0.74	0.5
Copper (Dissolved)	µg/l	0.5	0.8	0.6	0.5
Cyanide	µg/l	<2.0	<2.0	<2.0	2.0
Iron (Dissolved)	µg/l	<100	<100	<100	100
Magnesium (Dissolved)	mg/l	1	3	2	1
Manganese (Dissolved)	µg/l	5	28	15.5	0.6
Mercury	ng/l	<2.0	<2.0	<2.0	2.0
Nickel (Dissolved)	µg/l	<1.0	<1.2	<1.2	1.2
Silver (Dissolved)	µg/l	<0.5	<0.6	<0.6	0.5
TDS	mg/l	40	72	52	10
TSS	mg/l	<1.0	3.4	2.4	1.0
Zinc (Dissolved)	µg/l	<2.0	<2.5	<2.5	2.5

Source: Reclamation 2009
Key:
RL = reporting limit

Merced River Area of Analysis

Lake McClure

Very little water quality data was available for Lake McClure. The lake is listed as impaired for mercury due to resource extraction. Table 3.2-16 presents general water quality data collected on the Merced River, just upstream from Lake McClure.

Table 3.2-16. Water Quality Parameters Sampled[1] on the Merced River Near Briceburg

Water Quality Parameter	Average
pH (standard units)	7.2
Turbidity (NTU)	2
Dissolved Oxygen (mg/L)	10
Total Organic Carbon (mg/L)	1.6
Total Nitrogen (mg/L)	0.16
Total Phosphorus (mg/L)	0.02
Electrical Conductivity (µS/cm)	43

Source: Kratzer and Shelton 1998
[1] Samples were collected during the period from 1972 through 1990.

The results from three additional sampling events in March and April 2003 on the Merced River at Briceberg are presented in Table 3.2-17.

Table 3.2-17. Water Quality Parameters Sampled on the Merced River At Briceburg

Water Quality Parameter	Average[1]
pH (standard units)	7.8
Turbidity (NTU)	1.7
Dissolved Oxygen (mg/L)	12
Total Organic Carbon (mg/L)	1.5
Electrical Conductivity (µS/cm)	61

Source: DWR 2013
[1] Samples were collected from March-April 2003

Merced River
Table 3.2-18 presents general water quality data for the Merced River near Stevinson (near the mouth of the Merced River). The Merced River is listed as impaired by mercury due to resource extraction.

Table 3.2-18. Water Quality Parameters Sampled[1] on the Merced River Near Stevinson

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	6.29	7.5	6.9
Turbidity (NTU)	2.13	22.8	7.3
Dissolved Oxygen (mg/L)	7.88	12.1	9.7
Electrical Conductivity (µS/cm)	58	156	105

Source: DWR 2013
[1] Samples were collected during the period from 09/1998 – 05/1999.

San Joaquin River Area of Analysis
Agricultural drainage, along with wastewater treatment plant discharges, runoff from dairies, and other sources, contribute to suspended sediment and other constituents of concern in the river. San Joaquin River water quality standards include salinity standards at Vernalis, which is just downstream of the confluence with the Stanislaus River. The salinity standard (measured as EC) is 700 µS/cm from April 1 to August 31, and 1000 µS/cm for the remainder of the year. Water quality in the San Joaquin River at Maze River (just upstream of the water quality compliance point at Vernalis) is shown in Table 3.2-19. Water quality at Vernalis is presented in Table 3.2-20. The Stanislaus River enters the San Joaquin River between these two points, and at some times, can be used to improve water quality to meet standards at Vernalis.

Table 3.2-19. Water Quality Parameters Sampled[1] on the San Joaquin River At Maze Bridge

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	7.2	8.5	7.8
Turbidity (NTU) [2]	5	160	32.1
Total Organic Carbon (mg/L)	3.6	7.7	4.9
Total Nitrogen (mg/L)	1.6	3.3	2.4
Total Phosphorus (mg/L)	0.19	0.57	0.42
Electrical conductivity (μS/cm)	213	1700	1140

Source: DWR 2013
[1] Samples taken from 1984 through 1994.

Table 3.2-20. Water Quality Parameters Sampled[1] on the San Joaquin River At Vernalis

Water Quality Parameter	Minimum	Maximum	Average
pH (standard units)	6.9	9.07	7.7
Turbidity (NTU) [2]	1.9	157	18.5
Total Organic Carbon (mg/L)	1.4	10.4	3.8
Total Nitrogen (mg/L)	0.08	3.2	1.3
Total Phosphorus (mg/L)	0.05	0.37	0.15
Electrical conductivity (μS/cm)	99	1077	531

Source: DWR 2013
[1] Samples taken from 2006 through 2013.

Delta Region

Delta Water Quality Concerns

The existing water quality constituents of concern in the Delta can be categorized broadly as metals, pesticides, nutrient enrichment and associated eutrophication, constituents associated with suspended sediments and turbidity, salinity, bromide, and organic carbon. Salinity is a water quality constituent that is of specific concern and is described below. Table 3.2-21 presents water quality data for salinity at selected stations within the Delta.

Table 3.2-21. Water Quality Data for Selected Stations within the Delta

Location	Mean TDS (mg/L)	Mean Electrical Conductivity (μS/cm)	Mean Chloride, Dissolved (mg/L)
Sacramento River at Hood	92.4	155	6.1
North Bay Aqueduct at Barker Slough	188	323	24
SWP Clifton Court Intake	235	401	62
CVP Banks Pumping Plant	225	392	59
Contra Costa Intake at Rock Slough	255	553	77
San Joaquin River at Vernalis	324	531	68

Source: DWR 2013
mg/L = milligram per liter.
μS/cm = microsiemen per centimeter
Sampling period varies, depending on location and constituent, but generally is between 2006-2012

Salinity

Salinity is a measure of the mass fraction of dissolved salts (including chloride and bromide) in water, typically measured in parts per thousand (ppt). Salinity may also be measured using other methods. TDS is a measure of the concentration of salt, as measured in milligrams per liter (mg/L) (DWR 2001). TDS is defined as those solids remaining after drying a sample to a constant weight at 180 degrees Celsius. EC is a measure of the ability of a solution to carry a current and depends on the total concentration of ionized substances dissolved in the water. Because changes in EC of water are generally directly proportional to changes in dissolved salt concentrations, EC is a convenient surrogate measure for TDS.

Salinity is a concern in the Delta because it can adversely affect municipal, industrial, agricultural, and recreational uses. Table 3.2-22 illustrates that within the Delta, mean TDS concentrations are highest in the west Delta and the south Delta channels that are affected by the San Joaquin River (CALFED 2007~~0~~). Salinity issues in the Sacramento and San Joaquin rivers result from natural sources, urban discharges, and agricultural discharges. As the water from the rivers flows through the Delta, salinity intrusion from the Pacific Ocean contributes to these issues. The extent of seawater intrusion into the Delta is a function of daily tidal fluctuations, the freshwater inflow to the Delta from the Sacramento and San Joaquin rivers, the rate of export at the SWP and CVP intake pumps, and the operation of various control structures, such as the Delta Cross-Channel Gates and Suisun Marsh Salinity Control System (DWR 2001). In the southern Delta, salinity is largely associated with the high concentrations of salts carried by the San Joaquin River into the Delta (SWRCB 1999). The high mean concentration of TDS in the San Joaquin River at Vernalis reflects the accumulation of salts in agricultural soils and the effects of recirculation of salts via the Delta Mendota Canal (CALFED 2007~~0~~). Locations in the north portion of the Delta at Barker Slough and in the Sacramento River at Greene's Landing, which are not substantially affected by seawater intrusion, have lower mean concentrations of TDS than other locations in the Delta. A similar pattern is seen using mean EC levels as a surrogate for TDS.

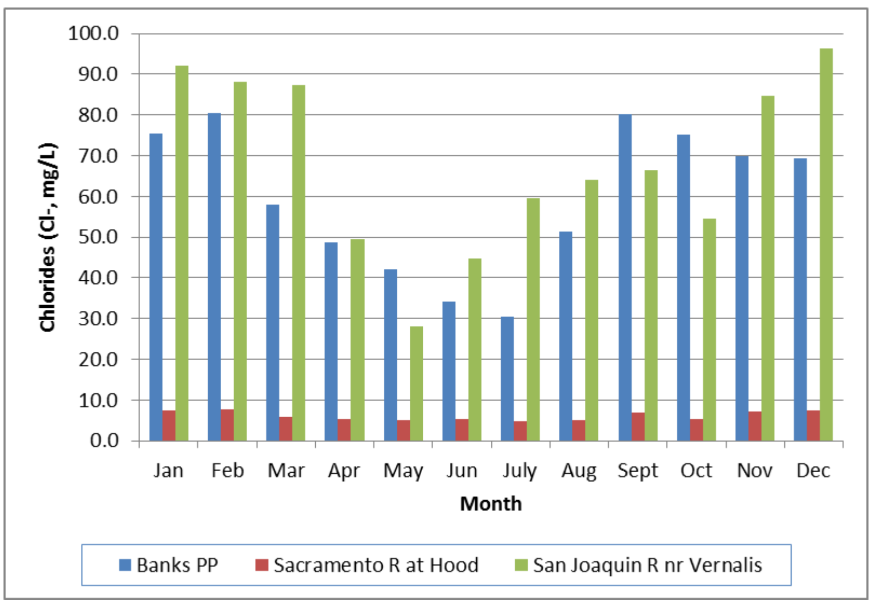
Table 3.2-22. Comparison of TDS Concentrations at Selected Stations Within the Delta

TDS (mg/L)	Sacramento River at Greenes/Hood	Old River at Station 9	Banks Pumping Plant	San Joaquin River Near Vernalis/Mossdale
Mean	95	200	195	273
Median	92	173	182	261
Low	50	107	116	83
High	404	450	388	578

Source: DWR 2001
TDS detection limit = 1.0 mg/L
Samples collected between 1996 and 1999

Water quality data collected between 1996 and 1999 show that TDS levels at Banks Pumping Plant, in the Sacramento River at Hood, and in the western Delta at Old River at Station 9 never exceeded the secondary MCL for drinking water of 500 mg/L (Table 3.2-22) (DWR 2001). In the San Joaquin River near Vernalis, only six out of the 143 samples exceeded the secondary MCL for TDS. The secondary MCL for chloride is 250 mg/L, and the secondary MCL for EC is 900 microsiemen per centimeter (µS/cm). Because TDS is a measure of the TDS and does not measure the relative contribution of individual constituents such as chloride and bromide, it is possible to meet the secondary TDS MCL for TDS (500 mg/L) but still exceed a standard for an individual salt constituent such as chloride (250 mg/L) (DWR 2001). For this reason, and because of their importance in formation of disinfection by-products, chloride is addressed in detail in the following sections.

Figure 3.2-2 presents monthly median chloride concentrations at Banks Pumping Plant, Sacramento River at Hood, and the San Joaquin River near Vernalis. As Figure 3.3-2 shows, the lowest median concentrations of chloride typically occur in spring and early summer (April through July). The monthly median concentrations of chloride for the period of record (January 2006-December 2012) do not exceed the secondary MCL for chloride of 250 mg/L. D-1641 standards also require that export locations maintain mean monthly chloride concentration less than 250mg/L.

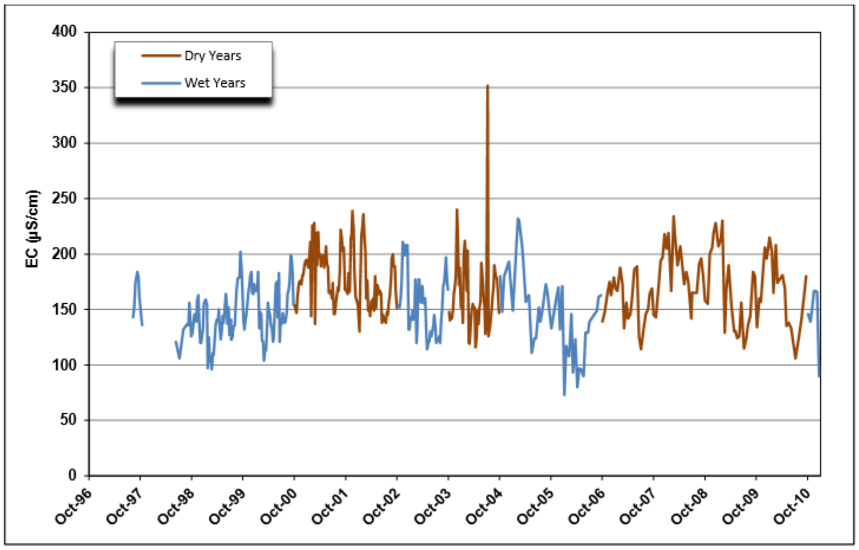


Source: DWR 2013.

Note: Bars represent the average monthly value.

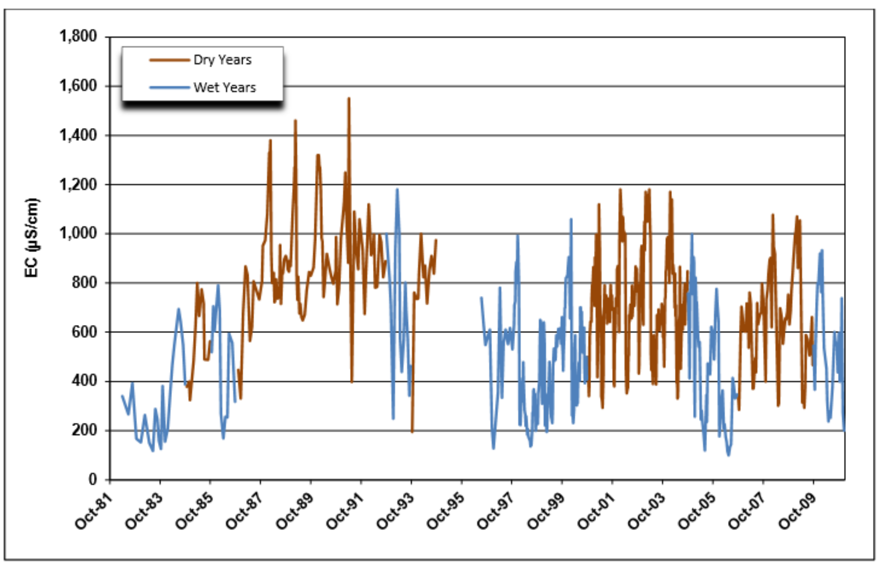
Figure 3.2-2. Monthly Average Chloride Concentrations at Banks Pumping Plant, Sacramento River at Hood, and San Joaquin River near Vernalis

Salinity patterns in the Delta also vary with water year type. As shown in Figure 3.2-3 through 3.2-5, salinity, as measured by EC, is higher in dry years than in wet years. In addition, EC levels generally rise during the late summer and fall months when river flows are low and saltwater from the San Francisco Bay flows into the Delta.



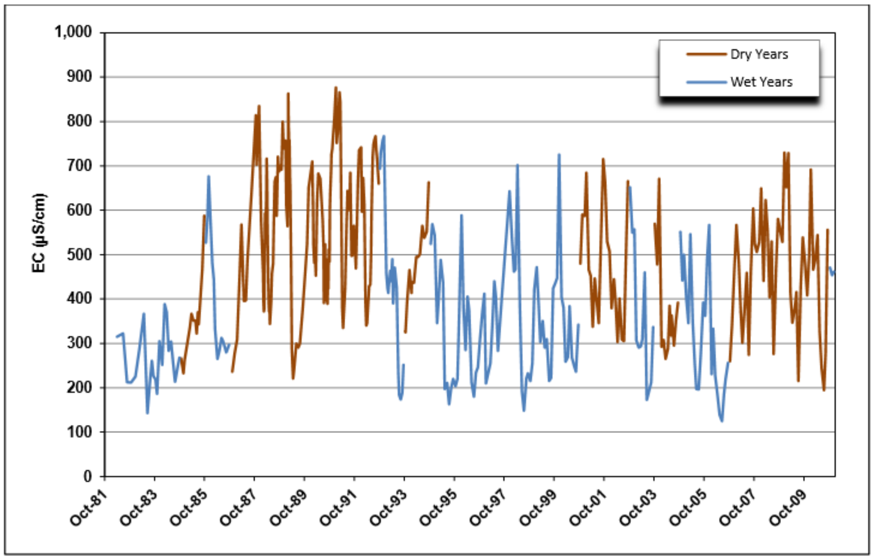
Source: DWR 2013.

Figure 3.2-3. Average EC (µS/cm) by Year Type at the Sacramento River at Hood in the Sacramento-San Joaquin Delta



Source: DWR 2013. Blank periods indicate no data available.

Figure 3.2-4. Average EC (µS/cm) by Year Type at the San Joaquin River at Vernalis in the Sacramento-San Joaquin Delta



Source: DWR 2013.

Figure 3.2-5. Average EC (µS/cm) by Year Type at Banks Pumping Plant in the Sacramento-San Joaquin Delta

Buyer Service Area

San Luis Reservoir

San Luis Reservoir is an off-stream reservoir that stores excess winter and spring water from Delta. Water is delivered to the reservoir through the California Aqueduct and Delta-Mendota Canal. In the summer months, the reservoir provides a water supply for over 20 million residents and more than half a million acres of irrigated agriculture. Water levels in San Luis Reservoir vary each season because of the amount and timing of water delivered from the California Aqueduct and Delta-Mendota Canal.

The 2013 *San Luis Reservoir State Recreation Area Final Resource Management Plan/General Plan and Final Environmental Impact Statement/Environmental Impact Report (EIS/EIR)* states that water quality in the reservoir generally meets drinking water standards, but the reservoir has several water quality concerns:

- High turbidity and TDS levels in the reservoir;
- Algal blooms and taste and odor problems (during a drought year);
- High total organic carbon and bromide concentration from the source water; and
- Pathogen contamination through grazing trespass and recreation (Reclamation and CDPR 2013).

During the summer months, when water levels are lowest, water quality in San Luis Reservoir can decline due to a combination of warmer temperatures, wind-induced nutrient mixing, and algal blooms near the reservoir surface. When San Luis Reservoir approaches its late summer/early fall low point, algae concentrations in water drawn into the reservoir's pumping plants may be high enough that the water becomes difficult to treat. A low point issue occurs when the water levels continue to decline and the algae blooms reach the Lower San Felipe Intake. Typically, this point occurs when water levels reach an elevation of 369 feet above mean sea level or 300 thousand acre-feet (TAF). If water levels fall below 369 feet (300 TAF), Santa Clara Valley Water District cannot withdraw water for M&I purposes from San Luis Reservoir because their existing water treatment plants cannot treat the algae-laden water to meet their existing water quality standards.

San Luis Reservoir was designated as mercury impaired on the 2010 California 303(d) List. The potential source of the mercury was listed as unknown (SWRCB 2011).

3.2.2 Environmental Consequences/Environmental Impacts

This section describes the methodology applied for the water quality analysis and presents the environmental impacts/environmental consequences associated with each alternative.

3.2.2.1 Assessment Methods

This section describes the assessment methods used to analyze potential water quality effects of the alternatives.

3.2.2.1.1 Reservoirs and Waterways within the Seller and Buyer Service Areas

The analysis for reservoirs and waterways uses both quantitative and qualitative methods to assess changes in water quality. The quantitative analysis relies on hydrologic modeling results that estimate changes in river flow rates and reservoir storage for the CVP and SWP reservoirs and the rivers that they influence. ~~If the change in storage is equal to or less than 1,000 AF, or if the change in flow is less than ten cubic feet per second (cfs), it is assumed that there would be no water quality impacts as this is within the error margins of the model.~~ If the changes are small and within the normal range of fluctuations (similar to the No Action/No Project Alternative) for that time period, it is generally assumed that any water quality impacts would be less than significant. Appendix B describes the modeling efforts to quantify changes in reservoir surface water storage and river flow rates.

Reservoir storage data is not available for all reservoirs included in the area of analysis. Where this data is not available, effects are evaluated based on transfer quantities, anticipated changes in water storage (increases or decreases), and the timing of the changes.

3.2.2.1.2 Sacramento-San Joaquin Delta

The analysis for the Delta uses both quantitative and qualitative methods to assess changes in water quality. The quantitative analysis relies on water quality modeling results that predict changes in various water quality parameters under each of the action alternatives. Appendix C describes the modeling analysis undertaken to quantify changes in water quality in the Delta. Where modeling is not available, effects are evaluated based on transfer quantities, anticipated changes in flow through the Delta (increases or decreases), and the timing of the changes.

3.2.2.1.3 Other Water Quality Impacts

All other water quality effects are analyzed at a qualitative level using the best available information and taking into consideration the magnitude and timing of the change, as well as any location specific water quality issues.

3.2.2.2 Significance Criteria

For the purposes of this EIS/EIR, impacts to water quality would be considered significant if implementation of any of the alternatives would:

- Violate existing water quality objectives or standards;
- Result in long-term adverse effects on beneficial uses; or
- Substantially degrade existing water quality.

3.2.2.3 Alternative 1: No Action/No Project Alternative

3.2.2.3.1 Seller Service Area

Under the No Action/No Project Alternative, changes in reservoir storage and river flows would not affect water quality in reservoirs within the Seller Service Area. Reservoir storage and river flows would continue to fluctuate seasonally and annually based on hydrologic conditions. Therefore, there would be no changes in water quality associated with the No Action/No Project Alternative.

3.2.2.3.2 Buyer Service Area

The No Action/No Project Alternative could result in crop idling, which could increase sediment deposition into waterways and could degrade water quality in the Buyer Service Area. Under the No Action/No Project Alternative, significant water shortages are anticipated in the Buyer Service Area. These water shortages have the potential to lead to a decrease in agricultural water supply, therefore forcing farmers to resort to crop idling due to lack of irrigation water. Leaving fields bare would increase the potential for sediment transport via wind erosion and deposition of transported sediment onto surface water, which could affect water quality. However, users in the buyers' area have faced shortages under the existing conditions, and have had to make these types of planting decisions for many years. Overall, crop idling is not expected to increase significantly from existing conditions in the Buyer Service Area, therefore potential crop idling would cause no change from existing conditions. There would be no changes to water quality in the Buyer Service Area compared to existing conditions.

San Luis Reservoir

Under the No Action/No Project Alternative, changes in reservoir storage would not affect water quality in San Luis Reservoir. Similar to the Seller Service Area, the water operations in the Buyer Service Area in the No Action/No Project Alternative would not change from existing conditions. Water quality and water temperatures in the San Luis Reservoir would exhibit the same range of constituent levels and be subject to the same environmental influences and variations that are already present. Therefore, there would be no water quality effects and no changes from existing conditions associated with the No Action/No Project Alternative in San Luis Reservoir.

3.2.2.4 Alternative 2: Full Range of Transfers (Proposed Action)

3.2.2.4.1 Seller Service Area

Cropland idling transfers could result in increased deposition of sediment on water bodies. Crop management practices and soil textures are key factors to determine erosion potential. The Proposed Action could result in farmers in Butte, Colusa, Glenn, Solano, Sutter, and Yolo counties leaving up to 59,973 acres of fields idle. Since these fields would be dry and have less vegetative cover, they may be more susceptible to erosion from strong winds and runoff. Increased sediment transport via wind erosion could result in increased deposition of transported sediment onto surface water bodies which could increase turbidity and affect water quality.

As described in Section 3.4, the rice crop cycle and the prevalent soil textures in Butte, Colusa, Glenn, Sutter, and Yolo Counties would reduce potential impacts from wind erosion in this region. Rice cultivation typically includes discing the field after harvest to incorporate the leftover rice straw into the soils. After harvest and discing in late September and October, rice fields are flooded to aid in decomposition of the straw. Once dried, the combination of decomposed straw and clay texture soils typically produces a hard, crust-like surface. If left undisturbed, this surface crust would remain intact throughout the summer, when wind erosion would be expected to occur, until winter rains begin. This surface crust would not be conducive to soil loss from wind erosion. During the winter rains, the hard, crust-like surface typically remains intact and the amount of sediment transported through winter runoff would not be expected to increase. Therefore, there would be little-to-no increase in sediment transport resulting from wind erosion or winter runoff from idled rice fields under the Proposed Action.

In Butte, Colusa, Glenn, Solano, Sutter, and Yolo counties, there could be a combined maximum of 8,500 acres of alfalfa, corn, or tomato cropland idled. The sellers who expressed interest in participating in cropland idling transfers in these counties are located mainly on clay and clay loam soils that have low erodibility (as described in greater detail in Section 3.4). Due to the primary clay soil textures in counties in the Seller Service Area as well as relatively small acreages of non-rice crops proposed for idling, substantial soil erosion as a result of idling non-rice crops is not expected.

Under normal farming practices, farmers typically leave fields fallow during some cropping cycles in order to make improvements such as land leveling and weed abatement or to reduce pest problems and improve soils. As discussed in Section 3.4, Geology and Soils, farmers employ management practices to reduce potential soil erosion impacts, to avoid substantial loss of soils and to protect soil quality (U.S. Department of Agriculture [USDA] Natural Resources Conservation Service [NRCS] 2009). While farmers would not be able to engage in management practices that require consumptive use of water on an idled field, they could continue to employ erosion control techniques such as surface roughening tillage to produce clods, ridges, and depressions to reduce wind velocity and trap drifting soil; establishment of barriers at intervals perpendicular to wind direction; or, application of mulch covers (USDA NRCS 2009). Therefore, cropland idling under the Proposed Action would not result in substantial soil erosion or sediment deposition into waterways. Impacts to water quality would be less than significant.

Cropland idling/shifting transfers could change the water quality constituents associated with leaching and runoff. Under the Proposed Action, cropland idling/shifting would occur, and regionally, changes in irrigation practices and pesticide application could occur compared to the No Action/No Project Alternative. The changes in the quantity of irrigation water applied to the land could alter the concentration of pollutants associated with leaching and runoff. Because farmers would apply less water to fields under the Proposed Action, there would be less potential for leaching of salts and other pollutants. In addition, the reduction in application of fertilizers and pesticides under the Proposed Action compared to the No Action/No Project Alternative would result in decreased concentrations of nitrogen and phosphorus in surface water runoff. In cases of crop shifting, farmers may alter the application of pesticides and other chemicals which negatively affect water quality if allowed to enter area waterways. Since crop shifting would only affect currently utilized farmland, a significant increase in agricultural constituents of concern is not expected.

Because there would be less total leaching potential and runoff under the Proposed Action than there would be under the No Action/No Project Alternative, water quality would not decrease as a result of a reduction in applied water. There could be an improvement in the quality of surface water runoff returning to nearby water bodies. Overall, the effect on water quality with respect to leaching and surface water runoff would be less than significant.

Cropland idling/shifting transfers could change the quantity of organic carbon in waterways. Both cropland idling and crop shifting would lead to reductions in irrigation which would decrease the amount of agricultural runoff entering waterways. Agricultural runoff often contains nutrients such as nitrogen and phosphorous that promote excessive algae growth and increase organic carbon in waterways. A reduction in agricultural runoff could reduce the amount of nutrients that would enter waterways and could reduce one source of organic carbon. The reduction in agricultural runoff may not actually cause a quantifiable decrease in organic carbon because there are other sources and a variety of factors that contribute to organic carbon levels in waterways. However, cropland idling/crop shifting under the Proposed Action would not be expected to increase organic carbon in waterways, and therefore this impact would be less than significant.

Groundwater substitution transfers could introduce contaminants that could enter surface waters from irrigation return flows. Groundwater substitution transfers would use groundwater for irrigation instead of surface water. The amount of groundwater substituted for surface water under the Proposed Action would be relatively small compared to the amount of surface water used to irrigate agricultural fields in the Seller Service Area. Groundwater would mix with surface water in agricultural drainages prior to irrigation return flow reaching the rivers. Constituents of concern that may be present in the groundwater could enter the surface water as a result of mixing with irrigation return flows. Any constituents of concern, however, would be greatly diluted when mixed with the existing surface waters applied because a much higher volume of surface water is used for irrigation purposes in the Seller Service Area. Additionally, groundwater quality in the area is generally good and sufficient for municipal, agricultural, domestic, and industrial uses. Section 3.3 provides additional discussion of groundwater quality. Groundwater substitution transfers would result in a less-than-significant impact on water quality.

Water transfers could change reservoir storage in CVP and SWP reservoirs and could result in water quality impacts. Based on modeling efforts, changes in CVP and SWP reservoir storage between the Proposed Action and the No Action/No Project Alternative are shown in Table 3.2-23. Changes in reservoir storage are primarily influenced by storing transfer water in April, May, and June of dry and critical years (until the Delta pumps can convey the water to the buyers) and streamflow depletion from groundwater substitution transfers.

Table 3.2-23. Changes in CVP and SWP Reservoir Storage between the No Action/No Project Alternative and the Proposed Action (in 1,000 AF)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Shasta Reservoir												
W	-0.6	-0.6	-0.4	-0.1	0.0	0.0	-0.1	-0.2	-0.3	-0.4	-0.6	-0.7
AN	-4.6	-4.6	-3.4	-2.8	-2.3	-2.3	-2.3	-0.1	-0.4	-0.5	-0.7	-0.8
BN	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.3	-1.5	-1.5	-1.7	-1.7
D	-2.3	-2.1	-2.1	-2.0	-2.0	-2.0	4.4	16.2	43.3	29.0	-3.5	-3.6
C	-5.0	-5.2	-5.2	-5.2	-5.7	-5.7	-3.1	25.6	70.5	10.8	-7.3	-7.3
Lake Oroville												
W	-4.1	-3.8	-2.8	-2.3	0.0	0.0	0.0	0.0	-0.3	-0.6	-1.5	-2.2
AN	-13.0	-13.0	-13.1	-13.1	-10.9	-0.9	-0.9	-0.9	-0.3	-6.3	-4.4	-3.1
BN	-3.2	-3.8	-4.9	-4.9	-4.9	-4.9	-4.9	-4.9	-5.2	-5.5	-6.4	-6.8
D	-5.1	-5.2	-5.5.	-5.5	-5.5	-5.5	-5.2	1.9	3.4	0.7	-9.6	-5.5
C	-12.8	-13.5	-14.6	-14.6	-15.0	-15.2	-15.5	-14.4	-10.9	-5.7	-20.1	-20.1
Folsom Reservoir												
W	0.9	-1.5	-1.1	0.0	0.0	0.0	0.0	0.0	-0.1	-0.4	-0.4	-0.8
AN	-2.2	-2.9	-3.1	-0.9	0.0	0.0	0.0	0.0	-0.2	-1.4	-2.8	-4.5
BN	-2.5	-3.1	-4.4	-4.4	0.0	0.0	0.0	0.0	-0.8	-1.6	-1.6	-2.1
D	2.2	1.7	-1.1	-1.1	-2.0	-1.0	-1.0	7.5	12.0	10.2	10.9	12.6
C	6.1	4.0	2.5	1.4	0.4	-1.3	0.0	4.4	12.1	7.8	6.7	8.8

Note: Negative numbers indicate that the Proposed Action would decrease reservoir storage compared to the No Action/No Project Alternative; positive numbers indicate that the Proposed Action would increase reservoir storage.

Key: Year Type = Sacramento watershed year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

During dry and critical years, Shasta and Folsom reservoirs show an increase in reservoir storage during spring months. Lake Oroville shows a similar change in dry years. These changes are caused by the CVP and SWP storing water, when possible, until the transfer period for the Delta pumps becomes available in July. The transfer water is released from July through September. This type of operation would not be possible in all transfer years because of downstream temperature and flow requirements for fish.

Folsom Reservoir shows elevated reservoir levels for several additional months during dry and critical years because of upstream stored reservoir water transfers. Placer County Water Agency could transfer water through reservoir release, and this water would be stored in Folsom Reservoir until the buyers can convey this water to the end user. Water from Placer County Water Agency may go to East Bay Municipal Utility District (MUD), which could accept transfer water at its Freeport Diversion over a longer period than the CVP and SWP Delta export pumps. Therefore, water levels in Folsom could be elevated while water is stored and slowly released to East Bay MUD.

Reservoir storage during other times of the year (not April through September of a transfer year) is decreased because of streamflow depletion from groundwater substitution transfers. Refilling groundwater storage after a groundwater substitution transfer would decrease flows in neighboring streams. The CVP and SWP would have less water in key waterways (including the Sacramento, Feather, and American rivers). The CVP and SWP would either reduce Delta exports or release additional water from storage to account for those streamflow reductions. These changes would reduce water in storage; however, these reductions are small and less than one percent of the reservoir volumes.

CVP and SWP reservoirs within the Seller Service Area would experience only small changes in storage, which would not be of sufficient magnitude and frequency to result in substantive changes to water quality. These changes would not be large enough to affect dilution of other runoff into the reservoir, or the water quality within the reservoir. Any small changes to water quality would not adversely affect designated beneficial uses, violate existing water quality standards, or substantially degrade water quality. Consequently, potential effects on reservoir water quality would be less than significant.

Water transfers could change reservoir storage in non-Project reservoirs participating in reservoir release transfers, which could result in water quality impacts. Table 3.2-24 shows the changes in reservoir storage in the reservoirs that could participate in reservoir release transfers. These reservoirs would release additional water for transfers, so the reservoir storage would decline during and after a transfer (until the reservoir refills).

As described in the existing conditions, water in these facilities is of generally good quality. Collins Lake and French Meadows Reservoir are not identified as impaired for any water quality constituents. Camp Far West Reservoir, Hell Hole Reservoir, and Lake McClure are listed as impaired for mercury, which is from legacy mining operations. Mercury entered the system from upstream flows, and short-term changes in storage would not likely affect mercury within the reservoir. Therefore, changes to reservoir levels in non-Project reservoirs would have less than significant impacts on water quality.

Table 3.2-24. Changes in Non-Project Reservoir Storage between the No Action/No Project Alternative and the Proposed Action (in 1,000 AF)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Camp Far West Reservoir												
W	-0.4	-0.4	-0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-2.5	-2.5	-2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-1.8	-2.5
C	-3.6	-3.6	-3.6	-3.6	-1.1	-0.7	-0.7	-0.7	-0.7	-4.3	-4.3	-4.3
Collins Lake												
W	-0.4	-0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	-0.8	-0.8	-0.8	-0.8	-0.2	0.0	0.0	0.0	0.0	-1.1	-1.7	-1.7
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Hell Hole and French Meadows Reservoirs												
W	-6.1	-6.1	-4.1	-1.8	-0.7	-0.6	-0.6	-1.2	-0.4	-0.4	-0.3	-0.1
AN	-22.3	-22.3	-22.3	-13.9	-1.8	0.2	0.2	0.2	0.2	0.2	0.1	0.1
BN	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	-16.6	-16.7	-16.7	-13.4	-11.4	-7.9	-1.1	-4.9	-8.5	-12.5	-16.8	-20.4
C	-28.2	-28.5	-29.0	-29.0	-29.0	-29.0	-28.9	-34.5	-39.5	-44.5	-49.8	-55.2
Lake McClure												
W	-2.3	-2.3	-2.3	-2.3	0.0	0.0	-3.3	-4.8	-3.5	-2.0	-0.8	-0.2
AN	-15.0	-15.0	-15.0	-15.0	-15.0	-10.0	-17.7	-20.9	-12.8	-9.3	-6.4	-5.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	-9.1	-15.0	-15.0	-15.0	-15.0	-15.0
D	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-15.7	-21.9	-19.9	-17.8	-16.1	-15.2
C	0.0	0.0	0.0	0.0	0.0	0.0	-6.7	-10.3	-8.6	-6.6	-5.1	-4.5

Note: Negative numbers indicate that the Proposed Action would decrease reservoir storage compared to the No Action/No Project Alternative; positive numbers indicate that the Proposed Action would increase reservoir storage.

Key: Year Type = Sacramento watershed year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Water transfers could change flow rates in rivers within the Seller Service Area and could affect water quality. Based on modeling results, Table 3.2-25 provides changes in river flows in the Seller Service Area between the Proposed Action and the No Action/No Project Alternative.

Under the Proposed Action, long-term average flow rates in the Sacramento River at Freeport would be lower than flow rates under the No Action/No Project Alternative during October through June. Average monthly flow rates would decrease by less than 0.5 percent during this period because of streamflow depletion associated with groundwater substitution transfers (as described above). From July through September, long-term monthly average flow rates at Freeport would be higher under the Proposed Action compared with the No Action/No Project Alternative. Greater increases in flow rates would occur during dry and critical years because transfers would be released upstream for conveyance through the Delta. During critical years, average flow rates in July and August may increase by greater than 13 percent. Sacramento River flows at Wilkins Slough would follow the same trend, with minor decreases during non-transfer periods and increased flow during water transfers.

Long-term average monthly flow rates in the Feather River below Thermalito Afterbay and in the Lower Feather River would be similar to the flows under the No Action/No Project Alternative. Long-term monthly average flow rates at locations along the Feather River would increase during August, when flows would increase by 1.7 percent below Thermalito Afterbay and 1.8 percent in the Lower Feather River. This increase in flows in August would be the result of a release of transfer water. Slight variations in flow throughout the year result from required releases from Lake Oroville to address stream depletion. Increases in Feather River flow during August would be small and would not result in any adverse water quality impacts, but may have some small benefits.

Under the Proposed Action, average monthly flow rates along the Yuba River at Marysville would not change substantially from the No Action/No Project Alternative. Flow rates would increase by about 1.6 percent during July of dry and critical years when reservoir release transfers from Collins Lake are released downstream for conveyance through the Delta. During the rest of the year, flows would decrease by a maximum of 0.4 percent because of reservoir refill (the reservoir will capture additional flow to refill the empty storage after the transfer) and streamflow depletion. These small changes would not affect water quality in the Yuba River.

Average monthly flow rates in the Bear River at Feather River would remain similar to the No Action/No Project Alternative, with the exception of July and August. Flows in July and August would increase substantially (34 percent and 50 percent, respectively). Flows during August and September are extremely low in this reach of the Bear River, averaging only 12 and 17 cfs respectively. Although the Proposed Action would only increase flows by a maximum of 18 cfs, this is a substantial increase over the No Action/No Project Alternative. Increases in flows on the Bear River at the Feather River would occur during August and September in dry and critical years when storage and releases from Camp Far West Reservoir would occur due to transfer requirements; the remaining months would have almost no change except for the few months when the reservoir refills. These increases would not adversely affect water quality, and the increased summer flows may have small water quality benefits as they would have the potential to dilute pollutants.

Under the Proposed Action, long-term average monthly flow rates in the lower American River at H Street below Nimbus Dam would be slightly lower than the No Action/No Project Alternative during winter and spring months of January through June, by up to one percent. Under the Proposed Action, Reclamation may store water from transfers in Folsom Reservoir during April through October. During summer and fall months of July through October when stored reservoir water would be released, flow rates are expected to be higher, by up to 2.2 percent. The increases in flows in the lower American River would allow dilution of water quality constituents, including pesticides and fertilizers present in agricultural runoff. These changes in flow throughout the year are not substantial relative to the No Action/No Project Alternative. During the remainder of the year, when reservoir storage refills, the small decreases in river flows would be a very small percentage of river flows and would have less than significant effects on water quality.

Under the Proposed Action, flows in the Merced River at the confluence with the San Joaquin River would increase in April and May by 105 cfs (20.4 percent) and 59 cfs (7.2 percent), respectively, when water is released from stored reservoir release transfers. During winter months, as the reservoir refills, the river flows would decrease during winter months up to 1.3 percent. The decreases in flow would be small compared to overall river flows. The increased flow from the Merced River would carry high quality water into the San Joaquin River, which could dilute the constituents of concern in the San Joaquin River. The modeling effort analyzed the potential impacts of diverting these transfers at Banks or Jones pumping plants, but they could also be diverted upstream at Banta-Carbona ID, West Stanislaus ID, or Patterson ID pumping plants. If the transferred water was diverted upstream, the transfers would still contribute to increased quality in the San Joaquin River water, but the flows entering the Delta in April and May would be the same as under the No Action/No Project Alternative.

Overall, changes in flows in the Seller Service Area would not be of significant frequency and magnitude to affect water quality. Predicted changes in flow are not sufficient to adversely affect designated beneficial uses, violate existing water quality standards, or substantially degrade water quality. Therefore, water quality impacts associated with changes in flow in the Seller Service Area are expected to be less than significant.

Overall, the decreases in flow under the Proposed Action would be very small and would occur during the wetter months of October through June. They would not be of sufficient frequency or magnitude to adversely affect water quality or result in adverse effects to designated beneficial uses, violate existing water quality standards, or substantially degrade water quality. The anticipated increases in flows under the Proposed Action would occur in July through September when transfer water would be released from upstream reservoirs to be conveyed through the Delta. The increases in flow could be beneficial to water quality, but are fairly small in comparison to average monthly flow rates and would be unlikely to result in substantive water quality improvements.

Table 3.2-25. Changes in River Flows between the No Action/No Project Alternative and the Proposed Action (in cfs)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Sacramento River at Freeport												
W	-22.0	-20.6	-122.3	-148.0	-121.4	-62.3	-49.2	-32.5	-42.2	-17.9	-13.1	-7.2
AN	-12.6	-43.8	-106.3	-421.5	-385.3	-306.3	-83.0	-147.6	-62.6	130.4	9.2	7.8
BN	0.0	0.0	0.0	-42.5	-119.6	-38.3	-33.2	-24.7	0.0	0.0	0.0	0.0
D	-42.0	-63.0	-56.8	-140.5	-94.8	-214.9	-176.4	-65.7	-73.2	885.3	1,243.6	248.8
C	-81.0	-69.6	-78.8	-112.0	-187.1	-162.3	-71.7	-63.1	-59.1	2,136.6	1,597.5	622.5
Sacramento River at Wilkins Slough												
W	-8.9	-5.1	-8.0	-10.7	-6.3	-5.3	-5.0	-3.2	-1.9	-2.4	-1.4	-1.3
AN	-8.3	-8.2	-27.2	-19.6	-18.2	-7.9	-8.2	-44.3	-2.6	7.2	7.2	7.8
BN	-4.5	-3.7	-3.5	-3.5	-3.5	-3.3	-4.3	0.0	0.0	-3.3	0.0	-3.0
D	-11.0	-14.1	-10.1	-11.0	-7.9	-7.6	-53.1	-33.5	-252.6	465.6	758.9	162.0
C	-21.5	-15.8	-15.2	-14.1	-5.2	-15.1	-0.2	-114.5	-274.4	1,517.7	838.4	356.1
Feather River below Thermalito Afterbay												
W	8.3	-5.4	-16.4	-9.0	-40.8	0.0	0.0	0.0	4.6	6.0	13.3	12.2
AN	29.4	1.1	2.0	0.0	-39.5	-162.9	0.0	0.0	-9.3	96.9	-29.8	-22.5
BN	10.2	10.0	17.9	0.0	0.0	0.0	0.0	0.0	5.4	4.7	14.1	7.0
D	10.7	1.7	3.7	0.0	0.0	0.0	0.0	-105.1	-12.1	43.5	168.1	-70.0
C	10.7	11.1	17.5	0.0	7.7	3.8	11.6	-1.8	-36.5	-84.9	233.4	0.8
Lower Feather River												
W	0.2	-13.8	-32.1	-25.8	-52.4	-16.4	-10.4	-9.1	-3.5	-1.1	7.1	6.4
AN	16.3	-11.7	-9.9	-55.2	-55.8	-196.8	-15.5	-58.8	-22.0	86.1	-39.3	-31.2
BN	5.3	5.4	13.4	-5.0	-7.5	-9.6	-9.2	-7.2	0.0	0.7	10.7	4.0
D	-1.9	-10.0	-8.2	-13.3	-25.2	-35.2	-7.9	-109.4	-16.0	120.1	240.8	-35.7
C	-11.0	-8.5	-0.3	-18.5	-56.0	-21.1	-0.6	-0.5	-31.3	113.9	318.3	49.2
Lower Yuba River												
W	-0.4	-0.9	-7.7	-0.9	-2.0	-6.3	-0.8	-0.7	-0.7	-0.6	-0.6	-0.6
AN	0.0	-1.0	-1.1	-1.2	-1.1	-19.1	-1.0	-45.6	-0.9	-0.9	-0.9	-0.9
BN	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3	-0.3
D	-0.3	-0.8	-0.7	-0.7	-12.7	-22.2	-0.5	0.0	0.0	34.8	8.9	-0.2
C	-0.6	-1.5	-1.5	-1.5	-1.5	-1.5	-0.1	-0.1	-0.1	50.4	0.0	0.0

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Bear River at the Feather River												
W	0.0	0.0	0.0	-6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	-40.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	26.6	12.3
C	0.0	0.0	0.0	0.0	-44.6	-5.8	0.0	0.0	0.0	58.1	0.0	0.0
All	0.0	0.0	0.0	-9.6	-9.2	-1.2	0.0	0.0	0.0	12.3	4.7	2.2
American River at H Street												
W	16.4	38.7	-36.7	-56.2	-22.4	-2.7	-1.3	8.3	-13.7	4.1	-1.6	3.5
AN	21.2	12.1	0.9	-173.0	-235.7	-34.9	-1.32	-1.3	1.8	32.7	36.5	41.0
BN	12.1	11.9	21.5	-0.4	-79.4	-0.5	-0.4	-0.5	12.3	13.6	-0.3	8.2
D	25.4	8.9	43.7	-53.1	-22.0	-73.9	-114.5	-63.7	-0.9	130.5	80.0	56.1
C	51.5	40.0	30.3	16.9	17.0	25.8	-23.3	19.4	-45.9	195.1	141.3	82.4
Merced River at San Joaquin River												
W	0.0	0.0	0.0	0.0	-41.6	0.0	0.0	32.9	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	-81.3	0.0	0.0	-84.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	127.5	71.4	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	85.0	47.6	0.0	0.0	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	36.4	20.4	0.0	0.0	0.0	0.0
San Joaquin River at Vernalis												
W	0.0	0.0	0.0	0.0	-41.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	-81.3	0.0	0.0	-84.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	32.5	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	21.7	0.0	0.0	0.0	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	9.3	0.0	0.0	0.0	0.0	0.0

Note: Negative numbers indicate that the Proposed Action would decrease river flows compared to the No Action/No Project Alternative; positive numbers indicate that the Proposed Action would increase river flows.

Key: Year Type = Sacramento watershed year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Water transfers could change Delta inflows and could result in water quality impacts. Under the Proposed Action, Delta inflows would be similar to the No Action/No Project Alternative. Inflows will generally increase during July through September of Dry and Critical water years. Delta inflows slightly decrease most other months of the year. The timing of these changes is due to the timing of the release of transfer water from storage in upstream dams. Percent decreases in Sacramento River inflow are less than 2 percent under the Proposed Action. Average increases in Sacramento River inflow may be as high as 15.8 percent during summer months of Critical water years. These changes would have a less than significant effect on water quality.

Water transfers could change Delta outflows and could result in water quality impacts. Under the Proposed Action, long-term Delta outflows would be similar to the No Action/No Project Alternative. Outflows would generally increase during the transfer period because carriage water would become additional Delta outflow. The most substantial change in flow would occur in August when Delta outflows would increase by an average of ~~1.8~~2.1 percent across all water years. During July of Critical water years. Outflows may increase by approximately 12 percent. Delta outflows would decrease slightly (by less than 0.~~3~~4 percent) during the winter and spring compared to the No Action/No Project Alternative as reservoir storage and groundwater storage refill. These slight changes in flow would not affect water quality in the Delta.

Net Delta Outflow (NDO) is the sum of all inflows and outflows. NDO percent changes calculated in DSM2 modeling reflect the changes in Sacramento inflow. During non-transfer periods, the NDO decreases by a small amount (less than 1 percent), which reflects the streamflow depletion changes in Delta inflow. The largest percent changes occur during July through September of Critical and Dry water years when transfers are moving through the Delta. The NDO increases during transfers by up to 12.3 percent during a critical year in July. Increased NDO could help Delta water quality, and the decreases could have an adverse effect. The decreases, however, represent a very small change in NDO. More detailed information is provided in Appendix C. These changes would have a less than significant effect on water quality.

Water transfers could change Delta salinity concentrations, resulting in water quality impacts. Changes in EC in the Delta are largely influenced by 1) increases in Sacramento River inflows which cause decreased EC and 2) increased SWP and CVP exports, which tend to increase EC. Based on water quality modeling results, minor changes in average monthly EC in the Delta occur between the No Action/No Project Alternative and the Proposed Action. Table 3.2-26 shows average monthly EC percent change from the No Action/No Project Alternative for the Proposed Action at several locations, with the largest variation in percent change at SWP and CVP locations occurring at the SWP intake to Clifton Court Forebay. Trends at CVP intakes were similar but with smaller magnitudes. Increases in EC are greatest (up to 4.2 percent) in July and August of critical and dry water years. Delta SWP and CVP exports are highest during the summer months of critical and dry water years, which increases EC near the diversion facilities. Decreases are greatest (4.3 percent) during September of critical water years because of Sacramento River flow increases compared to the No Action/No Project Alternative. Additional intake locations show similar trends in average monthly percent change in EC.

Table 3.2-26. Average Monthly Percent Change in EC from the No Action/No Project Alternative to the Proposed Action ~~at SWP intake to Clifton Court Forebay~~

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
SWP intake to Clifton Court Forebay												
W	-0.3	-0.2	-0.1	0.0	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
AN	-1.8	-1.0	-0.3	0.1	0.0	-0.5	0.0	0.0	-0.6	0.0	0.1	-0.2
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
D	-1.9	-0.9	-0.2	0.1	0.2	0.1	0.2	0.6	0.6	1.2	1.9	-1.6
C	-3.8	-2.2	-1.1	-0.7	-0.1	0.4	0.3	0.6	0.6	4.2	1.0	-4.3
CVP intake at Delta Mendota Canal												
W	-0.3	-0.2	-0.1	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-1.6	-0.8	-0.2	0.0	-0.1	-0.7	-0.1	0.0	-0.6	0.1	0.1	-0.1
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
D	-1.6	-0.8	-0.2	0.1	0.2	0.0	0.2	0.6	0.5	1.0	0.7	-1.4
C	-3.2	-1.8	-0.8	-0.5	0.0	0.4	0.2	0.7	0.6	3.3	0.8	-3.9
CCWD Victoria Canal location												
W	-0.2	-0.1	-0.1	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
AN	-1.8	-0.7	-0.3	0.0	1.1	-0.3	-0.1	0.1	-0.6	-0.3	0.1	-0.1
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
D	-1.5	-0.6	-0.2	0.1	0.2	0.1	0.2	0.3	0.5	-0.3	0.0	-1.8
C	-3.1	-1.3	-0.9	-0.6	-0.2	0.2	0.3	0.4	0.4	0.5	-1.9	-5.9
CCWD Old River location												
W	-0.3	-0.2	-0.1	0.0	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
AN	-1.9	-1.1	-0.4	0.1	0.5	-0.4	-0.1	0.0	-0.4	0.2	0.1	-0.2
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
D	-2.0	-1.0	-0.2	0.2	0.2	0.2	0.2	0.5	0.5	1.7	2.4	-1.5
C	-4.0	-2.3	-1.5	-0.9	-0.3	0.3	0.3	0.6	0.6	4.9	0.5	-4.4
CCWD Rock Slough location												
W	-0.4	-0.3	-0.2	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
AN	-1.8	-1.4	-0.6	0.2	0.3	0.3	-0.3	0.0	-0.3	0.3	0.2	-0.2
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	-2.0	-1.4	-0.5	0.1	0.2	0.2	0.2	0.4	0.4	2.6	2.9	-0.6
C	-4.1	-2.9	-1.8	-1.1	-0.4	0.2	0.3	0.4	0.6	7.3	2.3	-3.3
RSAC081 Collinsville												
W	-0.1	-0.1	0.2	0.2	0.0	0.0	0.1	0.1	0.2	0.1	0.2	0.2
AN	-0.9	-0.3	0.5	0.9	0.1	0.2	0.0	0.2	1.3	0.3	-0.1	-0.2
BN	0.0	0.0	0.0	0.3	0.2	0.1	0.3	0.3	0.1	0.0	0.0	0.0
D	-1.0	-0.1	0.5	0.5	0.9	0.9	1.5	1.1	0.6	-3.1	-5.6	-3.7
C	-1.9	-0.8	-0.2	0.5	1.4	1.7	1.5	1.0	1.1	-6.9	-9.2	-6.1

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
RSAN007 near Antioch												
W	-0.3	-0.2	0.2	0.2	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.1
AN	-1.2	-0.5	0.4	0.7	0.0	0.0	-0.2	0.0	0.7	0.5	-0.2	-0.2
BN	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
D	-1.3	-0.3	0.5	0.5	0.5	0.5	0.6	0.9	0.5	-2.6	-5.0	-4.2
C	-2.5	-1.1	-0.5	0.1	0.9	1.4	1.4	1.1	1.3	-5.8	-8.8	-6.5
RSAN018 Jersey Point												
W	-0.5	-0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
AN	-1.7	-1.0	0.0	0.4	0.1	0.0	-0.2	0.0	0.1	1.0	-0.1	-0.2
BN	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	-1.9	-0.8	0.3	0.3	0.0	0.1	0.1	0.1	0.0	2.2	1.1	-3.2
C	-3.8	-2.2	-1.3	-0.9	0.0	0.5	0.5	0.6	1.4	3.5	-2.4	-5.0

Key: Year Type = Sacramento watershed year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Changes in EC regime were calculated at all D-1641 locations. It was found that results at many locations were either small, with average monthly percent difference of around +/- 1 percent or less, or were characteristic of a region (e.g., Suisun Marsh). It was found that at locations RSAN018, Jersey Point, and RSAC092, Emmaton, there are potential violations of D-1641 EC criteria in June and July of Critical water years; however, these exceedances would occur only a few days sooner than under the No Action/No Project Alternative, and this could be changed with a minor variation in export timing. The CVP and SWP regularly make this type of variation in real-time operations; therefore, this change is a modeling artifact that does not reflect real Delta operations.

Modeling results also indicate that San Joaquin River inflow EC for the Proposed Action makes little difference to inflow EC, as changes in San Joaquin River EC were found to be infrequent and small in magnitude.

Chloride calculations were completed to convert values from EC. Bay-Delta D-1641 standards dictate maximum mean daily chloride levels of 250 mg/L for all intake locations. Modeling results indicate that chloride concentrations are below the 250 mg/L threshold at all export locations.

The modeling efforts estimated X2 locations to determine the movement of salinity throughout the Delta. The “X2” water quality parameter represents the distance (in kilometers [km]) from the Golden Gate to the location of 2 ppt salinity concentration in the Delta. Larger values indicate higher salinity concentrations in the Delta, and smaller values indicate lower salinity concentrations. According to SWRCB criteria (SWRCB 1999), eastward changes in monthly average X2 position (positive values in our analysis) of 1.1 km are not significant in general, and in critically dry years an eastward movement of 3.0 km is not significant. Based on these criteria, all monthly changes in X2 were found to be are insignificant, as all monthly average differences are less than 1.1 km.

Overall, the Proposed Action would not cause significant changes to Delta water quality. aAny violation of Delta water quality standards could be changed with minor variations in export timing; therefore, the impacts to water quality would be less than significant.

Diversion of transfer water at Banta Carbona ID, West Stanislaus ID, and Patterson ID could affect water quality in the Delta-Mendota Canal. Reservoir release transfers from Merced ID could be diverted at these diversion facilities on the San Joaquin River or at CVP or SWP Delta pumping facilities. If Merced ID transfer water is diverted at these facilities, the districts could use the water in their districts and transfer their CVP water, or they could move the water through their districts into the Delta-Mendota Canal. Water quality at these diversions in the San Joaquin River is different than the water that is diverted from the Delta into the Delta-Mendota Canal. Banta Carbona ID is downstream of Vernalis, and water quality at Vernalis (Table 3.2-20) is similar to the Banta Carbona ID diversion location. West Stanislaus ID and Patterson ID are upstream of Vernalis, so Table 3.2-19 is more similar to the water quality at these diversion points.

The San Joaquin River has greater EC concentrations than those at the Delta diversion pumps (see Table 3.2-21). If this water travels through the diverting districts to the Delta-Mendota Canal, it has the potential to degrade the water quality of CVP diversions. However, the amount of water would be relatively small compared to the overall flow in the Delta-Mendota Canal. At most, the transfer would result in about 250 cfs entering the Delta-Mendota Canal from all three districts added together. The canal capacity is about 4,600 cfs in the northern portion. While the Delta-Mendota Canal may not be at maximum capacity during dry and critical years, the flows would still be great enough that the increased EC in the water entering the canal would likely not result in a substantive change to EC in the canal. The impacts to water quality in CVP deliveries would be less than significant.

3.2.2.4.2 Buyer Service Area

Transfers water would result in increased irrigation in the Buyer Service Area, which could affect water quality. Under the Proposed Action, surface water supplies in the San Joaquin Valley would increase. If this water were used to irrigate drainage impaired lands, increased irrigation could cause water to accumulate in the shallow root zone and could leach pollutants into the groundwater and potentially drain into the neighboring surface water bodies. Because the Proposed Action would be implemented to meet water needs during a potential shortage, it is likely that most water would be applied to permanent crops or crops planted on prime or important farmlands. As a result, farmers would continue to leave marginal land and drainage impaired lands out of production and use water provided by the Proposed Action for more productive lands.

The amount of transfer water that would be provided is minimal compared to existing applied irrigation water in the area. Further, many farmers in the drainage impaired areas have decreased drain water by improving irrigation efficiency and changing cropping patterns. The small incremental supply within the drainage-impaired service areas would not be sufficient to change drainage patterns or existing water quality, particularly given drainage management, water conservation actions and existing regulatory compliance efforts already implemented in that area. Therefore, the Proposed Action would not result in impacts to water quality in the Buyer Service Area as a result of crop irrigation.

Water transfers could change reservoir storage in San Luis Reservoir and could result in water quality impacts. Table 3.2-27 presents average end-of-month differences in combined SWP and CVP storage at San Luis Reservoir under the Proposed Action compared to the No Action/No Project Alternative. Storage under the Proposed Action would be less than the No Action/No Project Alternative for all months of the year because of decreased CVP and SWP exports associated with streamflow depletion from groundwater substitution transfers. San Luis Reservoir storage could decrease by as much as six percent (of water in storage in the No Action/No Project Alternative) during August of critical water years. Monthly storage changes during most year types would be less than three percent.

As discussed in Section 3.2.1.3, Existing Conditions, a low point water quality issue exists when reservoir volumes fall below approximately 300 TAF. Based on historical monthly data from 1970-2003 used for CalSim modeling purposes, average monthly storage for San Luis Reservoir fell below the 300 TAF threshold a total of 30 times under the No Action/No Project Alternative. Under the Proposed Action, modeling indicates storage levels below 300 TAF over three additional months (total of 33 times) during this time period, with storage declining from 324, 338, and 306 TAF to 291, 299, and 275 TAF, respectively. Under the Proposed Action, during these 33 times storage levels fall below 300 TAF, overall average storage falls 9 TAF below the No Action/No Project Alternative, with a maximum decline of 42 TAF (during a period where levels are below 300 TAF under the No Action/No Project Alternative) and a maximum increase in storage of 28 TAF. Reclamation and Santa Clara Valley Water District are evaluating alternatives that would address the water quality and water supply issues associated with the reservoir low point.

Additionally, in some cases water levels are expected to increase in San Luis Reservoir under the Proposed Action due to additional water storage opportunities based on regulation of the delivery schedule of transfer water. San Luis Reservoir may be used for short term water storage prior to delivery based on contractors' desired delivery schedules. These short term increases in storage were not included in the CalSim modeling analysis, and they would reduce the potential effects on the frequency of the San Luis Low Point issue. Based on modeling results, the Proposed Action would not substantially affect the low point issue beyond the complications experienced under the No Action/No Project Alternative.

These small changes in storage are not sufficient to adversely affect designated beneficial uses, violate existing water quality standards, or substantially degrade water quality. Consequently, potential storage-related effects on water quality would be less than significant for San Luis Reservoir.

Table 3.2-27. Changes in San Luis Reservoir Storage between the No Action/No Project Alternative and the Proposed Action (in 1,000 AF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	-0.5	-1.2	-1.2	-1.2	-1.2	-1.2	-1.2	-0.8	-0.4	-0.2	0.1	0.0
AN	-16.5	-18.5	-18.8	-18.8	-11.8	-11.8	-11.8	-11.7	-11.6	-12.1	-12.0	-12.0
BN	-20.8	-20.8	-20.8	-20.8	-20.8	-20.8	-20.8	-20.8	-20.8	-20.8	-20.8	-20.8
D	-5.6	-7.2	-6.5	-8.8	-9.9	-10.1	-10.5	-8.8	-9.0	-9.8	-11.5	-16.6
C	-29.4	-33.6	-36.8	-39.3	-39.8	-41.2	-41.5	-30.6	-20.4	-15.4	-11.4	-19.8
All	-11.4	-13.2	-13.9	-14.6	-13.7	-14.0	-14.2	-11.5	-9.2	-7.6	-7.6	-10.3

3.2.2.5 Alternative 3: No Cropland Modifications

3.2.2.5.1 Seller Service Area

Groundwater substitution transfers could introduce contaminants that could enter surface waters from irrigation return flows. Groundwater substitution transfers would use groundwater for irrigation instead of surface water. Groundwater would mix with surface water in agricultural drainages prior to irrigation return flow reaching the rivers. Constituents of concern that may be present in the groundwater could enter the surface water as a result of mixing with irrigation return flows.

Alternative 3, similar to the Proposed Action, would result in a small amount of increased groundwater pumping compared to the overall surface water use in the Seller Service Area. Any constituents of concern would be greatly diluted when mixed with the existing surface waters applied. Additionally, groundwater quality in the area is generally good and sufficient for municipal, agricultural, domestic, and industrial uses. Section 3.3 provides additional discussion of groundwater quality. Groundwater substitution transfers would result in a less-than-significant impact on water quality.

Water transfers could change reservoir storage in CVP and SWP reservoirs and could result in water quality impacts. Based on modeling efforts, changes in CVP and SWP reservoir storage Alternative 3 and the No Action/No Project Alternative are shown in Table 3.2-28. Changes in reservoir storage are primarily influenced by storing transfer water in April, May, and June of dry and critical years (until the Delta pumps can convey the water to the buyers) and streamflow depletion from groundwater substitution transfers.

Table 3.2-28. Changes in CVP and SWP Reservoir Storage between the No Action/No Project Alternative and the Alternative 3 (in 1,000 AF)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Shasta Reservoir												
W	-0.6	-0.6	-0.4	-0.1	0.0	0.0	-0.1	-0.2	-0.3	-0.4	-0.6	-0.7
AN	-4.6	-4.6	-3.4	-2.8	-2.3	-2.3	-2.3	-0.1	-0.4	-0.5	-0.7	-0.8
BN	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.32	-1.5	-1.5	-1.7	-1.7
D	-2.3	-2.1	-2.1	-2.0	-2.0	-2.0	4.4	11.1	30.4	18.3	-3.5	-3.6
C	-5.0	-5.2	-5.2	-5.2	-5.7	-5.7	-3.1	10.7	33.5	-1.1	-7.3	-7.3
Lake Oroville												
W	-4.1	-3.8	-2.8	-2.3	0.0	0.0	0.0	0.0	-0.3	-0.6	-1.5	-2.2
AN	-13.0	-13.0	-13.1	-13.1	-10.9	-0.9	-0.9	-0.9	-0.3	-6.3	-4.4	-3.1
BN	-3.2	-3.8	-4.9	-4.9	-4.9	-4.9	-4.9	-4.9	-5.2	-5.5	-6.4	-6.8
D	-5.1	-5.2	-5.5	-5.5	-5.5	-5.5	-5.2	1.4	2.5	0.4	-9.6	-5.5
C	-12.8	-13.5	-14.6	-14.6	-15.0	-15.2	-15.5	-14.9	-12.3	-13.3	-20.1	-20.1
Folsom Reservoir												
W	0.9	-1.5	-1.1	0.0	0.0	0.0	0.0	0.0	-0.1	-0.4	-0.4	-0.8
AN	-2.2	-2.9	-3.1	-0.9	0.0	0.0	0.0	0.0	-0.2	-1.4	-2.8	-4.5
BN	-2.5	-3.1	-4.4	-4.4	0.0	0.0	0.0	0.0	-0.8	-1.6	-1.6	-2.1
D	2.2	1.7	-1.1	-1.1	-2.0	-1.0	-1.0	7.5	12.0	10.2	10.9	12.6
C	6.1	4.0	2.5	.14	0.4	-1.3	0.0	4.3	12.0	7.9	6.7	8.8

Note: Negative numbers indicate that Alternative 3 would decrease reservoir storage compared to the No Action/No Project Alternative; positive numbers indicate that Alternative 3 would increase reservoir storage.

Key: Year Type = Sacramento watershed year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

During dry and critical years, Shasta and Folsom reservoirs show an increase in reservoir storage during spring months. Lake Oroville shows a similar change in dry years. These changes are caused by the CVP and SWP storing water, when possible, until the transfer period for the Delta pumps becomes available in July. The transfer water is released from July through September. This type of operation would not be possible in all transfer years because of downstream temperature and flow requirements for fish.

Folsom Reservoir shows increased reservoir storage for several additional months during dry and critical years because of upstream stored reservoir water transfers. Placer County Water Agency could transfer water through reservoir release, and this water would be stored in Folsom Reservoir until the buyers can convey this water to the end user. Water from Placer County Water Agency may go to East Bay MUD, which could accept transfer water at its Freeport Diversion over a longer period than the CVP and SWP Delta export pumps. Therefore, water storage in Folsom could be elevated while water is stored and slowly released to East Bay MUD.

Reservoir storage during other times of the year (not April through September of a transfer year) is decreased because of streamflow depletion from groundwater substitution transfers. Refilling groundwater storage after a groundwater substitution transfer would decrease flows in neighboring streams. The CVP and SWP would have less water in key waterways (including the Sacramento, Feather, and American rivers). The CVP and SWP would either reduce Delta exports or release additional water from storage to account for those streamflow reductions. These changes would reduce water in storage; however, these reductions are small and less than one percent of the reservoir volumes.

CVP and SWP reservoirs within the Seller Service Area would experience only small changes in storage, which would not be of sufficient magnitude and frequency to result in substantive changes to water quality. Any small changes to water quality would not adversely affect designated beneficial uses, violate existing water quality standards, or substantially degrade water quality. Consequently, potential effects on reservoir water quality would be less than significant.

Water transfers could change reservoir storage non-Project reservoirs participating in reservoir release transfers, which could result in water quality impacts. Alternative 3 includes the same reservoir release transfers as the Proposed Action; therefore, the changes in reservoir storage in these facilities would be the same as those described above for the Proposed Action. As described in the existing conditions, water in these facilities is of generally good quality; therefore, changes to reservoir storage in non-Project reservoirs would have less than significant impacts on water quality.

Water transfers could change river flow rates in the Seller Service Area and could affect water quality. Differences in river flows between Alternative 3 and the No Project/No Action Alternative are shown in Table 3.2-29. Generally, the changes in river flows are very similar to those shown in the Proposed Action, and the reasons for the changes are similar. The peak changes during the transfer period are less in Alternative 3 because it has fewer overall transfers because cropland idling and crop shifting transfers are not included.

Table 3.2-29. Changes in River Flows between the No Action/No Project Alternative and Alternative 3 (in cfs)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Sacramento River at Freeport												
W	-22.0	-20.6	-122.3	-148.0	-121.4	-62.3	-49.2	-32.5	-42.2	-17.9	-13.1	-7.2
AN	-12.6	-43.8	-106.3	-421.5	-385.3	-306.3	-83.0	-147.6	-62.6	130.4	9.2	7.8
BN	0.0	0.0	0.0	-42.5	-119.6	-38.3	-33.2	-24.7	0.0	0.0	0.0	0.0
D	-42.0	-63.0	-56.8	-140.5	-94.8	-214.9	-176.4	-63.3	-69.5	696.7	924.7	157.4
C	-81.0	-69.6	-78.8	-112.0	-187.1	-162.3	-71.7	-61.3	-49.6	1,410.3	893.5	366.1
Sacramento River at Wilkins Slough												
W	-8.9	-5.1	-8.0	-10.7	-6.3	-5.3	-5.0	-3.2	-1.9	-2.4	-1.4	-1.3
AN	-8.3	-8.2	-27.2	-19.6	-18.2	-7.9	-8.2	-44.3	-2.6	7.2	7.2	7.8
BN	-4.5	-3.7	-3.5	-3.5	-3.5	-3.3	-4.3	0.0	0.0	-3.3	0.0	-3.0
D	-11.0	-14.1	-10.1	-11.0	-7.9	-7.6	-53.1	-33.5	-248.9	294.9	452.1	75.6
C	-21.5	-15.8	-15.2	-14.1	-5.2	-15.1	-0.2	-119.3	-273.7	715.3	251.9	102.1
Feather River below Thermalito Afterbay												
W	8.3	-5.4	-16.4	-9.0	-40.8	0.0	0.0	0.0	4.6	6.0	13.3	12.2
AN	29.4	1.1	2.0	0.0	-39.5	-162.9	0.0	0.0	-9.3	96.9	-29.8	-22.5
BN	10.2	10.0	17.9	0.0	0.0	0.0	0.0	0.0	5.4	4.7	14.1	7.0
D	10.7	1.7	3.7	0.0	0.0	0.0	0.0	-102.6	-12.1	34.4	162.6	-70.0
C	10.7	11.1	17.5	0.0	7.7	3.8	11.6	-1.8	-34.7	15.8	110.3	0.8
Lower Feather River												
W	0.2	-13.8	-32.1	-25.8	-52.4	-16.4	-10.4	-9.1	-3.5	-1.1	7.1	6.4
AN	16.3	-11.7	-9.9	-55.2	-55.8	-196.8	-15.5	-58.8	-22.0	86.1	-39.3	-31.2
BN	5.3	5.4	13.4	-5.0	-7.5	-9.6	-9.2	-7.2	0.0	0.7	10.7	4.0
D	-1.9	-10.0	-8.2	-13.3	-25.2	-35.2	-7.9	-106.9	-16.0	102.1	228.7	-40.7
C	-11.0	-8.5	-0.3	-18.5	-56.0	-21.1	-0.6	-0.5	-29.5	185.5	197.5	40.6
Lower Yuba River												
W	-0.4	-0.9	-7.7	-0.9	-2.0	-6.3	-0.8	-0.7	-0.7	-0.6	-0.6	-0.6
AN	0.0	-1.0	-1.1	-1.2	-1.1	-19.1	-1.0	-45.6	-0.9	-0.9	-0.9	-0.9
BN	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3	-0.3
D	-0.3	-0.8	-0.7	-0.7	-12.7	-22.2	-0.5	0.0	0.0	33.7	10.0	-0.2
C	-0.6	-1.5	-1.5	-1.5	-1.5	-1.5	-0.1	-0.1	-0.1	43.7	6.7	0.0

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Bear River at the Feather River												
W	0.0	0.0	0.0	-6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	-40.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	26.6	12.3
C	0.0	0.0	0.0	0.0	-44.6	-5.8	0.0	0.0	0.0	49.0	9.0	0.0
American River at H Street												
W	16.4	38.7	-36.7	-56.2	-22.4	-2.7	-1.3	8.4	-13.7	4.1	-1.6	3.5
AN	21.2	12.1	0.9	-173.0	-235.7	-34.9	-1.3	-1.3	1.8	32.7	36.5	41.0
BN	12.1	11.9	21.5	-0.4	-79.4	-0.5	-0.4	-0.5	12.3	13.6	-0.3	8.2
D	25.4	8.9	43.7	-53.1	-22.0	-73.9	-114.5	-63.7	-0.9	130.5	80.0	56.9
C	51.5	40.0	30.3	16.9	17.0	25.8	-23.3	20.5	-44.3	191.3	142.5	82.4
Merced River at San Joaquin River												
W	0.0	0.0	0.0	0.0	-41.6	0.0	58.8	32.9	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	-81.3	127.5	71.4	-84.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	85.0	47.6	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	85.0	47.6	0.0	0.0	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	36.4	20.4	0.0	0.0	0.0	0.0
San Joaquin River at Vernalis												
W	0.0	0.0	0.0	0.0	-41.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	-81.3	0.0	0.0	-84.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	32.5	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	21.7	0.0	0.0	0.0	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	9.3	0.0	0.0	0.0	0.0	0.0

Note: Negative numbers indicate that Alternative 3 would decrease river flows compared to the No Action/No Project Alternative; positive numbers indicate that Alternative 3 would increase river flows.

Key: Year Type = Sacramento watershed year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

The small changes expected in river flow rates in the seller's service area under Alternative 3 would not be of sufficient magnitude or frequency to result in adverse effects to designated beneficial uses, violate existing water quality standards, or substantial degrade water quality. Consequently, potential flow-related effects on water quality would be less than significant.

Water transfers could change Delta inflows and could result in water quality impacts. Under Alternative 3, Delta inflows would be similar to the No Action/No Project Alternative. Inflows will generally increase during July through September of Dry and Critical water years, but these increases would be less than those under the Proposed Action. Delta inflows slightly decrease most other months of the year. The timing of these changes is due to the timing of the release of transfer water from storage in upstream dams. Percent decreases in Sacramento River inflow are less than 2 percent under Alternative 3. Average increases in Sacramento River inflow may be as high as 9.9 percent during summer months of Critical water years.

Water transfers could change outflow rates in the Delta and could result in water quality impacts. Under Alternative 3, long-term Delta outflows would be similar to the No Action/No Project Alternative. The most substantial change would occur in August when Delta outflows would increase by an average of 1.4 percent. Outflows would decrease slightly by approximately 0.1-0.3 percent during the winter and spring when water demands are lower in the region. This slight change in Delta region outflows would have a less than significant effect on water quality.

Under Alternative 3, NDOs would be similar to the No Action/No Project Alternative. Small decreases would occur during non-transfer periods (less than 1 percent) because streamflow depletion decreases Delta inflow. The largest percent changes occur during July through September of Critical and Dry water years when transfers are moving through the Delta. The NDO increases during transfers by up to 7.9 percent during a critical year in July. More detailed information is provided in Appendix C. These changes would have a less than significant effect on water quality.

Water transfers could change Delta salinity and could result in water quality impacts. EC modeling results are shown at several Delta locations in Table 3.2-30. Modeled impacts to EC, chloride concentrations, and X2 indicate that under Alternative 3, water quality impacts in the Delta would be less than those under the Proposed Action. As a result, impacts to water quality in the Delta region under Alternative 3 are less than significant.

Table 3.2-30. Average Monthly Percent Change in EC from the No Action/No Project Alternative to Alternative 3

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
SWP intake to Clifton Court Forebay												
W	-0.3	-0.2	-0.1	0.0	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
AN	-1.4	-0.7	-0.2	0.1	0.0	-0.5	0.0	0.0	-0.6	0.0	0.1	-0.2
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
D	-1.4	-0.7	-0.1	0.2	0.2	0.1	0.2	0.6	0.6	0.8	1.5	-1.3
C	-3.0	-1.7	-0.9	-0.6	-0.1	0.4	0.3	0.6	0.5	2.7	0.6	-3.6
CVP intake at Delta Mendota Canal												
W	-0.3	-0.1	-0.1	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-1.2	-0.6	-0.1	0.0	-0.1	-0.7	-0.1	0.0	-0.6	0.1	0.1	-0.1
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
D	-1.2	-0.5	-0.1	0.1	0.2	0.0	0.2	0.6	0.5	0.6	0.6	-1.1
C	-2.5	-1.4	-0.6	-0.4	0.0	0.4	0.2	0.7	0.6	2.1	0.5	-3.2
CCWD Victoria Canal location												
W	-0.2	-0.1	-0.1	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
AN	-1.3	-0.5	-0.1	0.1	1.1	-0.3	-0.1	0.1	-0.6	-0.3	0.1	-0.1
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
D	-1.1	-0.4	-0.1	0.2	0.2	0.1	0.2	0.3	0.5	-0.3	0.1	-1.2
C	-2.3	-0.9	-0.7	-0.4	-0.1	0.2	0.3	0.4	0.4	0.3	-1.1	-4.3
CCWD Old River location												
W	-0.3	-0.2	-0.1	0.0	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
AN	-1.4	-0.8	-0.2	0.2	0.5	-0.4	-0.1	0.0	-0.4	0.2	0.1	-0.2
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
D	-1.5	-0.7	-0.1	0.2	0.3	0.2	0.2	0.5	0.5	1.1	1.8	-1.4
C	-3.1	-1.8	-1.2	-0.8	-0.2	0.3	0.3	0.6	0.5	3.2	0.1	-3.8
CCWD Rock Slough location												
W	-0.4	-0.3	-0.1	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
AN	-1.3	-1.0	-0.4	0.2	0.3	0.3	-0.3	0.0	-0.3	0.3	0.2	-0.2
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	-1.5	-1.1	-0.4	0.2	0.2	0.2	0.2	0.4	0.4	1.9	2.1	-0.6
C	-3.3	-2.3	-1.4	-0.9	-0.3	0.3	0.3	0.4	0.5	5.2	1.6	-2.8
RSAC081 Collinsville												
W	-0.1	-0.1	0.3	0.2	0.0	0.0	0.1	0.1	0.2	0.1	0.2	0.2
AN	-0.6	-0.2	0.6	0.9	0.1	0.2	0.0	0.2	1.3	0.3	-0.1	-0.2
BN	0.0	0.0	0.0	0.3	0.2	0.1	0.3	0.3	0.1	0.0	0.0	0.0
D	-0.7	-0.1	0.6	0.5	1.0	0.9	1.5	1.1	0.5	-2.5	-4.4	-2.8
C	-1.3	-0.5	0.0	0.6	1.5	1.8	1.5	1.0	0.8	-4.6	-5.9	-3.9
RSAN007 near Antioch												
W	-0.2	-0.1	0.2	0.2	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.1
AN	-0.8	-0.3	0.5	0.7	0.0	0.0	-0.2	0.0	0.7	0.5	-0.2	-0.2
BN	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
D	-1.0	-0.1	0.6	0.5	0.5	0.5	0.6	0.8	0.4	-2.1	-4.0	-3.3
C	-1.9	-0.8	-0.3	0.2	1.0	1.4	1.4	1.1	1.0	-3.8	-5.8	-4.3

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
RSAN018 Jersey Point												
W	-0.4	-0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
AN	-1.3	-0.8	0.2	0.5	0.1	0.0	-0.2	0.0	0.1	1.0	-0.1	-0.2
BN	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	-1.5	-0.6	0.4	0.3	0.0	0.1	0.1	0.1	-0.1	1.5	0.4	-2.9
C	-3.0	-1.8	-1.1	-0.7	0.0	0.5	0.5	0.6	1.0	2.3	-2.4	-4.0

Key: Year Type = Sacramento watershed year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Diversion of transfer water at Banta Carbona ID, West Stanislaus ID, and Patterson ID could affect water quality in the Delta-Mendota Canal. Water quality impacts to the Delta-Mendota Canal would be the same as those described above for the Proposed Action. While the new water introduced to the Delta-Mendota Canal may have higher EC concentrations, the flow would be much smaller than the flows in the Delta-Mendota Canal. Therefore, the increased EC in the water entering the canal would likely not result in a substantive change to EC in the canal. The impacts to water quality in CVP deliveries would be less than significant.

3.2.2.5.2 Buyer Service Area

Transfer water would result in increased irrigation in the Buyer Service Area, which could affect water quality. Under Alternative 3, surface water supplies in the San Joaquin Valley would increase. Some of this water may be used to irrigate drainage impaired lands, but it is much more likely to be used to support permanent crops or high quality farmland. This impact would be the same as described for the Proposed Action. Therefore, Alternative 3 would have less than significant impacts to water quality in the Buyer Service Area as a result of crop irrigation.

Water transfers could change reservoir storage in San Luis Reservoir and could result in water quality impacts. Under Alternative 3, storage would be the same as that under the Proposed Action. These small changes in storage are not sufficient enough to adversely affect designated beneficial uses, violate existing water quality standards, or substantially degrade water quality. Modeling indicates that San Luis Reservoir would fall below 300,000 acre-feet in 33 years rather than 30 years (under the No Action/No Project Alternative), but the modeling does not incorporate seasonal storage that would increase water levels during this period. Consequently, potential storage-related effects on water quality would be less than significant for San Luis Reservoir.

3.2.2.6 Alternative 4: No Groundwater Substitution

3.2.2.6.1 Seller Service Area

Cropland idling transfers could result in increased deposition of sediment on water bodies. The effects of cropland idling transfers under Alternative 4 would be the same as described under the Proposed Action. Cropland idling would not result in substantial soil erosion or sediment deposition into waterways. Impacts to water quality would be less than significant.

Cropland idling/shifting transfers could change the water quality constituents associated with leaching and runoff. The effects of cropland idling/crop shifting under Alternative 4 would be the same as described under the Proposed Action. Overall, the effect on water quality with respect to leaching and surface water runoff would be less than significant.

Cropland idling/shifting transfers could change the quantity of organic carbon in waterways. The effects of cropland idling/crop shifting under Alternative 4 would be the same as described for the Proposed Action. Cropland idling/shifting under Alternative 4 would not be expected to increase organic carbon in waterways, and therefore this impact would be considered less than significant.

Water transfers could change reservoir storage in CVP and SWP reservoirs and could result in water quality impacts. Based on modeling efforts, changes in CVP and SWP reservoir storage Alternative 4 and the No Action/No Project Alternative are shown in Table 3.2-~~30~~31. Changes in reservoir storage are primarily influenced by storing transfer water in April, May, and June of dry and critical years (until the Delta pumps can convey the water to the buyers). No impacts to Shasta Reservoir or Lake Oroville are predicted during other time periods. Folsom Reservoir is downstream of French Meadows and Hell Hole reservoirs, which has small effects on storage to re-regulate releases and later refill the reservoirs.

The small changes in average monthly storage volumes in reservoirs within the Seller Service Area would not be of sufficient magnitude and frequency to adversely affect designated beneficial uses, violate existing water quality standards, or substantially degrade water quality. Consequently, potential storage-related effects on water quality would be less than significant.

Table 3.2-~~30~~31. Changes in CVP and SWP Reservoir Storage between the No Action/No Project Alternative and the Alternative 4 (in 1,000 AF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Shasta Reservoir												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	17.5	8.7	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.2	46.0	7.4	0.0	0.0
Lake Oroville												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.3	-0.8	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	2.9	9.0	-4.5	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	2.6	6.6	0.0	0.0
Folsom Reservoir												
W	3.5	1.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2
AN	-0.3	-0.5	-0.7	-0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
BN	0.2	0.3	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	4.2	3.5	-0.1	-0.1	-1.0	0.0	0.0	5.2	8.9	9.5	11.7	13.5
C	8.5	7.2	5.7	4.6	3.6	1.9	0.3	3.6	9.1	8.2	10.0	12.1

Note: Negative numbers indicate that Alternative 4 would decrease reservoir storage compared to the No Action/No Project Alternative; positive numbers indicate that Alternative 4 would increase reservoir storage.

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Water transfers could change reservoir storage non-Project reservoirs participating in reservoir release transfers, which could result in water quality impacts. Alternative 4 includes the same reservoir release transfers as the Proposed Action; therefore, the changes in reservoir storage in these facilities would be the same as those described above for the Proposed Action. As described in the existing conditions, water in these facilities is of generally good quality; therefore, changes to reservoir storage in non-Project reservoirs would have less than significant impacts on water quality.

Water transfers under Alternative 4 could change river flow rates in the Seller Service Area and could affect water quality. Changes in river flow rates between Alternative 4 and the No Action/No Project Alternative are shown in Table 3.2-~~31~~32.

Table 3.2-~~31~~32. Changes in River Flows between the No Action/No Project Alternative and Alternative 4 (in cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Sacramento River at Freeport												
W	0.0	31.4	-39.7	-24.9	-20.7	-5.0	0.0	9.6	-13.5	-0.5	-0.8	0.0
AN	0.0	0.0	0.0	-172.8	-233.9	-50.0	0.3	-33.5	0.0	54.2	-40.7	-14.0
BN	0.0	0.0	0.0	0.0	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	47.2	-52.2	-33.2	-91.7	-113.6	-6.1	-9.2	37-.2	585.3	67.1
C	0.0	0.0	0.0	0.0	-44.6	-5.8	0.0	65.4	-16.6	1,286.2	805.4	368.2
Sacramento River at Wilkins Slough												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-73.8	279.9	279.9	89.1
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-31.7	-108.3	1,024.0	516.0	255.9
Feather River below Thermalito Afterbay												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54.2	-40.7	-14.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-24.~~8~~3	0.0	-99.0	219.6	-75.6
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-13.2	-65.5	107.9	0.0
Lower Feather River												
W	0.0	0.0	-6.3	-6.3	0.0	-3.9	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	-40.7	0.0	-16.8	0.0	-33.6	0.0	54.2	-40.7	-14.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	-12.0	-19.5	0.0	-24.3	0.0	-2.1	237.2	-66.0
C	0.0	0.0	0.0	0.0	-44.6	-5.8	0.0	0.0	-13.2	65.2	127.2	12.4
Lower Yuba River												
W	0.0	0.0	-6.3	0.0	0.0	-3.9	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	-16.8	0.0	-33.6	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	-12.0	-19.5	0.0	0.0	0.0	43.9	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.4	0.0	0.0
All	0.0	0.0	-2.4	0.0	-2.1	-7.9	0.0	-5.9	0.0	18.1	0.0	0.0

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Bear River at the Feather River												
W	0.0	0.0	0.0	-6.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	-40.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.9	2.7	0.0
C	0.0	0.0	0.0	0.0	-44.6	-5.8	0.0	0.0	0.0	58.1	0.0	0.0
American River at H Street												
W	9.7	36.2	-28.6	-18.6	-20.7	-1.1	0.0	9.6	-13.5	-0.5	-0.8	0.0
AN	10.4	4.4	1.7	-132.1	-233.9	-33.2	0.3	0.1	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	20.8	11.7	57.6	-52.2	-21.2	-72.2	-113.6	-24.3	0.0	55.6	33.9	32.2
C	36.5	28.6	31.5	18.2	18.3	26.8	26.8	38.6	-6.8	97.4	59.6	55.8
Merced River at San Joaquin River												
W	0.0	0.0	0.0	0.0	-41.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-84.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	162.6	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	69.7	0.0	0.0
San Joaquin River at Vernalis												
W	0.0	0.0	0.0	0.0	-41.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-84.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	162.6	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	69.7	0.0	0.0

Note: Negative numbers indicate that Alternative 4 would decrease river flows compared to the No Action/No Project Alternative; positive numbers indicate that Alternative 4 would increase river flows.

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Under Alternative 4, long-term average flow rates in the Sacramento River at Freeport would be up to 0.2 percent lower than flow rates under existing conditions during October through April. Long-term average flow rates at Freeport would be, at most, 1.8 percent higher than flow rates under the No Action/No Project Alternative during the summer months of May through September. Increases in flow during the summer months would be the result of increased reservoir releases. These increases in flow, however, would be slightly less than those resulting from the Proposed Action, as the Proposed Action would include additional flows from groundwater substitution. Sacramento River flows at Wilkins Slough show a similar trend.

Long-term average changes flow rates in the Feather River below Thermalito Afterbay and in the Lower Feather River would be less than under the Proposed Action. Long-term average monthly changes in flow rates in the lower American River at H Street would be less than under the Proposed Action due to the lack of groundwater substitution.

The effects of water transfers under Alternative 4 in the Lower Yuba, Bear, and Merced rivers are caused by reservoir release transfers, which would be the same as those described in the Proposed Action. The changes in flow would be similar to those described for the Proposed Action.

Overall, any changes in river flows under Alternative 4 would not be of sufficient magnitude or frequency to result in adverse effects to designated beneficial uses, violate existing water quality standards, or substantial degrade water quality. Consequently, potential flow-related effects on water quality in the rivers within the Seller Service Area would be less than significant.

Water transfers could change Delta inflows and could result in water quality impacts. Under Alternative 4, Delta inflows would be similar to the No Action/No Project Alternative. Inflows will generally increase during July through September of Dry and Critical water years, but these increases would be less than those under the Preferred Action. Delta inflows slightly decrease most other months of the year. The timing of these changes is due to the timing of the release of transfer water from storage in upstream dams. Percent decreases in Sacramento River inflow are less than 2 percent under Alternative 4. Average increases in Sacramento River inflow may be as high as 9.2 percent during summer months of Critical water years.

Water transfers could change outflows to the Delta and could result in water quality impacts. Under Alternative 4, the average maximum changes in long-term Delta outflows across all water years are less than one percent and this would occur during the summer months (July through August) when transfers are moving through the Delta. Outflows would decrease slightly by approximately 0.1 percent during the winter and spring when water demands are lower in the region. The maximum change in an individual water year type would occur during July of critical water years when outflows could increase by

7 percent. This slight change in Delta region outflows would have a less than significant effect on water quality.

Under Alternative 3, NDOs would be similar to the No Action/No Project Alternative. Small decreases would occur during January through April (less than 0.6 percent), likely because of decreased river flows during reservoir refill associated with reservoir release transfers. The largest percent changes occur during July through September of Critical and Dry water years when transfers are moving through the Delta. The NDO increases during transfers by up to 7.1 percent during a critical year in July. More detailed information is provided in Appendix C. These changes would have a less than significant effect on water quality.

Water transfers could change Delta salinity and could result in water quality impacts. Modeled impacts to EC, chloride concentrations, and X2 indicate that under Alternative 4, water quality impacts in the Delta would be less than those under the Proposed Action. Percent changes in EC at locations within the Delta are shown in Table 3.2-33. As a result, impacts to water quality in the Delta region under Alternative 4 are less than significant.

Table 3.2-33. Average Monthly Percent Change in EC from the No Action/No Project Alternative to Alternative 4

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
SWP intake to Clifton Court Forebay												
W	-0.1	-0.1	-0.1	0.0	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
AN	-0.7	-0.4	-0.2	0.0	0.0	0.0	0.1	0.0	-0.6	-0.2	0.0	-0.2
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
D	-0.7	-0.4	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.3	1.0	-0.2
C	-1.5	-0.8	-0.4	-0.2	-0.1	0.0	0.0	0.0	-0.2	2.2	1.1	-1.6
CVP intake at Delta Mendota Canal												
W	-0.1	-0.1	0.0	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-0.6	-0.4	-0.2	0.0	0.0	0.0	0.1	0.0	-0.6	-0.1	0.0	-0.1
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
D	-0.6	-0.3	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.3	-0.2
C	-1.3	-0.7	-0.3	-0.1	0.0	0.0	0.0	0.0	-0.1	0.6	0.2	-0.4
CCWD Victoria Canal location												
W	-0.1	-0.1	-0.1	0.0	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
AN	-0.8	-0.4	-0.2	0.0	0.0	0.0	0.0	0.1	-0.6	-0.3	0.0	-0.1
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
D	-0.6	-0.3	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.2	-0.4
C	-1.4	-0.6	-0.4	-0.2	-0.1	0.0	0.0	0.0	-0.2	-0.1	-0.7	-2.8

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CCWD Old River location												
W	-0.1	-0.1	-0.1	0.0	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
AN	-0.8	-0.5	-0.2	-0.1	0.0	0.0	0.0	0.1	-0.4	-0.1	-0.1	-0.2
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
D	-0.7	-0.4	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.4	1.2	-0.1
C	-1.5	-0.9	-0.5	-0.3	-0.1	0.0	0.0	0.0	-0.3	2.7	0.8	-1.7
CCWD Rock Slough location												
W	-0.1	-0.1	-0.1	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
AN	-0.6	-0.6	-0.3	-0.1	0.0	0.0	0.0	0.0	-0.3	0.0	0.0	-0.2
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	-0.6	-0.5	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.5	1.0	0.7
C	-1.5	-1.1	-0.6	-0.3	-0.1	0.0	0.0	0.0	-0.4	4.7	2.1	-0.7
RSAC081 Collinsville												
W	-0.1	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-0.5	-0.2	-0.2	0.1	0.1	0.0	0.0	0.0	0.5	0.2	0.1	0.1
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	-0.5	-0.2	-0.3	-0.1	0.3	0.3	0.9	0.5	0.3	-1.5	-2.4	-1.2
C	-0.9	-0.4	-0.2	-0.2	0.4	0.3	0.1	-0.9	-0.2	-4.2	-4.9	-3.0
RSAN007 near Antioch												
W	-0.1	-0.1	-0.1	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-0.6	-0.2	-0.2	0.0	0.1	0.0	0.0	0.0	0.1	0.2	0.1	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	-0.6	-0.2	-0.2	-0.1	0.1	0.2	0.3	0.4	0.4	-1.2	-2.0	-1.3
C	-1.1	-0.5	-0.3	-0.2	0.3	0.3	0.1	-1.1	-0.2	-3.5	-4.6	-3.0
RSAN018 Jersey Point												
W	-0.1	-0.1	-0.1	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-0.7	-0.3	-0.2	0.0	0.1	0.0	0.0	0.0	-0.1	0.4	-0.1	-0.2
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	-0.6	-0.3	-0.3	-0.1	0.0	0.0	0.0	0.1	0.3	0.9	1.1	-0.8
C	-1.3	-0.7	-0.4	-0.2	0.0	0.2	0.1	-0.9	-0.3	2.3	-0.9	-1.6

Key: Year Type = Sacramento watershed year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Diversion of transfer water at Banta Carbona ID, West Stanislaus ID, and Patterson ID could affect water quality in the Delta-Mendota Canal. Water quality impacts to the Delta-Mendota Canal would be the same as those described above for the Proposed Action. While the new water introduced to the Delta-Mendota Canal may have higher EC concentrations, the flow would be much smaller than the flows in the Delta-Mendota Canal. Therefore, the increased EC in the water entering the canal would likely not result in a substantive change to EC in the canal. The impacts to water quality in CVP deliveries would be less than significant.

3.2.2.6.2 Buyer Service Area

Transfer water would result in increased irrigation in the Buyer Service Area, which could affect water quality. Under Alternative 4, surface water supplies in the San Joaquin Valley would increase. Some of this water may be used to irrigate drainage impaired lands, but it is much more likely to be used to support permanent crops or high quality farmland. This impact would be the same as described for the Proposed Action. Therefore, Alternative 4 would have less than significant impacts to water quality in the Buyer Service Area as a result of crop irrigation.

Table 3.2-~~32~~34. Comparison of Alternatives

Potential Impact	Alternatives	Significance	Proposed Mitigation	Significance After Mitigation
Changes in reservoir storage and river flows would not affect water quality in reservoirs within the Seller Service Area.	1	NCFEC	None	NCFEC
Changes in reservoir storage would not affect water quality in San Luis Reservoir.	1	NCFEC	None	NCFEC
Cropland idling in the Buyer's Service Area could result in increased deposition of sediment on water bodies	1	NCFEC	None	NCFEC
Cropland idling transfers could result in increased deposition of sediment on water bodies.	2, 4	LTS	None	LTS
Cropland idling/shifting transfers could change the water quality constituents associated with leaching and runoff.	2, 4	LTS	None	LTS
Cropland idling/shifting transfers could change the quantity of organic carbon in waterways.	2, 4	LTS	None	LTS
Groundwater substitution transfers could introduce contaminants that could enter surface waters from irrigation return flows.	2, 3	LTS	None	LTS
Water transfers could change reservoir storage in CVP and SWP reservoirs and could result in water quality impacts.	2, 3, 4	LTS	None	LTS
Water transfers could change reservoir storage non-Project reservoirs participating in reservoir release transfers, which could result in water quality impacts.	2, 3, 4	LTS	None	LTS
Water transfers could change river flow rates in the Seller Service Area and could affect water quality.	2, 3, 4	LTS	None	LTS

Potential Impact	Alternatives	Significance	Proposed Mitigation	Significance After Mitigation
Water transfers could change Delta inflows and could result in water quality impacts.	2, 3, 4	LTS	None	LTS
Water transfers could change Delta outflows and could result in water quality impacts.	2, 3, 4	LTS	None	LTS
Water transfers could change Delta salinity and could result in water quality impacts.	2, 3, 4	LTS	None	LTS
Diversion of transfer water at Banta Carbona ID, West Stanislaus ID, and Patterson ID could affect water quality in the Delta-Mendota Canal.	2, 3, 4	LTS	None	LTS
Use of transfer water in the Buyer Service Area could result in increased irrigation on drainage impaired lands in the Buyer Service Area which could affect water quality.	2, 3, 4	LTS	None	LTS
Water transfers could change reservoir storage in San Luis Reservoir and could result in water quality impacts.	2, 3, 4	LTS	None	LTS

Water transfers could change reservoir storage in San Luis Reservoir and could result in water quality impacts. Under Alternative 4, storage changes would be smaller than those~~would be the same as that~~ under the Proposed Action because the small decreases associated with streamflow depletion would not occur. The~~se~~ small changes in storage are not sufficient enough to adversely affect designated beneficial uses, violate existing water quality standards, or substantially degrade water quality. Modeling indicates that San Luis Reservoir would not fall below 300,000 acre-feet in more years than under the No Action/No Project Alternative. Consequently, potential storage-related effects on water quality would be less than significant for San Luis Reservoir.

3.2.3 Comparative Analysis of Alternatives

Table 3.2-~~32~~ 34 summarizes the potential water quality effects of each of the action alternatives and the No Action/No Project Alternative. The following text supplements the table by comparing the effects of the action alternatives and No Action/No Project Alternative.

3.2.3.1 No Action/No Project Alternative

Under the No Action/No Project Alternative, there would be no impacts from water transfers and no changes in river flows or reservoir storage; therefore, there would be no water quality impacts.

3.2.3.2 Alternative 2: Full Range of Transfers (Proposed Action)

The Proposed Action would result in the most water being transferred overall; however the impacts on river flows and reservoir storage are minimal. There would not be any significant water quality effects from the Proposed Action.

3.2.3.3 Alternative 3: No Cropland Modification

Alternative 3 would result in slightly less overall water to transfer than the Proposed Action. The effects on water quality would be similar to the Proposed Action, but less in some reservoirs and river systems. Overall, there would not be any significant water quality impacts.

3.2.3.4 Alternative 4: No Groundwater Substitution

Alternative 4 would result in slightly less overall water to transfer than the Proposed Action. The effects on water quality would be similar to the Proposed Action, but less in some reservoirs and river systems. Overall, there would not be any significant water quality impacts.

3.2.4 Cumulative Effects

The timeframe for the water quality cumulative effects analysis extends from 2015 through 2024, a ten year period. The projects considered for the water quality cumulative condition are the SWP water transfers, the CVP M&I Water Shortage Policy (WSP), the Lower Yuba River Accord, refuge transfers, and the San Joaquin River Restoration Program, described in more detail in Section 4.3. SWP transfers and the Lower Yuba River Accord could involve transfers in the Seller Service Area and, therefore, could affect water quality resources. The WSP could reduce agricultural water deliveries and increase land idling in the Buyer Service Area. Effects of the WSP in the Seller Service Area would be minor as agricultural water supplies would not substantially change relative to existing conditions. Refuge transfers could increase cropland idling in the San Joaquin Valley near the Buyer Service Area to make water available for transfer, and a small portion of the transferred water could flow through the Delta. The San Joaquin River Restoration Program could increase flows and affect water quality in the San Joaquin River system.

In addition to the efforts described in Section 4.3, the Central Valley Salinity Alternatives for Long-Term Sustainability initiative (CV-SALTS) could affect water quality in the Central Valley. CV-SALTS is a stakeholder-driven effort to manage salinity and nitrates in the Central Valley, and it includes efforts to implement the TMDL for salinity.

The following sections describe potential water quality cumulative effects for each of the proposed alternatives.

3.2.4.1 Alternative 2: Full Range of Transfers (Proposed Action)

3.2.4.1.1 Seller Service Area

Cropland idling transfers could result in increased deposition of sediment on water bodies. A combination of farming practices and soil types in the Seller Service Area reduce the potential of long-term water transfers to erode sediments from idled fields. SWP transfers could also include cropland idling of 86,930 AF, but these transfers would be on fields with similar crops (rice) and soil types. Therefore, the Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact related to water quality.

Cropland idling/shifting transfers could change the water quality constituents associated with leaching and runoff. Cropland idling/crop shifting would change irrigation practices and pesticide application. The changes in the quantity of irrigation water applied to the land could alter the concentration of pollutants associated with leaching and runoff, resulting in less runoff of potential constituents. SWP transfers could have similar effects as those described above for the Proposed Action. Therefore, the Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact with respect to leaching and surface water runoff.

Cropland idling/shifting transfers could change the quantity of organic carbon in waterways. Both cropland idling and crop shifting would decrease agricultural runoff entering waterways, which could reduce one source of organic carbon. SWP transfers would have a similar effect. The overall reduction in agricultural runoff may not actually cause a quantifiable decrease in organic carbon because there are other sources and a variety of factors that contribute to organic carbon levels in waterways. Therefore, the Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact related to organic carbon.

Groundwater substitution transfers could introduce contaminants that could enter surface waters from irrigation return flows. Groundwater substitution transfers would use groundwater for irrigation instead of surface water, which has the potential to change the constituents in agricultural runoff. SWP transfers through groundwater substitution (approximately 6,800 AF) could have the same effect. The amount of groundwater substituted for surface water in the cumulative condition would be relatively small compared to the amount of surface water used to irrigate agricultural fields in the seller areas. Additionally, groundwater quality in the area is generally good and sufficient for municipal, agricultural, domestic, and industrial uses. Therefore, the Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact related to water quality associated with groundwater contributions to agricultural runoff.

Changes in CVP and SWP operations could affect reservoir storage and river flows. Long-term water transfers would increase reservoir storage April through September and decrease storage at other times of year. They would also increase river flows from July through September and decrease river flows at other times. Other cumulative programs could also affect CVP and SWP operations. SWP transfers would have similar operations, and would change reservoir storage and river flows at the same time as long-term water transfers. The Yuba Accord would increase river flows during potential transfers, which could also have similar timing. The M&I WSP would have minor effects to CVP operations in Folsom Reservoir (and negligible effects to other parts of the CVP system). These overall changes to the operations of reservoirs would still represent a very small change based on the size of the reservoirs and the river flows. Therefore, the Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact related to water quality of reservoirs and rivers.

Changes in Delta outflows could result in water quality impacts. As described in the existing conditions, the Delta has number water quality constituents of concern. Past and current projects have affected Delta outflows and degraded water quality in the Delta. Several efforts, including CV-SALTS and other SWRCB actions, are working to improve water quality in the Delta in the future. SWP transfers, refuge transfers, and the Yuba Accord would have similar effects. These effects on Delta outflow would generally be small, but would be increasing outflow during dry periods of the year. SWP transfers and the Yuba Accord~~These programs~~ could also decrease Delta outflow during other times of year, but these times are generally during wet parts of the year when the decrease would not affect water quality. Because of existing degraded water quality conditions in the Delta, the combination of cumulative actions is considered to have significant impacts on water quality in the Delta. Long-term water transfers would increase Delta outflows slightly during the transfer period because carriage water would become additional Delta outflow, which would not adversely affect Delta water quality. Therefore, the Proposed Action's incremental contribution to potentially significant cumulative water quality impacts would not be cumulatively considerable.

Changes in Delta inflows, outflows, and exports could affect Delta salinity. As discussed in existing conditions, salinity is a concern in the Delta because it can adversely affect municipal, industrial, agricultural, and recreational uses. Numerous projects and operations, including CVP and SWP operations, urban discharges, and agricultural discharge affect salinity in the Delta. SWP transfers, refuge transfers, and the Yuba Accord would increase Sacramento River Delta inflow and increase Delta exports; these two actions have opposite effects on Delta salinity. Other programs, such as CV-SALTS, are working to improve water quality in the tributaries to the Delta. These programs would decrease salinity in Delta inflow, which would improve conditions within the Delta in the future. While the end results of these programs may not achieve the desired benefits, it is likely that gradual improvements would occur. Because of existing salinity concerns in the Delta, the combination of cumulative actions is considered to have significant impacts on salinity in the Delta. As shown in the water quality modeling, the Proposed Action would not substantially change the position of X2. Therefore, the Proposed Action's incremental contribution to potentially significant cumulative salinity impacts in the Delta would not be cumulatively considerable.

Diversion of transfer water at Banta Carbona ID, West Stanislaus ID, and Patterson ID could affect water quality in the Delta-Mendota Canal. If Merced ID transfer water is diverted at these facilities, the districts could use the water in their districts and transfer their CVP water, or they could move the water through their districts into the Delta-Mendota Canal. Lake McClure is listed as impaired for mercury due to resource extraction, but otherwise, water quality is generally good. As discussed in existing conditions, water quality in the San Joaquin River is degraded from agricultural discharges, runoff, and wastewater discharges. The San Joaquin River has greater EC concentrations than those at the Delta diversion pumps. Some programs could improve water quality in the San Joaquin River in the future. CV-SALTS is working to reduce salinity in the river and its tributaries. Additionally, the San Joaquin River Restoration Program would increase flows from the upstream watershed into the San Joaquin River, which could provide high quality inflow to dilute constituents of concern in the system. Based on past and current projects, the combination of cumulative actions result in degraded water quality in the San Joaquin River. While the new water introduced to the Delta-Mendota Canal may have higher EC concentrations, the flow from the San Joaquin River into the Delta-Mendota Canal would be much smaller than the flows in the canal. Therefore, the cumulative impacts to water quality in CVP deliveries from San Joaquin River salinity would be less than significant.

Increased irrigation in the Buyer Service Area could affect water quality. Long-term water transfers could increase water supplies in the Central Valley and San Francisco Bay area. SWP transfers are generally to SWP contractors in southern California, but may also provide additional supplies to some of the same buyers. The Yuba Accord can also increase water supplies to these areas. The M&I WSP may result in decreases to water supplies for agricultural CVP contractors in the Central Valley. Refuge transfers could involve cropland idling transfers from the San Joaquin Valley near the Buyer Service Area, but the quantity of land idled would be very small.

Increased surface water supplies could be used to irrigate drainage impaired land. Increased irrigation could cause water to accumulate in the shallow root zone and could leach pollutants into the groundwater and potentially drain into the neighboring surface water bodies. Because of the severe supply limitations in the agricultural areas in the Buyer Service Area, increased supplies would likely be used for permanent crops or prime or important farmlands. As a result, farmers would continue to leave marginal land and drainage impaired lands out of production.

The amount of additional water supplies in the cumulative condition is minimal compared to existing applied irrigation water in the area. Therefore, the combination of cumulative actions is considered to have a less than significant impact on water quality in the Buyer Service Area as a result of crop irrigation.

3.2.4.2 Alternative 3: No Cropland Modification

Cumulative effects would be the same or less than those described for the Proposed Action in the Seller and Buyer Service Areas.

3.2.4.3 Alternative 4: No Groundwater Substitution

Cumulative effects would be the same or less than those described for the Proposed Action in the Seller and Buyer Service Areas.

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Section 3.3
Groundwater Resources

This section presents the existing conditions of groundwater resources within the area of analysis and discusses potential effects of the proposed alternatives on groundwater levels, land subsidence, and groundwater quality.

The descriptions and analyses presented in this section focus primarily on the effects of groundwater substitution transfers and cropland idling transfers on groundwater resources. Other transfer methods discussed in Chapter 2 (stored reservoir releases, crop shifting, and conservation transfers) would not adversely affect groundwater resources in the area of analysis. Several other sections analyze how groundwater-related changes could affect other resources, including:

- Section 3.1, Water Supply, analyzes how changes in groundwater levels have the potential to interact with surface water and potential effects to surface water supplies;
- Section 3.7, Fisheries, assesses how changes in groundwater/surface water interaction could affect aquatic resources;
- Section 3.8, Vegetation and Wildlife, determines if groundwater level changes could reduce water in the root zone and affect terrestrial vegetation; and
- Section 3.10, Regional Economics, analyzes changes in pumping costs associated with declining groundwater levels.

3.3.1 Affected Environment/Existing Conditions

This section presents the area of analysis (Section 3.3.1.1), describes the regulatory setting pertaining to groundwater resources in the area of analysis (Section 3.3.1.2), and describes the existing hydrologic and groundwater characteristics in the area of analysis (Sections 3.3.1.3).

3.3.1.1 Area of Analysis

The area of analysis extends from Shasta County in the northern portion of the Sacramento Valley to Kings County in the southern portion of the San Joaquin Valley and extends as far west as Santa Clara County. The area of analysis consists of the following groundwater basins and subbasins:

- Redding Area Groundwater Basin: Anderson subbasin
- Sacramento Valley Groundwater Basin: Colusa subbasin, West Butte subbasin, Sutter subbasin, Yolo subbasin, Solano subbasin, North and South American subbasins
- San Joaquin Valley Groundwater Basin: Merced subbasin and Westside subbasin
- Santa Clara Valley Groundwater Basin: Santa Clara subbasin
- Gilroy-Hollister Valley Groundwater Basin: Llagas subbasin

Figure 3.3-1 shows the area of analysis and the groundwater basins. The groundwater area of analysis is divided into Seller Service Area and Buyer Service Area.

The Seller Service Area for this resource section includes water districts that have groundwater pumping capabilities and have expressed an interest in groundwater substitution transfers. Groundwater substitution transfers are made by the selling agencies (listed in Table 2-5) that forego their surface water supplies and pump an equivalent amount of groundwater within the Central Valley groundwater basins.

The Buyer Service Area represents water districts that have expressed interest in transfers for purposes of this Environmental Impact Statement/Environmental Impact Report (EIS/EIR). Districts interested in receiving transfers include East Bay Municipal Utility District (MUD), Contra Costa Water District (WD), and Participating Members of the San Luis & Delta-Mendota Water Authority (SLDMWA). See Table 2-6 for a detailed list of interested buyers.

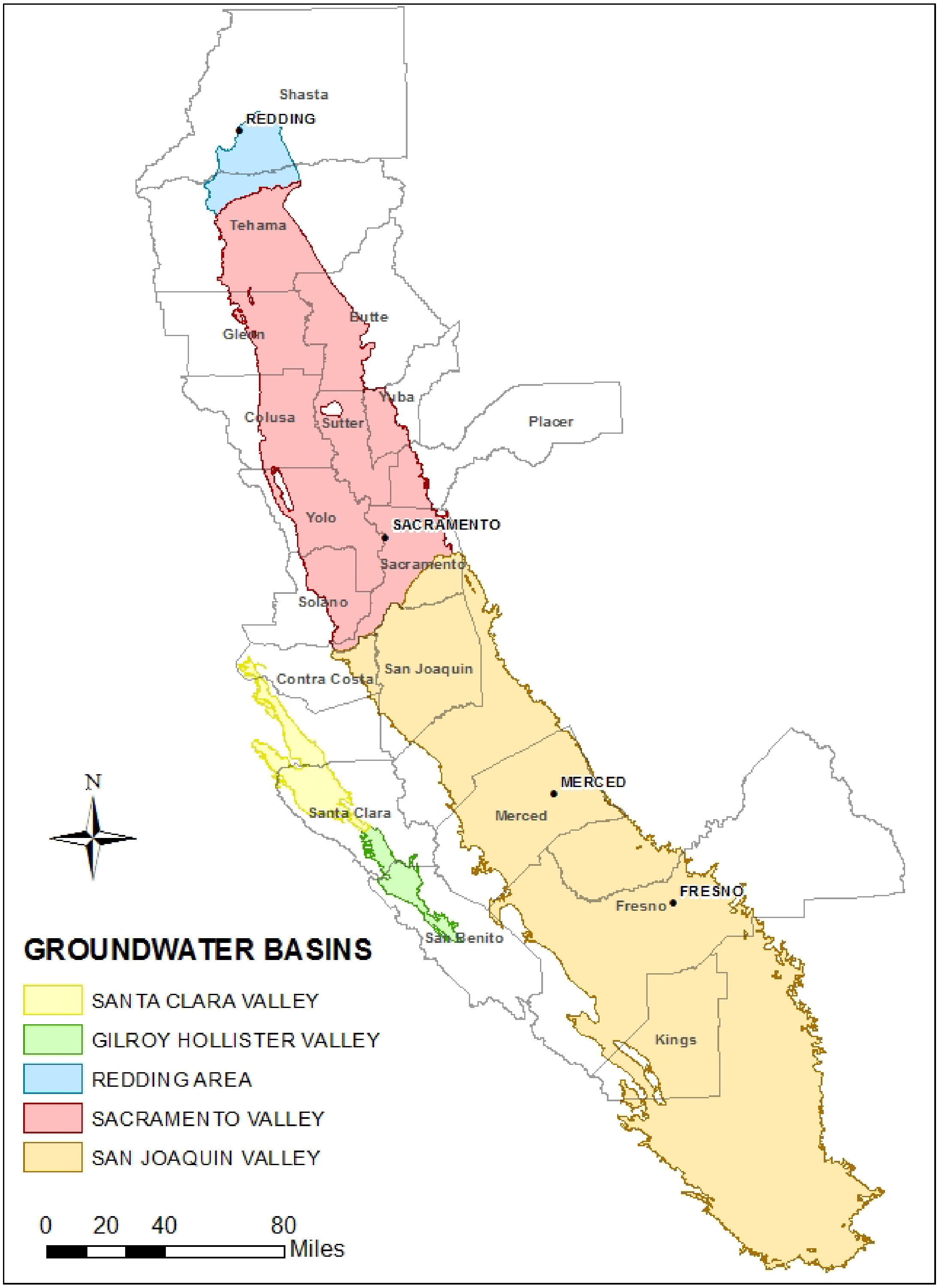

Figure 3.3-1. Groundwater Resources Area of Analysis

3.3.1.2 Regulatory Setting

All willing buying and selling agencies participating in this program will have to comply with applicable regulations: State regulations; Central Valley Project (CVP) and State Water Project (SWP) contractual requirements; and local regulations, as described below.

3.3.1.2.1 Federal Regulation

Central Valley Project Improvement Act (Section 3405)

Reclamation approves water transfers consistent with provisions of the Central Valley Project Improvement Act (CVPIA) and State law that protect against injury to other legal users of water. According to the CVPIA Section 3405, the following principles must be satisfied for any transfer:

- Transfer may not violate the provisions of Federal or state law;
- Transfer may not cause significant adverse effects on Reclamation's ability to deliver CVP water to its contractors or other legal user;
- Transfer will be limited to water that would be consumptively used or irretrievably lost to beneficial use;
- Transfers cannot exceed the average annual quantity of water under contract actually delivered; and
- Transfer will not adversely affect water supplies for fish and wildlife purposes.

Reclamation will not approve a water transfer if these basic principles are not satisfied and will issue its decision regarding potential CVP transfers in coordination with the U.S. Fish and Wildlife Service, contingent upon the evaluation of impacts on fish and wildlife.

3.3.1.2.2 State Regulation

Groundwater use is subject to limited statewide regulation; however, all water use in California is subject to constitutional provisions that prohibit waste and unreasonable use of water (State Water Resources Control Board [SWRCB] 1999). In general, groundwater and groundwater-related transfers are subject to a number of provisions in the California Water Code (Water Code). Some of these provisions are listed below:.

Water Code (Section 1745.10)
Section 1745.10 of the Water Code requires that for water transfers pursuant to Sections 1725[1] and 1735[2], the transferred water may not be replaced with groundwater unless the following criteria are met (SWRCB 1999):

- The transfer is consistent with applicable Groundwater Management Plans (GMPs); or
- The transferring water supplier approves the transfer and, in the absence of a GMP, determines that the transfer will not create, or contribute to, conditions of long-term overdraft in the groundwater basin.

Water Code (Section 1220)
Section 1220 of the Water Code regulates the direct export of groundwater from the combined Sacramento and Delta-Central Sierra Basins. It states that groundwater cannot be exported from these basins unless pumping complies with a GMP, adopted by the county board of supervisors in collaboration with affected water districts, and approved by a vote from the counties that lie within the basin. This excludes water seepage into groundwater from water supply project or export facilities, which may be returned to the facilities. In certain cases, the county board of supervisors may select a county water agency to represent the board.

In addition to these requirements, state well standards and local ordinances govern well placement, and the Water Code requires submission of well completion reports. Any groundwater substitution transfers would be subject to these regulations, as well as other applicable local regulations and ordinances. Reclamation requires sellers to submit well completion reports (if they are available) or video logs to evaluate proposed groundwater substitution transfers. Groundwater substitution transfers are not contingent on the submission of well completion reports.

Water Code (Section 1810) "no injury" provisions
Several provisions of the Water Code (including Sections 1702, 1706, 1725, 1735, and 1810, among others) provide that transfers cannot cause "injury to any legal user of the water involved." Both surface and groundwater users are protected by these provisions as long as they are legal users of water.

[1] Section 1725 of the Water Code pertains to short-term/temporary transfers of water under post 1914 water rights that involve the amount of water that would have been consumptively used or stored by the transferee in the absence of the change or transfer. Such changes or transfers are exempt from CEQA, but require findings of "no injury to other legal users" and "no unreasonable effects on fish and wildlife."

[2] Section 1735 of the Water Code pertains to long-term transfers of water or water rights involving a change of point of diversion, place of use, or purpose of use. A transfer is considered long-term if it exceeds a period of one year.

Water Code (Section 10750) or Assembly Bill (AB) 3030

AB 3030, commonly referred to as the Groundwater Management Act, permits local agencies to develop GMPs that cover certain aspects of management. Subsequent legislation has amended this chapter to make the adoption of a management program mandatory if an agency is to receive public funding for groundwater projects, creating an incentive for the development and implementation of plans.

Water Code (Section 10753.7) or Senate Bill (SB) 1938

SB 1938, requires local agencies seeking State funds for groundwater construction or groundwater quality projects to have the following: (1) a developed and implemented GMP that includes basin management objectives[3] (BMOs) and addresses the monitoring and management of groundwater levels, groundwater quality degradation, inelastic land subsidence, and surface water/ groundwater interaction; (2) a plan addressing cooperation and working relationships with other public entities; (3) a map showing the groundwater subbasin the project is in, neighboring local agencies, and the area subject to the GMP; (4) protocols for the monitoring of groundwater levels, groundwater quality, inelastic land subsidence, and groundwater/surface water interaction; and (5) GMPs with the components listed above for local agencies outside the groundwater subbasins delineated by the Department of Water Resources' (DWR) California's Groundwater Bulletin 118 (Bulletin 118), published in 2003 (DWR 2003).

Water Code (Section 10920-10936 and 12924) or SB X7 6

SB X7 6, established a voluntary statewide groundwater monitoring program and requires that groundwater data collected be made readily available to the public. The bill requires DWR to: (1) develop a statewide groundwater level monitoring program to track seasonal and long-term trends in groundwater elevation; (2) conduct an investigation of the state's groundwater basins delineated by Bulletin 118 and report its findings to the Governor and Legislature no later than January 1, 2012 and thereafter in years ending in five or zero; and (3) work cooperatively with local Monitoring Entities to regularly and systematically monitor groundwater elevations to demonstrate seasonal and long-term trends. AB 1152, Amendment to Water Code Sections 10927, 10932 and 10933, allows local Monitoring Entities to propose alternate monitoring techniques for basins meeting certain conditions and requires submittal of a monitoring plan to DWR for evaluation.

Water Code (Section 10927, 10933, 12924, 10750.1 and 10720) or SB 1168

SB 1168 requires the establishment of Groundwater Sustainability Agencies (GSA) and adoption of Groundwater Sustainability Plans (GSP). GSAs must be formed by June 30, 2017. GSAs are new entities that consist of local

[3] BMOs are management tools that define the acceptable range of groundwater levels, groundwater quality, and inelastic land subsidence that can occur in a local area without causing significant adverse impacts.

agency(ies) and include new authority to: 1) investigate and determine the sustainable yield of a groundwater basin; 2) regulate groundwater extractions; 3) impose fees for groundwater management; 4) require registration of groundwater extraction facilities; 5) require groundwater extraction facilities to use flow measurement devices; and 6) enforce the terms of a GSP.

Additionally, this bill requires groundwater basins to be prioritized as high-, medium-, low- or very low- with respect to groundwater conditions, adverse impacts on local habitat and adverse impacts on local stream flow no later than January 31, 2015. DWR has determined that the initial basin prioritization developed in June 2014 will be the initial prioritization adopted under this legislation. DWR has not identified basins with critical overdraft conditions as of January 31, 2015.

GSPs for groundwater basins designated by DWR as high- and medium-priority with critical overdraft conditions (per SB X7 6) are required to be developed by January 31, 2020. GSPs for the remaining high- and medium-priority groundwater basins are to be developed by January 31, 2022. GSPs are encouraged to be developed for groundwater basins prioritized as low- or very low-priority (Pavley 2014a). All high- and medium-priority basins must achieve sustainability within 20 years of adopting a GSP.

Water Code (Section 10729, 10730, 10732, 10733 and 10735) or AB 1739

AB 1739 establishes the following: (1) provides the specific authorities to a GSA (as defined by SB 1168); (2) requires DWR to publish best management practices for the sustainable management of groundwater by January 1, 2017; and (3) requires DWR to estimate and report the amount of water available for groundwater replenishment by December 31, 2016. The bill authorizes DWR to approve and periodically review all GSPs (Dickinson 2014).

The bill authorizes the State Water Resources Control Board (SWRCB) to: (1) conduct inspections and obtain an inspection warrant; (2) designate a groundwater basin as a probationary groundwater basin; (3) develop interim plans for probationary groundwater basins in consultation with DWR if the local agency fails to remedy a deficiency resulting in the designation of probationary; and (4) issue cease and desist orders or violations of restrictions, limitations, orders, or regulations issued under AB 1739 (Dickinson 2014).

Water Code (Section 10735.2 and 10735.8) or SB 1319

SB 1319 would authorize the SWRCB to designate high- and medium-priority basins (defined by SB 1168) as a probationary basin after January 31, 2025. This bill allows the SWRCB to develop interim management plans that may override a local agency. However, if the appointed GSA can demonstrate compliance with sustainability goals for the basin, then the SWRCB has to exclude the groundwater basin or a portion of the groundwater basin from probationary status (Pavley 2014b).

Other Groundwater Regulations

Groundwater quality issues are monitored through a number of different legislative acts and are the responsibility of several different State agencies including:

- SWRCB and nine Regional Water Quality Control Boards (RWQCB) - responsible for protecting water quality for present and future beneficial use;
- California Department of Toxic Substances Control - responsible for protecting public health from improper handling, storage, transport, and disposal of hazardous materials;
- California Department of Pesticide Regulation - responsible for preventing pesticide pollution of groundwater;
- California Department of Public Health (CDPH) - responsible for drinking water supplies and standards;
- California Integrated Waste Management Board - oversees non-hazardous solid waste disposal, and
- California Department of Conservation - responsible for preventing groundwater contamination due to oil, gas, and geothermal drilling and related activities.

3.3.1.2.3 Local Regulation

Local GMPs and county ordinances vary by authority/agency and region, but typically involve provisions to limit or prevent groundwater overdraft, regulate transfers, prevent subsidence and protect groundwater quality.

AB 3030, the Groundwater Management Act, encourages local water agencies to establish local GMPs. The Groundwater Management Act lists 12 elements that should be included within the GMPs to ensure efficient groundwater use, good groundwater quality, and safe production of water. Table 3.3-1 lists the current GMPs that apply to agencies that have expressed interest in participating in the Long-Term Water Transfers EIS/EIR.

Table 3.3-1. Local GMPs and Ordinances

Groundwater Basin	Potential Participating Agencies	GMPs, Agreements and County Ordinances
Redding Area	• Anderson-Cottonwood ID	• Shasta County AB 3030 Plan • Anderson-Cottonwood ID GMP
Sacramento Valley	• Conaway Preservation Group • Cranmore Farms • Eastside MWC • Glenn-Colusa ID • Natomas Central MWC • Pleasant Grove-Verona MWC • RD 108 • RD 2068 • Sycamore MWC • Te Velde Revocable Family Trust • Butte WD • Cordua ID • Garden Highway MWC • Gilsizer Slough Ranch • Goose Club Farms and Teichert Aggregates • Tule Basin Farms	• Glenn-Colusa ID GMP AB 3030 Plan • Glenn County GMP • Colusa County GMP • Reclamation District 108 GMP • RD 2068 GMP • Yolo County Water Management Plan • Butte County GMP • Yuba GMP
	• City of Sacramento • Sacramento County Water Agency • Sacramento Suburban WD	• Sacramento Groundwater Authority GMP • Sacramento County Water Agency GMP • Central Sacramento County GMP
San Joaquin Valley	• Merced ID • SLDMWA	• Merced ID AB 3030 Plan • Merced Groundwater Basin AB 3030 Plan • Merced County Wellhead Protection Program • Water Supply Plan and Update • Westlands Water District GMP
Santa Clara Valley	• East Bay MUD • Santa Clara Valley WD	• South East Bay Plain Basin GMP • Santa Clara Valley WD GMP

Source: DWR 2010a
Key:
AB = Assembly Bill
GMP = Groundwater Management Plan
ID = Irrigation District
MUD = Municipal Utility District
MWC = Mutual Water Company
RD = Reclamation District
SLDMWA = San Luis & Delta-Mendota Water Authority
WD = Water District

The following are descriptions of local regulations/ordinances which may need to be considered during a water transfer:

Shasta County Ordinance SCC 98-1

This ordinance requires a permit for extraction and export of groundwater, either directly or indirectly, for use outside the county. Groundwater substitution transfers as defined in Chapter 2 of this document will be subject to this ordinance. Applications for a transfer permit should be submitted to Shasta County Water Agency. Permits may only be granted if the proposed groundwater extraction (1) will not cause or increase an overdraft of the groundwater underlying the county; (2) will not adversely affect the long term ability for storage or transmission of groundwater; (3) will not exceed the annual yield of the groundwater underlying the county; (4) will not result in an injury to water replenishment, storage, or restoration project; (5) is in compliance with Water Code 1220; and (6) will not be detrimental to the health, safety and welfare of property owners overlying or in the vicinity of the proposed extraction site(s).

Glenn County Ordinance No. 1115

This ordinance does not prohibit the export of water nor does it prohibit groundwater management practices that may involve the export of water. The ordinance clearly states that groundwater management practices including water exports shall not cause harm to adjacent areas. The ordinance cites modification, reduction, or termination of wells involved with water exports as a first priority in a sequence of management actions to be taken in the event groundwater levels become critical.

Colusa County Ordinance No. 615

This ordinance prohibits direct or indirect extraction of groundwater for transfer outside county boundaries without permit approval, except in certain circumstances. The permit approval process includes public and environmental reviews. Permits may only be approved after the environmental review determines that the Proposed Action would not result in the following: (1) overdraft or increased overdraft, (2) damage to aquifer storage or transmissivity, (3) exceedance of the annual yield or foreseeable injury to beneficial overlying groundwater users and property users, (4) injury to water replenishment, storage, or restoration projects, or (5) noncompliance with Water Code Section 1220. If Colusa County grants a three-year permit under Ordinance 615, the permit may also be subject to additional conditions to avoid adverse effects. Violators of this permitting process may be subject to a fine (Colusa County 1999). The ordinance does have an exemption process that would allow transfers to occur without obtaining a permit.

Sacramento County Ordinance (Title 3 Section 3.40.090)

This ordinance requires a permit to be issued for groundwater or surface water export of any manner from Sacramento County. The Director of the Sacramento County Department of Water Resources (or his designated representative) is required to (1) issue a permit for each source of transfer (i.e. pumping location); (2) conduct necessary investigations to determine if the transfers in in conformance with county water planning policies; (3) investigate if transfers could cause adverse impacts on the source, the area of use or the environment; and (4) determine if transfers is consistent with the general plan of the County of Sacramento, or the water plan of the Sacramento County Water Agency, or a specific plan of the county or water agency that may be affected by the work or activity.

Yolo County Export Ordinance No. 1617

Yolo County Export Ordinance No. 1617 is similar to the Colusa County ordinance described above. Indirect or direct export of groundwater outside Yolo County requires a permit. In addition to review by the county, the Director of Community Development may review the permit application with other affected county departments, DWR, RWQCB, and any other interested local water agency neighboring the area of the proposed transfer. Following a California Environmental Quality Act (CEQA) environmental review and a public review, the Yolo County Board of Supervisors may grant the permit if the evidence suggests that the extraction would not cause (1) adverse effects to long-term storage and transmissivity of the aquifer, (2) exceedance of safe yield unless it is in compliance with an established conjunctive use program, (3) noncompliance with Water Code section 1220, or (4) injury to water replenishment, storage, or restoration projects. The Yolo County Board of Supervisors may impose additional conditions to the permit to ensure compliance with the aforementioned criteria. This ordinance subjects violators to fines (Yolo County 1996).

Water Forum Agreement (WFA)

The WFA consists of seven major elements designed to meet the following overall objective to: "Provide a reliable and safe water supply for the region's economic health and planned development to the year 2030; and preserve the fishery, wildlife, recreational, and aesthetic values of the Lower American River." The WFA's Groundwater Element encourages the management of the limited groundwater resources in three hydrogeologic areas within Sacramento County (Water Forum 1999). The WFA areas that could be affected by the proposed action include the areas termed as the North Area and Central Area. The major outcomes of this agreement included (Water Forum 1999):

- Formation of the Sacramento Groundwater Authority (SGA) and the American River Basin Cooperating Agencies (ARBCA); and

- A recommended sustainable yield of 131,000 acre-feet (AF) per year for the North Area and 273,000 AF per year for the Central Area.

Groundwater management negotiations in the Central area and the South area will continue.

SGA's primary mission is to protect the basin's safe yield, defined in the WFA, and water quality. Additional goals and objectives of the SGA include: (1) develop/facilitate a regional conjunctive use program consistent with the WFA; (2) mitigate conditions of regional groundwater overdraft; (3) replenish groundwater extraction; (4) mitigate groundwater contaminant migration; (5) monitor groundwater elevations and quality; and (6) develop relationships with State and Federal Agencies. The basin has approximately 600,000 AF of evacuated storage that could be exercised in such a program. The ultimate potential wet year in-lieu banking potential is about 100,000 AF per year, with a potential dry year surface water exchange potential of over 50,000 AF per year.

American River Basin Regional Conjunctive Use Program (ARBCUP)
A partnership between the SGA and the ARBCA resulted in the ARBCUP.

An outcome of the WFA, the ARBCUP intends to assist in meeting the WFA objectives, discussed above, by using the overdrafted basin in the North Area for groundwater banking. Groundwater recharge as part of the ARBCUP consists of either (1) direct recharge using surface water from the American River and/or Sacramento River or (2) in lieu of recharge in which surface water is substituted for groundwater. The ARBCUP includes a combination of the use of groundwater and surface water to maximize "banking" of both groundwater below ground and surface water in reservoirs. ARBCUP assists in maintaining the WFA American River environmental flow standards. When the ARBCUP was completed in 2008, the program increased water supplies by 20,000 AF per year (Regional Water Authority [RWA] 2012).

Groundwater Management Plans
While GMPs aid in establishing best practices, not all of the GMPs set quantitative groundwater elevation triggers for their BMOs. Table 3.3-2 lists the counties in the Sacramento Valley with existing GMPs. The table also provides a description of the BMOs, as described in each GMP. This list is provided for the entire Sacramento Valley; however, in addition to listing counties that contain potential groundwater substitution pumping sellers, the list also contains counties that do not (e.g., Butte County).

Table 3.3-2. Groundwater Management Plans and BMOs in the Sacramento Valley

County	Basin Management Plan	Groundwater Basin Management Objective
Shasta (Anderson Cottonwood Irrigation District Groundwater Management Plan)	http://www.andersoncottonwoodirrigationdistrict.org/uploads/2/7/2/8/2728665/acid_gwmp.pdf	Pg. 3-2: No set elevation thresholds.
Shasta County (Shasta County Water Agency)	http://www.co.shasta.ca.us/index/pw_index/engineering/water_agency.aspx	No elevation thresholds.

County	Basin Management Plan	Groundwater Basin Management Objective
Tehama County (Tehama County Flood Control and Water Conservation District)	http://www.tehamacountypublicworks.ca.gov/Flood/ Groundwater trigger levels for each sub-basin located here: http://www.tehamacountypublicworks.ca.gov/Flood/groundwater.htm	Trigger levels vary based on groundwater measurements in each monitoring well. Trigger levels generally follow a pattern of: • Historical low of spring measurements plus 20% of the range of spring measurements: notify and inform public. • Second consecutive year of groundwater levels at or below spring trigger level 1: monitor and investigate cause. • Historical low of spring measurements: consider management options. • Historical low of late groundwater measurements: notify public and begin investigations.
Glenn County	http://www.glenncountywater.org/documents/GlennCoBMOdocument_000.pdf	There are 17 basin management sub-areas in the basin. BMOs for groundwater levels are established separately for each sub-area. There are no clear BMOs established yet. Objectives for the sub-areas are qualitative and relate to maintaining groundwater surface elevations at a level that will assure an adequate and affordable irrigation water supply; sustainable agricultural water supply; adequate groundwater supply for all domestic users. Additionally, some BMOs state that the objective is to develop an understanding of groundwater levels in the sub-area. Elevation thresholds vary depending on sub-area and monitoring well within each sub-area.
Butte County	http://www.buttecounty.net/Portals/26/GWMP/Section_3__1-7-05_2.pdf	Pg. 3-4: Groundwater level declines in many areas of the county have been observed. These range from 0.8 to 2.0 feet per year. Declining groundwater levels are used as a trigger for close observation of groundwater level trends.
Colusa County	http://colusagroundwater.ucdavis.edu/Technical%20Materials%20for%20Posting/ColusaCo_GMP_Volume-1_9-10-08.pdf	Pg. 34: From a review of the groundwater level hydrographs on Figure II.5, it can be seen that the extent to which the groundwater basin is utilized throughout the County varies significantly. Accordingly, the assessment of changes in groundwater levels in the respective areas must be performed with full consideration of the historic levels. It is premature to attempt to set groundwater level targets or thresholds in Colusa County. It is, however, very important to evaluate the groundwater level data in relation to historic data and report the results of that evaluation together with an assessment of overall hydrologic conditions, known changes in land use, etc.

County	Basin Management Plan	Groundwater Basin Management Objective
Sutter County	http://www.co.sutter.ca.us/pdf/pw/wr/gmp/Sutter_County_Final_GMP_20120319.pdf	There are three BMOs for groundwater levels. One is related to low groundwater levels: • Avoid ongoing declines in groundwater levels during water year types identified by DWR to be "above normal" or "wet" for the Sacramento Valley. The BMO also states "groundwater levels are to be managed to ensure adequate water supplies while avoiding adverse impacts and mitigating them if and when they do occur. Adverse impacts related to groundwater levels can occur from excessively high or low groundwater levels. What constitutes an excessively high or low groundwater level may change over time, and will also vary by land use and hydrologic and climatic conditions.
Yuba County Water Agency	http://www.ycwa.com/documents/943	Pg. 3-12: No specific threshold. Qualitative objectives: • Avoid potential unreasonable impacts that may occur from changes in groundwater surface elevations because of external transfers. • Monitor any lowering of groundwater surface elevations that may occur as a result of groundwater extraction to meet local demands in drier years.
Nevada County (Martis Valley Groundwater Management Plan)	http://www.pcwa.net/files/docs/enviro/MartisValleyGMPFinal07.22.2013.pdf	Very general BMO about protecting groundwater quantity. Plan includes details on the establishment of a groundwater elevation monitoring program.
Placer County Water Agency (Western Placer County Groundwater Management Plan)	http://www.pcwa.net/general-information/environmental-and-planning-documents.html and http://www.pcwa.net/files/docs/enviro/WPCGMP_Groundwater_Managerment_Plan_07.pdf	Pg. 3-8: discusses the need to create a uniform groundwater elevation monitoring program. No thresholds are set because historically, data have not been collected consistently.
Sacramento Groundwater Authority	http://www.sgah2o.org/sga/files/2008-SGA-GMP-FINAL-20090206-print_ready.pdf	Pg. 29: "SGA members intend that overall groundwater elevations in the basin be improved over time, and that the groundwater basin be managed such that the impacts during drier years will be minimized when surface water supplies are curtailed and are replaced by increased groundwater supplies. This is accomplished, similar to what is done in the Central Sacramento Basin, by measuring groundwater levels in more than 30 wells throughout the SGA. A similar 5 square mile grid pattern is used to monitor groundwater levels over time throughout the basin. SGA monitors groundwater elevations twice a year.

County	Basin Management Plan	Groundwater Basin Management Objective
Central Sacramento County	http://www.amwater.com/files/CSCGMP_final.pdf	Pg. 3-3: An operating range for groundwater elevations in the basin define the upper and lower groundwater elevation thresholds. Upper and lower elevation limits are defined for 5 square mile polygons throughout the basin. Each polygon represents its own management unit with lower and upper elevation attributes. Groundwater elevation contour maps are on pages 3-4 and 3-5 of the plan. Lower groundwater thresholds range from -90 feet msl in the southwestern part of the basin to 150 feet msl in the northeastern part of the basin. Upper groundwater thresholds range from -70 feet msl in the southwestern part of the basin to 200 feet msl in the northeastern part of the basin.
South Area Water Council	http://www.water.ca.gov/groundwater/docs/GWMP/SJ-20_SouthBasin_GWMP_2011.pdf	Similar to the Sacramento Groundwater Authority and Central Sacramento County, the South Area Water Council's groundwater management plan uses several wells throughout the basin to gather groundwater elevation data and high/low thresholds would be based on individual wells. The BMO, on p. 2-2, states generally: Maintain or enhance groundwater elevations to meet the long-term needs of groundwater users within the Groundwater Management Area.
Yolo County	http://www.water.ca.gov/groundwater/docs/GWMP/SR-35_YoloCountyFCWCD_GWMP_2006.pdf	p. 12: "when ¾ of monitoring wells reach within 25% of the lowest water level recorded for that well. Spring and fall measurements will be analyzed separately."

3.3.1.3 Affected Environment

3.3.1.3.1 Redding Area Groundwater Basin

The Redding Area Groundwater Basin is in the northernmost part of the Central Valley. Underlying Tehama and Shasta Counties, it is bordered by the Klamath Mountains to the north, the Coast Range to the west, and the Cascade Mountains to the east. Red Bluff Arch separates the Redding Area Groundwater Basin from the Sacramento Valley Groundwater Basin to the south. DWR Bulletin 118 subdivides the Redding Area Groundwater Basin into six subbasins (DWR 2003). Figure 3.3-2 shows the Redding Area Groundwater Basin and Subbasins. The following section provides information on geology, hydrogeology, hydrology, groundwater production, groundwater levels and storage, land subsidence, and groundwater quality.

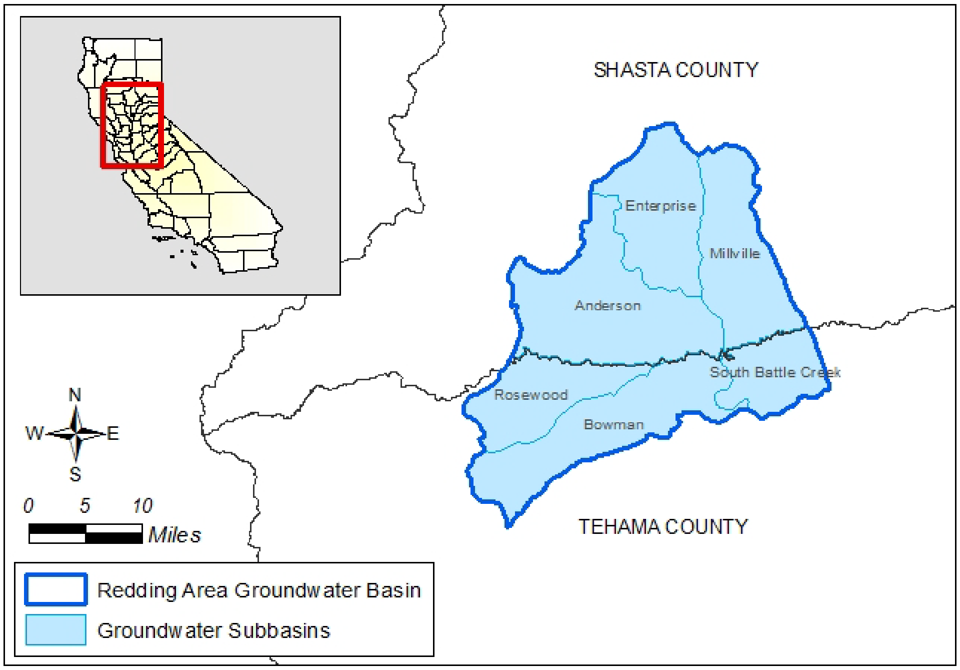

Figure 3.3-2. Redding Area Groundwater Basin and Subbasins

Geology, Hydrogeology, and Hydrology

The Redding Area Groundwater Basin is a sediment-filled, southward plunging symmetrical trough. The principal freshwater-bearing formation in the basin is formed by the simultaneous deposition of materials from the Coast and the Cascade Ranges. The Tuscan Formation in the eastern portion of the basin is derived from the Cascade Range volcanic sediments, and the Tehama Formation in the western and northwest portion of the basin is derived from Coast Range sediments. These formations are up to 2,000 feet thick near the confluence of the Sacramento River and Cottonwood Creek. The Tuscan Formation is generally more permeable and productive than the Tehama Formation (Shasta County Water Agency 2007).

Figure 3.3-3 shows a generalized geologic cross ~~sections~~section looking from north to south across the Redding Area Groundwater Basin (Shasta County Water Agency 2007).

The principal surface water features in the Redding Area Groundwater Basin are the Sacramento River and its tributaries: Battle Creek, Cow Creek, Little Cow Creek, Clear Creek, Dry Creek, and Cottonwood Creek. Surface water and groundwater interact in many areas in the Redding Basin. In general, groundwater flows southeasterly on the west side of the basin and southwesterly on the east side, toward the Sacramento River. The Sacramento River is the main drain for the basin (DWR Northern District 2002). The Shasta County Water Resources Master Plan Phase 1 Report estimated the total annual groundwater discharge to rivers and streams at about 266,000 AF, and seepage from streams and canals into groundwater at 59,000 and 44,000 AF, respectively (CH2M Hill 1997 as cited in CH2M Hill 2003). Groundwater is typically unconfined to semi-confined in the shallow aquifer system and confined where deeper aquifers are present.

Groundwater Production, Levels and Storage

The watersheds overlying the Redding Basin yield an average of 850,000 AF of annual runoff (CH2M Hill 2003). Much of this water is potentially available to recharge the Redding Area Groundwater Basin and replenish water levels that have been depressed because of groundwater pumping. Applied irrigation water (from all sources) totals approximately 270,000 AF annually in the Redding Basin area (CH2M Hill 1997 as cited in CH2M Hill 2003). While the exact quantity of groundwater pumped annually from the Redding Area Groundwater Basin is not known, it has been estimated that approximately 55,000 AF per year of water is pumped from municipal and industrial (M&I) and agricultural production wells (CH2M Hill 2003). This magnitude of pumping represents approximately six percent of the average annual runoff.

Figure 3.3-4 shows Spring 2013 groundwater elevation contours within the Redding Area and Sacramento Valley Groundwater Basin. In general, groundwater flows inward from the edges of the basin and south, towards the Sacramento River in the Redding Area Groundwater Basin.

The storage capacity for the entire Redding Area Groundwater Basin is estimated to be 5.5 million AF for 200 feet of saturated thickness over an area of approximately 510 square miles (Pierce 1983 as cited in Bulletin 118; DWR 2003).

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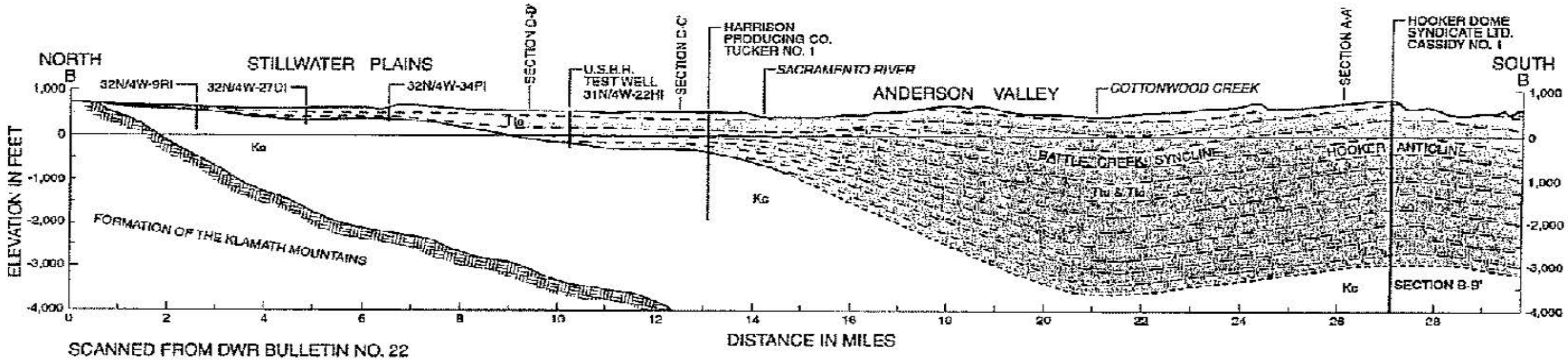

Source: Shasta County Water Agency, 2007

Figure 3.3-3. Generalized Geologic cross section of the Redding Area Groundwater Basin

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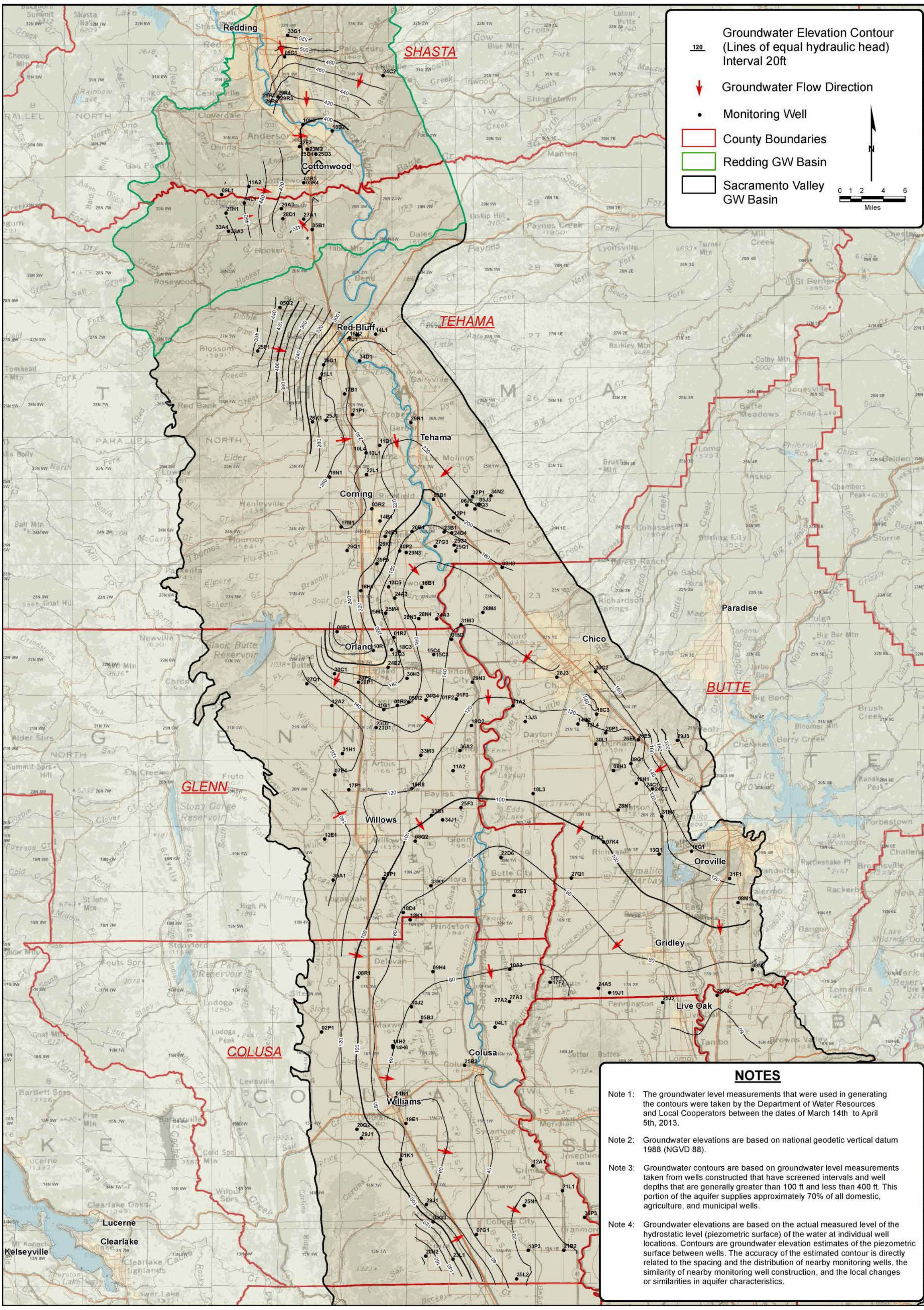

Source: DWR 2013

Figure 3.3-4. Redding Area and Sacramento Valley Spring 2013 Groundwater Elevation Contours

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Groundwater-Related Land Subsidence

Land subsidence has not been monitored in the Redding Area Groundwater Basin. However, there would be potential for subsidence in some areas of the basin if groundwater levels decline below historic low levels. The groundwater basin west of the Sacramento River is composed of the Tehama Formation; this formation has exhibited subsidence in Yolo County and the similar hydrogeologic characteristics in the Redding Area Groundwater Basin could be conducive to land subsidence.

Groundwater Quality

Groundwater in the Redding Area Groundwater Basin is typically of good quality, as evidenced by its low total dissolved solids (TDS) concentrations, which range from 70 to 360 milligrams per liter (mg/L). Areas of high salinity (poor water quality), are generally found on the western basin margins, where the groundwater is derived from marine sedimentary rock. Elevated levels of iron, manganese, nitrate, and high TDS have been detected in some areas. Localized high concentrations of boron have been detected in the southern portion of the basin (DWR Northern District 2002).

3.3.1.3.2 Sacramento Valley Groundwater Basin

The Sacramento Valley Groundwater Basin includes portions of Butte, Colusa, Glenn, Placer, Sacramento, Sutter, Solano, Tehama, Yuba and Yolo counties. The Sacramento Valley Groundwater Basin is bordered by the Red Bluff Arch to the north, the Coast Range to the west, the Sierra Nevada to the east, and the San Joaquin Valley to the south. Bulletin 118 further divides the Sacramento Valley Groundwater Basin into subbasins (DWR 2003). Figure 3.3-5 shows the Sacramento Valley Groundwater Basin and subbasins. The following section provides information on geology, hydrogeology, hydrology, groundwater production, groundwater levels and storage, land subsidence, and groundwater quality.

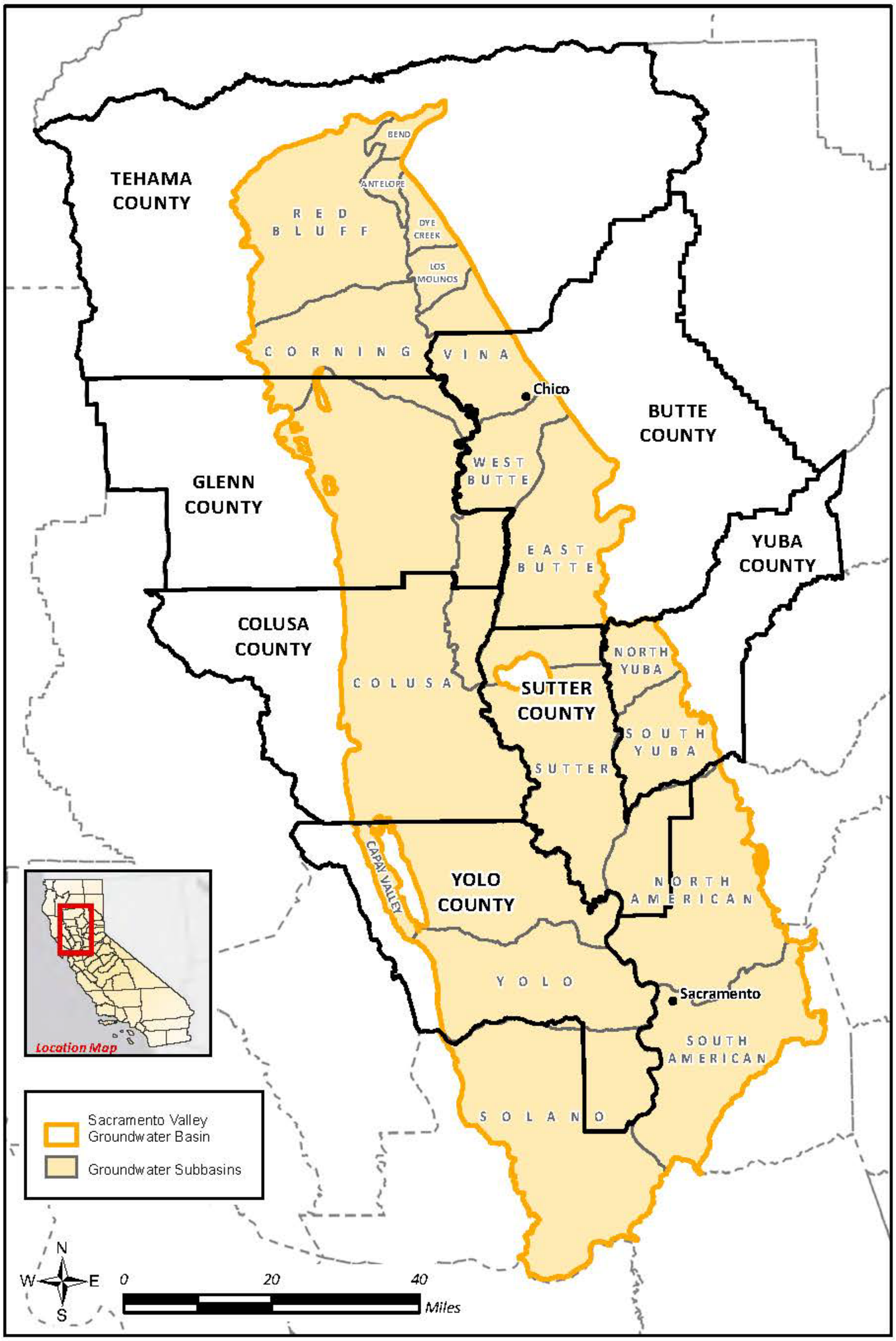


Figure 3.3-5. Sacramento Valley Groundwater Basin

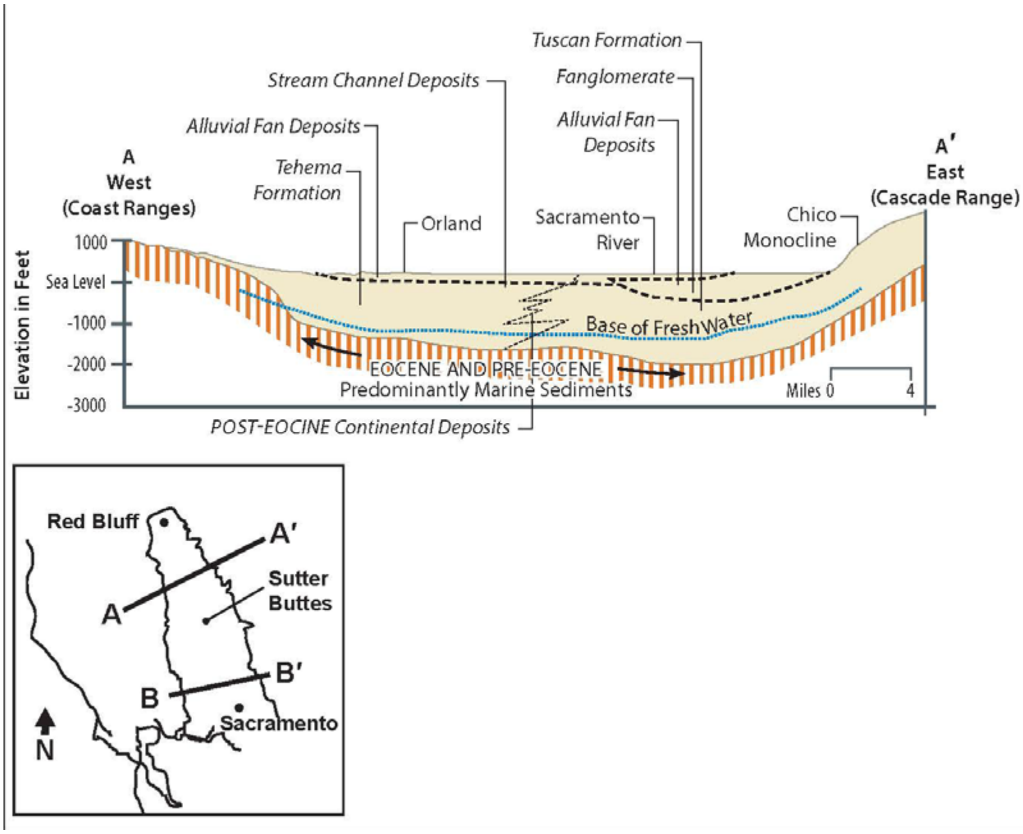
Geology, Hydrogeology, and Hydrology

The Sacramento Valley Groundwater Basin is a north-northwest trending asymmetrical trough filled with both marine and continental rocks and sediment. On the eastern side, the basin overlies basement rock that rises relatively gently to the Sierra Nevada, while on the western side the underlying basement rock rises more steeply to form the Coast Range. Overlying the basement rock are marine sandstone, shale, and conglomerate rocks, which generally contain brackish or saline water (DWR 1978). The freshwater-bearing formation in the valley comprises of sedimentary and volcanic rocks that have the ability to absorb, transmit and yield fresh water. The depth below ground surface (bgs) to the base of freshwater is approximately 1,150 feet in the northern portion of the Sacramento Valley and approximately 1,600 feet in the southern portion of the Sacramento valley (DWR 1978).

Along the eastern and northeastern portion of the basin are the Tuscan and Mehrten formations, derived from the Cascade and Sierra Nevada ranges. The Tehama Formation in the western portion of the basin is derived from Coast Range sediments. In most of the Sacramento Valley Groundwater Basin, the Tuscan, Mehrten, and Tehama formations are overlain by relatively thin alluvial deposits.

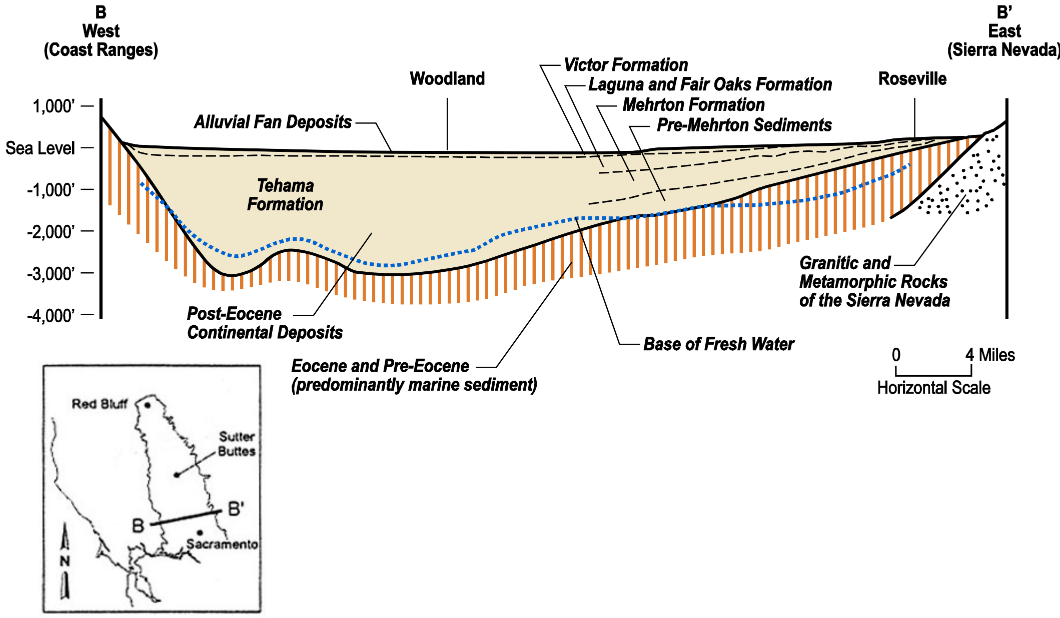
Freshwater is present primarily in the heterogeneous gravel and sand layers of the Laguna, Mehrten, Tehama, and Tuscan formations and in shallower alluvial deposits of the Riverbank and Modesto formations and the Stony Creek fan alluvium that overly the deeper Eocene and Pre-Eocene marine deposits (DWR Northern District 2014). Figures 3.3-6 and ~~Figure~~ 3.3-7 are generalized cross sections for the northern and southern portions of the Sacramento Valley Groundwater Basin, respectively. Groundwater users in the basin pump primarily from aquifers above the marine deposits.

Groundwater is recharged by deep percolation from rainfall infiltration, leakage from streambeds, lateral inflow along the basin boundaries, and landscape processes, including irrigation. The primary source of recharge has become deep percolation of irrigation water past crop roots, sometimes referred to as recharge from excess applied irrigation water. Of the average 13.3 million AF of groundwater recharged annually from 1962 to 2003, the USGS's Central Valley Hydrologic Model (CVHM) estimates that approximately 19 percent was from streamflow leakage and 79 percent was from the landscape processes, including recharge from excess applied irrigation water and from precipitation (Faunt 2009). Average annual precipitation in the Sacramento Valley Groundwater Basin ranges from 13 to 26 inches, with the higher precipitation of 46 inches occurring along the eastern and northern edges of the basin. Typically, 85 percent of the basin's precipitation occurs from November to April, half of it during December through February in average years (Faunt 2009).



Source: DWR 1978

Figure 3.3-6. North Geologic Cross Section of the Sacramento Valley Groundwater Basin



Source: DWR 1978

Figure 3.3-7. South Geologic Cross Section of the Sacramento Valley Groundwater Basin

The main surface water feature in the Sacramento Valley Groundwater Basin is the Sacramento River which flows from north to south through the basin. The Sacramento River has several major tributaries draining the Sierra Nevada, including the Feather River, Yuba River, and American River. Stony Creek, Cache Creek, and Putah Creek drain the Coast Range and are the main west side tributaries of the Sacramento River. Surface water and groundwater interact on a regional basis, and gains and losses to groundwater vary spatially and temporally.

Groundwater Production, Levels, and Storage

Groundwater pumping can be generally grouped into agricultural and urban, which includes M&I sources. Agricultural groundwater pumping supplies water for the crops grown in the basin. Truck, field, orchard, and rice crops are grown on approximately 2.1 million acres; rice represents about 23 percent of the total acreage (DWR 2003 as cited in Faunt 2009). The water supply for growing rice relies on a combination of surface water and groundwater. Groundwater accounts for less than 30 percent of the annual supply used for agricultural and urban purposes in the Sacramento Valley (Faunt 2009). Urban pumping in the Sacramento Valley increased from approximately 250,000 AF annually in 1961 to more than 800,000 AF annually in 2003 (Faunt 2009).

DWR and other monitoring entities, as defined by SB X7 6 extensively monitors groundwater levels in the basin. The total depth of monitoring wells range from 18 to 1,380 feet bgs within the Sacramento Valley Groundwater Basin.

Figures 3.3-8a, 3.3.-8b, and Figure 3.3-9 8c show the location and groundwater elevation of select monitoring wells across the Sacramento Valley that portray show the local groundwater elevations in the shallow, intermediate, and deep portions of the aquifer, respectively.within the Sacramento Valley Groundwater Basin. The dotted blue line in these figures is the measured groundwater level data. Each graph in these figures represents the period of available data for that well between 1970 and 2014. Appendix L shows a larger format version of each hydrograph in Figures 3.3-8a, 3.3-8b and 3.3-8c. The shallow wells in Figure 3.3-8a show long term trends that are either increasing, stable, or decreasing, depending on the well. Several wells also show the recovery of groundwater levels following drought periods. For example, well 09N02E16N001M (shallow well) shows declines in water levels during drought periods (1976 to 1977; and 1987 to 1992). Groundwater levels at this well recovered to levels observed before each drought during subsequent wet periods. This response following drought periods can also be seen at other shallow wells (06N02E19J001M, 08N06E09Q004M). The groundwater level at 09N02E16N001M has declined since 2013. However, the levels at this well have not reached the historic low levels recorded during the 1970s.

Water levels at well 21N03W33A004M generally declined during the 1970s and prior to import of surface water conveyed by the Tehama-Colusa Canal. During the 1980s, groundwater levels recovered due to import and use of surface water supply and because of the 1982 to 1984 wet water years (DWR 2014a). Groundwater levels in well 15N03W01N001M (which is surrounded by agricultural lands) declined until 1978 and then recovered during the 1982-1984 wet years. After the 2008-2009 drought, water levels declined to historical lows. Water levels recovered quickly during 2010 and 2011, then after returned to the trend of long-term decline (DWR 2014a). Even though groundwater levels at wells 21N03W33A004M and 15N03W01N001M are generally showing a declining trend, groundwater levels in other wells in the basin have remained steady, declining moderately during extended droughts and recovering to pre-drought levels after subsequent wet periods (See Figure 3.3-8 and Figure 3.3-9 for Groundwater Elevations within the Sacramento Valley Groundwater Basin).

The hydrographs shown in Figure 3.3-8b show similar long term trends as the shallow wells (i.e., increasing, stable, or decreasing). Similar to the shallow wells, several intermediate wells show recovery of groundwater levels in wetter periods following drought conditions (17N02E31A001M, 18N04W23F001M, 22N02W09L003M). Several of A number of the wells in Figure 3.3-8b show recent groundwater levels at or below historic low levels. However, some of these wells also show levels above historic low levels.

Of the hydrographs shown in Figure 3.3-8c, several ofa number these wells show long-term declining water level trends. Most of the wells shown in this figure have a shorter measurement record. The recovery of water levels following drought periods can be seen in the hydrograph for well 06N01E02B001M.

Figure 3.3-4 shows Spring 2013 groundwater elevation contours within the Redding Area and Sacramento Valley Groundwater Basins. Figures 3.3-9a, 3.3-9b, and 3.3-9c show the change in groundwater elevation from Spring 2013 to Spring 2014 within the Sacramento Valley. Figures 3.3-10a, 3.3-10b, and 3.3-10c show the change in groundwater elevation from Spring 2004 to Spring 2014 within the Sacramento Valley. Figure 3.3-11 shows the change in groundwater levels between Spring 2010 and Spring 2014. All the aforementioned figures indicate a general decreasing trend in groundwater levels in the Sacramento Valley. As shown in Figure 3.3-12, WY 2014 was one of driest years on record since 1977 and was preceded by two consecutive dry years (WY 2013 and WY 2012). Groundwater levels in the spring of 2014 changed between +5 to -20 feet within the Sacramento Valley in comparison to Spring 2013. Comparisons of spring groundwater levels in the last decade (Spring 2004 to Spring 2014) indicate steep declines in groundwater levels up to 40 feet.

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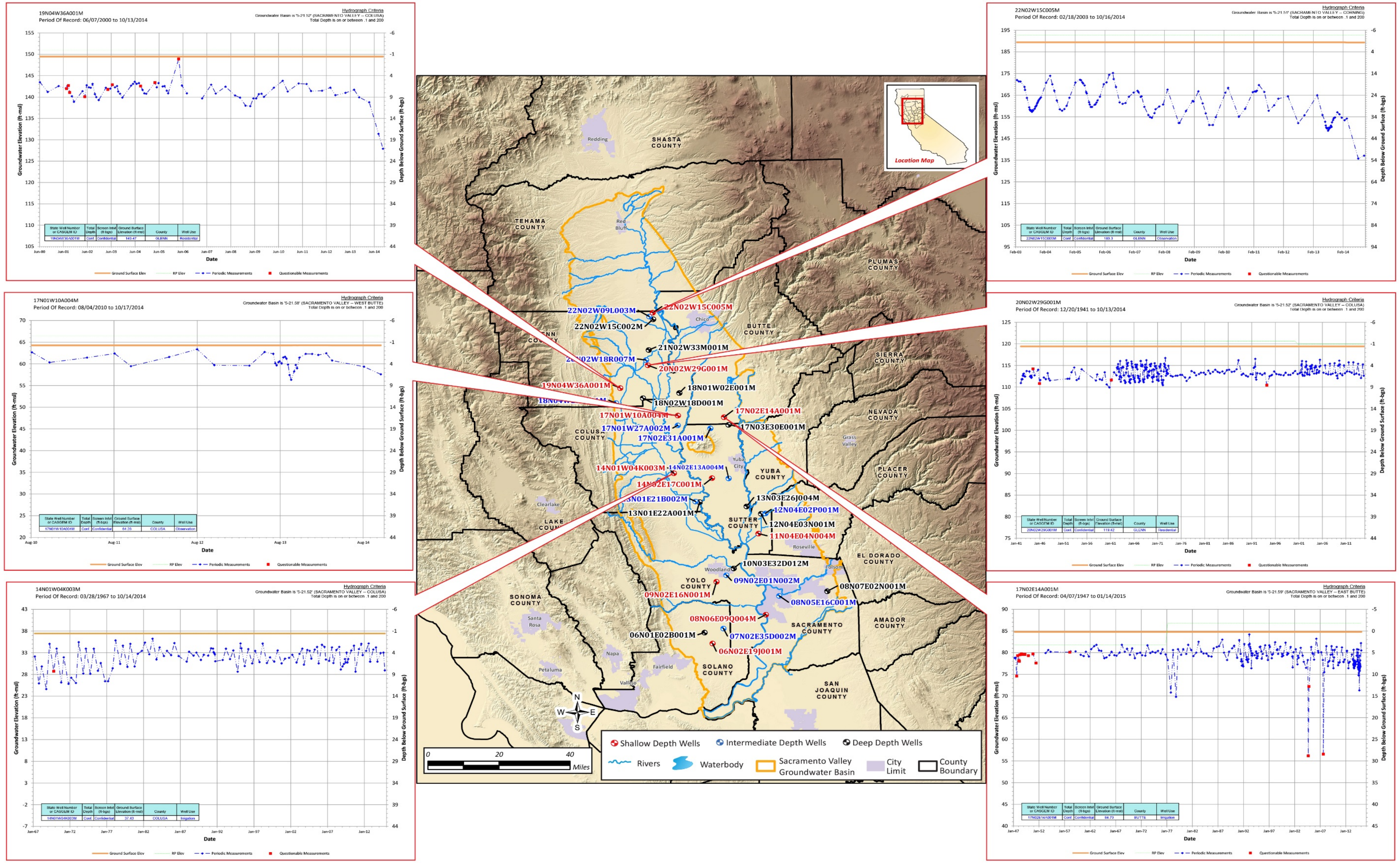

Source: DWR 2015b

Figure 3.3-8a. Sacramento Valley Groundwater Basin Historic Groundwater Elevations in Shallow Wells (less than 200 feet bgs)

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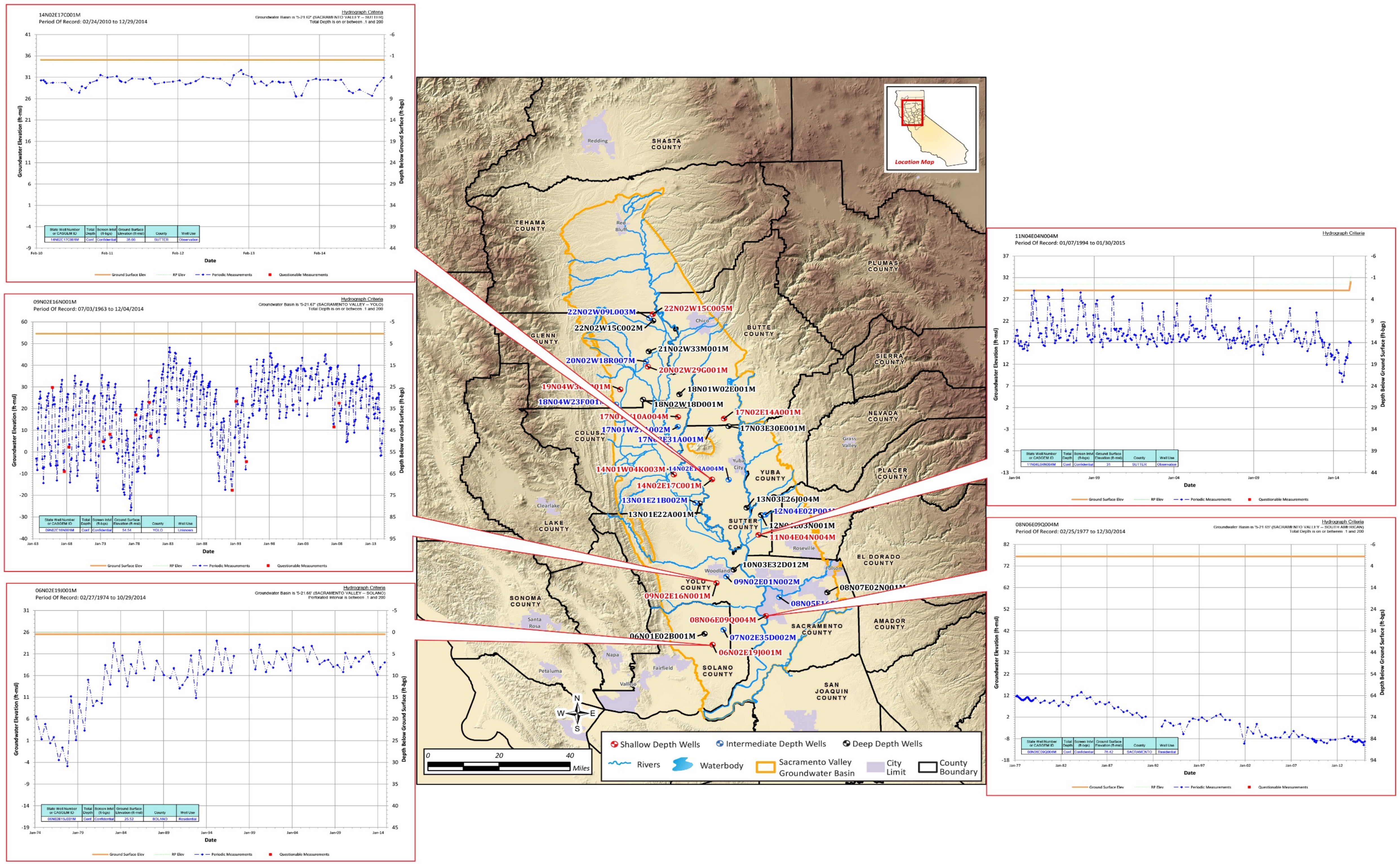

Source: DWR 2015b

Figure 3.3-8a continued. Sacramento Valley Groundwater Basin Historic Groundwater Elevations in Shallow Wells (less than 200 feet bgs)

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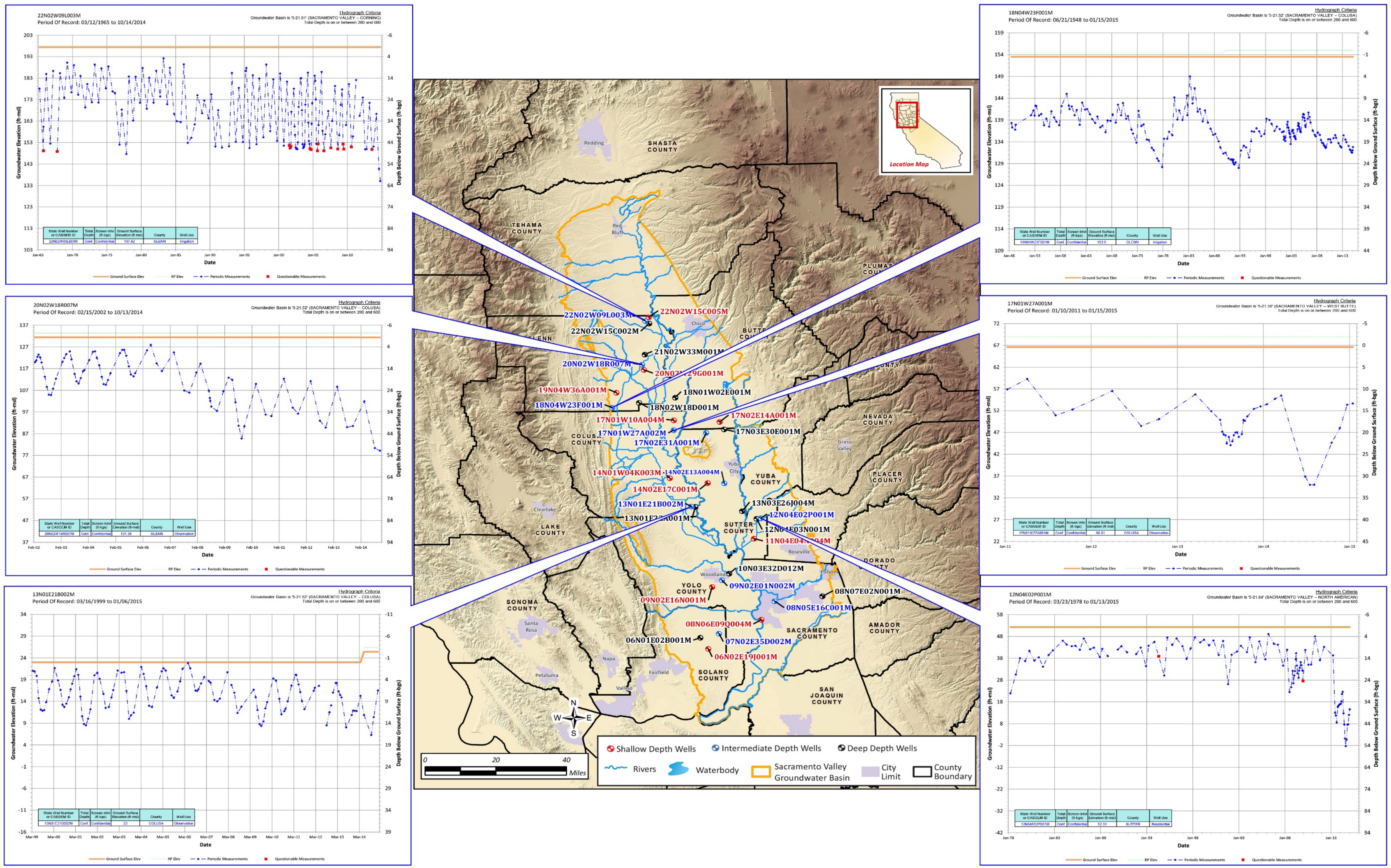

Source: DWR 2015b

Figure 3.3-8b. Sacramento Valley Groundwater Basin Historic Groundwater Elevations in Intermediate Depth Wells (between 200 feet to 600 feet bgs)

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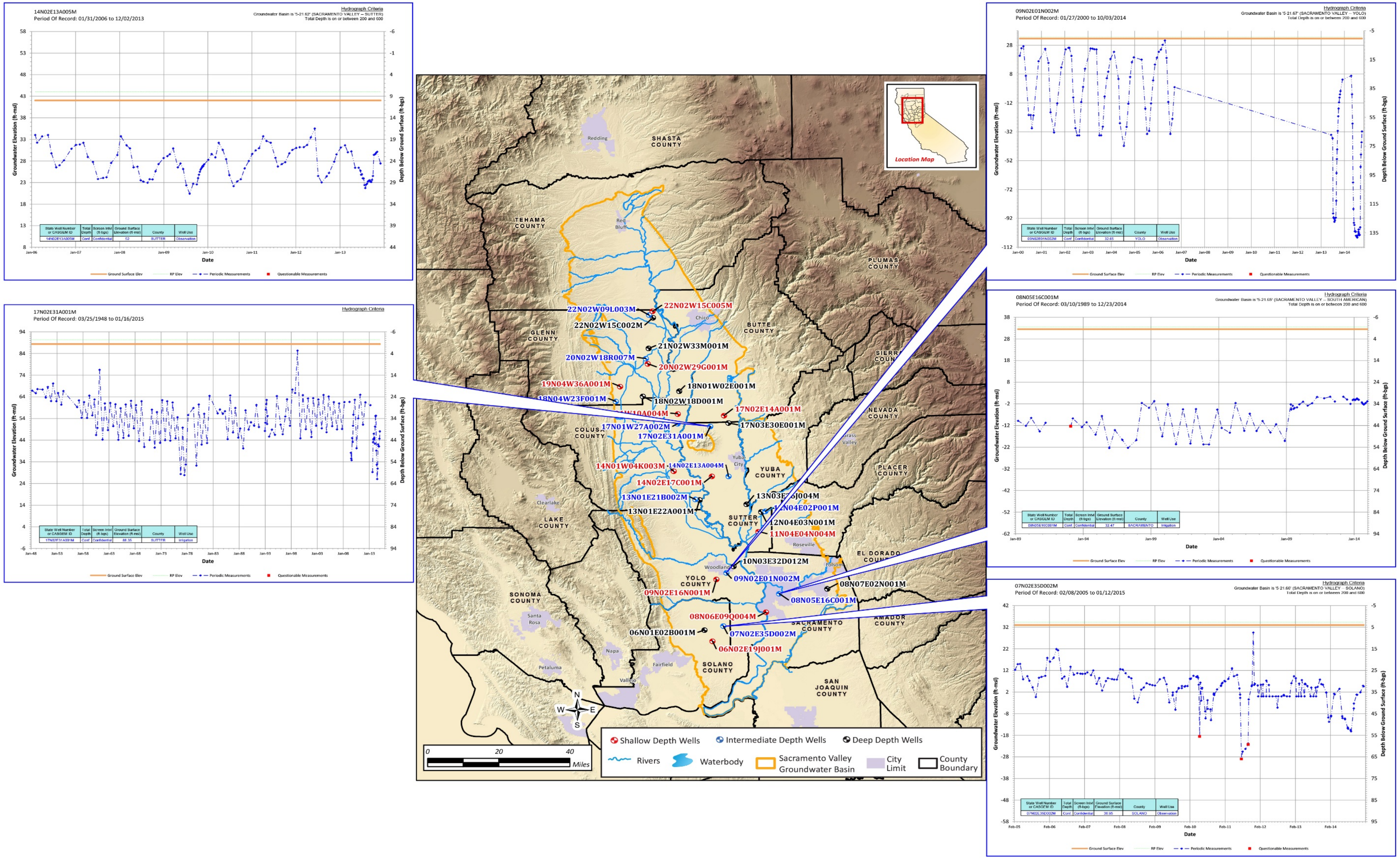

Source: DWR 2015b

Figure 3.3-8b continued. Sacramento Valley Groundwater Basin Historic Groundwater Elevations in Intermediate Depth Wells (between 200 feet to 600 feet bgs)

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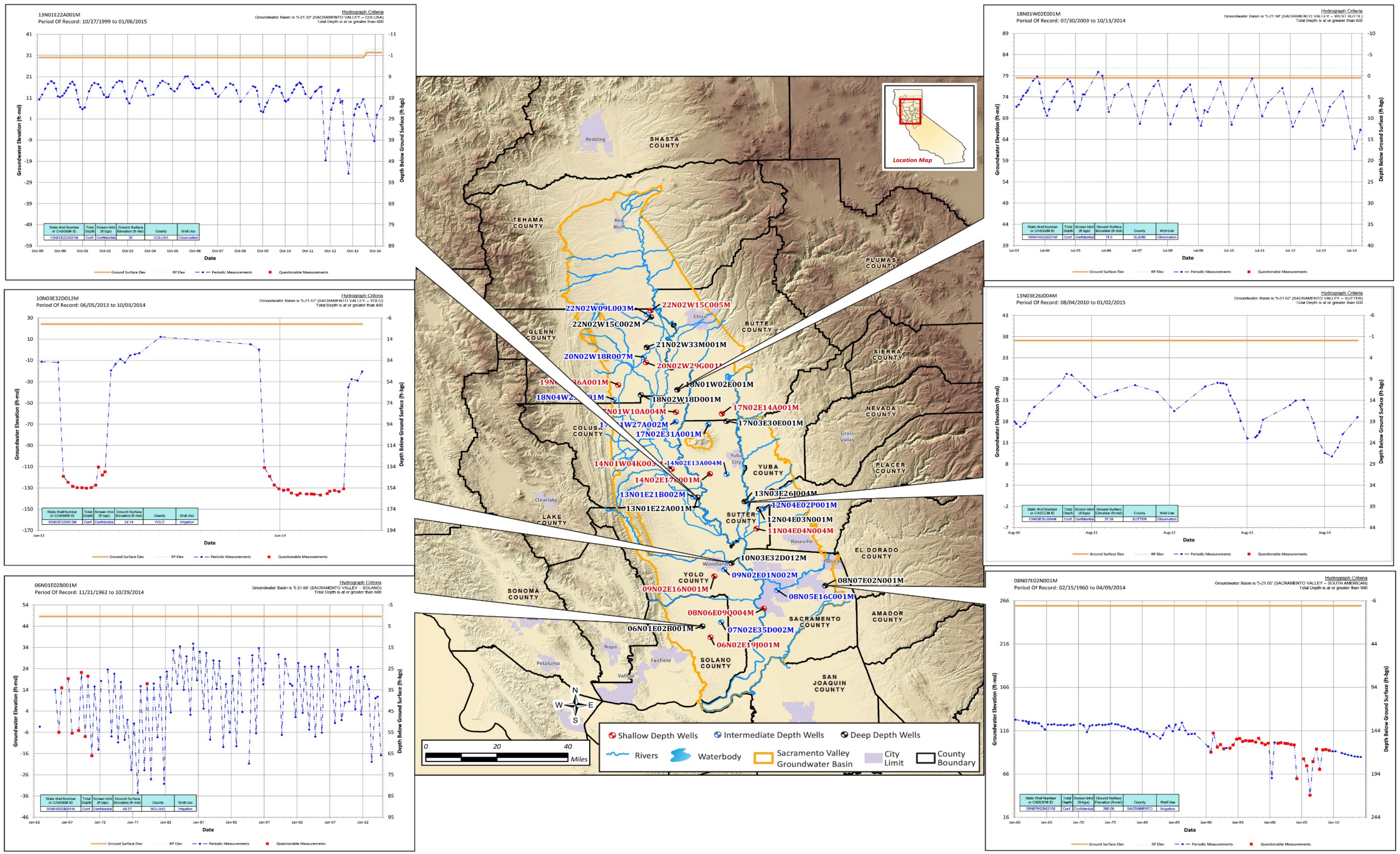

Source: DWR 2015b

Figure 3.3-8c. Sacramento Valley Groundwater Basin Historic Groundwater Elevations in Deep Wells (greater than 600 feet bgs)

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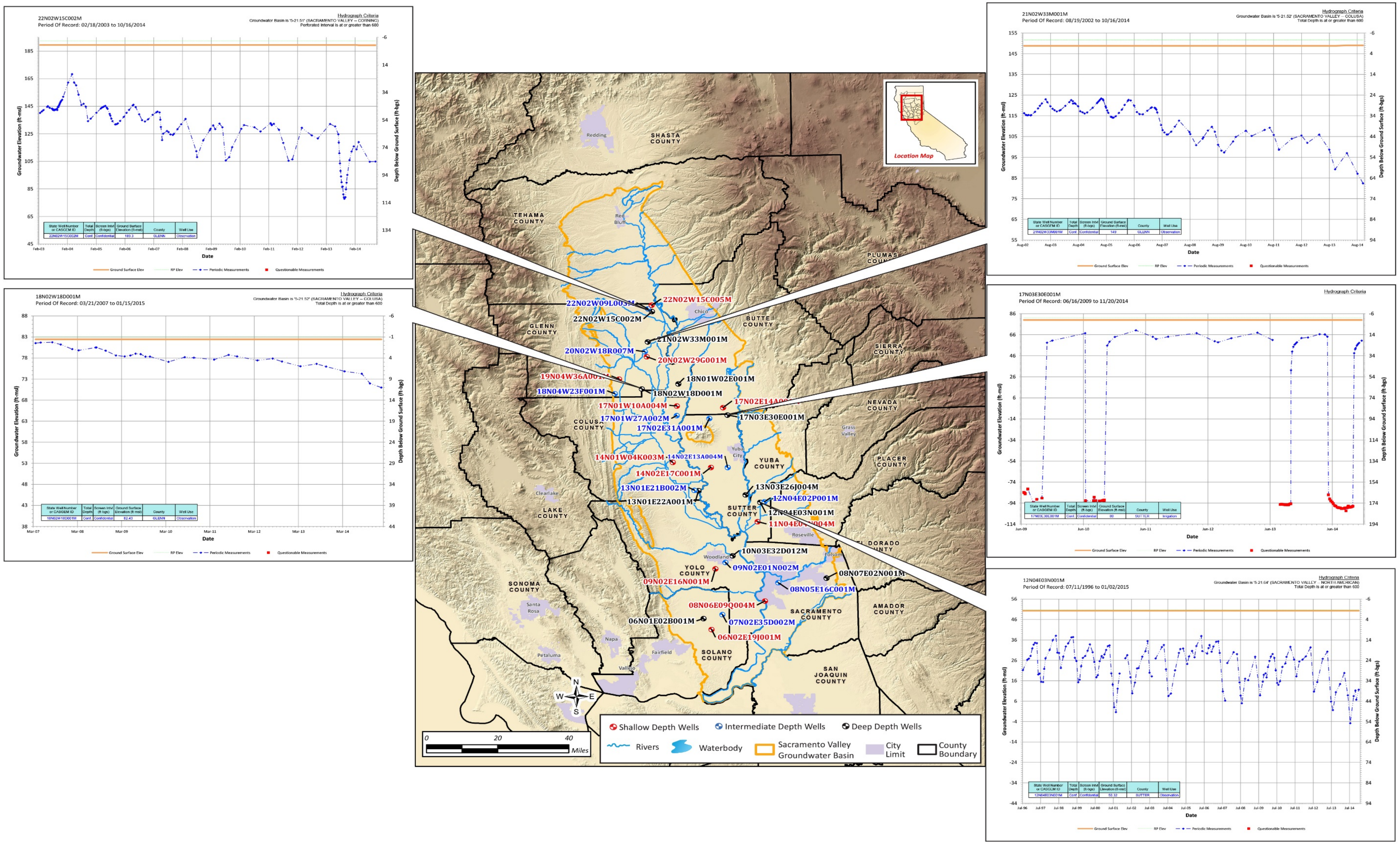

Source: DWR 2015b

Figure 3.3-8c continued. Sacramento Valley Groundwater Basin Historic Groundwater Elevations in Deep Wells (greater than 600 feet bgs)

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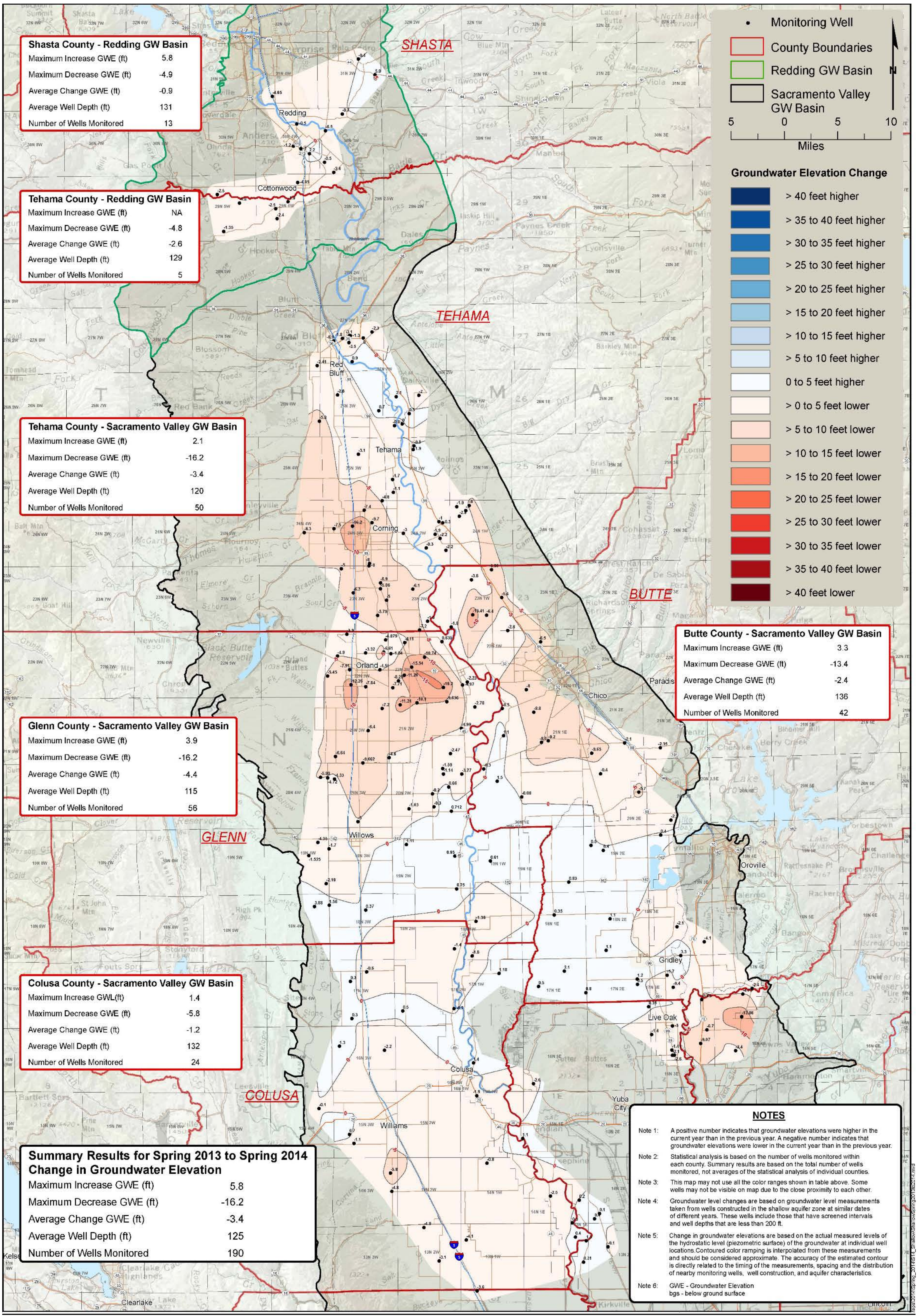

Source: DWR 2015

Figure 3.3-9a. Change in Groundwater Levels between Spring 2013 and Spring 2014 in Shallow Aquifer Zone (less than 200 feet bgs)

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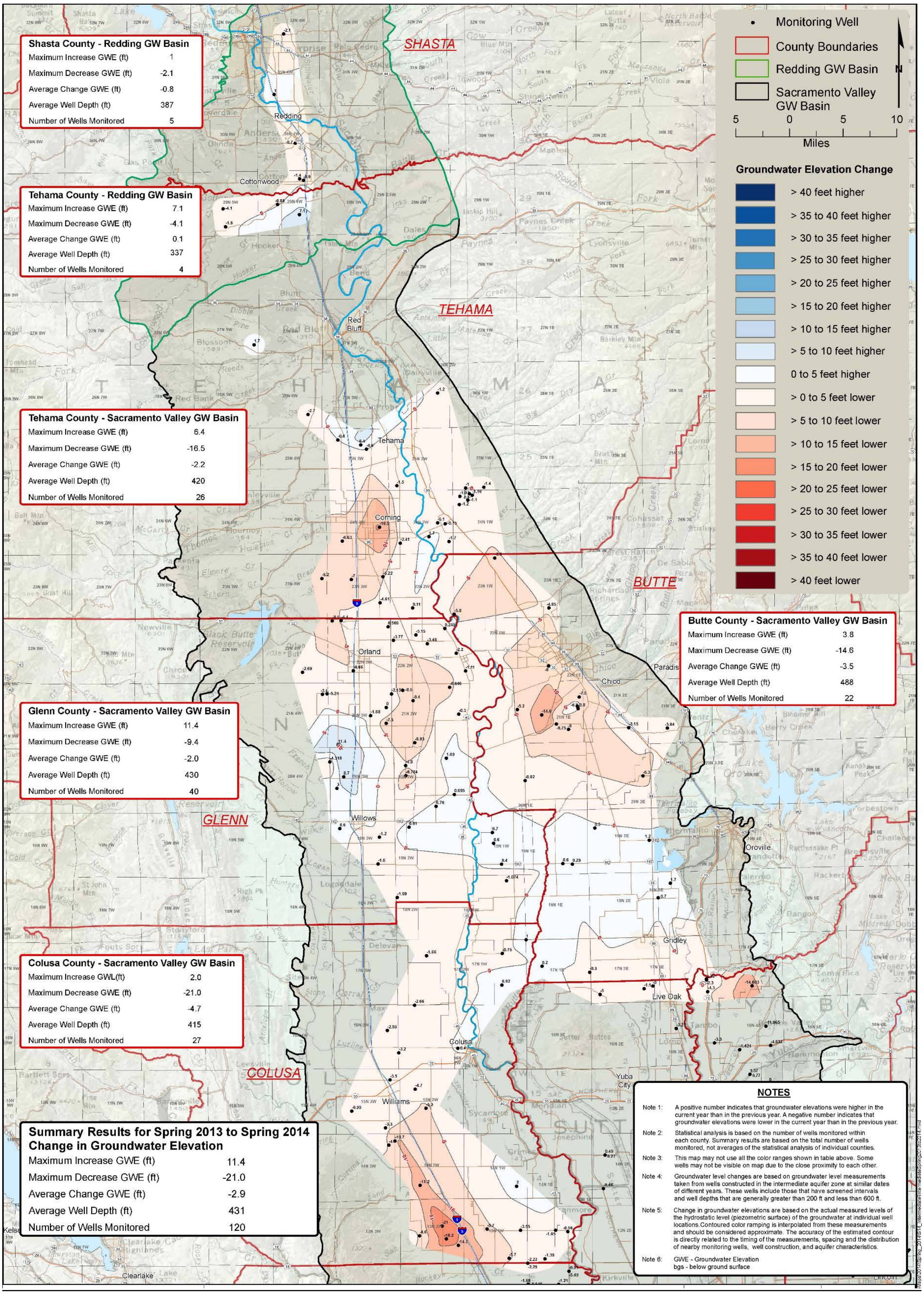

Source: DWR 2015

Figure 3.3-9b. Change in Groundwater Levels between Spring 2013 and Spring 2014 in Intermediate Aquifer Zone (between 200 feet to 600 feet bgs)

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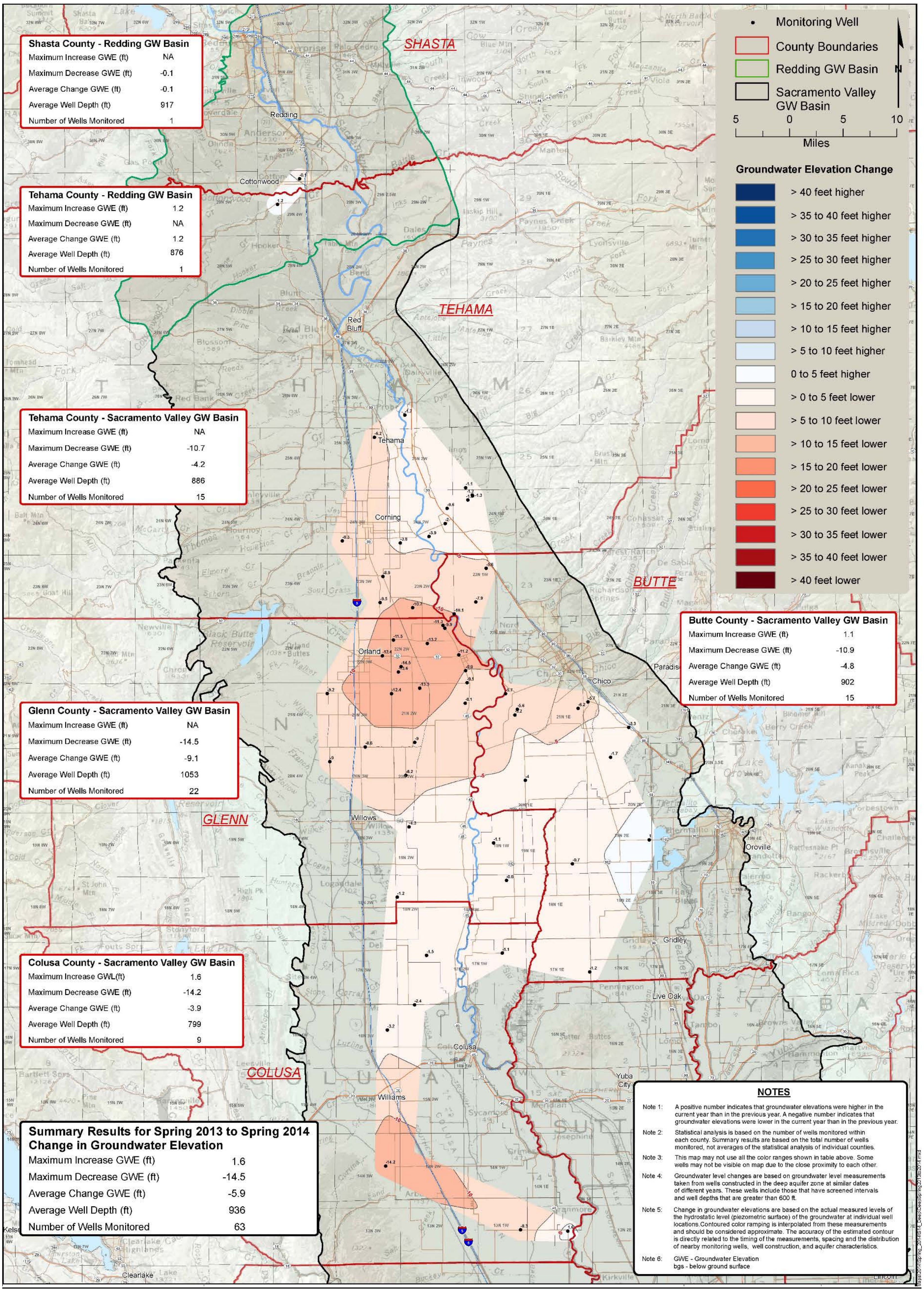

Source: DWR 2015

Figure 3.3-9c. Change in Groundwater Levels between Spring 2013 and Spring 2014 in Deep Aquifer Zone (greater than 600 feet bgs)

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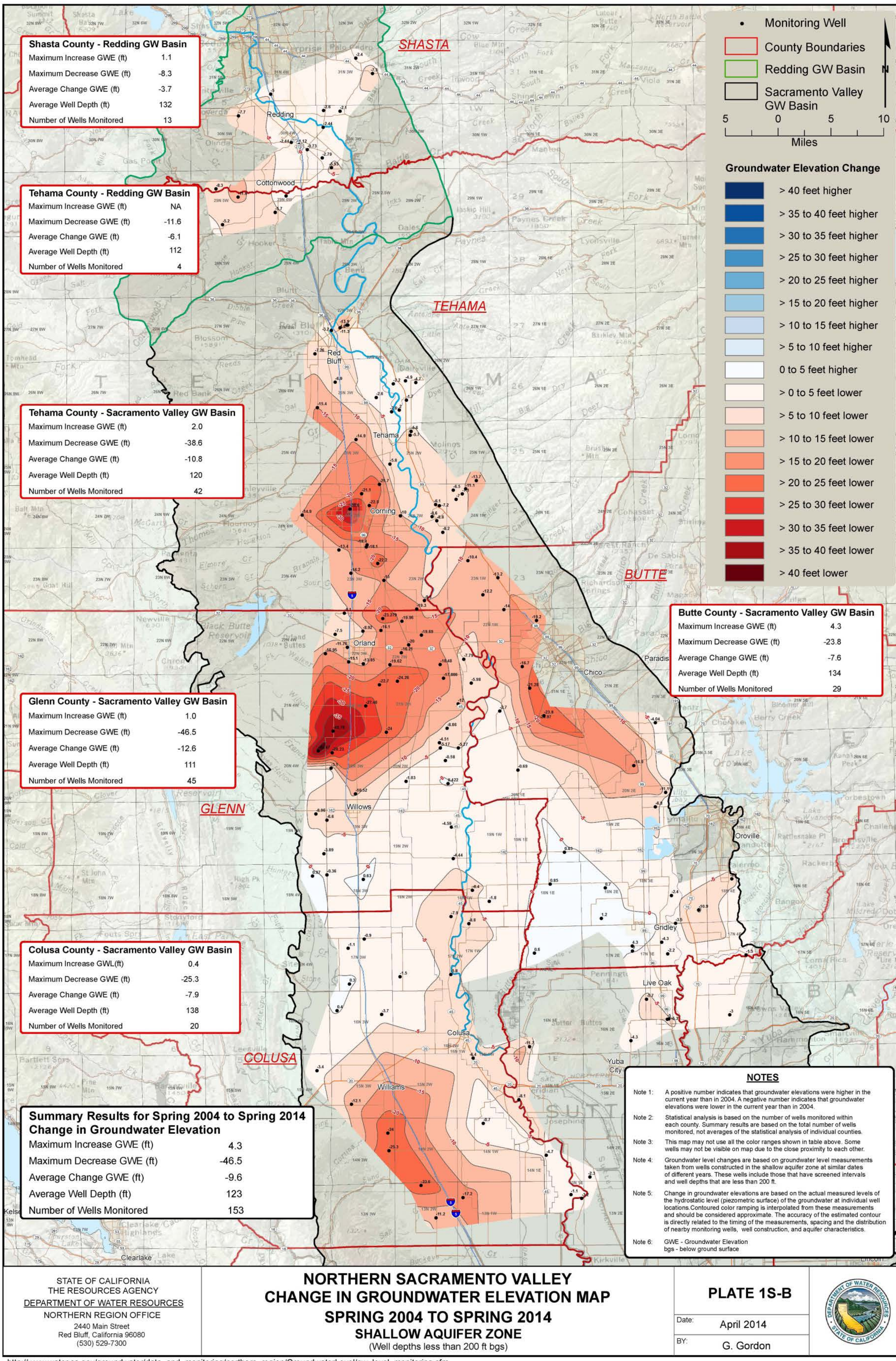

Source: DWR 2015

Figure 3.3-10a. Change in Groundwater Levels between Spring 2004 and Spring 2014 in Shallow Aquifer Zone (less than 200 feet bgs)

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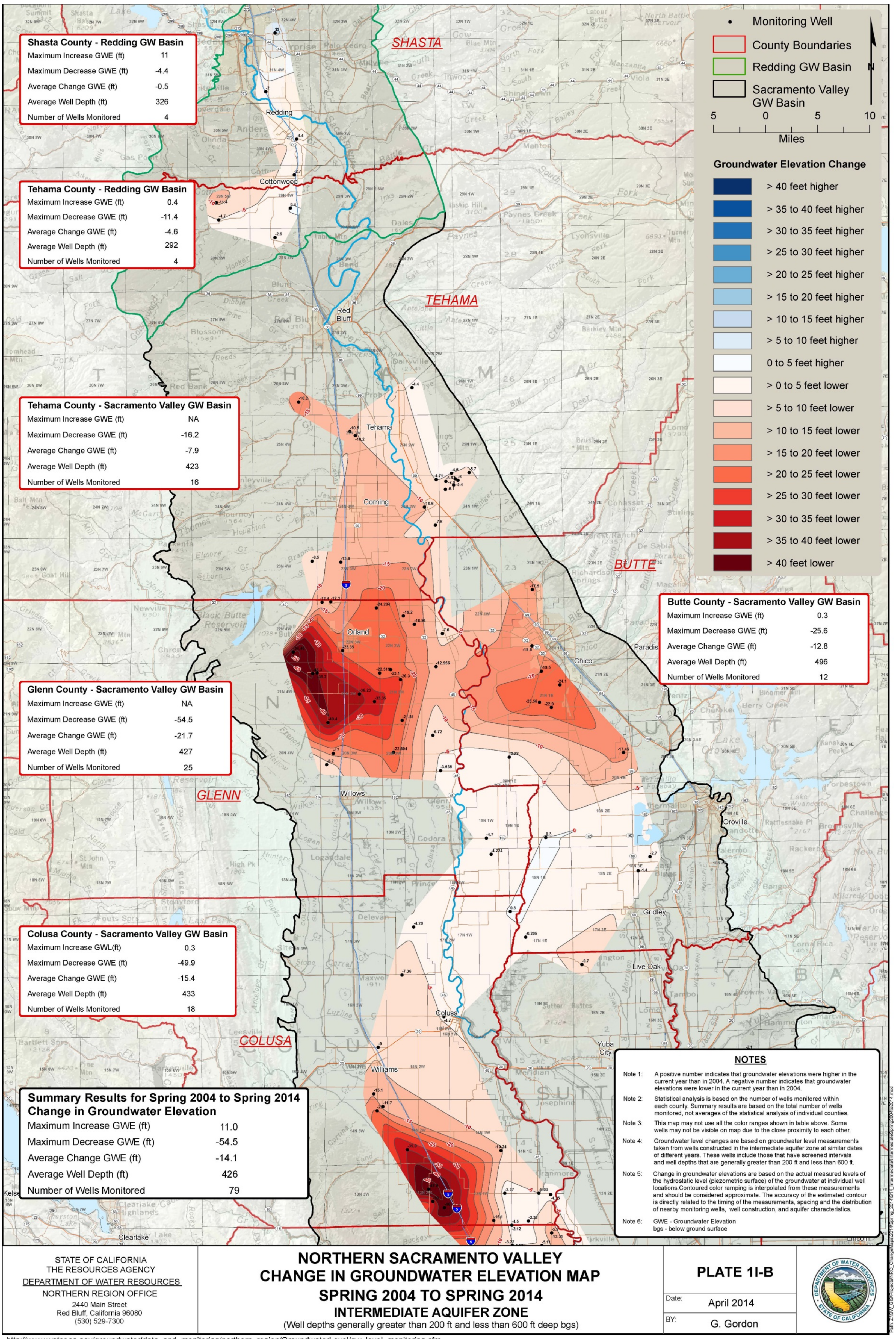

Source: DWR 2015

Figure 3.3-10b. Change in Groundwater Levels between Spring 2004 and Spring 2014 in Intermediate Aquifer Zone (between 200 to 600 feet bgs)

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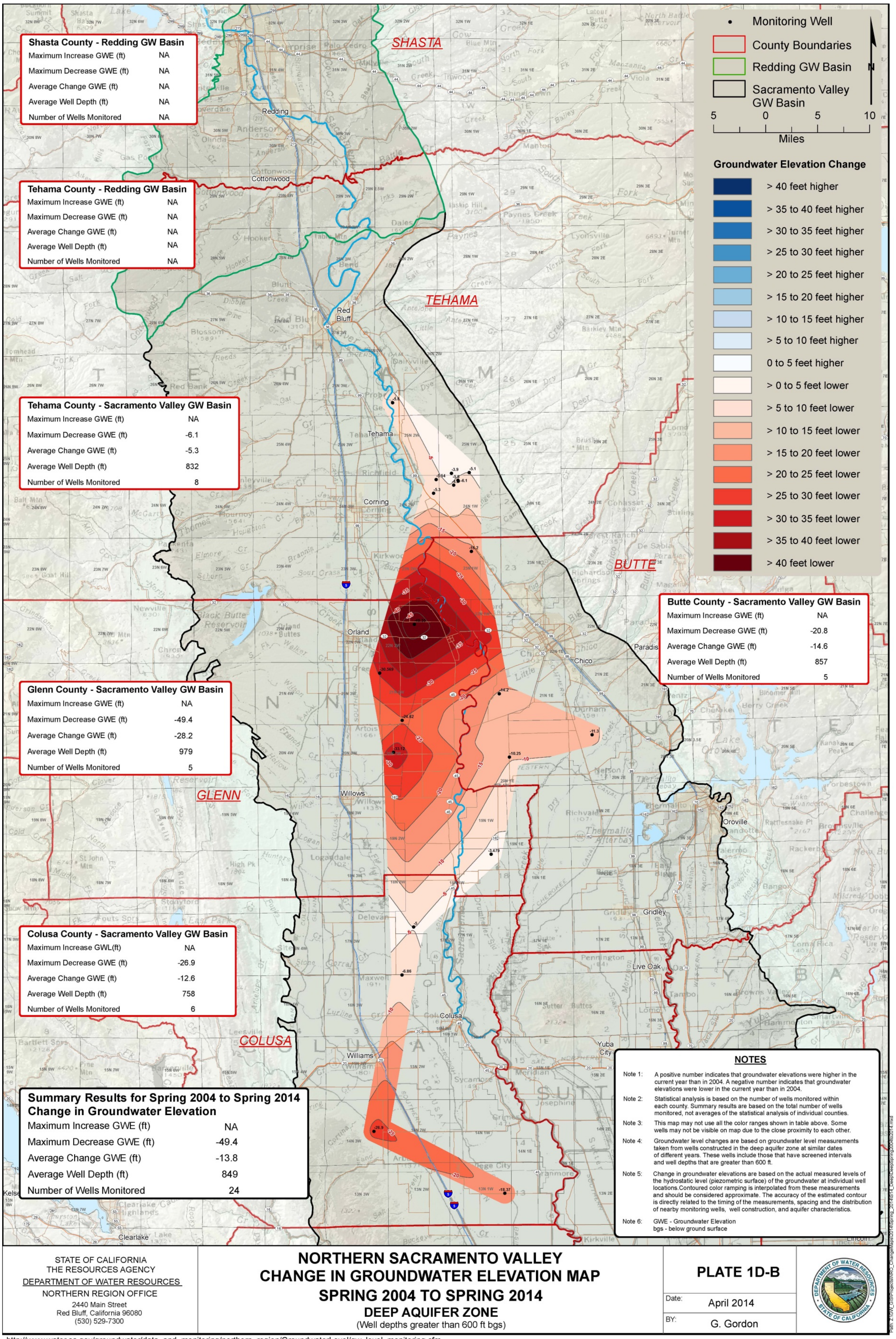

Source: DWR 2015

Figure 3.3-10c. Change in Groundwater Levels between Spring 2004 and Spring 2014 in Deep Aquifer Zone (greater than 600 feet bgs)

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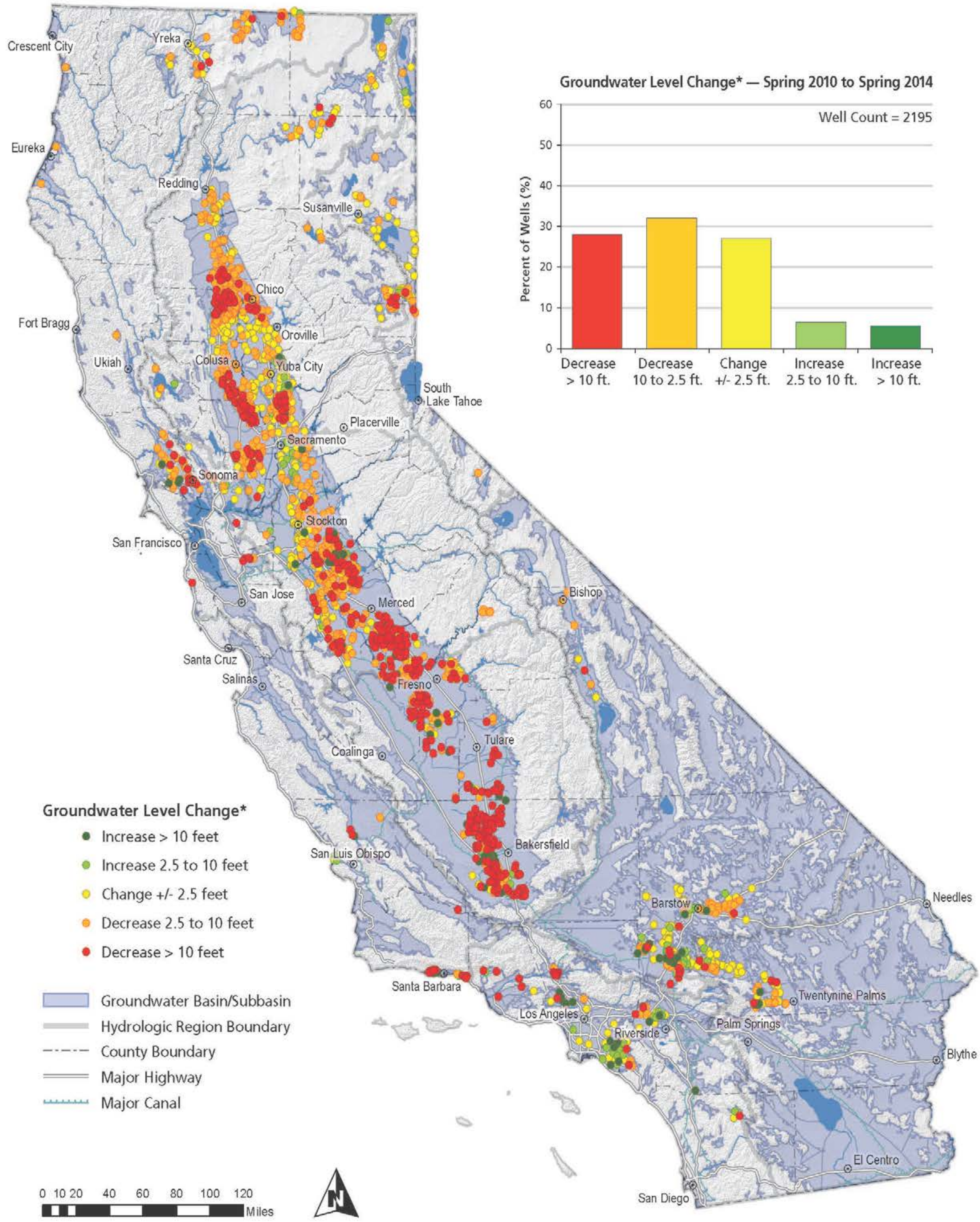

Source: DWR 2014a

Figure 3.3-11. Change in Groundwater Levels between Spring 2010 and Spring 2014

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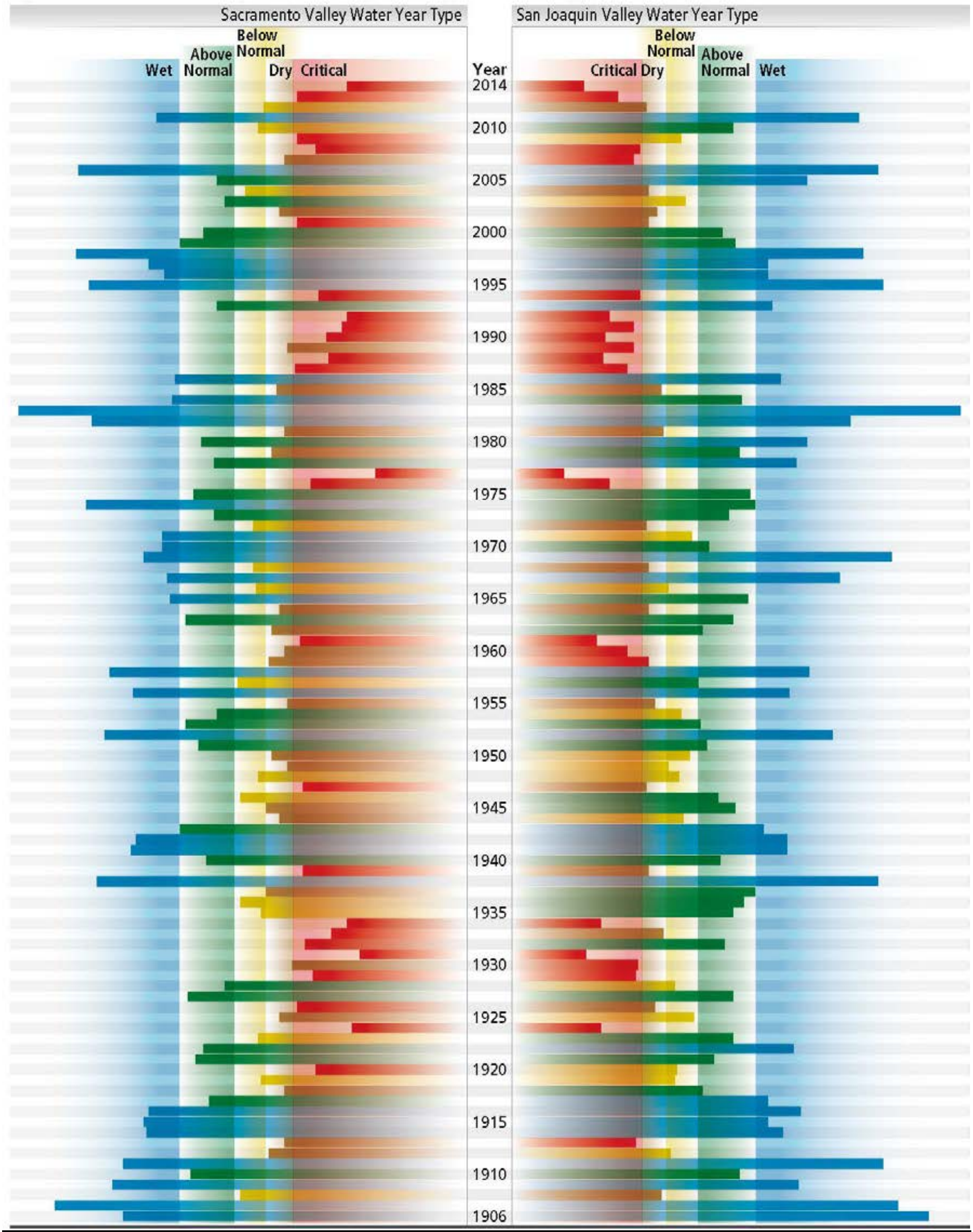
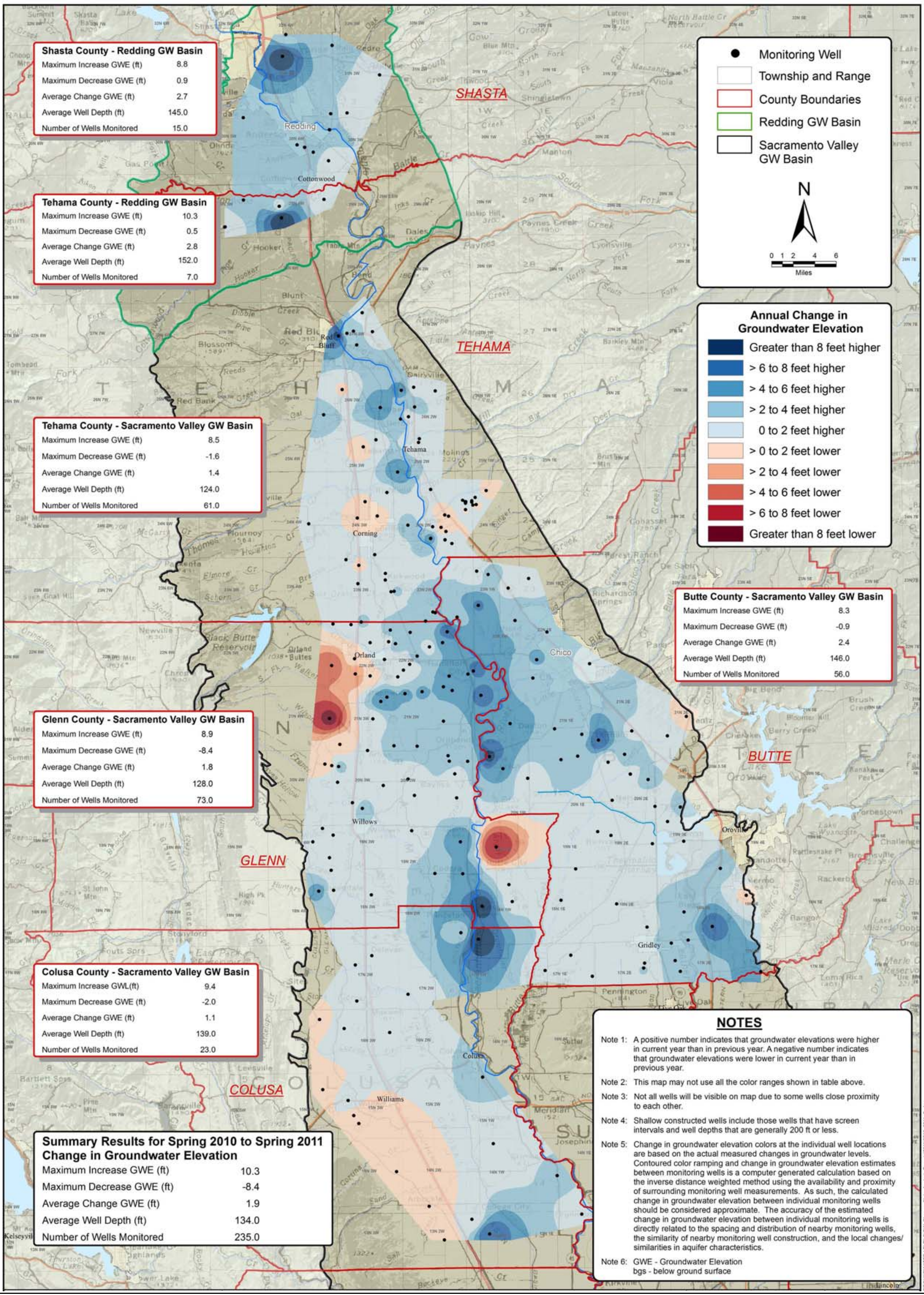
As shown in Figure 3.3-12, California has been experiencing dry weather conditions since 2000. WY 2011 has been the only year since 2006 classified as a wet water year. Figures 3.3-13a, 3.3-13b and 3.3-13c show the change in groundwater elevation between Spring 2010 and Spring 2011. Figures 3.3-13a, 3.3-13b and 3.3-13c indicate an overall increasing trend up to eight feet in the shallow aquifer (less than 200 feet bgs). Recovery in the intermediate aquifer (between 200 to 600 feet bgs) was approximately +7.5 feet. Recovery in the deep aquifer (greater than 600 feet bgs) was lower (up to +4.5 feet). Increases in groundwater levels in 2011 occurred after four consecutive years of dry or critical dry conditions in the Sacramento valley (WY 2007 to WY 2010). Though Sacramento Valley and other parts of California are currently noticing declining groundwater level trends, past groundwater trends are indicative of groundwater levels declining moderately during extended droughts and recovering to pre-drought levels after subsequent wet periods.

In general, groundwater flows inward from the edges of the basin and south, parallel to the Sacramento River in the Sacramento Valley. In some areas there are groundwater depressions associated with pumping that influence local groundwater gradients and flow direction. Prior to the completion of CVP facilities in the area (1964-1971), pumping along the west side of the basin caused groundwater levels to decline. Following construction of the CVP, the delivery of surface water and reduction in groundwater extraction resulted in a recovery to historic groundwater levels by the mid to late-1970s. Throughout the basin, individuals, counties, cities, and special legislative agencies manage and/or develop groundwater resources. Many agencies use groundwater to supplement surface water; therefore, groundwater production is closely linked to surface water availability. Climatic variations and the resulting surface water supply directly affect the demand and the amount of groundwater required to meet agricultural and urban water demands (Faunt 2009).



Source: DWR et al. 2014

Figure 3.3-~~8.~~-12. Sacramento Valley and San Joaquin Valley Water Year Types (1906 to 2014)



Source: DWR 2015

Figure 3.3-13a. Change in Groundwater ~~Basin Historic Groundwater Elevations~~Levels between Spring 2010 and Spring 2011 in Shallow Aquifer Zone (less than 200 feet bgs)

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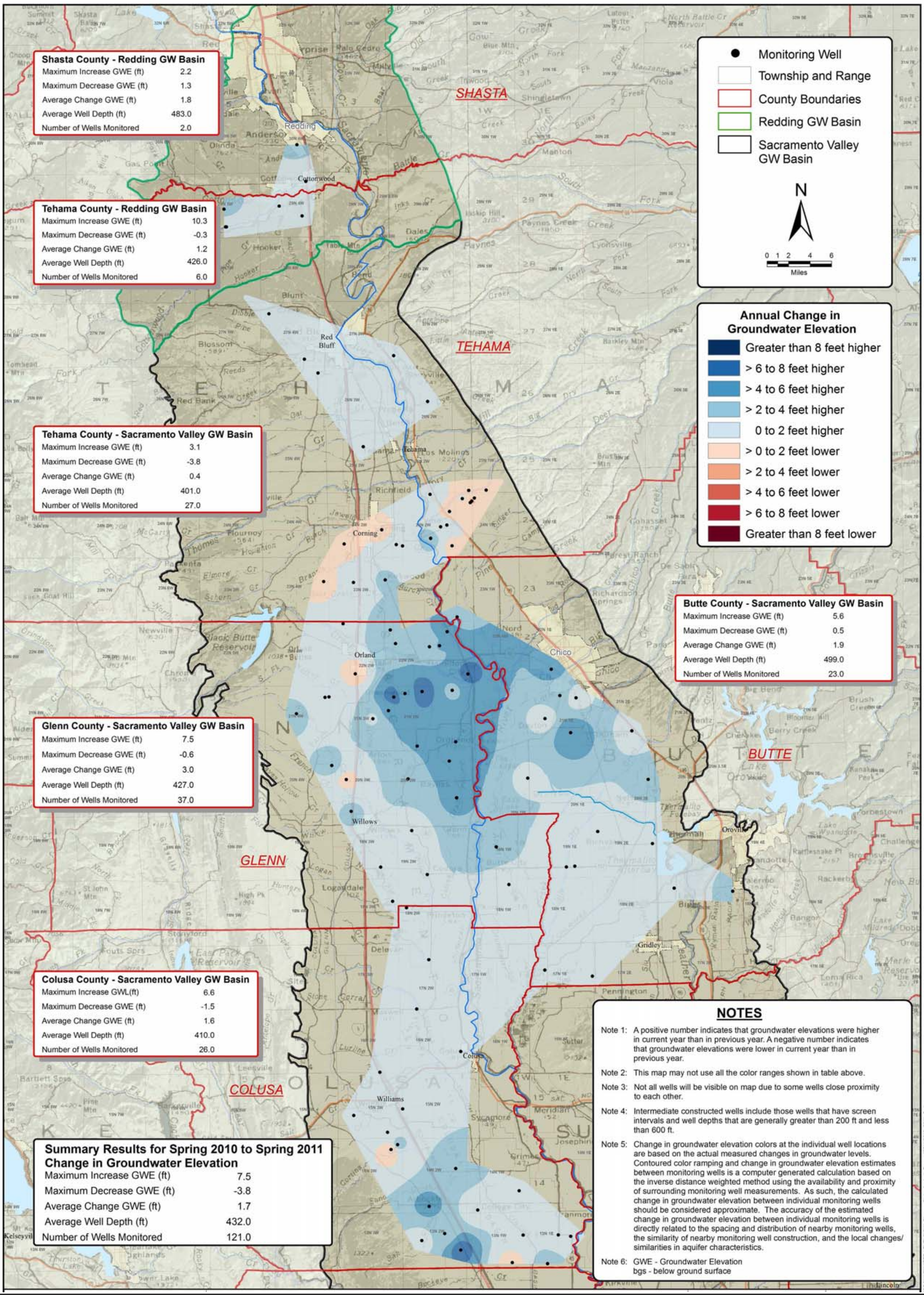

Source: DWR 2015

Figure 3.3-9. Sacramento Valley-13b. Change in Groundwater Basin Historic Groundwater ElevationsLevels between Spring 2010 and Spring 2011 in Intermediate Aquifer Zone (between 200 feet to 600 feet bgs)

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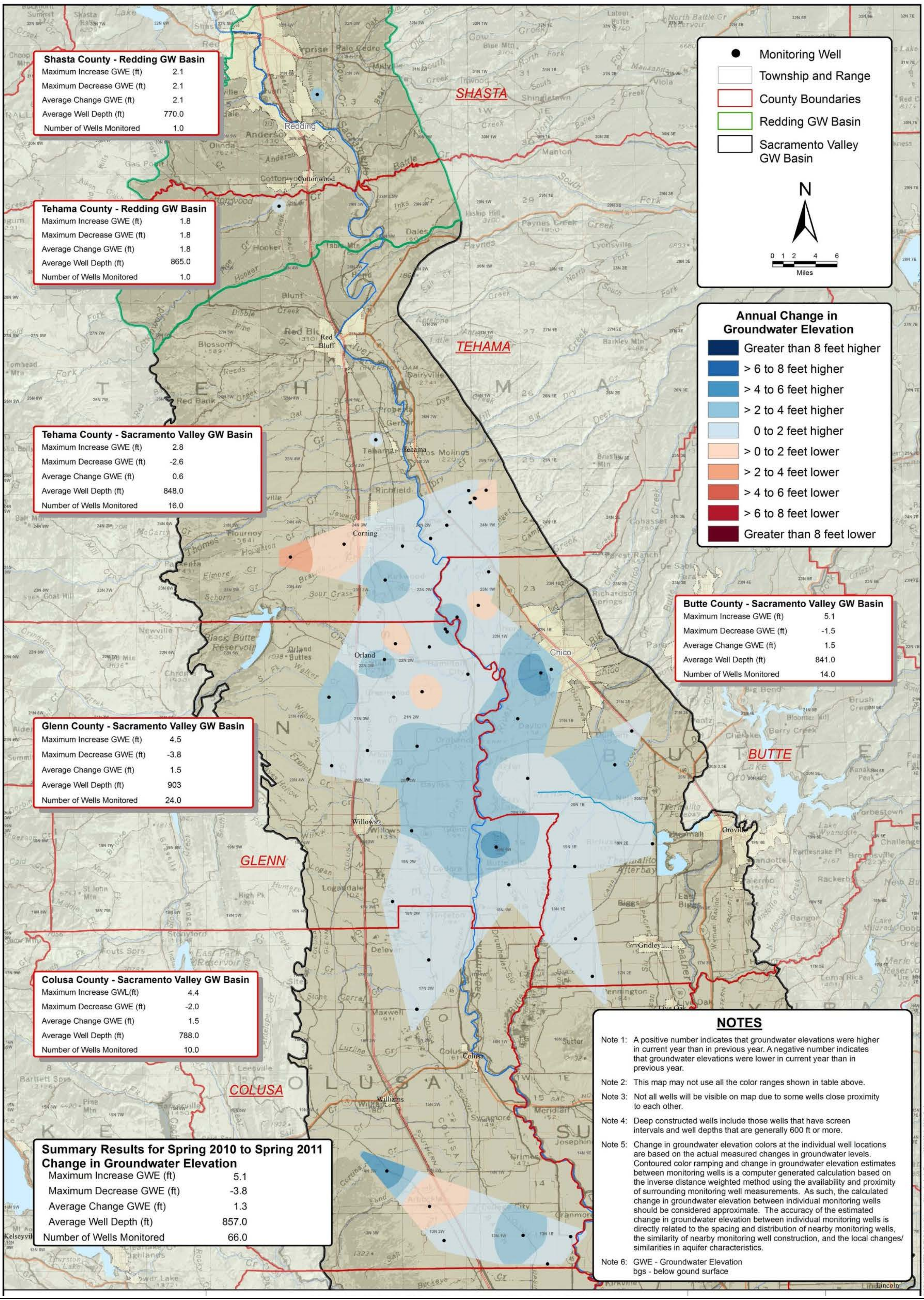

Source: DWR 2015

Figure 3.3-13c. Change in Groundwater Levels between Spring 2010 and Spring 2011 in Deep Aquifer Zone (greater than 600 feet bgs)

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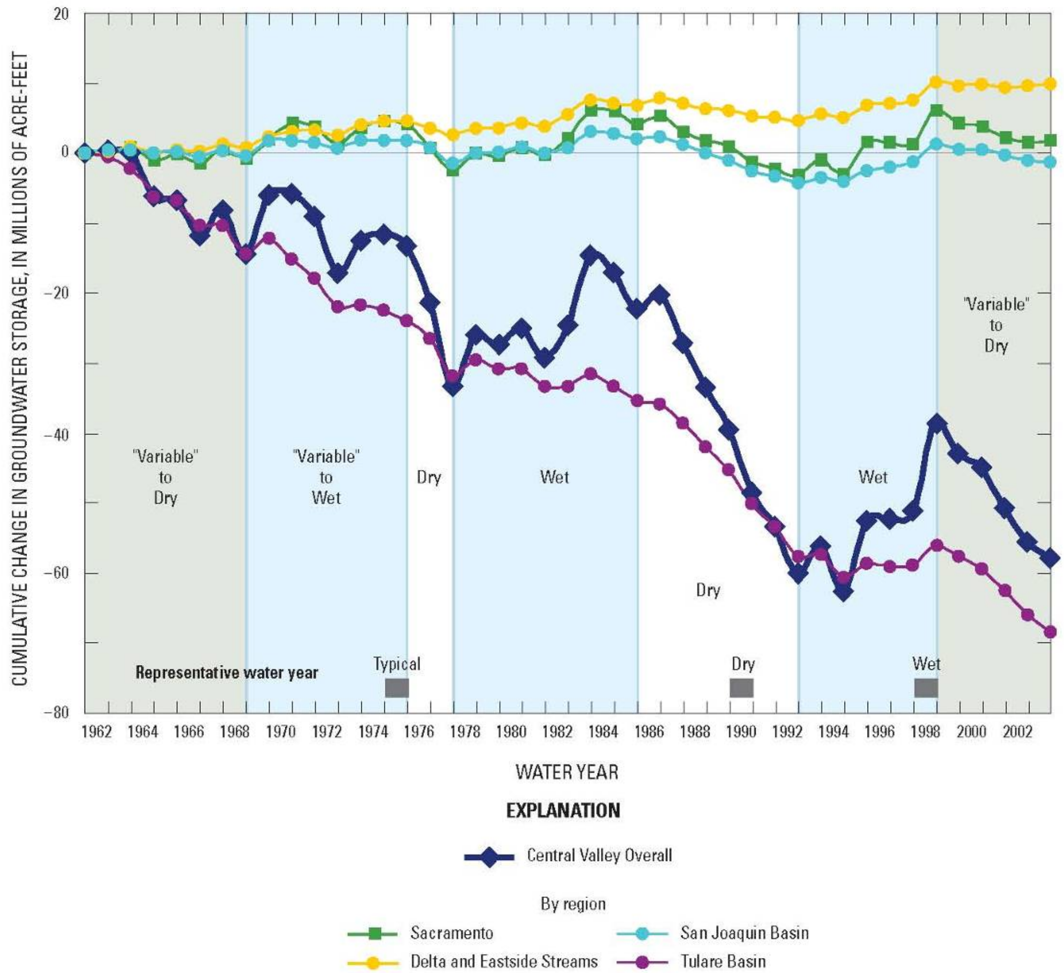
Table 3.3-3 below summarizes the number of wells reported dry in 2014 within the area of analysis.

Table 3.3-3. Summary of Dry Wells Reported In 2014

Counties	Number of wells reported dry in 2014	Information received as of
Shasta	3	9/16/2014
Tehama	34	10/2/2014
Glenn	26	10/23/2014
Butte	60	12/4/2014
Colusa	8	7/7/2014
Sutter	Data not available	Data not available
Yuba	Data not available	Data not available
Solano	1	11/12/2014
Yolo	2*	10/21/2014
Sacramento	1	10/16/2014

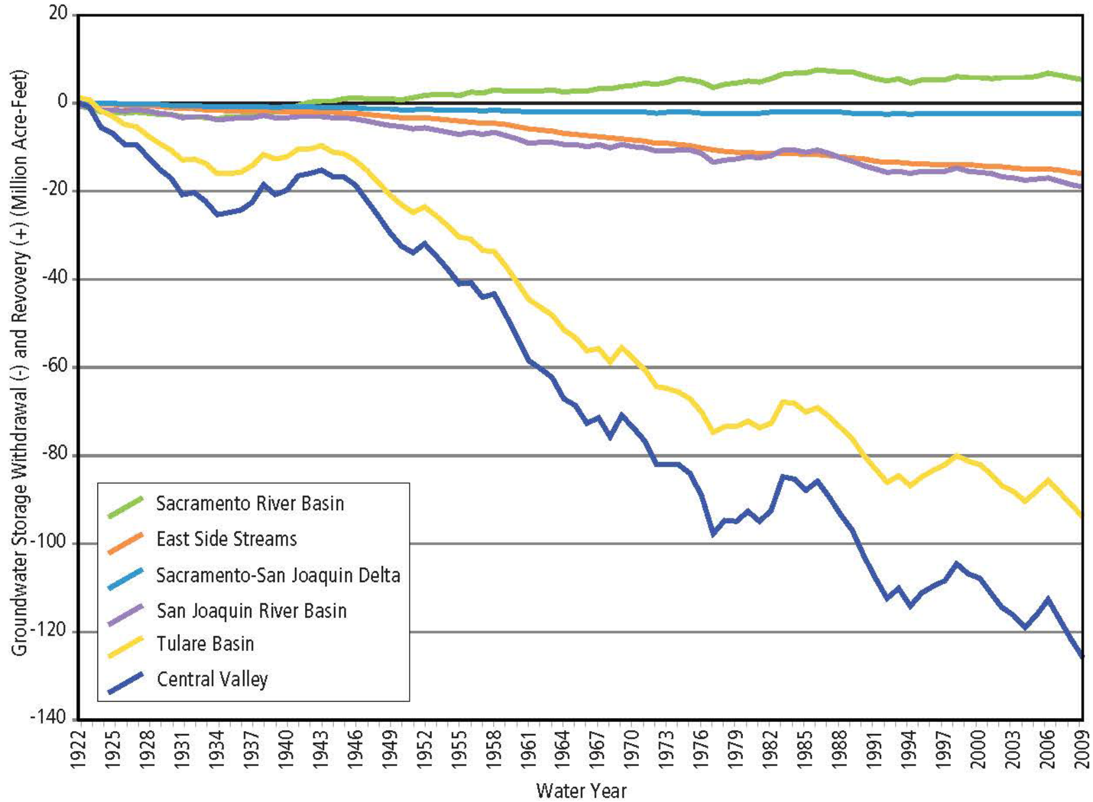
Source: Data collected by UC Davis
**Number of dry wells reported includes data only for October; data for prior months not reported*

Figure 3.3-~~10~~14a shows the simulated cumulative annual change in groundwater storage in the Sacramento Valley Groundwater Basin ~~since 1962, along with the other major groundwater basins in the Central Valley of California. As shown in this figure,~~and other major groundwater basins in the Central Valley since 1962 as modeled in USGS's Central Valley Hydrologic Model (CVHM). Figure 3.3-14b shows the simulated change in groundwater storage in the Sacramento Valley Groundwater Basin and other major groundwater basins in the Central Valley since 1922 as modeled in DWR's Central Valley Groundwater-Surface Water Simulation Model (C2VSim). Figure 3.3-14c shows the change in monthly groundwater storage as observed and analyzed by Gravity Recovery and Climate Experiment (GRACE). As shown in Figure 3.3-14c there was no significant change in groundwater storage prior to 2006 (from 2003 to 2006), the change in storage was in the magnitude of -1.4 ± 12.7 millimeter/year i.e. approximately 0.4 ± 3.9 million acre-feet/ year. Between April, 2006 to March, 2010 change in storage decreased by 38.9±9.5 mm/year (i.e., approximately 31.5±7.7 million acre-feet/year). The GRACE results shown in Figure 3.3-14c are combined results for the Sacramento and San Joaquin Valleys and are not representative of conditions in Sacramento Valley alone. Figures 3.3-14a and 3.3-14b show, for the periods graphed, groundwater storage in the Sacramento Valley Groundwater Basin has been relatively constant over the long term. Storage ~~tends to~~ decreased during dry years and increased during wetter periods.



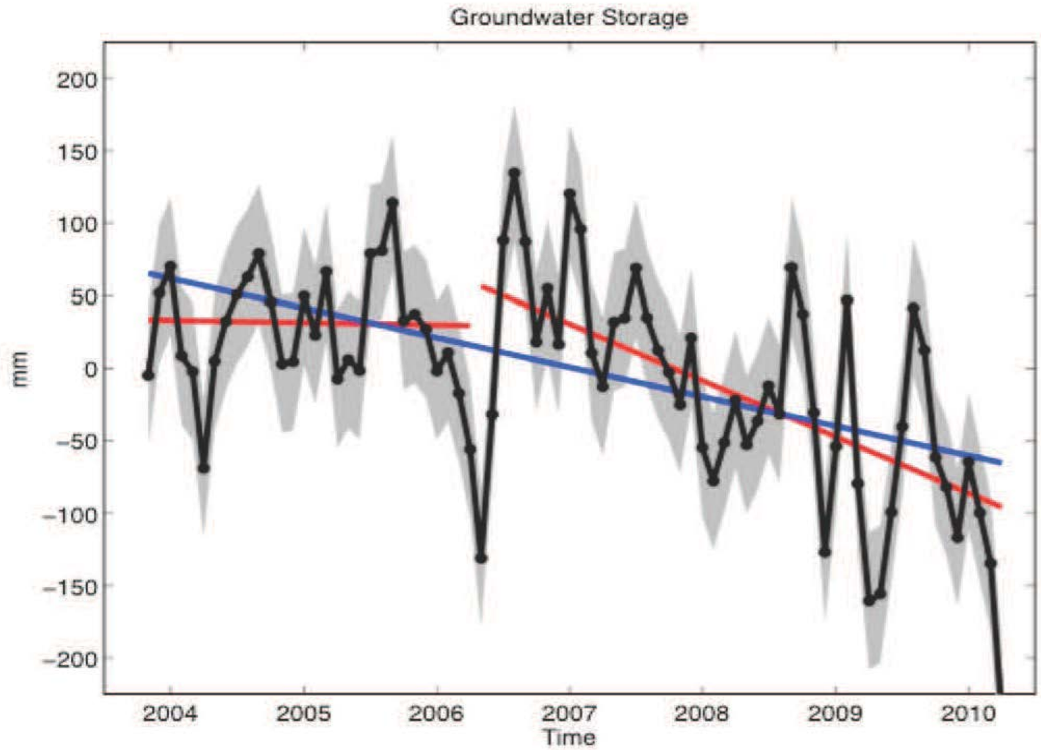
Source: Faunt 2009

Figure 3.3~~-10.~~-14a. Cumulative Annual Change in Storage, as simulated by the USGS's Central Valley Hydrologic Model



Source: Brush et al 2013

Figure 3.3-14b. Cumulative Annual Change in Storage, as simulated by DWR's Central Valley Groundwater-Surface Water Simulation Model



Source: Famiglietti et al 2011

Figure 3.3-14c. Monthly Groundwater Storage for Sacramento and San Joaquin Valley, as observed by Gravity Recovery and Climate Experiment (GRACE)

Note:
[1] Gray shading represents error zone;
[2] Blue line represents the overall trend in groundwater storage changes for the 78-month period;
[3] Red line represents the trends from October 2003 and March 2006 and April 2006 through March 2010.

Groundwater-Related Land Subsidence

This section discusses land subsidence due to groundwater extraction. Groundwater-related land subsidence is a process that causes the elevation of the ground surface to lower in response to groundwater pumping occurring in the region. Non-reversible land subsidence occurs where groundwater extraction lowers groundwater levels causing loss of pore pressure and subsequent consolidation of clay beds in aquitards within a groundwater system. Subsidence is typically a slow process that occurs over a large area. Because of the slow rate of subsidence, the general appearance of the landscape may not change; however, subsidence can lead to problems with flood control and water distribution systems due to changes in elevation. Subsidence can reduce the freeboard of levees, allowing water to over top them more easily. It also can change the slope, and even the direction of flow, in conveyance and drainage systems, including canals, sewers, and storm drains. In addition, subsidence can also damage infrastructure, including building foundations and collapsed well casings.

Subsidence generally occurs in small increments during dry years when groundwater pumping lowers groundwater levels below historical lows in areas that are geologically susceptible because they have compressible clays. There are several methods used to measure land subsidence. Global Positioning System (GPS) surveying is a method used for monitoring subsidence on a regional scale. DWR is using this method to monitor subsidence in the ~~Tulelake~~Tule Lake Basin, Glenn and Yolo counties, and the Sacramento-San Joaquin Delta. The GPS network consists of 339 survey monuments spaced about seven kilometers apart and covers all or part of ten counties within the Sacramento Groundwater basin (DWR 2008). It extends from northern Sacramento County eastward to the Bureau of Reclamation's Folsom Reservoir network, southwest to DWR's Delta/Suisun Marsh network, and north to Reclamation's Shasta Reservoir network. The network is scheduled to be re-surveyed on a three-year frequency to measure elevation changes over time.

Vertical extensometers are a more site specific method of measuring land subsidence. DWR's subsidence monitoring program within the Sacramento Valley Groundwater Basin includes 11 extensometer stations that are located in Yolo (2), Sutter (1), Colusa (2), Butte (3), and Glenn (3) counties. Figure 3.3-~~11~~15 shows the areas within the Sacramento Valley Groundwater Basin that have experienced subsidence due to significant declines in groundwater levels as a result of increased groundwater pumping (DWR 2008).

Figure 3.3-~~11~~15 shows the locations of DWR's extensometers and extent of subsidence at the locations. Data from the GPS subsidence monitoring network and complementary groundwater levels in monitoring wells revealed a correlation between land subsidence and groundwater declines during the growing season (DWR 2008). DWR found that the land surface partially rebounds as aquifers recharge in winter (DWR 2008). Out of the 11 extensometers five show potential subsidence over time:

- 09N03E08C004M, in Yolo County within Conaway Ranch: DWR observed ~~inelastic~~ land subsidence estimated at approximately 0.2 foo~~ee~~t from 2012 to 201~~4~~3 and an additional 0.6 foot from 2013 to 2014 (DWR 2014b). In comparison, slightly less than 0.1 ~~feet~~ foot of subsidence occurred over the previous 22 years (1991-2012);

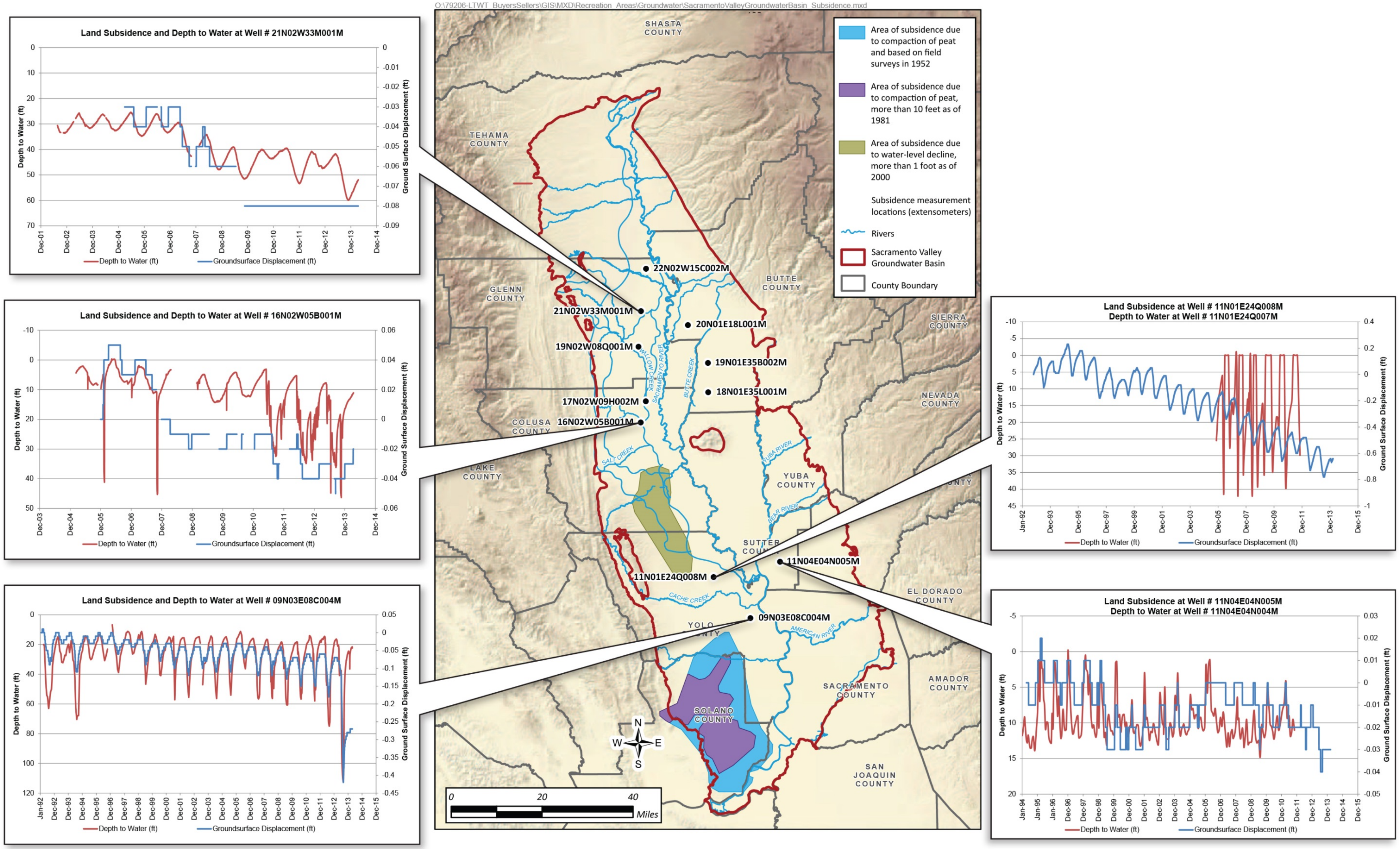
- 11N01E24Q008M, in Yolo County near the Yolo-Zamora area: 0.5 to 0.6 foot decline from 1992 to present;

- 11N04E04N005M, in Sutter County: approximately 0.01 foot decline from 1994 to present;

- 21N02W33M001M, in Glenn County: 0.05 foot decline from 2005 to present; this extensometer is located in areas in which the Tehama Formation is mapped in the subsurface and indicates the potential for inelastic subsidence (West Yost Associates 2012); and

- 16N02W05B001M, in Colusa County: 0.04 foot decline from 2006 to present.

Historically, land subsidence occurred in the eastern portion of Yolo County and the southern portion of Colusa County, due to extensive groundwater extraction and that region's geology. The earliest studies on land subsidence in the Sacramento Valley occurred in the early 1970s when the U.S. Geological Survey (USGS), in cooperation with DWR, measured elevation changes along survey lines containing first and second order benchmarks. As much as four feet of land subsidence due to groundwater withdrawal occurred east of Zamora over the last several decades. The area between Zamora, Knights Landing, and Woodland has been most affected (Yolo County 2009). Subsidence in this region is generally related to groundwater pumping and subsequent consolidation of compressible clay sediments.



Source: DWR 2010b

Figure 3.3-~~11.~~-15. Sacramento Valley Groundwater Basin Land Subsidence

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Groundwater Quality

Groundwater quality in the Sacramento Valley Groundwater Basin is generally good and sufficient for municipal, agricultural, domestic, and industrial uses. However, there are some localized groundwater quality issues in the basin. In general, groundwater quality is influenced by stream flow and recharge from the surrounding Coast Range and Sierra Nevada. Runoff from the Sierra Nevada is generally of higher quality than runoff from the Coast Range because of the presence of marine sediments in the Coast Range. Specific groundwater quality issues are discussed below.

Within the Sacramento Valley, water quality issues may include occurrences of high TDS or elevated levels of nitrates, naturally occurring boron, and other introduced chemicals. The SWRCB's Groundwater Ambient Monitoring and Assessment (GAMA) Program's Priority Basin Project evaluated statewide groundwater quality and sampled 108 wells within the Central Sacramento Valley region and 96 wells in the Southern Sacramento Valley region in 2005 and 2006. Water quality data was analyzed for inorganic constituents (e.g., nutrients, radioactive constituents, TDS and iron/manganese); special interest constituents (e.g., perchlorate); and organic constituents (e.g., solvents, gasoline additives, and pesticides).

Inorganic Constituents

Arsenic and boron were the two trace elements that were most frequently detected at concentrations greater than the maximum contaminant level (MCL) within the basin. Arsenic was detected above the MCL in 22 percent of the primary aquifers. Boron was detected in seven percent of the primary aquifers. Aluminum, chromium, lead, and fluoride were also detected in concentrations above the MCLs, but in less than one percent of the primary aquifers. Concentrations of radioactive constituents were above the MCLs in less than one percent of the primary aquifers within the Central Sacramento Valley region. Most of the radioactivity in groundwater comes from decay of naturally occurring isotopes of uranium and thorium in minerals in the sediments of the aquifer (Bennett 2011a, 2011b).

Nutrient concentrations within the Central Sacramento Valley region were above the MCLs in about three percent of the primary aquifers. In the southern portion of the basin, nutrients were detected above the MCLs in about one percent of the primary aquifers (Bennett 2011a, 2011b).

CDPH and U.S. Environmental Protection Agency's (USEPA's) secondary drinking water standard for TDS is 500 mg/L, and the agricultural water quality goal for TDS is 450 mg/L. TDS concentrations were above these standards in about four percent of the primary aquifers in the central portion of the valley. TDS levels in the Sacramento Valley Groundwater Basin are generally between 200 and 500 mg/L. TDS levels in the southern part of the basin are higher because of the local geology (DWR 2003). Along the eastern boundary of the basin, TDS concentrations tend to be less than 200 mg/L, indicative of the low concentrations of TDS in Sierra Nevada runoff. Several areas in the basin have naturally occurring high TDS, with concentrations that exceed 500 mg/L. TDS concentrations as high as 1,500 mg/L have been recorded (Bertoldi 1991). One of these high TDS areas is west of the Sacramento River, between Putah Creek and the confluence of the Sacramento and San Joaquin Rivers; another is in the south-central part of the Sacramento Basin, south of Sutter Buttes, in the area between the confluence of the Sacramento and Feather Rivers.

Chloride concentrations, a component of TDS, were observed to be above the MCL in two percent of the primary aquifers. TDS concentrations between the recommended and upper limit[4] were detected in about 11 percent of the primary aquifers in the central portion of the valley. In the southern portion of the valley, TDS concentrations were greater than the upper limit (1,000 mg/L) in only about one percent of the primary aquifers and were between the recommended (500 mg/L) and upper limits (1,000 mg/L) in about 22 percent of the primary aquifers (Bennett 2011a, 2011b).

Organic Constituents

Volatile organic compounds (VOCs) are present in many household, commercial, industrial, and agricultural products used as solvents, and are characterized by their tendency to volatilize into the air. Solvents have been used for a number of purposes, including manufacturing and cleaning. Solvents were detected at concentrations greater than the MCLs in less than one percent of the primary aquifers throughout the basin. The solvent present at higher concentrations than the MCL was perchloroethylene. Gasoline additives were detected at higher concentrations in less than one percent of the primary aquifers throughout the basin. The gasoline additives detected at higher concentrations were benzene and tert-butyl alcohol (Bennett 2011a, 2011b). Additionally, groundwater wells around Chico have exceeded standards for VOCs (trichloroethylene and perchloroethylene) (City of Chico 2006).

Other VOCs (trihalomethanes and organic synthesis reagents) were not detected at concentrations above the MCLs in the primary aquifers (Bennett 2011a, 2011b).

Special Interest Constituents

Perchlorate is an inorganic constituent that has been regulated in California drinking water since 2007. Perchlorate was not detected at concentrations above the MCLs in the primary aquifers (Bennett 2011a, 2011b).

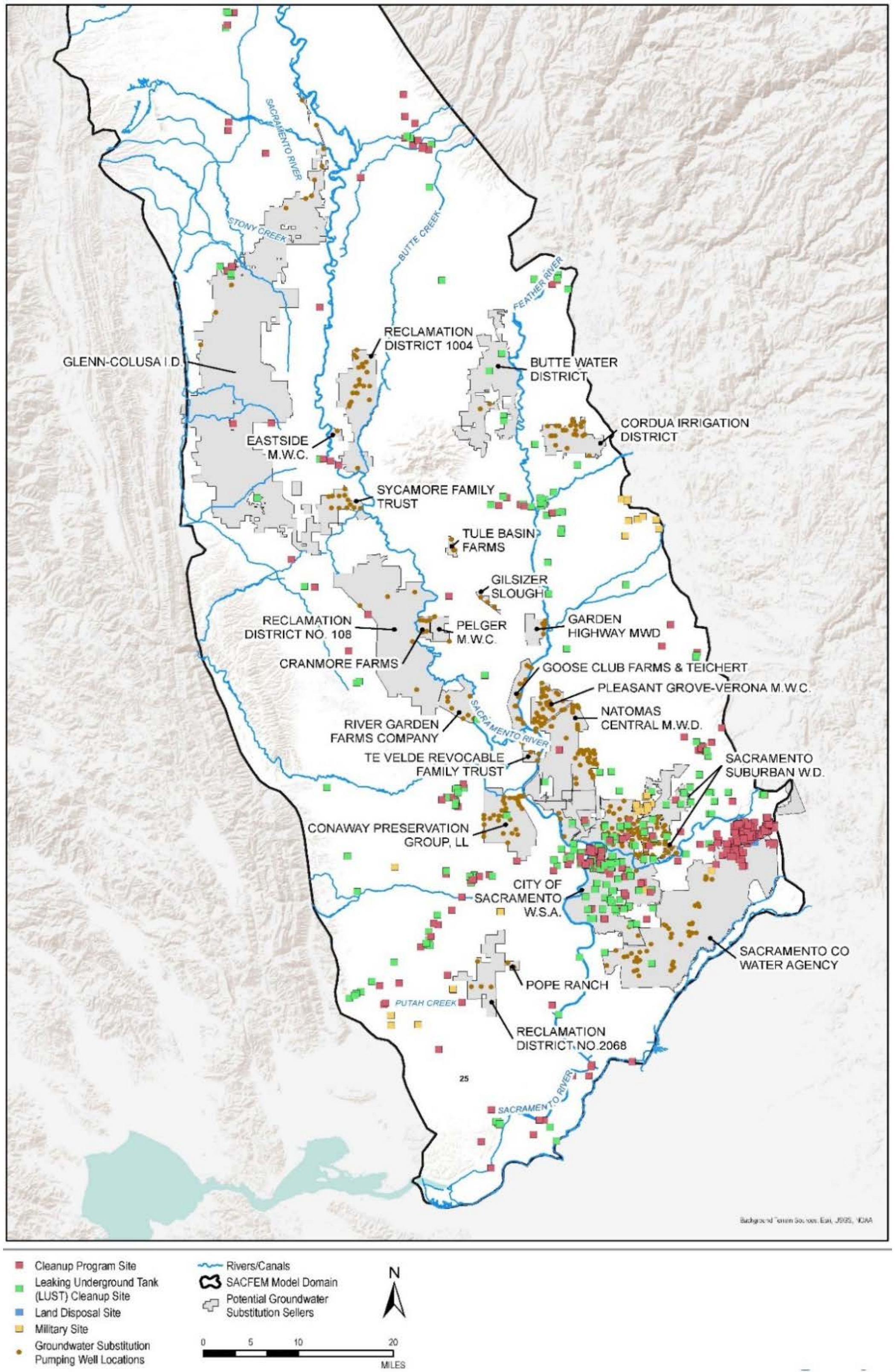
[4] The State of California has a recommended and an upper limit for TDS in drinking water. The recommended limit in 500 mg/L and the upper limit is 1,000 mg/L.

DWR Monitoring
From 1994 to 2000, water quality data from 1,356 public supply water wells indicated that 1,282 wells, or 95 percent, met the primary MCLs for drinking water. In the remaining five percent, analysis detected at least one constituent above a primary MCL. Out of the five percent of samples that had a constituent over the MCL, the ~~exceedences~~exceedances included 33 percent for nitrates, 32 percent for VOCs and semi-VOCs (mostly tetrachloroethylene, trichloroethylene, and benzene), 26 percent for inorganic compounds (mostly manganese and iron), five percent for radiological compounds (gross alpha 4), and four percent for pesticides (di(2-ethylhexyl)phthalate) (DWR 2003).

GeoTracker Clean-Up Sites
Figure 3.3.-16 below shows the active and open "clean-up" sites from SWRCB's GeoTracker database. The Sacramento Valley has 481 active clean-up program sites, 234 leaking underground tank (UST) sites, 54 Military sites (includes military privatized UST sites), and one land disposal site as of December 29, 2014 (SWRCB 2014). These sites are in various stages of open investigation which includes site assessment, remediation, and/or monitoring. Most of the clean-up sites shown in Figure 3.3-16 are clustered around urban areas.

3.3.1.3.3 San Joaquin Valley Groundwater Basin
The San Joaquin Valley Groundwater Basin extends over the southern two-thirds of the Central Valley regional aquifer system and has an area of approximately 13,500 square miles. ~~The northern portion of the~~The San Joaquin Valley Groundwater Basin, shown on Figure 3.3-~~12~~17, extends from just north of Stockton in San Joaquin County to ~~north of Fresno in Fresno~~Kern County~~, covering approximately 5,800 square miles~~.

The southern portion of the San Joaquin Valley Groundwater Basin extends from the Fresno-Madera County line through Kings and Tulare counties into Kern County. The South San Joaquin Groundwater Basin covers approximately 8,000 square miles.



Source: SWRCB 2014

Figure 3.3-16. Active Geotracker Clean-Up Sites as of December 29, 2014

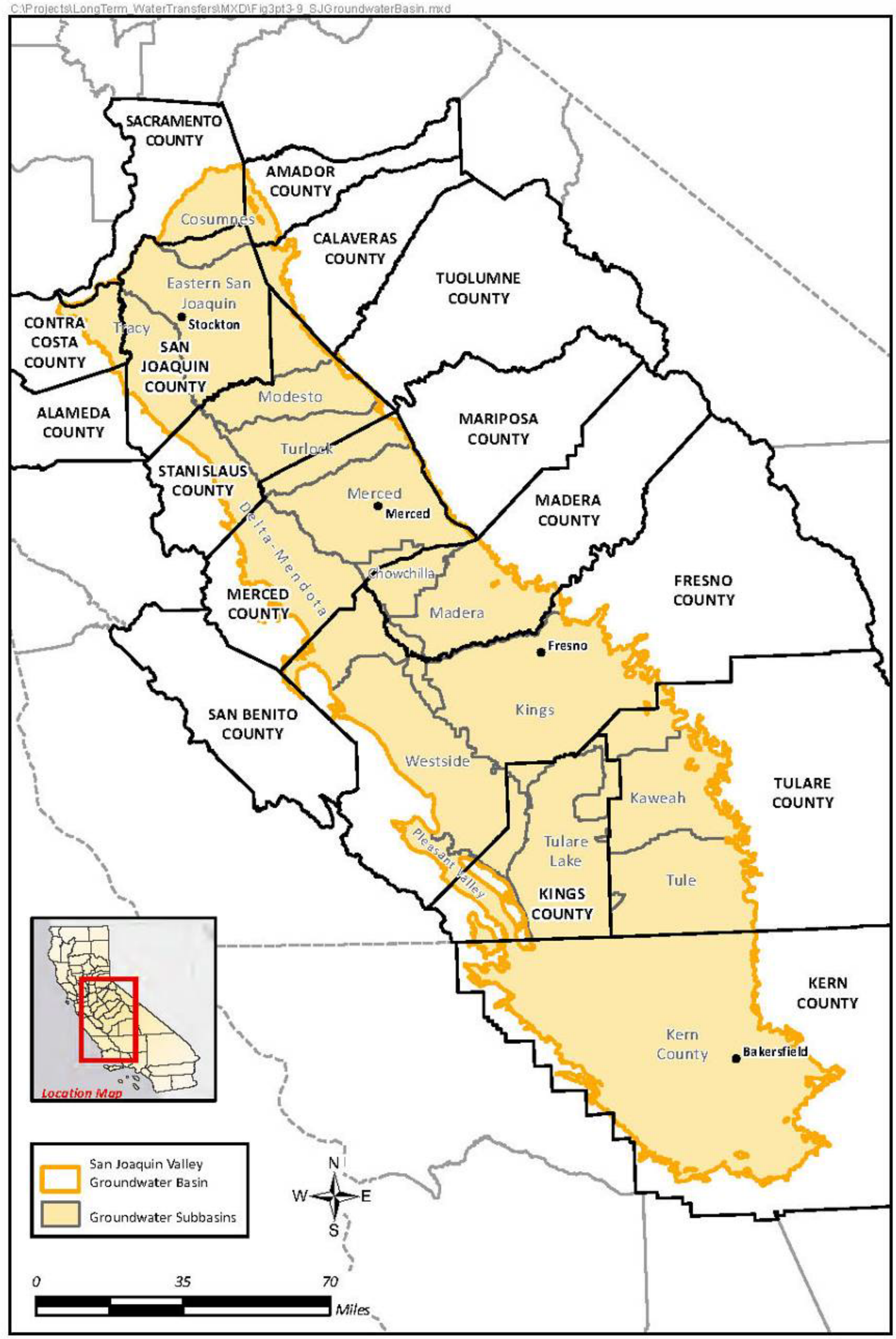


Figure 3.3-17. San Joaquin Valley Groundwater Basin

Geology, Hydrogeology, and Hydrology

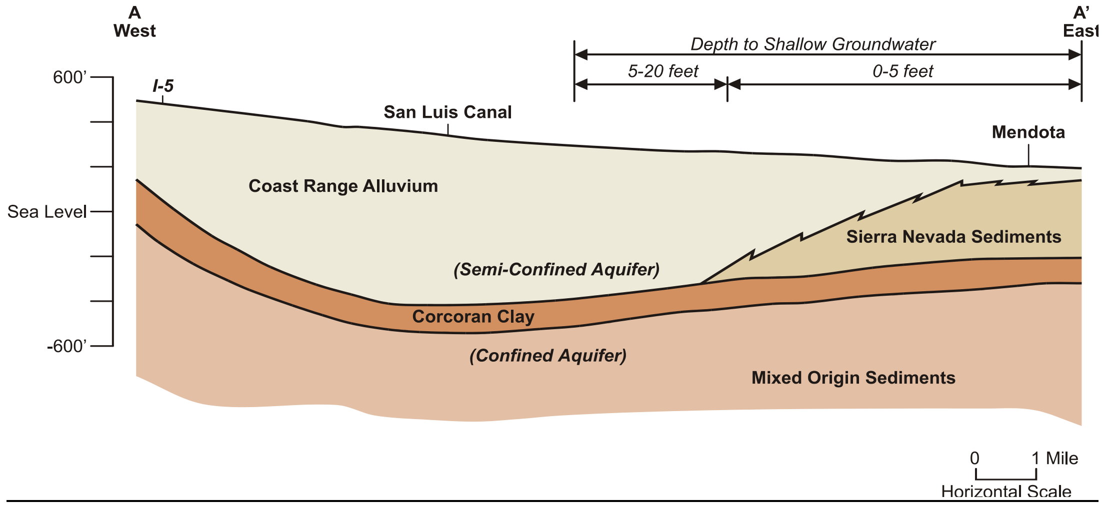
The northern portion of the San Joaquin Valley Groundwater Basin is similar in shape to the Sacramento Valley Groundwater Basin and was formed by the deposition of several miles of sediment in a north-northwestern trending trough. The Sierra Nevada lies on the eastern side of the basin, and the Coast Range is to the west.

The aquifer system in the northern portion of the San Joaquin Valley Groundwater Basin is comprised of continental and marine deposits up to six miles thick, of which the upper 2,000 feet generally contain freshwater (Page 1986). A significant hydrogeologic feature in the basin is the Corcoran Clay. This clay layer divides the aquifer system into two distinct zones, an upper unconfined to semi-confined aquifer and a lower confined aquifer. Both aquifers are composed of formations derived from the deposition of Sierra Nevada sediment in the eastern portions of the basin, and from deposition of Coast Range sediments in the western portions of the basin. Overlying these formations are flood-plain deposits. The formations in the eastern portions of the basin are derived from the granitic Sierra Nevada and are generally more permeable than the sediments derived from the western marine formations. Sediments derived from marine rocks generally contain more silt and clay and also contain higher concentrations of salts. The lower confined aquifer system contains sediments of mixed origin.

Historically, these aquifers were two separate systems; however, wells in the western side of the basin have penetrated both aquifers and are commonly perforated directly above and below the Corcoran Clay. This has allowed "almost free flow [of groundwater] through the well casings and gravel packs" (Williamson 1989) and has resulted in groundwater interaction between the upper and lower aquifer in some localized areas (Reclamation 1990).

In the southern portion of the basin, the central axis of the basin contains Tulare Lake sediments. These Tulare Lake sediments are estimated to be more than 3,600 feet thick, with a lateral extent of more than 1,000 square miles (Page 1986).

Figure 3.3-~~13~~18a shows a generalized geologic cross section of the northern portion of the San Joaquin Valley Groundwater Basin and Figure 3.3-~~14~~18b shows a generalized geologic cross section for the southern portion of the basin. Figure 3.3-~~15~~18c shows the location of these cross sections.



Source: Reclamation 1997

Figure 3-3.18a. Geologic Cross Section of the Northern Portion of the San Joaquin Valley Groundwater Basin

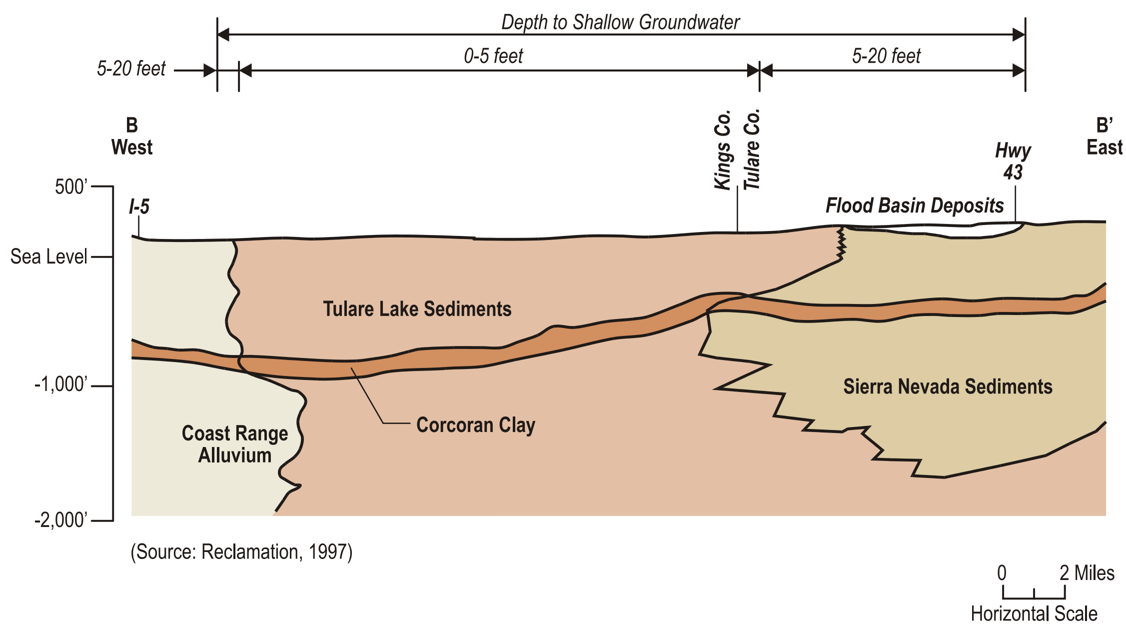


Figure 3.3-18b. Geologic Cross Section of the Southern Portion of the San Joaquin Valley Groundwater Basin

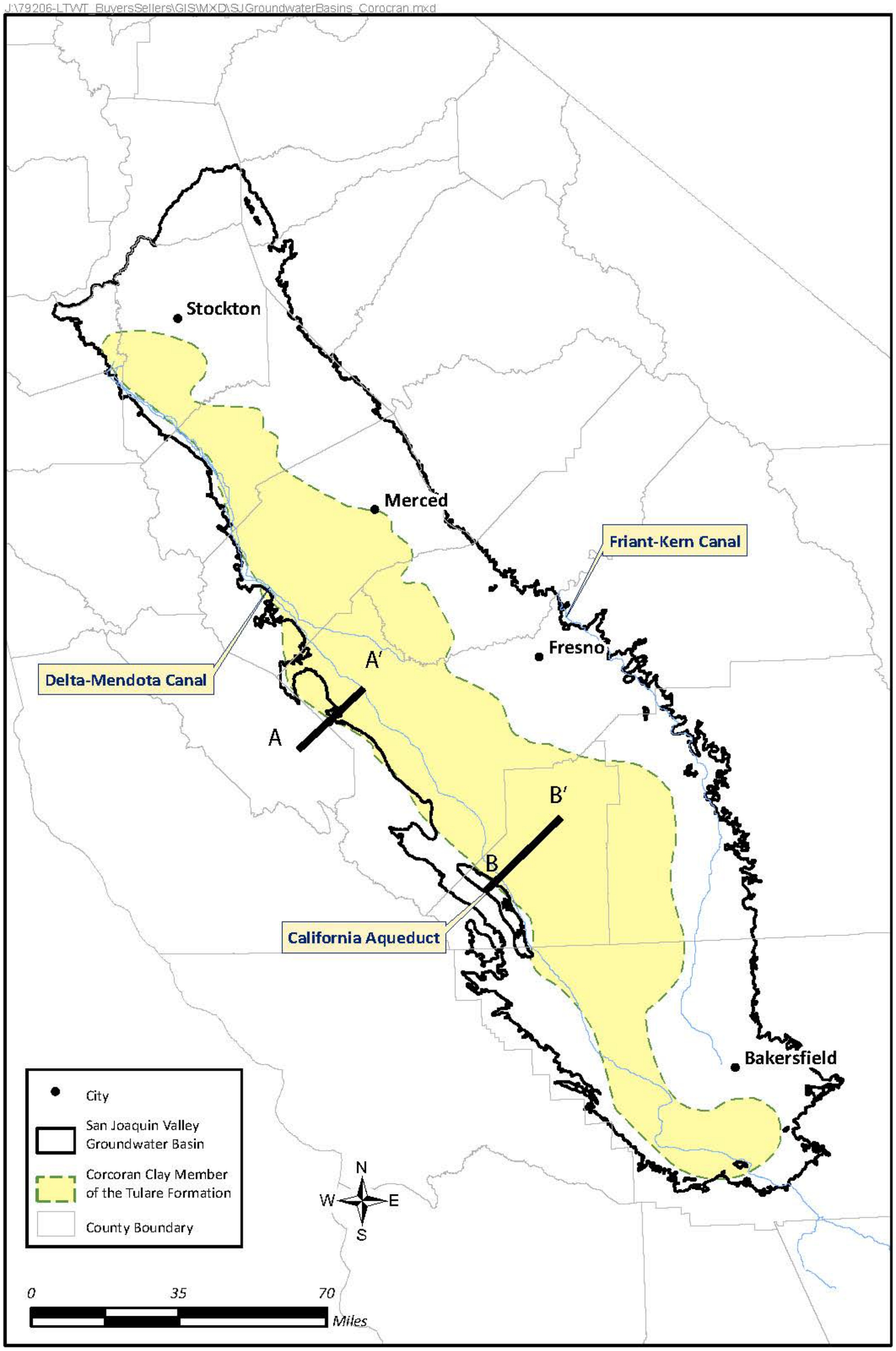


Figure 3.3-18c. Location of Geologic Cross-Sections and Lateral Extent of the Corcoran Clay in the San Joaquin Valley Groundwater Basin

The Corcoran Clay, the most extensive of several clay layers, was formed by the periodic filling and draining of ancient lakes in the San Joaquin Valley. Six laterally extensive clays, designated Clays A through F, have been mapped (Page 1986). The Modified E-Clay includes the Corcoran Clay, which is between 0 and 160 feet thick at depths between 100 and 400 feet bgs.

Historically, groundwater in the unconfined to semi-confined upper aquifer system was recharged by streambed infiltration, rainfall infiltration, and lateral inflow along the basin boundaries. Average annual precipitation in the area is significantly less than in the Sacramento Valley Groundwater Basin and ranges from five to 18 inches (Faunt 2009). The percolation of applied agricultural surface water supplements natural groundwater replenishment. The lower confined aquifer is recharged primarily from lateral inflow from the eastern portions of the basin, beyond the eastern extent of the Corcoran Clay. Precipitation in the Sierra Nevada to the east of the basin can be as high as 65 to 75 inches, although much of it is in the form of snow. Peak runoff in the basin generally lags precipitation by five to six months (Bertoldi 1991).

The main surface water feature in the northern portion of the San Joaquin Valley Groundwater Basin is the San Joaquin River, which has several major tributaries draining the Sierra Nevada, including the Fresno, Chowchilla, Merced, Tuolumne, and Stanislaus rivers. Historically, these streams were “gaining” streams (i.e., they had a net gain of water from groundwater discharge into the river). With the decline of groundwater levels in the basin, areas of substantial pumping have reversed the local groundwater flow, and reaches of streams now lose water to the aquifer system (losing streams). The main surface water features in the southern portion of the San Joaquin Valley Groundwater Basin (Tulare Lake Hydrologic Region) are the Kern, Kaweah, and Kings Rivers. Agricultural development and groundwater pumping in the area, with the resultant decline in groundwater levels, has caused the majority of the rivers and streams to lose water to the aquifer system (losing streams).

Groundwater Production, Levels, and Storage

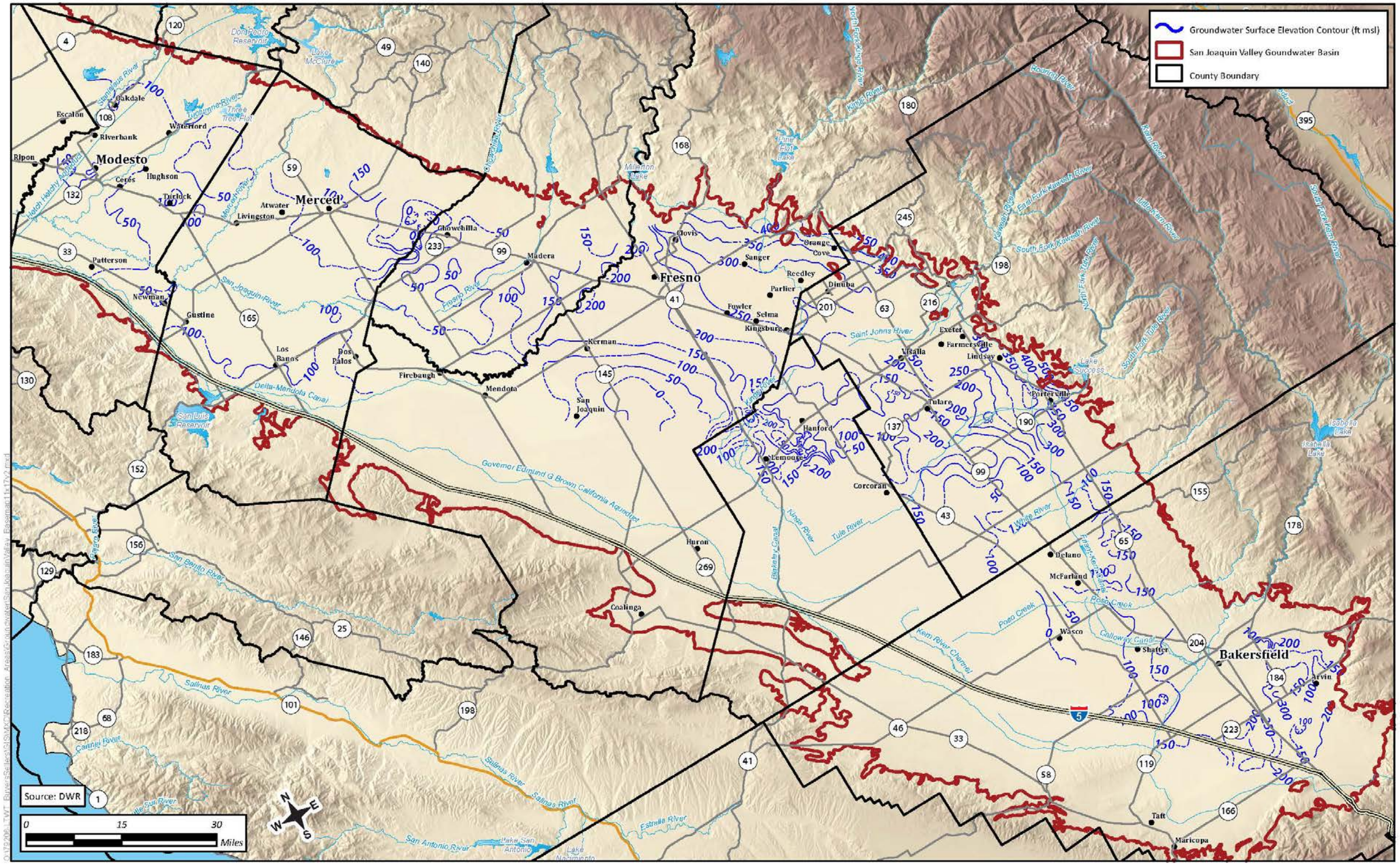
Prior to the large-scale development of irrigated agriculture, groundwater in the basin generally flowed from areas of higher elevation (i.e., the edges of the basin) toward the San Joaquin River and ultimately to the Delta. Most of the water in the San Joaquin Valley moved laterally, but a small amount leaked upward through the intervening confining unit (Planert and Williams 1995). Upward vertical flow to discharge areas from the deep confined part of the aquifer system was impeded partially by the confining clay beds, particularly the Corcoran Clay. Extensive groundwater pumping and irrigation (with imported surface water) have modified local groundwater flow patterns and in some areas, groundwater depressions are evident. Groundwater flow has become more rapid and complex. Groundwater pumping and percolation of excess irrigation water has resulted in steeper hydraulic gradients as well as shortened flow paths between sources and sinks (Faunt 2009).

Irrigated agriculture in the northern portion of the San Joaquin Valley Groundwater Basin increased from about one million acres in the 1920s to more than 2.2 million acres by the early 1980s (Reclamation 1997). Two water balance subregions (12 and 13) in the USGS's Central Valley Hydrologic Model (CVHM),CVHM, show average groundwater pumping to be 799,000 AF per year from 1962 through 2003 (Faunt 2009).

Figure 3.3-1619 shows Spring 2010 groundwater elevation contours for the San Joaquin Valley Groundwater Basin. TheAccording to CVHM, the cumulative change in groundwater storage for the entire San Joaquin Valley Groundwater Basin was relatively constant from 1962 through 2003 according to the CVHM (Figure 3.3-10). Similar to the Sacramento Valley Groundwater Basin,14a), storage tends to dropdropped during dry periods and increaseincreased during wetter years. However according to C2VSim (Figure 3.3-14b), storage within the San Joaquin Valley has been showing a steady decline since the 1940s. Annual average groundwater production in the basin was estimated to be 0.9 million AF in the CVHM model (Faunt 2009).

Groundwater-Related Land Subsidence

From the 1920s until the mid-1960s, the use of groundwater for irrigation of crops in the San Joaquin Valley increased rapidly, causing land subsidence throughout the west and southern portions of the valley. From 1920 to 1970, almost 5,200 square miles of irrigated land in the San Joaquin River Watershed showed at least one foot and as much as 28 feet of land subsidence in northwest Fresno County (CALFED 2000). Land subsidence is concentrated in areas underlain by the Corcoran Clay. Figure 3.3-1720a shows areas of subsidence in the San Joaquin Valley as of 2000.



Source: DWR 2011

Figure 3.3-~~16.~~-19. San Joaquin Valley Spring 2010 Groundwater Elevation Contours

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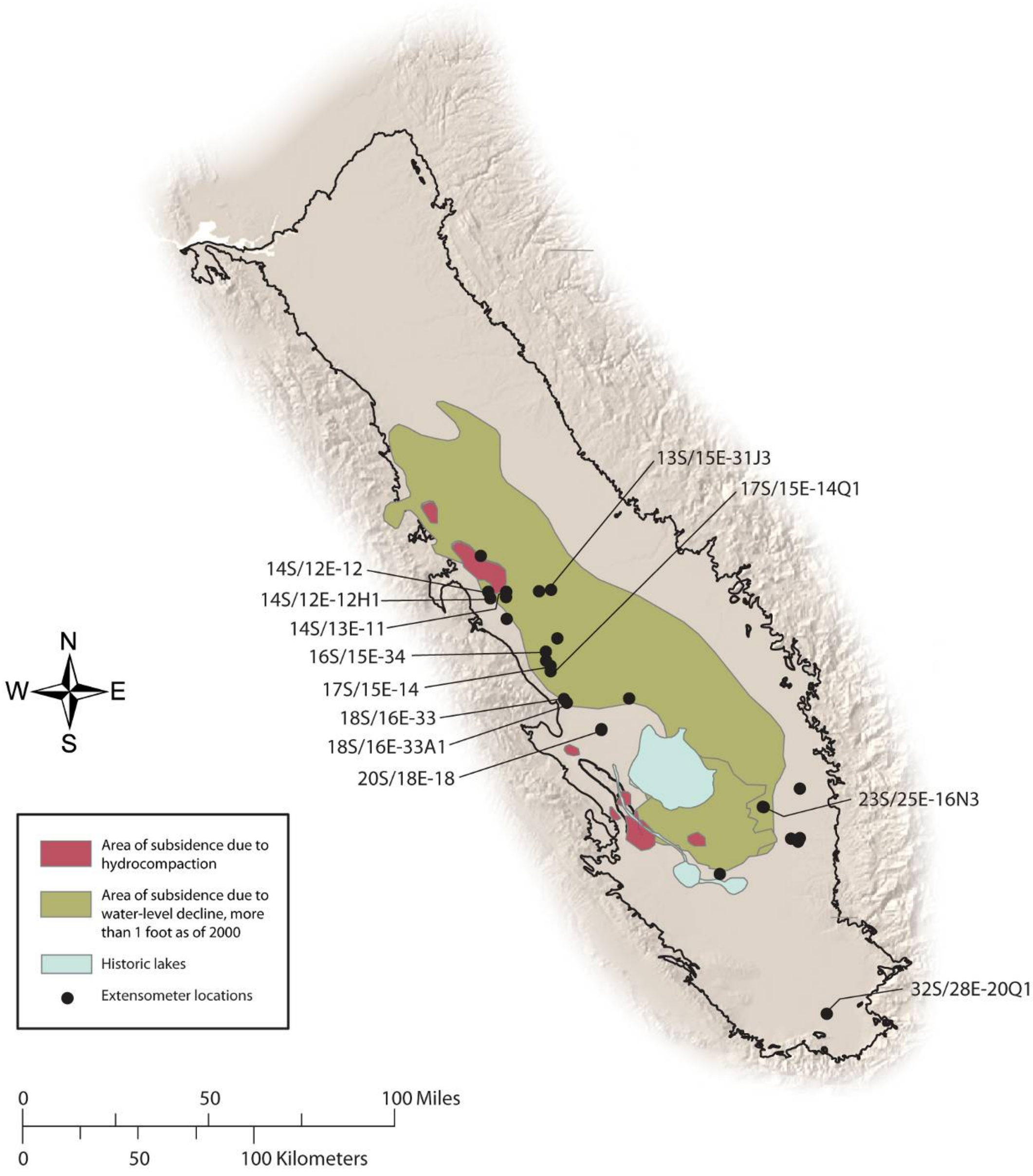

Source: Faunt 2009

Figure 3.3-~~17.~~-20a. Areas of Subsidence in the San Joaquin Valley, as of 2000

Land subsidence studies conducted during the 1950s and 1970s focused on the vicinity of the California Aqueduct. During this period, the ~~State~~California was considering construction of the California Aqueduct, and subsidence due to the large amount of groundwater extraction in the area was a major concern. Following construction, delivery of surface water conveyed by the aqueduct reduced the irrigators' need to extract groundwater, thus reducing the rate of subsidence. Interferometric Synthetic Aperture Radar (InSAR) analyses conducted over the San Joaquin Valley in 2013 indicates substantial subsidence at (1) approximately 7,000 square kilometers of area west of Tulare and east of Kettleman City; and (2) 3,100 square kilometers of area near El Nido (South of Merced and west of Madera). Land elevation benchmark surveys conducted by Caltrans along Highway 198 corroborate the InSAR analyses and indicate 9.37 feet of subsidence occurring in this area between 1960 and 2004.

Land subsidence measurements have shown that an increase in groundwater pumping during 1984-1996from1984 to1996 resulted in land subsidence of up to two feet along the Delta-Mendota Canal (CALFED 2000). Similarly, increased pumping caused Westlands WD to experience up to two feet of subsidence between 1983 and 2001, with most of the subsidence occurring after 1989 (Westlands WD 2000). Six extensometers near the California Aqueduct measure subsidence, as shown in Figure 3.3-1720a. Figure 3.3-1820b shows the extent of subsidence from 1983 to 1998. Data beyond 1998 was not available from DWR for these locations.

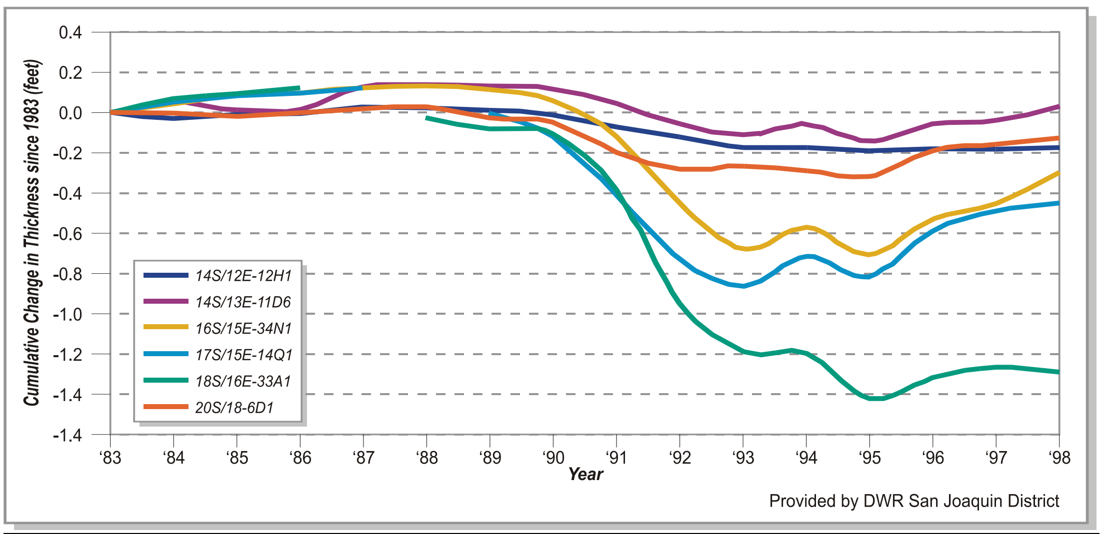

Figure 3.3-20b. Measured Land Subsidence in the San Joaquin Valley, 1983 through 1998

A 2013 USGS study found that the northern portion of the Delta-Mendota Canal was stable or experienced little subsidence from 2003-2010. The southern portion of the Delta-Mendota Canal subsided as part of a large area of subsidence centered near the town of El Nido. Subsidence measurements indicated more than 20 millimeters of subsidence from 2008 to 2010 (Sneed et al 2013). Land subsidence will continue if overdraft of the underlying aquifers continues.

Groundwater Quality

Groundwater quality varies throughout the San Joaquin Valley Groundwater Basin. The GAMA Program's Priority Basin Project evaluates statewide groundwater quality and sampled 67 wells in the northern San Joaquin Valley region; 79 wells in the central region (includes Modesto, Turlock, Merced, and Uplands subbasins) and 126 wells in the southern region (Kings, Kaweah, Tule, and Tulare basins) between 2004 and 2006. Water quality data was analyzed for inorganic constituents (e.g., nutrients, radioactive constituents, TDS, and iron/manganese); special interest constituents (e.g., perchlorate) and organic constituents (e.g., solvents, gasoline additives, and pesticides).

Inorganic Constituents:

Arsenic, vanadium and boron were the trace elements that were most frequently detected at concentrations greater than the MCL within the basin. Aluminum, barium, lead, antimony, mercury, valadium, and fluoride were also detected at concentrations above the MCL in less than two percent of the primary aquifers (Belitz 2010, Bennett 2010, Burton 2012).

Nutrients such as nitrate and nitrite are naturally present at low concentrations in groundwater. High and moderate concentrations generally occur as a result of human activities, such as applying fertilizer to crops. Livestock, when in concentrated numbers, and septic systems also produce nitrogenous waste that can leach into groundwater. Nitrate was present at concentrations greater than the MCL in two percent of the primary aquifers in the northern and central portion of the basin and six percent of the primary aquifers in the southern region of the basin (Belitz 2010, Bennett 2010, Burton 2012).

CDPH and USEPA's secondary drinking water standard for TDS is 500 mg/L, and the agricultural water quality goal for TDS is 450 mg/L. TDS concentrations were greater than the upper limit in about two percent of the primary aquifers in the central portion of the valley and in about six percent of the primary aquifers in the northern portions of the basin (Belitz 2010, Bennett 2010, Burton 2012). TDS concentrations in the northern portion of the San Joaquin Valley Groundwater Basin are generally higher than in the Sacramento Valley Groundwater Basin. Concentrations of TDS along the east side of the Basin are generally lower than along the west side, as a result of higher quality water recharging the aquifer and soil types.

Organic Constituents:

Solvents were detected at concentrations greater than the MCL in less than one percent of the primary aquifers within the basin. Other VOCs (e.g., trihalomethanes and organic synthesis reagents) were not detected at concentrations above MCLs in the primary aquifers (Belitz 2010, Bennett 2010, Burton 2012).

3.3.1.3.4 Santa Clara Valley Groundwater Basin (Santa Clara Valley Subbasin)

Buyers in the San Francisco Bay area include Santa Clara WD, Contra Costa WD, and East Bay MUD.

Santa Clara WD is the only buyer within the San Francisco Bay area that relies on groundwater resources to meet their existing water supply demands. Santa Clara WD underlies the Santa Clara Valley Groundwater Basin and the Gilroy-Hollister Valley Groundwater Basin. The Santa Clara Valley Groundwater Basin contains the Santa Clara Valley, San Mateo Plain and East Plain subbasins. The Santa Clara subbasin occupies a structural trough parallel to the northwest trending Coast Range. The Diablo Range bounds it on the west and the Santa Cruz Mountains form the basin boundary on the east. It extends from the northern border of Santa Clara County to the groundwater divide near the town of Morgan Hill. Figure 3.3-~~19~~21 shows the Santa Clara Valley Groundwater Basin and subbasins within the area of analysis.

Contra Costa WD does not rely on groundwater resources as a significant part of its water supply (Contra Costa WD 2011). The water transfers alternatives discussed in this document are not anticipated to change the use of groundwater resources within the Contra Costa WD area; therefore, details of groundwater conditions in this area are not discussed here.

East Bay MUD also does not rely on groundwater resources but provides surface water supplies from the Mokelumne River and local runoff (East Bay MUD 2012). Thus, similar to the Contra Costa WD, the alternatives discussed in this document are not anticipated to change the use of groundwater resources within the East Bay MUD service area.

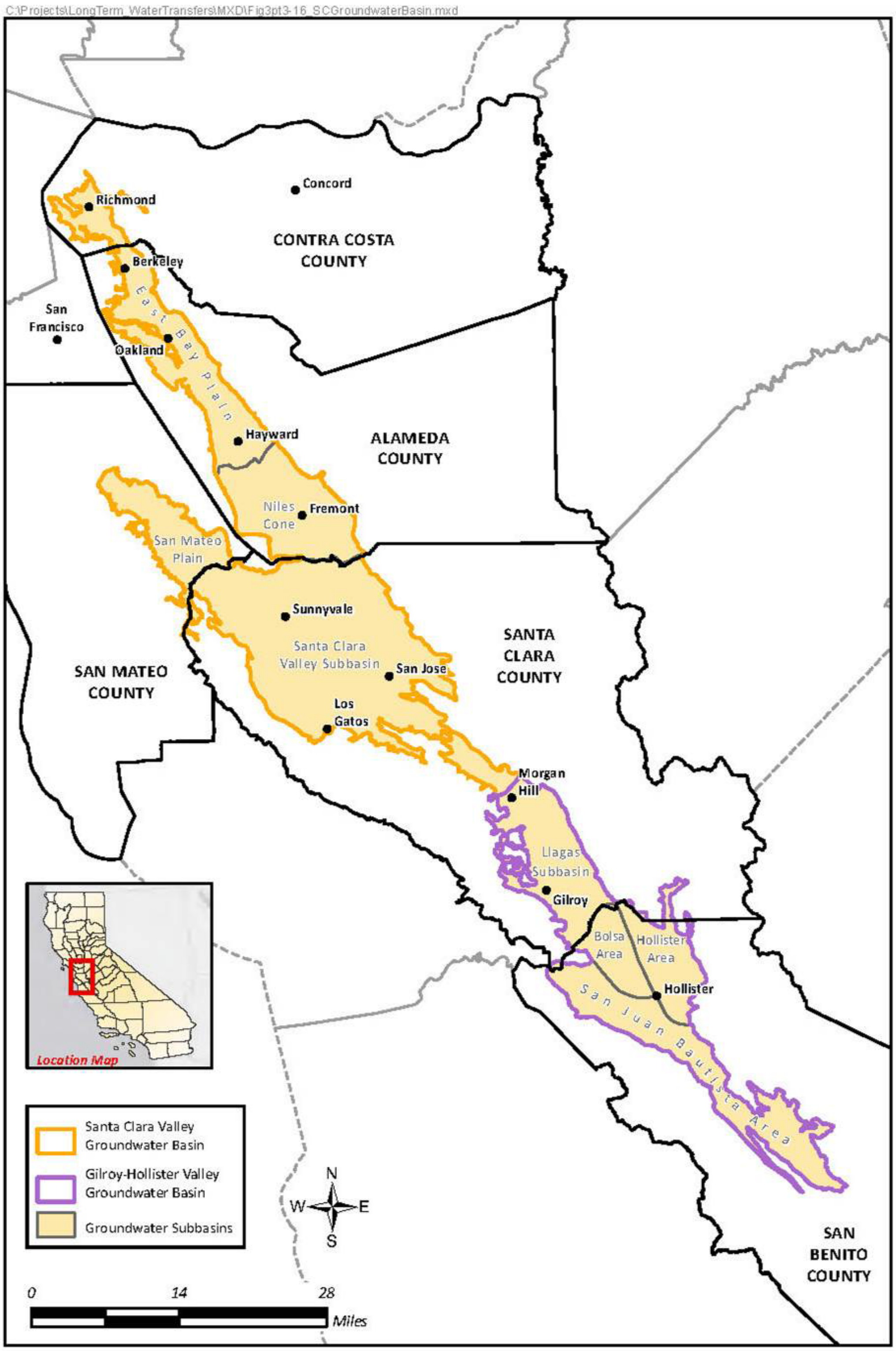

Figure 3.3-~~19.~~-21. Santa Clara Valley and Gilroy-Hollister Valley Groundwater Basins

Geology, Hydrogeology, and Hydrology

The Santa Clara Valley Subbasin includes continental deposits of unconsolidated to semi-consolidated gravel, sand, silt, and clay. Two members form this group, the Santa Clara Formation of Plio-Pleistocene age and the younger alluvium of Pleistocene to Holocene age (DWR 1975). The combined thickness of these two units likely exceeds 1,500 feet (DWR 1967).

The Santa Clara Formation rests unconformably on impermeable rocks that mark the bottom of the groundwater subbasin (DWR 1975). The Santa Clara Formation is exposed only on the west and east sides of the Santa Clara Valley. The exposed portions are composed of poorly sorted deposits ranging in grain size from boulders to silt (DWR 1975). Well logs indicate that permeability increases from west to east and that in the central part of the valley permeability and grain size decrease with depth (DWR 1975).

In the Santa Clara Valley, groundwater occurs in Pleistocene to Holocene alluvium deposits. The permeability of the valley alluvium is generally high and all large production wells derive their water from it (DWR 1975). Valley alluvium is deposited as a series of convergent alluvial fans generally comprised of unconsolidated gravel, sand, silt, and clay. It becomes progressively finer grained in the central portion of the valley. A confined aquifer zone is present in the northern portion of the subbasin where it is overlain by a low-permeability clay layer (Santa Clara Valley WD 2001). The southern portion of the subbasin is generally unconfined and contains no thick clay layers (Santa Clara Valley WD 2001).

Natural recharge occurs principally as infiltration from streambeds that exit the upland areas within the drainage basin and from direct percolation of precipitation that falls on the basin floor. Annual precipitation for the Santa Clara Valley Groundwater basin ranges from less than 16 inches in the valley to more than 28 inches in the upland areas (DWR 2003).

The main surface water features in the Santa Clara Valley Groundwater Basin are the tributaries to San Francisco Bay including Coyote Creek, Guadalupe River, and Los Gatos Creek. The Santa Clara Valley WD conducts an artificial recharge program by releasing locally conserved or imported water to in-stream and off-stream facilities (Santa Clara Valley WD 2001). District-wide controlled in-stream recharge accounts for about 45 percent of groundwater recharge in district facilities (Santa Clara Valley WD 2001). In-stream recharge occurs along stream channels in the alluvial apron upstream from the confined zone. Spreader dams (creating temporary or permanent impoundments in the stream channel) are a key component of the in-stream recharge program, increasing recharge capacity by approximately ten percent (Santa Clara Valley WD 2001).

Groundwater Production, Levels and Storage

Santa Clara Valley WD manages the Santa Clara Valley Subbasin. Groundwater is pumped within the district by major water retailers, well owners, and agricultural users. Annual average groundwater pumping within the Santa Clara Valley Subbasin has remained relatively constant over time. Figure 3.3-~~20~~22 shows historic groundwater pumping from 2000 to 2009 within the subbasin.

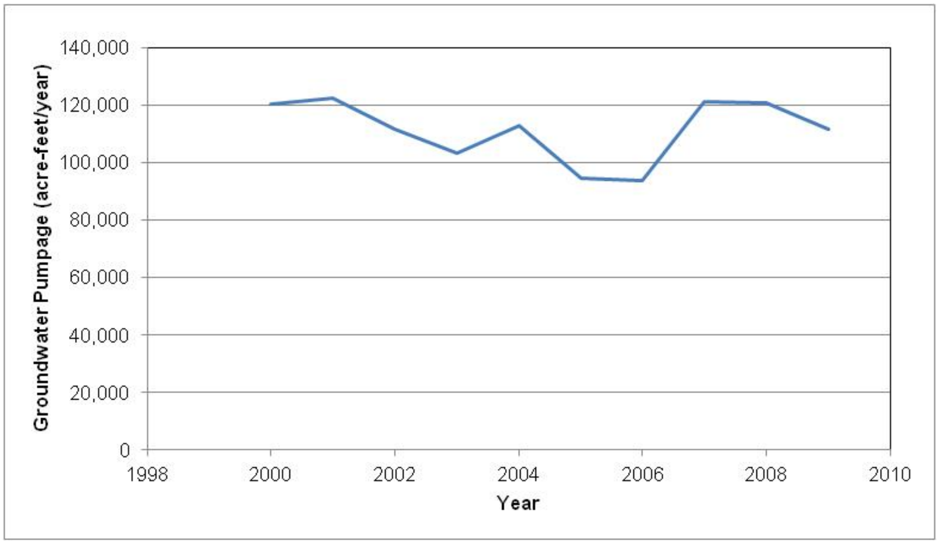

Figure 3.3-~~20.~~-22. Historic Groundwater Pumping in the Santa Clara Valley Subbasin

Historically, since the early 1900s through the mid-1960s groundwater level declines from groundwater pumping have induced subsidence in the Santa Clara Valley Subbasin and caused degradation of the aquifer adjacent to the bay from saltwater intrusion. Prior to surface water import via the Hetch Hetchy and South Bay Aqueducts and the introduction of an artificial recharge program, water levels declined more than 200 feet in the Santa Clara Valley (Santa Clara Valley WD 2000). Santa Clara Valley WD has also implemented various recharge programs that use local runoff and imported water deliveries to recharge groundwater through approximately 390 acres of recharge ponds and 90 miles of local creeks to stop groundwater overdraft and land subsidence (Santa Clara Valley WD 2001). Groundwater levels have generally increased since 1965 as a result of increased in-stream and off-stream recharge programs and decreased pumping due to increase in availability of imported surface water (Santa Clara Valley WD 2001). Figure 3.3-~~21~~23 shows the location of selected monitoring wells within the Santa Clara Valley Subbasin and the groundwater elevation at the wells.

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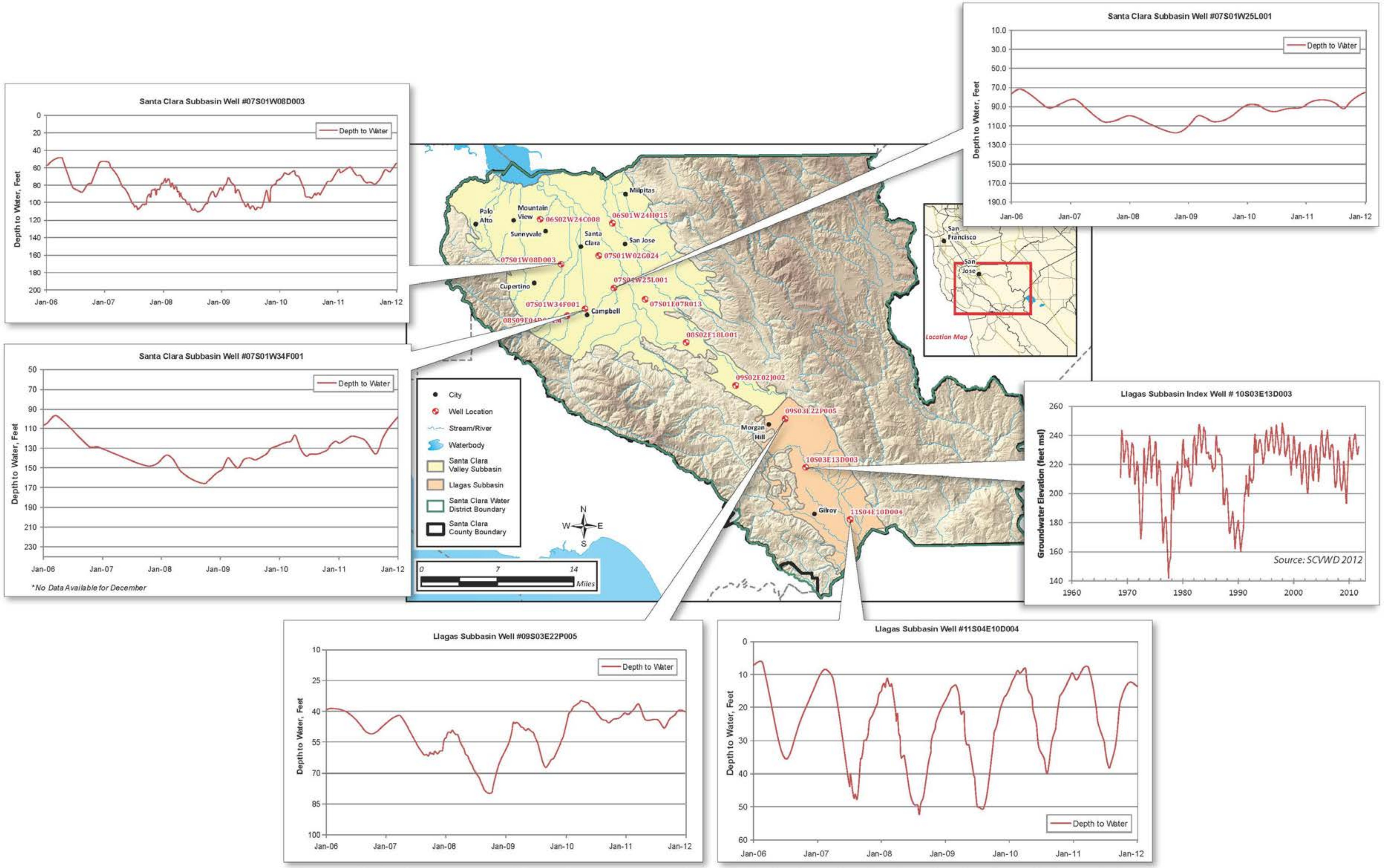

Figure 3.3-~~21.~~-23. Historic Groundwater Elevations at Selected Wells in the Santa Clara Valley Subbasin

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The operational storage capacity of the Santa Clara Valley Subbasin is estimated to be 350,000 AF (Santa Clara Valley WD 2001). The operation storage capacity is less than the total storage capacity of the basin and accounts for available pumping capacity, avoidance of land subsidence, and problems associated with high groundwater levels. This estimate of operation storage capacity is based on an area defined by Santa Clara Valley WD that is approximately 15 square miles smaller than the Santa Clara Valley Subbasin boundaries as defined in DWR's Bulletin 118 (DWR 2003).

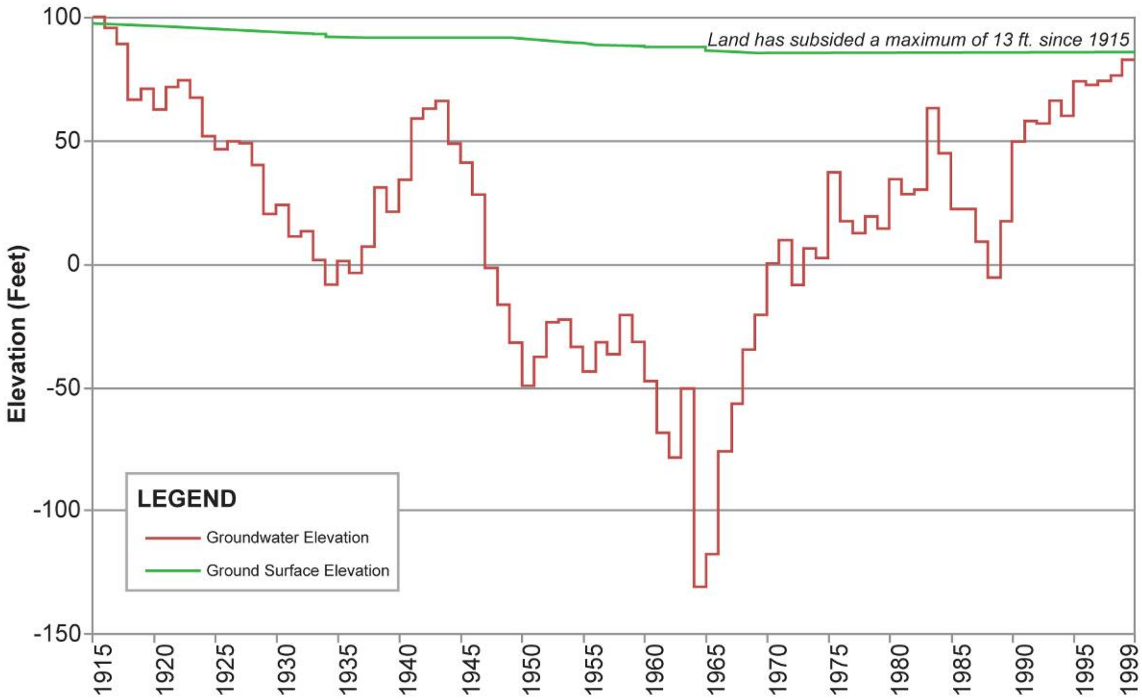
Groundwater-Related Land Subsidence

Historically, Santa Clara County has experienced as much as 13 feet of subsidence caused by excessive pumping of groundwater. One serious consequence of subsidence in Santa Clara County was that lands near the San Francisco Bay sank below sea level between 1940 and 1970, enabling salt water to intrude upstream through the mouths of rivers dramatically affecting the riparian habitat of the rivers. Figure 3.3-~~22~~24 reflects the elevation of groundwater at the downtown San Jose index well (7S01E07R013) and the land surface elevation measured at First and St. James Streets in San Jose. The figure illustrates the increase in groundwater levels since 1965 through the implementation of Santa Clara Valley WD's groundwater recharge, treated water ground reinjection and water use efficiency programs. The figure also illustrated the substantial reduction in land subsidence due to groundwater level recovery. Santa Clara Valley WD conducts routine groundwater elevation, quality and land subsidence monitoring within the valley. Land Subsidence monitoring in the valley show the reduction in subsidence to an average of 0.01 feet per (Santa Clara Valley WD 2001).

Groundwater Quality

Though groundwater in the Santa Clara Valley Groundwater Basin is hard, it is suitable for most uses and drinking water standards are met at public supply wells without the use of treatment methods (Santa Clara Valley WD 2001). Groundwater alkalinity in the Santa Clara Valley Groundwater Basin is generally a bicarbonate type with sodium and calcium being the principal cations (DWR 1975).

Groundwater in the region has elevated mineral levels which could be associated with historical saltwater intrusion observed in the northern basin due to land subsidence (Santa Clara Valley WD 2001). Some wells with elevated nitrate concentration have been identified in the southern portion of the basin (Santa Clara Valley WD 2001).



Source: Santa Clara Valley WD 2000

Figure 3.3-22.-24. Land Subsidence at the San Jose Index Well

3.3.1.3.5 Gilroy-Hollister Valley Groundwater Basin (Llagas Subbasin)

The Llagas subbasin is part of the Gilroy-Hollister Valley Groundwater Basin. The Llagas subbasin occupies a northwest trending structural depression. The Diablo Range bounds it on the east and the Santa Cruz Mountains form the subbasin boundary on the west. The subbasin extends from the groundwater divide at Cochran Road near the town of Morgan Hill in the north to the Pájaro River in the south (Santa Clara Valley WD 2001).

Geology, Hydrogeology, and Hydrology

The Llagas subbasin is similar to the Santa Clara Valley subbasin and was formed by continental deposits of unconsolidated to semi-consolidated gravel, sand, silt and clay (DWR 1981). The water bearing formation of the subbasin includes the Santa Clara Formation and the valley fill material (alluvial and alluvial fan deposits) (DWR 1981).

The Santa Clara Formation is of Plio-Pleistocene age. This formation underlies much of the valley and unconformably overlies older non-water bearing sediments (DWR 1981). It consists of fairly well consolidated clay, silt, and sand with lenses of gravel. These sediments are generally of fluvial origin with an estimated maximum thickness of 1,800 feet (DWR 1981). The lower portions of deeper wells within the subbasin likely intersect the Santa Clara Formation. Alluvial fan deposits of Holocene age occur at the margin of the valley basin. They are composed of a heterogeneous mixture of unconsolidated to semi-consolidated clay, silt, sand, and gravel that are partially confined locally (DWR 1981). The alluvial fan deposits range in thickness from three to 125 feet and overlie the Santa Clara Formation and other older non-water-bearing deposits (DWR 1981). A number of wells supply groundwater of excellent quality for irrigation and municipal purposes (DWR 1981).

Older Alluvium of Plio-Pleistocene age is distributed in the central portion of the valley from the northern boundary of the subbasin to Gilroy. Older Alluvium consists of unconsolidated clay, silt, and sand formed by floodplain processes. It characteristically is identified by a dense clayey subsoil that acts as an aquitard to vertical movement of water and limits recharge potential (DWR 1981). It provides adequate yields to wells up to 100 feet in depth and water obtained from this formation is generally suitable for most uses (DWR 1981). Younger alluvium of Holocene age occurs in the flat lying areas from Gilroy south to the subbasin's southern boundary. Similar to the Older Alluvium, the Younger Alluvium has been formed principally as a floodplain deposit but it does not have a well-defined clay subsoil. The Younger Alluvium has a maximum thickness of about 100 feet and generally overlies the Older Alluvium and alluvial fan deposits (DWR 1981). Groundwater in the Younger Alluvium is generally unconfined and the quality of water is acceptable for domestic purposes (DWR 1981).

The dominant geohydrologic feature in the subbasin is an inland valley that is drained to the south by tributaries of the Pájaro River, including Uvas and Llagas creeks. Annual precipitation for the Llagas subbasin ranges from less than 16 inches in the south to more than 24 inches in the north (DWR 2003).

Groundwater Production, Levels and Storage

Santa Clara Valley WD manages the Llagas subbasin and groundwater is pumped within the district by major water retailers, well owners and agricultural users. Figure 3.3-~~23~~25 shows historic groundwater pumping from 2000 to 2009 within the basin.

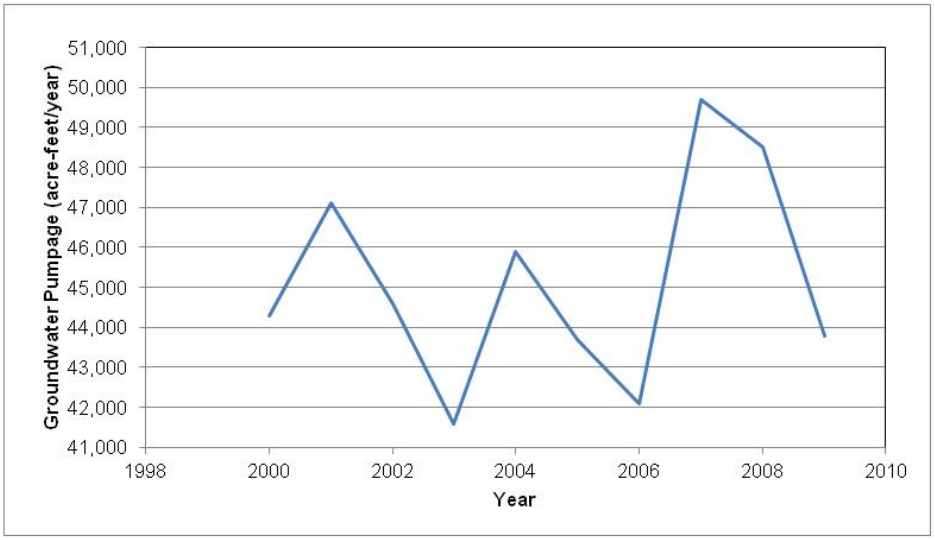


Figure 3.3-25. Historic Groundwater Pumping Within the Llagas Subbasin

~~21~~Figure 3.3-23 shows the groundwater elevation in the Llagas subbasin index well (10S03E13D003). Groundwater levels remained relatively stable over the period of record with the exception of water level declines and subsequent recovery associated with the 1976-1977 and 1987-1992 drought periods. While groundwater elevations in the index well are not indicative of elevations in all wells within the subbasin, it is representative of relative changes in groundwater levels within the subbasin (Santa Clara Valley WD 2001).

Natural groundwater recharge based on the long-term average for the Llagas subbasin is estimated to be 44,300 AF per year (Santa Clara Valley WD 2001). Total facility recharge (Artificial Recharge) countywide is estimated to be 157,200 AF (Santa Clara Valley WD 2001). The operational storage capacity of the Llagas subbasin is estimated to be between 150,000 and 165,000 AF (Santa Clara Valley WD 2010). The operation storage capacity is less than the total storage capacity of the subbasin and accounts for available pumping capacity, avoidance of land subsidence, and problems associated with high groundwater levels.

Groundwater-Related Land Subsidence

Historically, Santa Clara County has experienced as much as 13 feet of subsidence caused by excessive pumping of groundwater. Most of the subsidence occurred in the Santa Clara Valley subbasin (Santa Clara Valley WD 2000).

Groundwater Quality

Groundwater alkalinity in the Llagas subbasin is generally high, similar to the Santa Clara Valley subbasin. Though the water is hard, it is suitable for most uses and drinking water standards are met at public supply wells without the use of treatment methods (Santa Clara Valley WD 2001).

The Santa Clara Valley WD created a Nitrate Management Program in October 1991 to investigate and remediate increasing nitrate concentrations in the Llagas subbasin (Santa Clara Valley WD 2001). Nitrate concentrations appear to be increasing over time and elevated concentrations of nitrate still exist in the Llagas subbasin (Santa Clara Valley WD 2001). Since 1997, more than 600 wells in south Santa Clara County including the Llagas and Coyote subbasins have been tested for nitrate. The 2009 median nitrate concentration for the principal aquifer zone of the Llagas Subbasin was 30 mg/L, with a maximum value of 155 mg/L (Santa Clara Valley WD 2010).

3.3.2 Environmental Consequences/Environmental Impacts

This section describes assessment methods and presents effects of the proposed alternatives on groundwater resources in the area of analysis. Groundwater substitution and cropland idling transfers could alter the existing subsurface hydrology and thus result in a variety of effects to groundwater levels, land subsidence, or groundwater quality, which are further described below.

Groundwater Levels: Changes in groundwater levels could cause multiple secondary effects. Declining groundwater levels could result in: (1) increased groundwater pumping costs due to increased pumping depth; (2) decreased yield from groundwater wells due to reduction in the saturated thickness of the aquifer; or (3) lowered groundwater table elevation to a level below the vegetative root zone, which could result in environmental effects. This groundwater analysis examines effects associated with item (2~~); pumping~~). Pumping costs are considered in Section 3.10, Regional Economics~~,~~; impacts to fisheries are included in Section 3.7, Fisheries; and effects to vegetation are considered in Section 3.8, Vegetation and Wildlife.

Land Subsidence: Excessive groundwater extraction from confined and unconfined aquifers could lower groundwater levels and decrease pore-water pressure. The reduction in pore-water pressure could result in a loss of structural support for clay and silt beds, which could lower the ground surface elevation (land subsidence). The compression of fine-grained deposits, such as clay and silt, is largely permanent. Infrastructure damage to buildings, conveyance and drainage facilities, and wells and alteration of drainage patterns are possible consequences of land subsidence.

Groundwater Quality: Changes in groundwater levels and the potential change in groundwater flow directions could cause a change in groundwater quality through a number of mechanisms. One mechanism is the potential mobilization of areas of poorer quality water, drawn down from shallow zones, or drawn up into previously unaffected areas. Changes in groundwater gradients and flow directions could also cause (and speed) the lateral migration of poorer quality water.

3.3.2.1 Assessment Methods

3.3.2.1.1 Numerical Modeling of Regional Groundwater Level Declines

Numerical groundwater modeling analysis was performed using the Sacramento Valley Finite Element Groundwater Model (SACFEM2013) developed to simulate groundwater conditions in the Sacramento Valley. SACFEM2013 was selected as the numerical modeling tool for this analysis based on the state of the model and its capabilities to simulate groundwater conditions at a greater level of detail than other potential modeling tools within the Seller Service Area. Reclamation commissioned a peer review of the SACFEM2013 model in 2010 (WRIME 2011). Revisions were made to the model and the revised model was used for the impacts analysis described here.

SACFEM2013 uses the MicroFEM finite-element numerical modeling code. MicroFEM is capable of simulating multiple aquifer systems in both steady state and transient conditions. The model is capable of simulating groundwater conditions and groundwater/surface water interactions in the valley. SACFEM2013 was also used to estimate how groundwater pumping and recharge affects surface water; these impacts are assessed in Section 3.1, Water Supply.

SACFEM2013 covers the entire Sacramento Valley Groundwater Basin from just north of Red Bluff to the Cosumnes River in the south (see Figure 3.3-~~24~~26). The model was calibrated to historic conditions from Water Years (WY) 1970 through WY 2009. This SACFEM2013 model simulation, which includes highly variable hydrology (from very wet periods to very dry periods), was used as a basis for simulating groundwater substitution pumping.

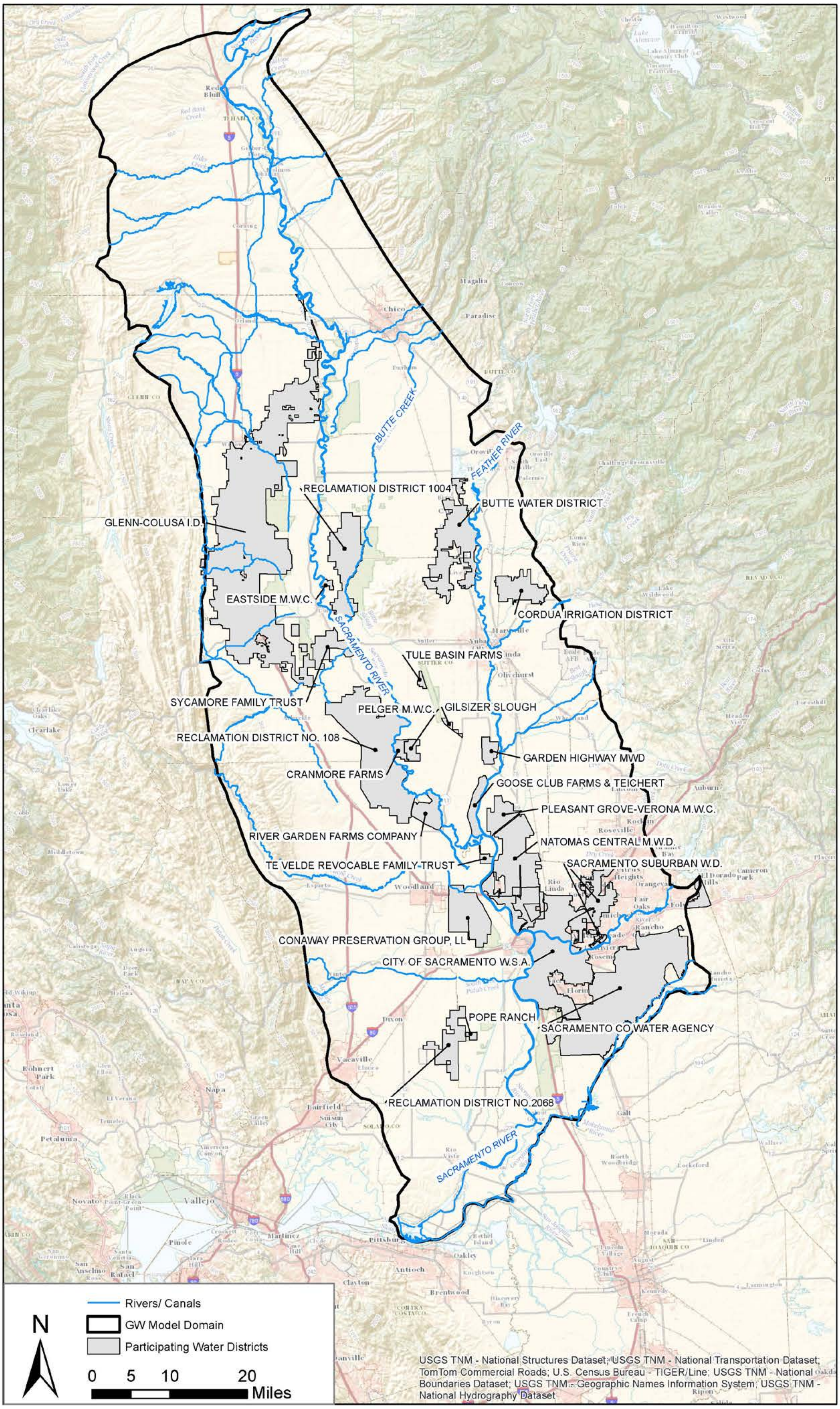


Figure 3.3-26. The SACFEM2013 Groundwater Model Domain

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Groundwater substitution pumping was simulated as an additional pumping stress on the system, above the baseline pumping volume. The annual volume of transfers was determined by comparing the supply in the seller service area to the demand in the buyer service area. The availability of supplies in the seller service area was determined based on data provided by the potential sellers. The demand was estimated using demand data provided by East Bay MUD and Contra Costa WD as well as the available capacity at the Delta export pumps to convey transfers. The available export capacity was determined from CalSim II model results. The CalSim II model currently only simulates conditions through WY 2003. The available capacity for south of delta exports was typically more limiting than the south of delta water supply demand. Because CalSim II results are only available through 2003, the SACFEM2013 model simulation was truncated at the end of WY 2003.

The analysis of supply and demand resulted in the potential to export groundwater substitution pumping transfers through the Delta during 12 of the years from WY 1970 through WY 2003 (33 years, SACFEM2013 simulation period). Each of the 12 annual transfer volumes was included in a single model simulation. Including each of the 12 years of transfer pumping in one simulation rather than 12 individual simulations allows for the potential compounding effects from pumping from prior years. Appendix D, Groundwater Model Documentation; and Appendix M, SACFEM User's Manual, includes more information about the use of SACFEM2013 in this analysis.

3.3.2.1.2 Qualitative Assessments

The groundwater model area includes most, but not all, of the potential sellers. Anderson-Cottonwood ID is not in the Sacramento Valley and is located outside of the area that is covered by the groundwater model. Therefore, changes to groundwater conditions in the Anderson-Cottonwood ID were assessed qualitatively. The buyers are also not included in the groundwater model, so the potential effects are analyzed qualitatively.

Potential land subsidence and changes in groundwater quality were also assessed qualitatively because these processes are not part of the numerical groundwater model. For land subsidence, the modeled groundwater drawdown was compared to areas with existing subsidence to identify areas that may be susceptible to impacts. Additionally simulated groundwater drawdown was compared to estimates of preconsolidated heads/historic low heads. Groundwater quality impacts were assessed by considering areas of known water quality concerns and determining whether modeled groundwater drawdown could cause those areas to migrate.

3.3.2.2 Significance Criteria

An impact would be potentially significant if implementation of groundwater substitution transfers or cropland idling would result in:

- A net reduction in groundwater levels that would result in substantial adverse environmental effects or effects to non-transferring parties;
- Permanent land subsidence caused by significant groundwater level declines; or~~.~~
- Degradation in groundwater quality such that it would exceed regulatory standards or would substantially impair reasonably anticipated beneficial uses of groundwater~~; or~~.

3.3.2.3 Alternative 1: No Action/No Project

3.3.2.3.1 Seller Service Area

Groundwater pumping would not affect groundwater levels, land subsidence, or groundwater quality. There would be no groundwater substitution pumping transfers in the Seller Service Area under the No Action/No Project Alternative. Groundwater pumping would be expected to continue on the same pattern as currently observed. Therefore, the potential for groundwater level declines, increased land subsidence, or groundwater quality degradation in the Seller Service Area would be the same as existing conditions.

3.3.2.3.2 Buyer Service Area

Increased groundwater pumping would not result in temporary groundwater level declines. Under the No Action/No Project Alternative, water users in the Buyer Service Area may use groundwater pumping to meet shortages, which could result in temporary groundwater level declines. Potential buyers have already taken steps to address shortages that have occurred in recent years, and several potential buyers rely heavily on groundwater to meet their water supply demands (see Table 3.3-~~2~~4 for details). Groundwater pumping in these areas has the potential to lower groundwater levels and affect the performance of wells nearby the pumping wells. However, existing pumping activities in the Buyer Service Area already include groundwater pumping to cover existing shortages, and future shortages are anticipated to follow current annual/seasonal and long-term trends. Therefore, the potential for groundwater level declines in the Buyer Service Area would be the same as existing conditions.

Table 3.3-4. Historic Groundwater Pumping and Groundwater Basin Safe Yields for Potential Buyers

Potential Buyer Agency	Underlying Groundwater Basin	Safe Yield of Groundwater Basin (AF)	Groundwater Pumping (AF/year)
Westlands WD[1]	Westside Subbasin	200,000	15,000 – 600,000[2]
Santa Clara Valley WD[3]	Santa Clara Plain Subbasin	373,000 – 383,000	93,500 - 122,300[4]
	Llagas Subbasin	150,000 – 165,000	41,600 - 49,700[4]
Contra Costa WD[5]	-	-	3,000

[1] Source: Westlands WD 1996 1 Based on data from 1988 to 2011.
[2] Average pumping is approximately 218,600 AF/yr
[3] Source: Santa Clara Valley WD 2012
[4] Based on data from 2000 to 2009.Average pumping is approximately 156,330 AF/yr
[5] Source: Contra Costa WD 2011

Groundwater pumping would not cause groundwater level declines that would lead to permanent land subsidence or migration of poor quality groundwater. In the Buyer Service Area, additional groundwater pumping may be expected during shortage periods. However, pumping activities in the Buyer Service Area already include groundwater pumping to cover shortages. Therefore, the potential for groundwater level declines that would cause permanent land subsidence or migration of poor quality groundwater in the Buyer Service Area would be the same as existing conditions.

Idling cropland would not decrease applied water recharge to the local groundwater system underlying the barren (idled) fields that would result in a decline in groundwater levels. Under the No Action/No Project Alternative, agricultural water users in the Buyer Service Area may increase the amount of cropland idling to meet shortages and reduce the amount of groundwater recharge. However, cropland idling activities in the Buyer Service Area already include actions to cover shortages. Therefore, the potential for changes in groundwater levels due to cropland idling in the Buyer Service Area would be the same as existing conditions.

3.3.2.4 Alternative 2: Full Range of Transfers (Proposed Action)

3.3.2.4.1 Seller Service Area: Redding Area Groundwater Basin

Increased groundwater substitution pumping could affect groundwater levels and may result in temporary declines of groundwater levels. The proposed Anderson-Cottonwood ID transfer would extract up to 5,130 AF/year of groundwater from production wells (see Table 3.3-~~3~~5 for details on number of wells and pumping capacity).

Unlike other groundwater substitution transfers, Anderson-Cottonwood ID's proposed transfer was not simulated in the SACFEM2013 because the model area does not include the Redding Area Basin. However, Anderson-Cottonwood ID has tested operation of these wells in the past at similar production rates and has observed no substantial impacts on groundwater levels or groundwater supplies (Anderson-Cottonwood ID 2013). Based on the results of the aquifer tests, effects from groundwater substitution transfers are likely to be less than significant. However, because of the uncertainty surrounding groundwater levels changes, especially during a very dry year, Anderson-Cottonwood ID would implement the Monitoring and Mitigation Plans described in GW-1 (see Section 3.3.4.1 for details).

Increased groundwater pumping may lead to permanent land subsidence caused by water level declines. Land subsidence has not been monitored in the Redding Area Groundwater Basin. However, there would be potential for subsidence in some areas of the basin if groundwater levels were substantially lowered. The groundwater basin west of the Sacramento River is composed of the Tehama Formation; this formation has exhibited subsidence in Yolo County and the similar hydrogeologic characteristics in the Redding Area Groundwater Basin could allow subsidence. Therefore, the effect of potential land subsidence in the Redding Area Groundwater Basin could be significant. To reduce these effects, the Mitigation Measure GW-1 (Section 3.3.4.1) specifies that transferring agencies establish monitoring and mitigation programs for groundwater substitution transfers. These programs will include periodic determination of land surface elevation in strategic locations throughout the transfer area. Mitigation Measure GW-1 would reduce the impacts to less than significant.

Changes in groundwater levels, or in the prevailing groundwater flow regime, could cause a change in groundwater quality. Additional pumping is not expected to be in locations or at rates that would cause substantial long-term changes in groundwater levels that would cause changes to groundwater quality. Consequently, changes to groundwater quality due to increased pumping would be less than significant in the Redding Area Groundwater Basin.

3.3.2.4.2 Seller Service Area: Sacramento Valley Groundwater Basin

Water Transfers via groundwater substitution could affect groundwater levels, land subsidence, and groundwater quality. Figure 3.3-~~25~~27 shows the potential water transferred through groundwater substitution through the period of analysis under the Proposed Action in the SACFEM2013 Model.

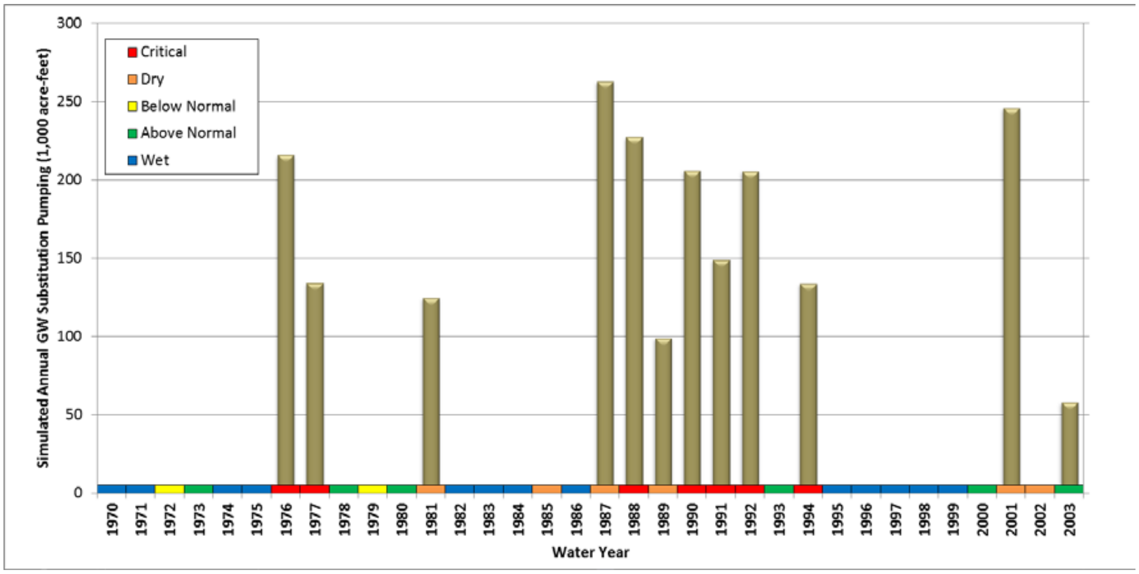

Figure 3.3-~~25.~~-27. Simulated Groundwater Substitution Transfers under the Proposed Action in the SACFEM2013 Model

Increased groundwater substitution pumping may result in temporary declines of groundwater levels. Groundwater substitution pumping would occur when the buyers have capacity to divert the water from the Sacramento River or the Delta.

The effects of the potential groundwater substitution shown in Figure 3.3-~~25~~27 from pumping 327 wells simultaneously based on data collected from potential sellers (listed in Table 3.3-~~3~~5) within the Sacramento Valley have been modeled in SACFEM2013 to estimate effects to groundwater resources. Additional information about the assignment of groundwater pumping in SACFEM2013 can be found in Appendix D, Groundwater Model Documentation. Figures 3.3-~~26~~28 through 3.3-~~28~~30 show the simulated drawdown of groundwater elevations under September 1976 hydrologic conditions (WY 1976 was historically a critical dry year). This time period represents the peak drawdown resulting from the first year of transfers in the groundwater model simulation period (WY 1970 through WY 2003). These figures show simulated drawdown at the water table (Figure 3.3-~~26~~28); at approximately 200-300 feet bgs (Figure 3.3-~~27~~29) and at approximately 700-900 feet bgs (Figure 3.3-~~28~~30). Drawdown at the water table (Figure 3.3-~~26~~28) represents the estimated decline in the water surface within the shallow, unconfined portion of the aquifer (i.e., the height of water within a shallow groundwater well). The changes in the deeper portion of the aquifer (Figure 3.3-~~27~~29 and Figure 3.3-~~28~~30) represent a change in piezometric head in a well that is screened in this lower portion of the aquifer.

A decrease in the head in the deeper aquifer would increase the work (and energy) required to withdraw the same amount of water from the deeper aquifer. The amount of drawdown in a deep well would vary depending on the aquifer characteristics, depth and screened interval of the well.

Similarly, Figures 3.3-2931 through 3.3-3133 show the simulated drawdown of groundwater elevations under September 1990 hydrologic conditions. This period represents the fourth year of a multi-year drought with transfers occurring in each year of the drought. Similar to the September 1976 figures, drawdown in 1990 is shown for the water table (Figure 3.3-2931); at approximately 200-300 feet bgs (Figure 3.3-3032) and at approximately 700-900 feet bgs (Figure 3.3-3133). Each of these figures show the cumulative effects of multi-year transfers as groundwater substitution pumping was simulated in 1987, 1988, 1989, and 1990. Because groundwater substitution transfers were simulated during each year of this drought period, the groundwater table does not completely recover to pre-substitution conditions during this period. Groundwater level drawdown and subsequent recovery are can also be viewed at a specific location through the entire 33 year simulation period. Representative hydrographs were extracted from the model results at the 42 locations shown with pink triangles in Figures 3.3-2628 through 3.3-3133. Appendix E, Groundwater Modeling Results, includes hydrographs for all 42 locations and seven simulated model layers (varying depths throughout the model).

Three Five of the 42 locations are presented here to illustrate the simulated groundwater drawdown and recovery process within the Sacramento Valley. These three five locations were selected as they are spread out over the Sacramento Valley and are shows the largest drawdowns within the 42 representative hydrograph locations.

Table 3.3-5. Water Transfer through Groundwater Substitution under the Proposed Action

Groundwater Basin	Potential Seller	Number of Wells	Pumping Rate per well (gpm)	Well Depth (ft)
Redding Area Valley	Anderson-Cottonwood ID	2	1,000-5,500	150-455
Sacramento Valley	Butte WD	2	4,000-4,200	263-580
	City of Sacramento	32	373-1,400	80-578
	Conaway Preservation Group	37	1,400-3,500	70-580
	Cordua ID	23	900-2,400	200-400
	Cranmore Farms	6	3,000-3,000	150-275
	Eastside MWC	1	3,800-3,800	150-240
	Garden Highway MWC	7	2,200-3,200	90-235
	Glenn-Colusa ID	11	2,389-3,305	500-1200
	Gilsizer Slough Ranch	3	2,016-2,016	150-275
	Goose Club Farms and Teichert Aggregates	13	3,000-3,000	150-275
	Natomas Central MWC	13	5,500-5,500	150-350
	Pelger MWC	3	4,700-4,700	101-485
	Pleasant Grove-Verona MWC	32	1,500-5,000	99-300
	Pope Ranch	2	2,117-2,117	150-275
	RD 1004	20	1,000-5,800	56-430
	RD 108	5	1,700-5,900	250-680
	RD 2068	4	1,500-1,500	209-438
	River Garden Farms	7	1,700-2,990	170-686
	Sacramento County Water Agency	39	455-3,000	170-1368
	Sacramento Suburban WD	47	180-3,500	131-750
	Sycamore MWC	12	2,500-3,500	256-900
	Te Velde	5	2,200-4,656	115-300
	Tule Basin Farms	3	3,050-4,850	150-275

Key:
ft = feet
gpm = gallons per minute
ID = Irrigation District
MWC = Mutual Water Company
RD = Reclamation District
WD = Water District

Location 21 is near Sycamore Mutual Water Company and is in the northwestern portion of the Sacramento Valley approximately four miles from the Sacramento River and Butte Creek intersection and two miles from the Sacramento River and Sycamore Creek intersection. Figures 3.3-~~32~~34a and 3.3-~~33~~34b show the simulated groundwater ~~level~~elevation over time ~~(i.e., hydrographs)~~ at Location 21. Groundwater levels at this location return to near-baseline conditions approximately three to four years after the single year ~~groundwater~~groundwater substitution transfer event in WY 1981. Recovery occurs after approximately six years following the multi-year transfer event from WY 1986 to WY 1994. ~~These drawdown and recovery periods are shown in Figure 3.3-34.~~Figure 3.3-34c shows the change in groundwater level between the baseline and the proposed action. Most of the recovery near the pumping zone occurs in the year following the transfer event. Recovery at the water table was more gradual. Groundwater level recovery is highly dependent on (1) hydrology of in the following year following the groundwater substitution tranfer,; (2) proximity of the pumping well to surface water and; (3) pumping in the following year (i.e., if the subsequent year also includes groundwater substitution transfer pumping); and (4) aquifer properties.

Location 14 is near Cordua ID in the northeastern portion of the valley and approximately three miles from the Yuba River. Figures 3.3-3535a and 3.3-3635b show the simulated groundwater level head over time at Location 14. Groundwater recovery at this location takes longer than at Location 21 (see Figure 3.3-37).35c which plots simulated changes in groundwater levelhead). It should be noted that Location 14 is located near the boundary of the model where the aquifer is thinner.

Location 31 is near the Sacramento County Water Agency in the southeastern portion of the Valley and approximately six miles from the American River. Figures 3.3-3836a and 3.3-3936b show the simulated groundwater level head over time at Location 31. Figure 3.3-4036c shows the change in groundwater heads at Location 31. Groundwater recovery at Location 31 is slower than at Location 21. Similar to Location 21 most of the recovery near the pumping zone occurs in the year after the transfer event. Groundwater levels return to approximately 75 percent of the baseline level five years after the single year transfer event in WY 1981 and between 50-75 percent six years after the multi-year transfer event from WY 1986 to WY1994 (see Figure 3.3-4036c).

Location 4 is near Butte Water District in the northwestern portion of the valley and approximately four miles from the Feather River and twelve miles from the Butte River. Figures 3.3-37a and 3.3-37b show the simulated groundwater level head over time at Location 4. Though the magnitude of drawdown at Location 4 is lesser than Location 31, the recovery period is nearly identical (see Figure 3.3.37c).

Location 6 is near Glenn-Colusa ID in the northern portion of the valley and approximately a mile and half from the confluence of the Sacramento River and Stony Creek. Figures 3.3-38a and 3.3-38b show the simulated groundwater level over time at Location 6. Groundwater levelshead at this location almost completely recover four years after a single year transfer event and six years after a multi-year transfer event from WY-1988 to WY 1991.

Most areas in the model exhibit smaller drawdown changes than those shown in Figure 3.3-3234 through Figure 3.3-4038. Appendix E, Groundwater Modeling Results, includes hydrographs for all 42 representative hydrograph locations.

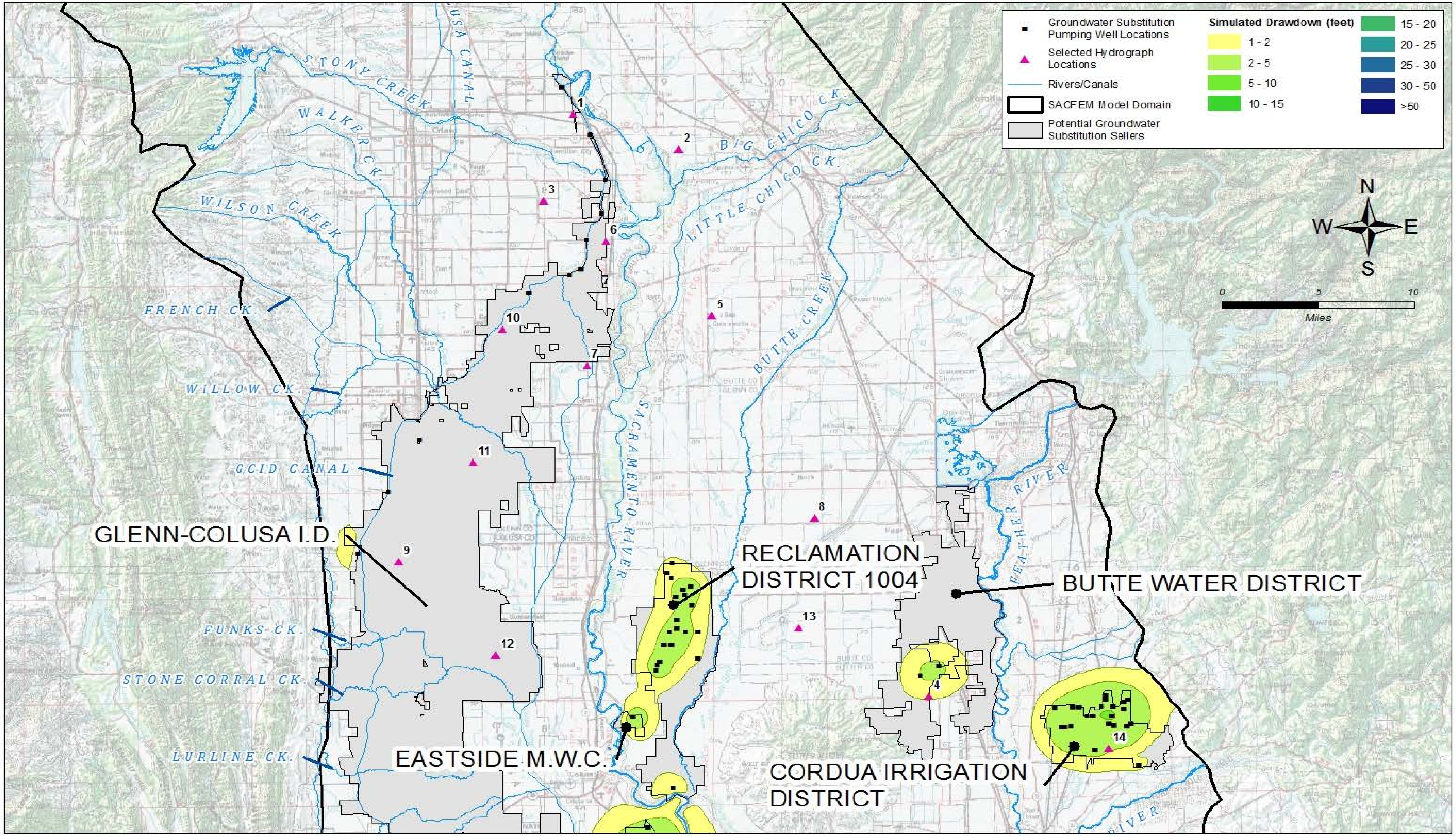

Figure 3.3-~~26.~~-28a. Simulated Change in Water Table Elevation (Aquifer Depth up to Approximately 35 feet), Based on September 1976 Hydrologic Conditions

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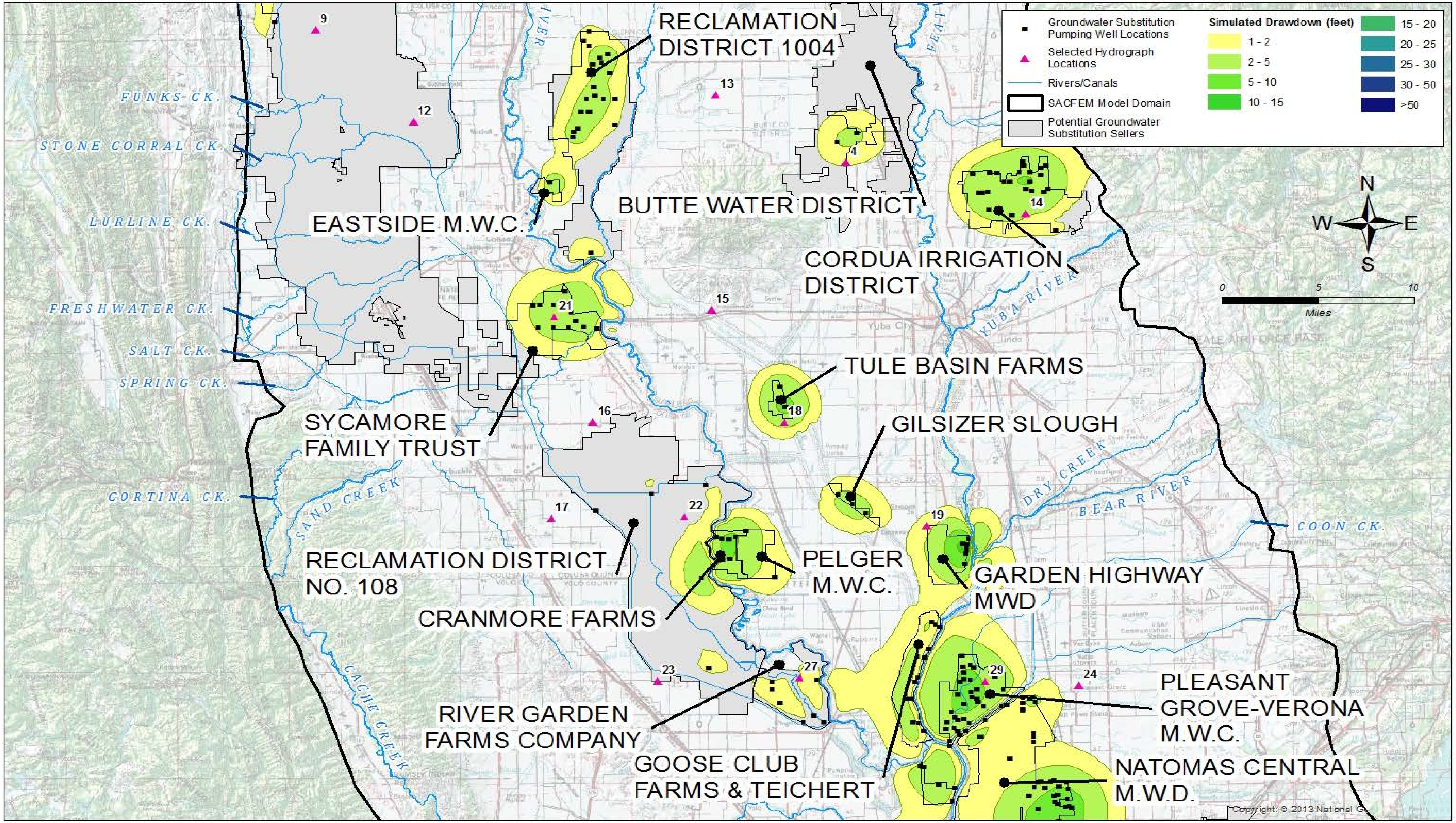

<u>**Figure 3.3-28b. Simulated Change in Water Table Elevation (Aquifer Depth up to Approximately 35 feet), Based on September 1976 Hydrologic Conditions**</u>

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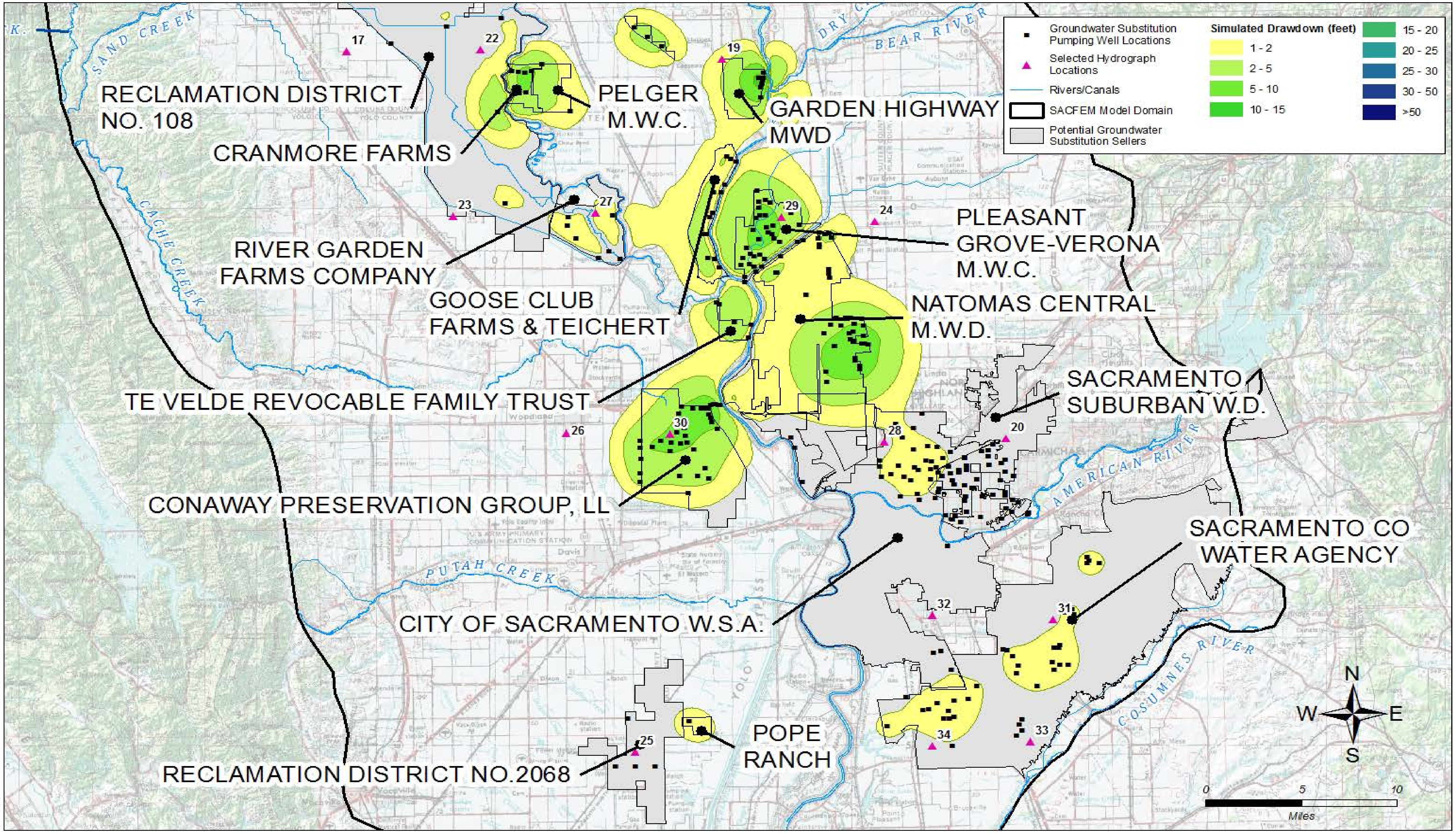

Figure 3.3-28c. Simulated Change in Water Table Elevation (Aquifer Depth up to Approximately 35 feet), Based on September 1976 Hydrologic Conditions

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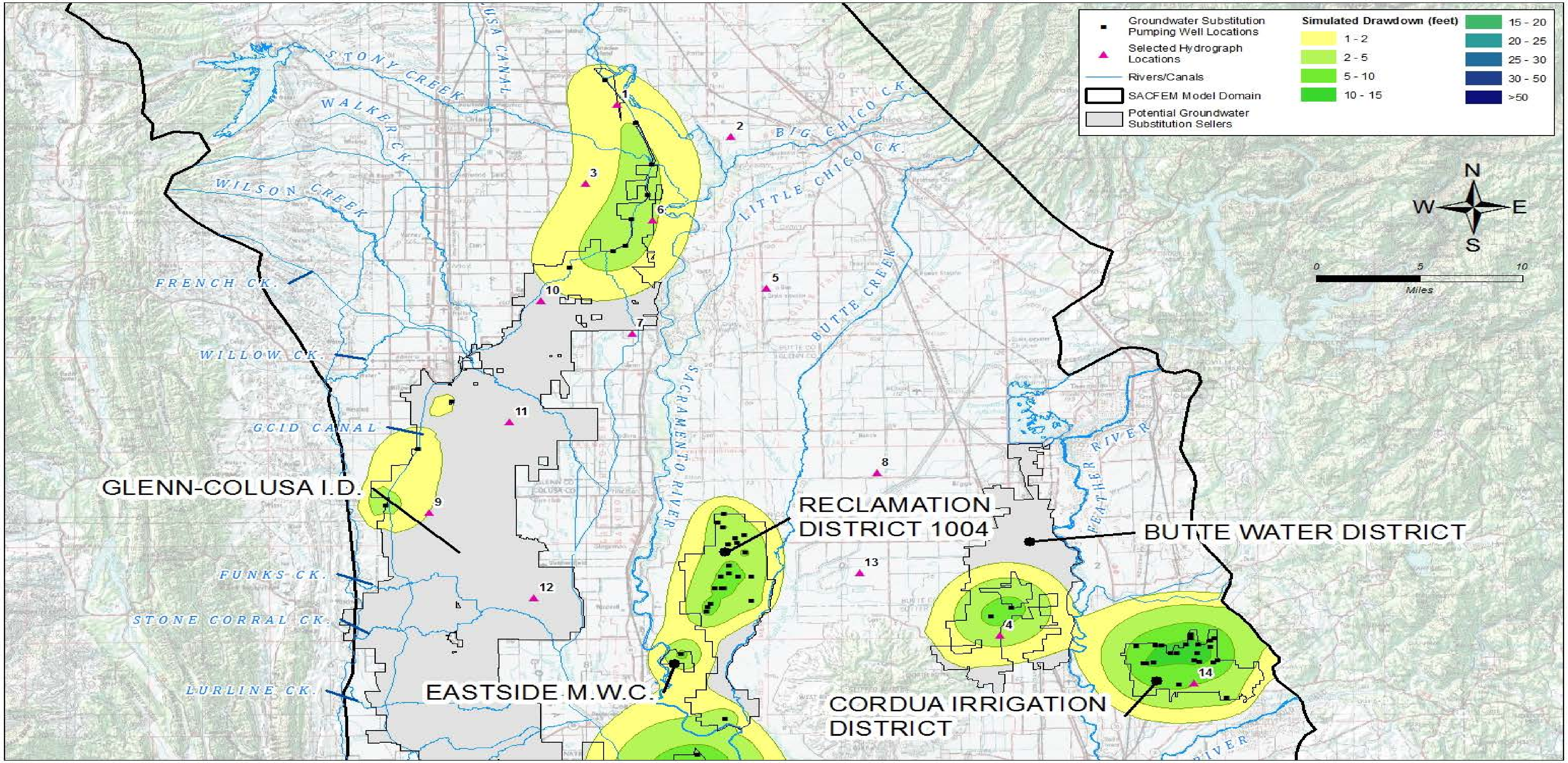

Figure 3.3-29a. Simulated Change in Groundwater Head (Aquifer Depth of Approximately 200 to 300 feet), Based on September 1976 Hydrologic Conditions

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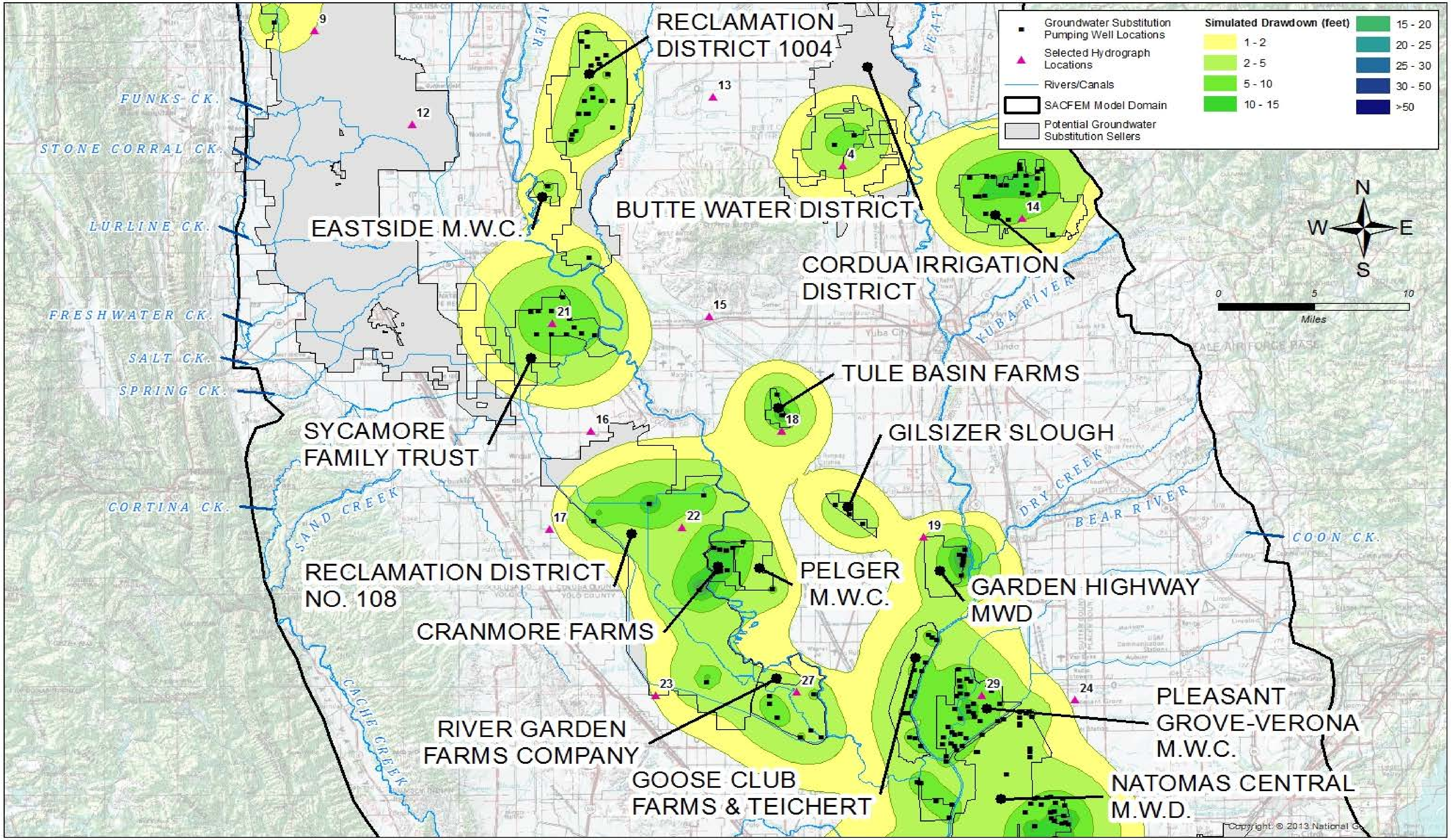

Figure 3.3-29b. Simulated Change in Groundwater Head (Aquifer Depth of Approximately 200 to 300 feet), Based on September 1976 Hydrologic Conditions

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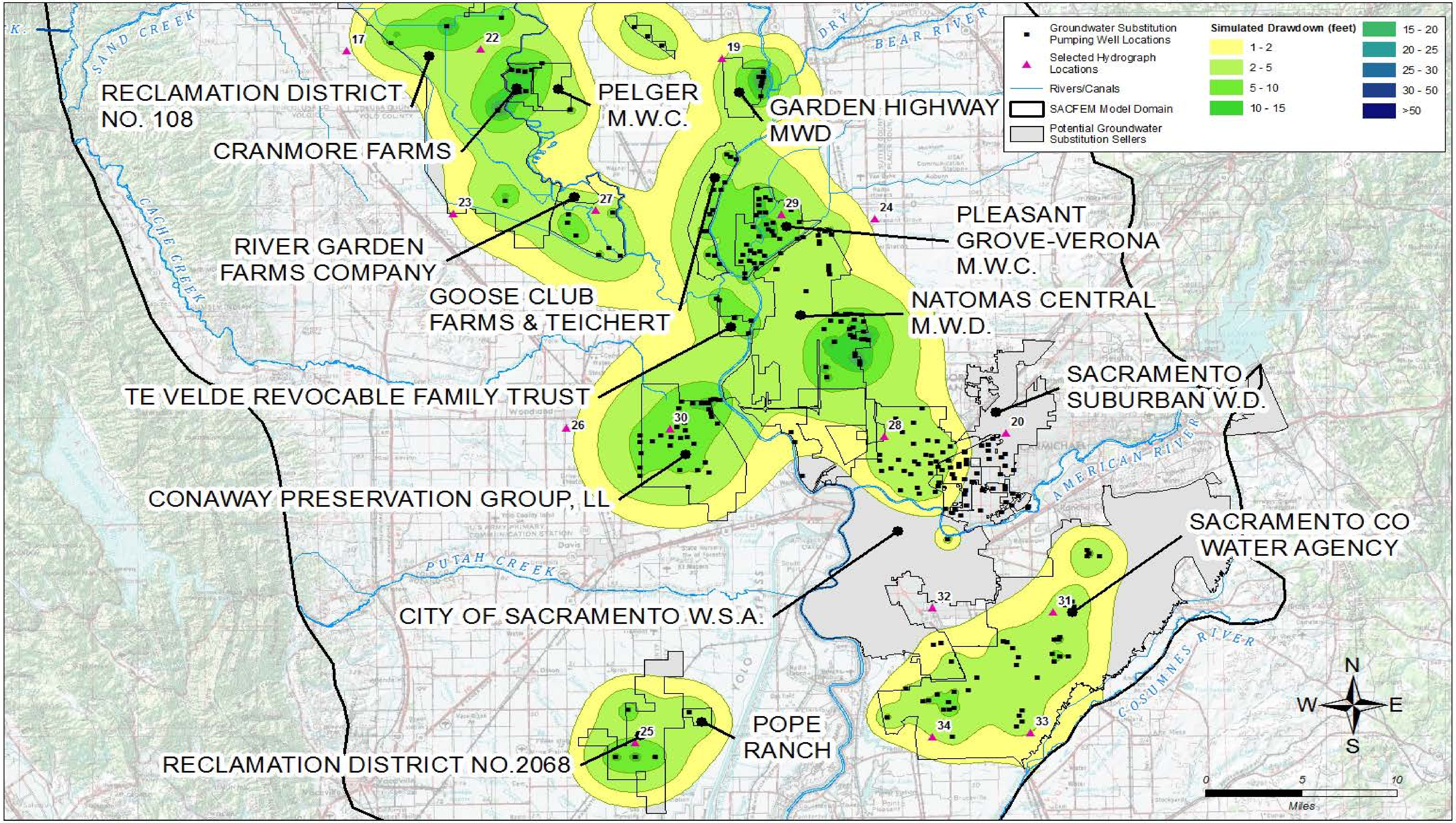

Figure 3.3-29c. Simulated Change in Groundwater Head (Aquifer Depth of Approximately 200 to 300 feet), Based on September 1976 Hydrologic Conditions

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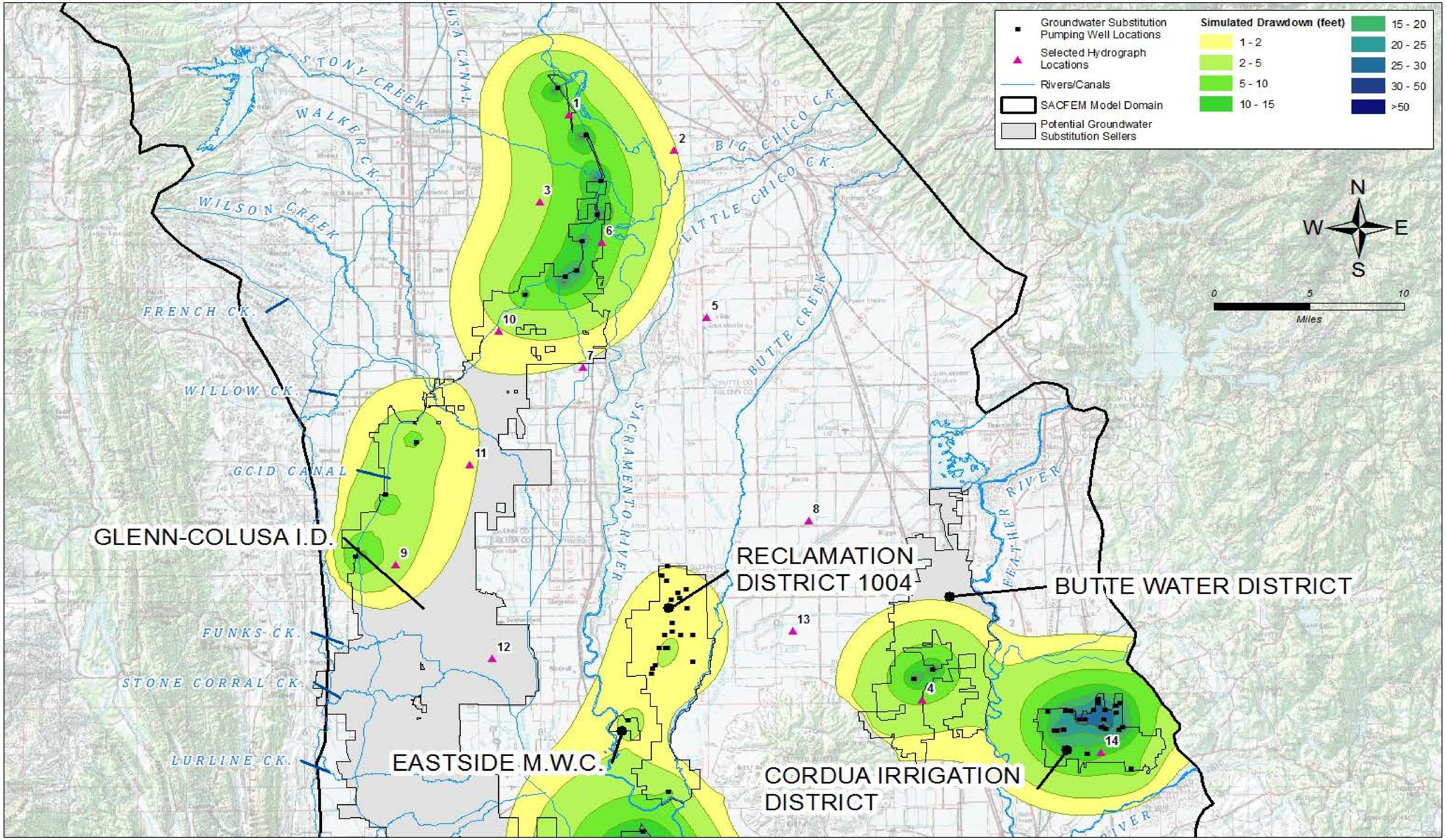

Figure 3.3-30a. Simulated Change in Groundwater Head (Aquifer Depth of Approximately 700 to 900 feet), Based on September 1976 Hydrologic Conditions

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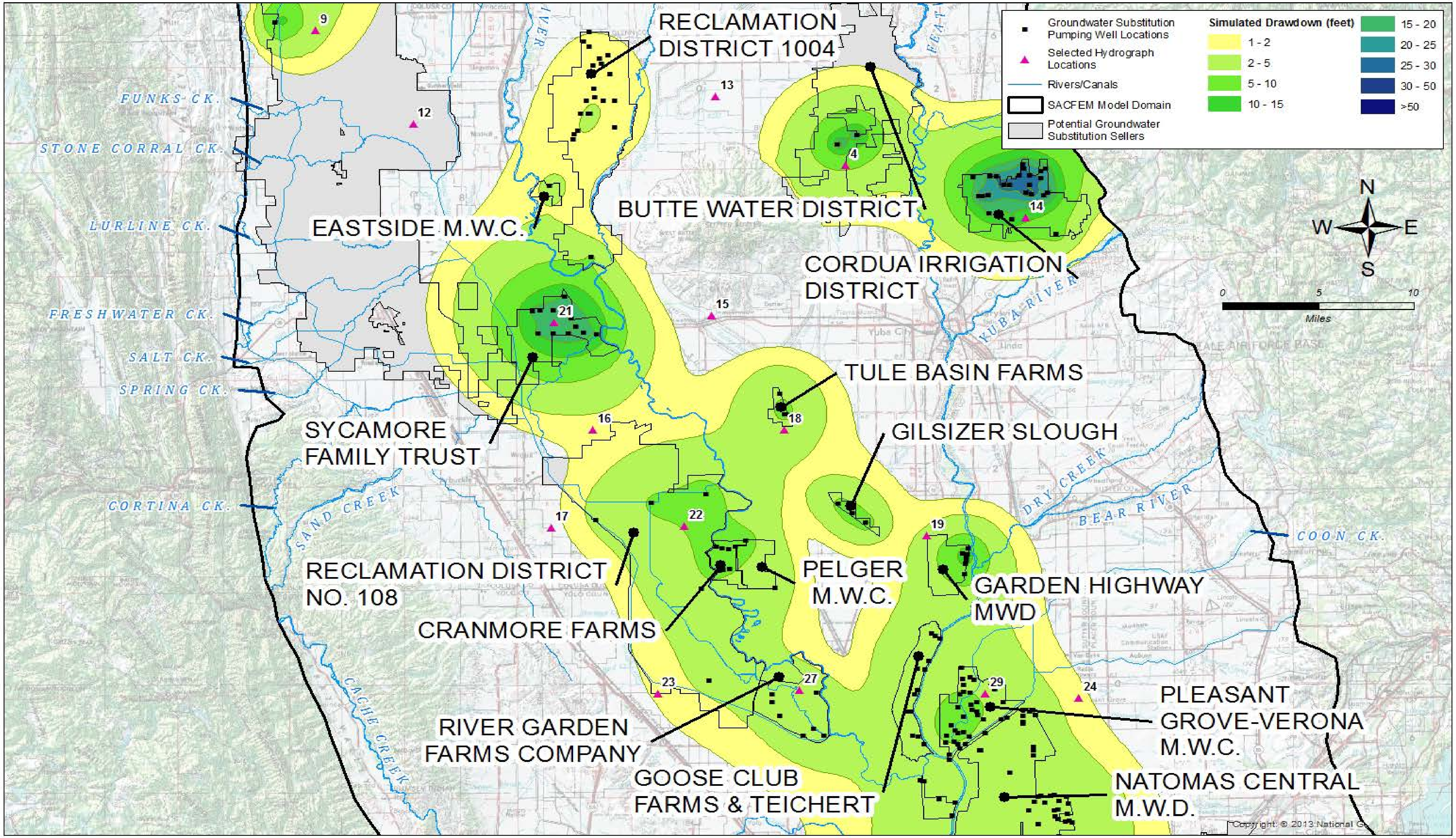

Figure 3.3-~~29.~~-30b. Simulated Change in Groundwater Head (Aquifer Depth of Approximately 700 to 900 feet), Based on September 1976 Hydrologic Conditions

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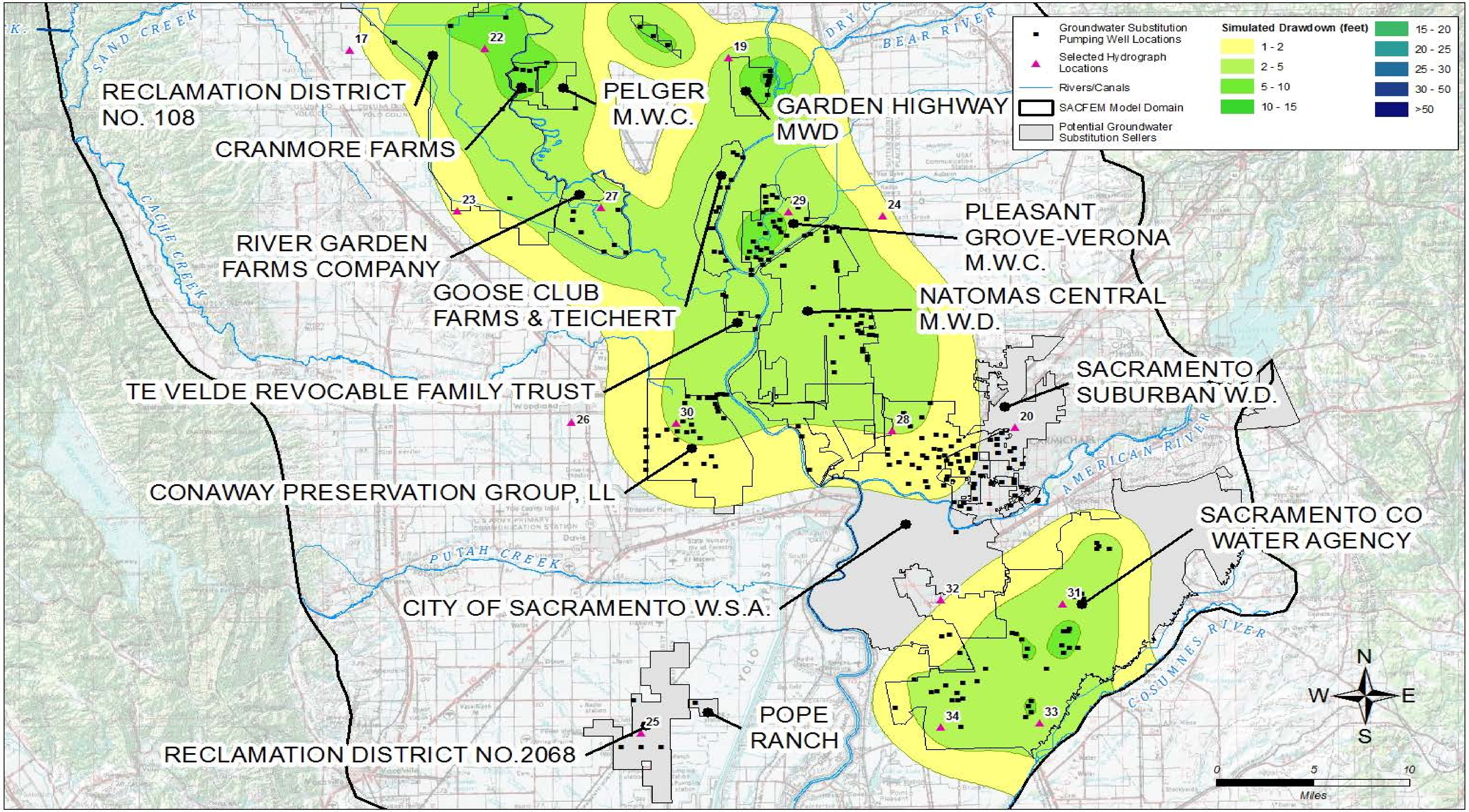

Figure 3.3-30c. Simulated Change in Groundwater Head (Aquifer Depth of Approximately 700 to 900 feet), Based on September 1976 Hydrologic Conditions

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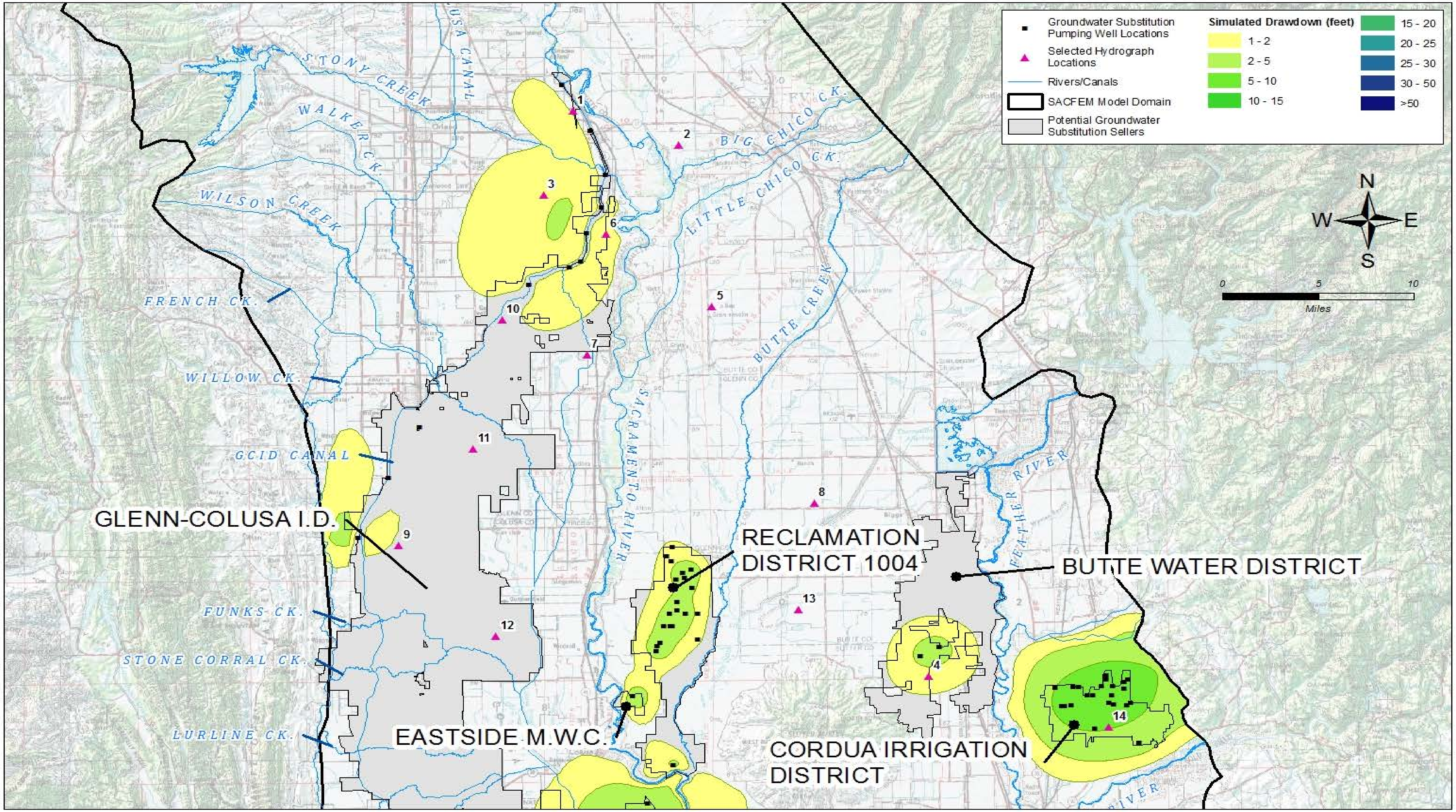

Figure 3.3-31a. Simulated Change in Water Table Elevation (Aquifer Depth up to Approximately 35 feet), Based on September 1990 Hydrologic Conditions

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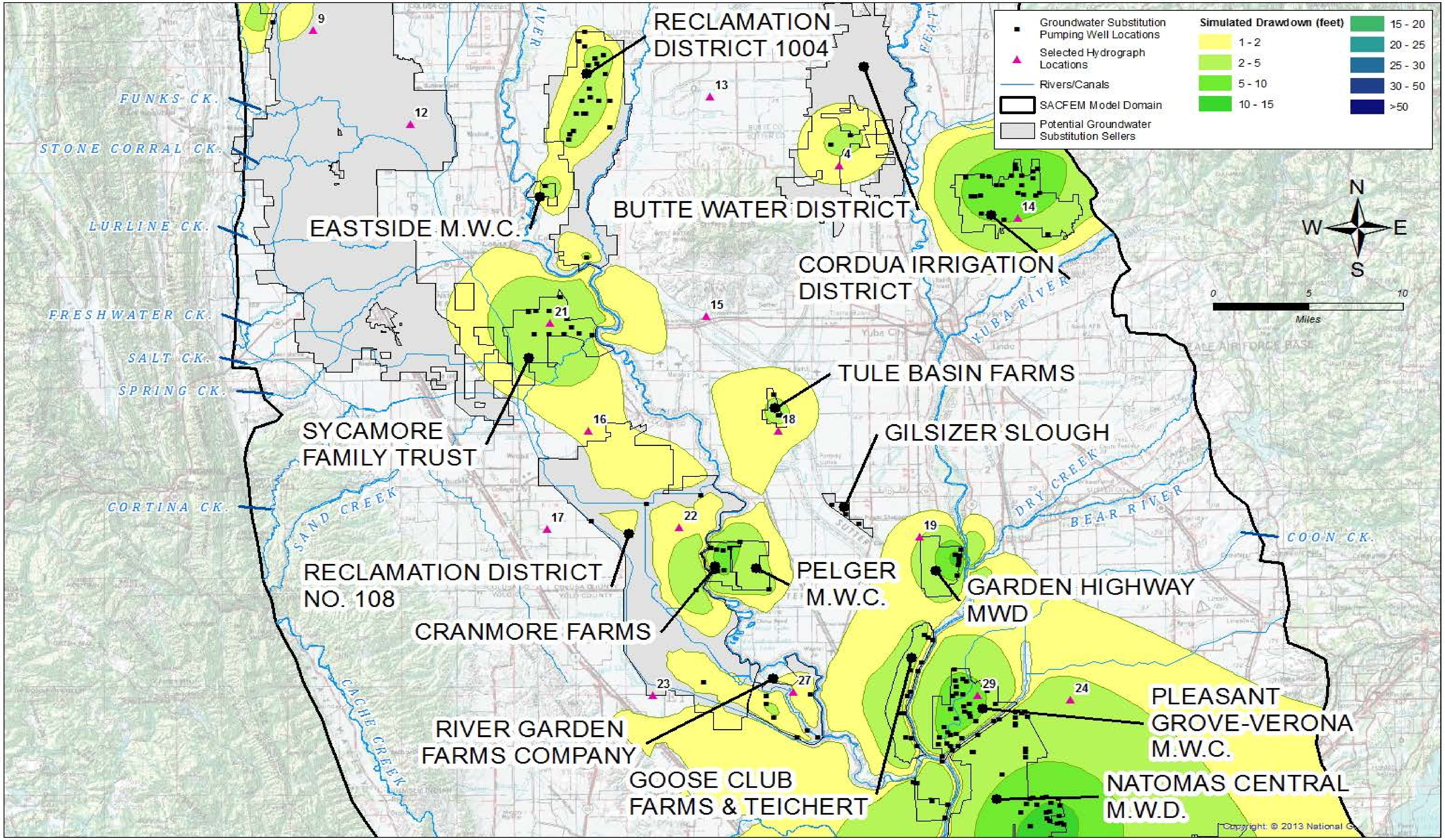

Figure 3.3-30.-31b. Simulated Change in Water Table Elevation (Aquifer Depth up to Approximately 35 feet), Based on September 1990 Hydrologic Conditions

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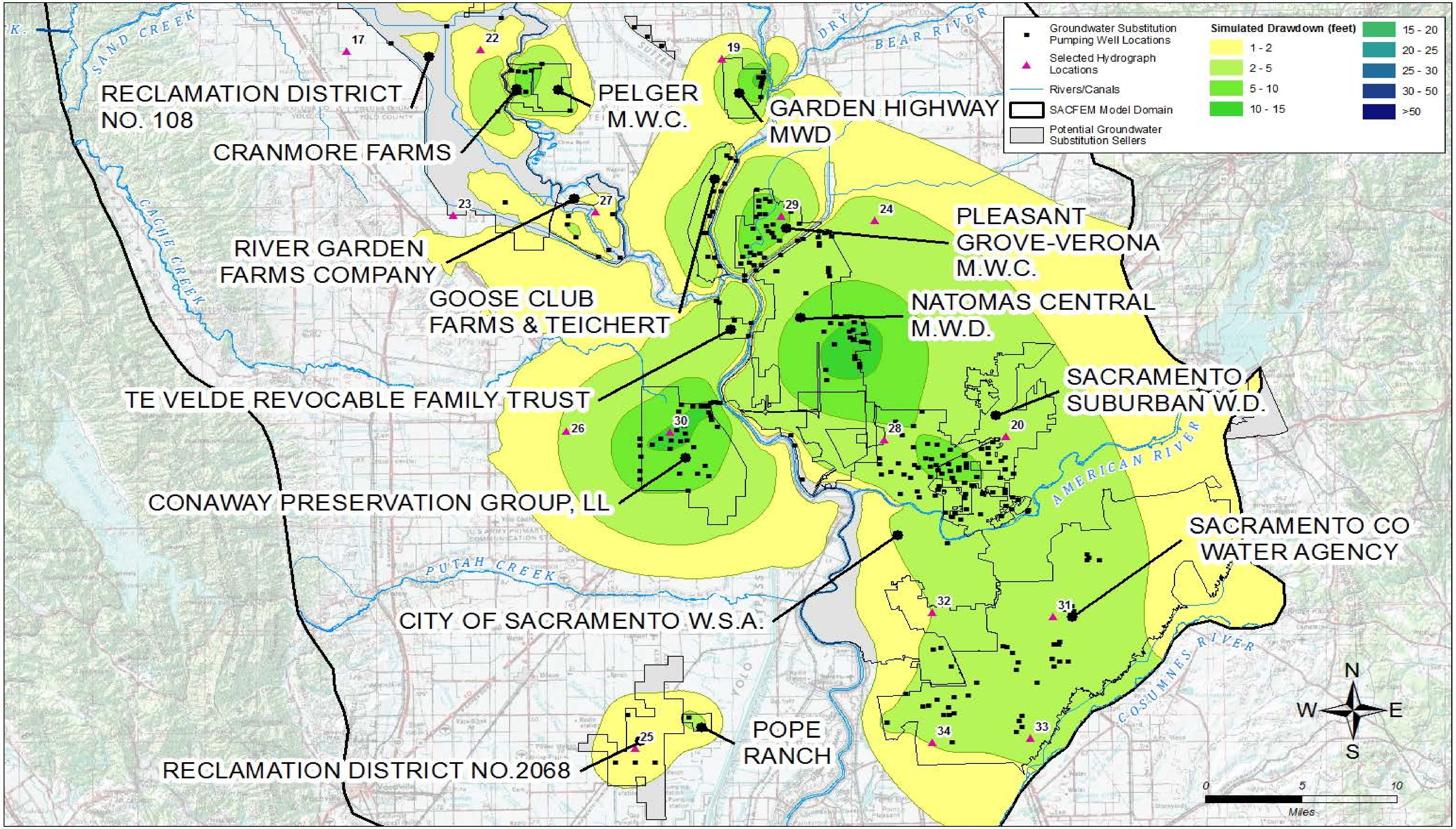

Figure 3.3-31c. Simulated Change in Water Table Elevation (Aquifer Depth up to Approximately 35 feet), Based on September 1990 Hydrologic Conditions

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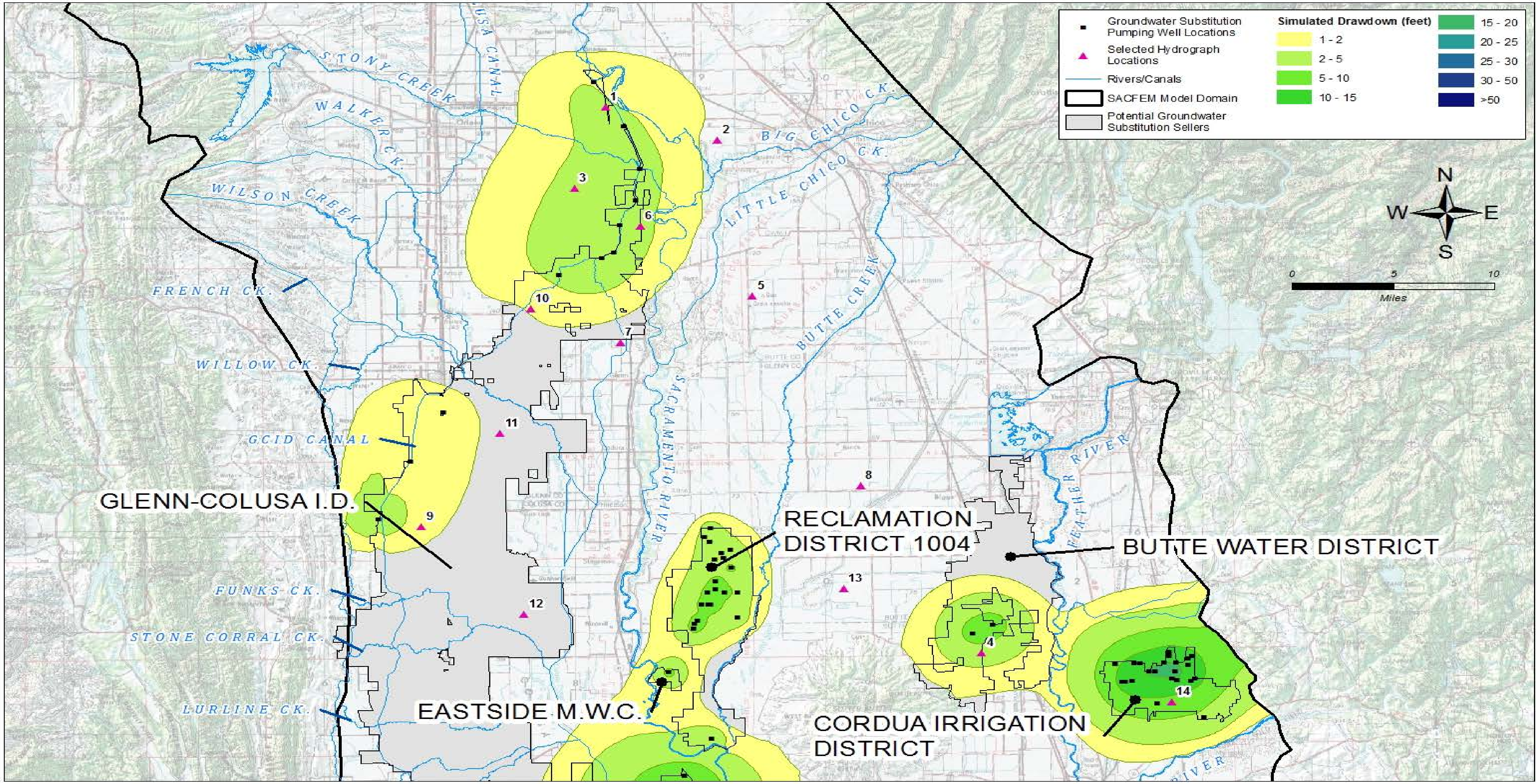

Figure 3.3-32a. Simulated Change in Groundwater Head (Aquifer Depth of Approximately 200 to 300 feet), Based on September 1990 Hydrologic Conditions

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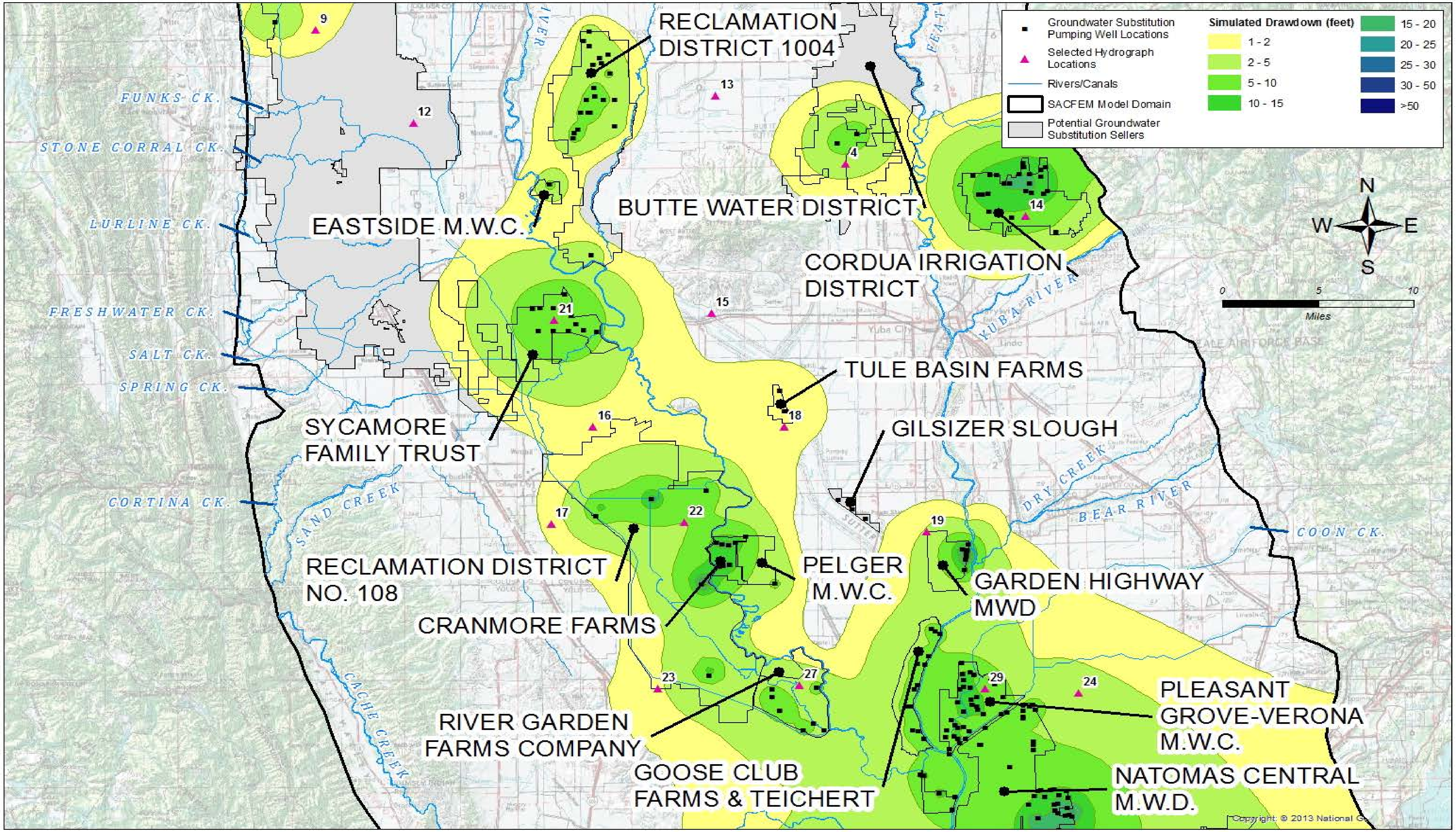

Figure 3.3-~~31.~~-32b. Simulated Change in Groundwater Head (Aquifer ~~depth~~Depth of Approximately 200 to 300 feet), Based on September 1990 Hydrologic Conditions

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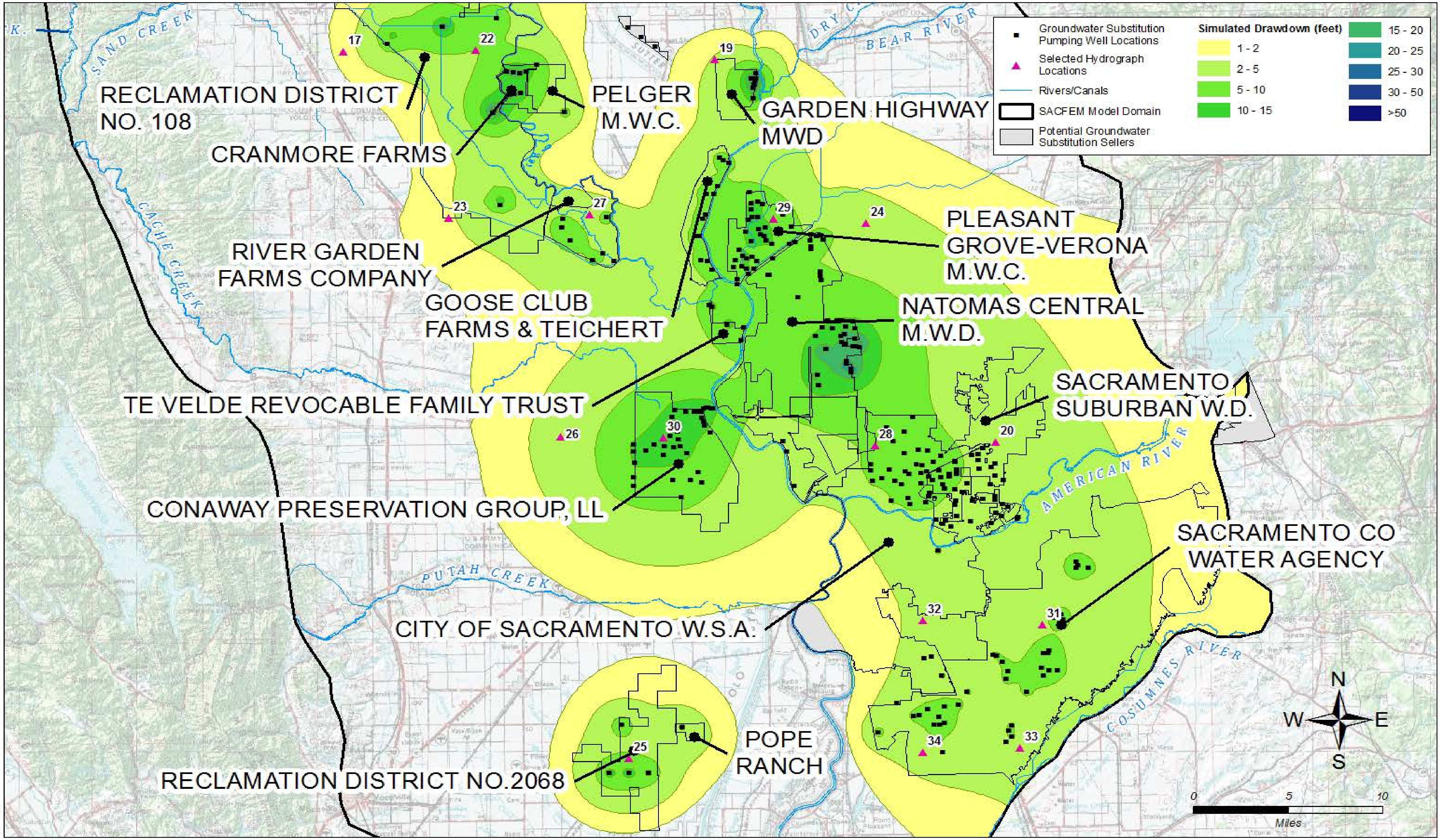

Figure 3.3-32c. Simulated Change in Groundwater Head (Aquifer Depth of Approximately 200 to 300 feet), Based on September 1990 Hydrologic Conditions

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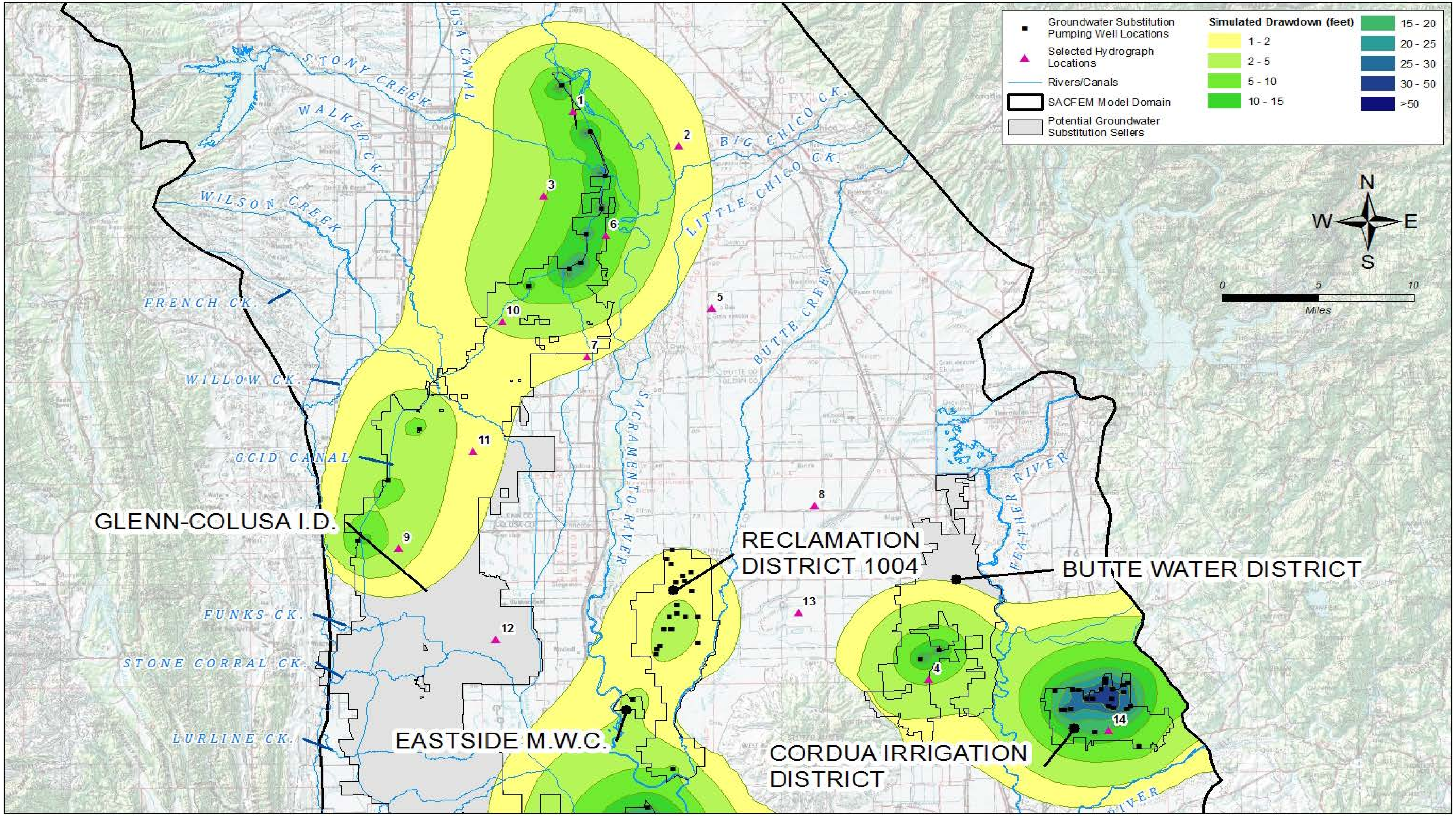

Figure 3.3-33a. Simulated Change in Groundwater Head (Aquifer Depth of Approximately 700- to 900 feet), Based on September 1990 Hydrologic Conditions

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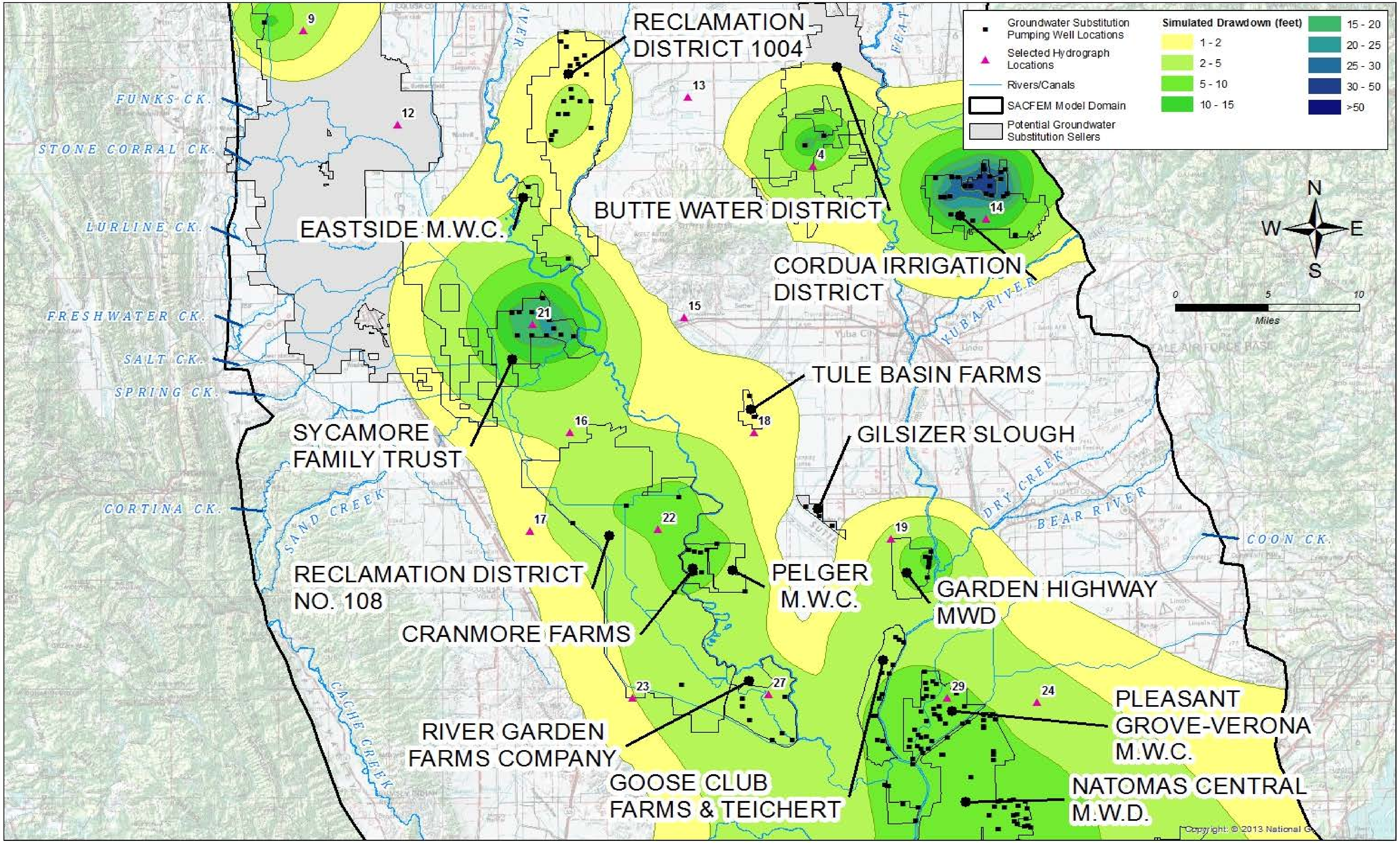

Figure 3.3-~~32.~~-33b. Simulated Change in Groundwater ~~Table Elevation (~~Head (Aquifer Depth of Approximately 700 to 900 feet), Based on September 1990 Hydrologic Conditions

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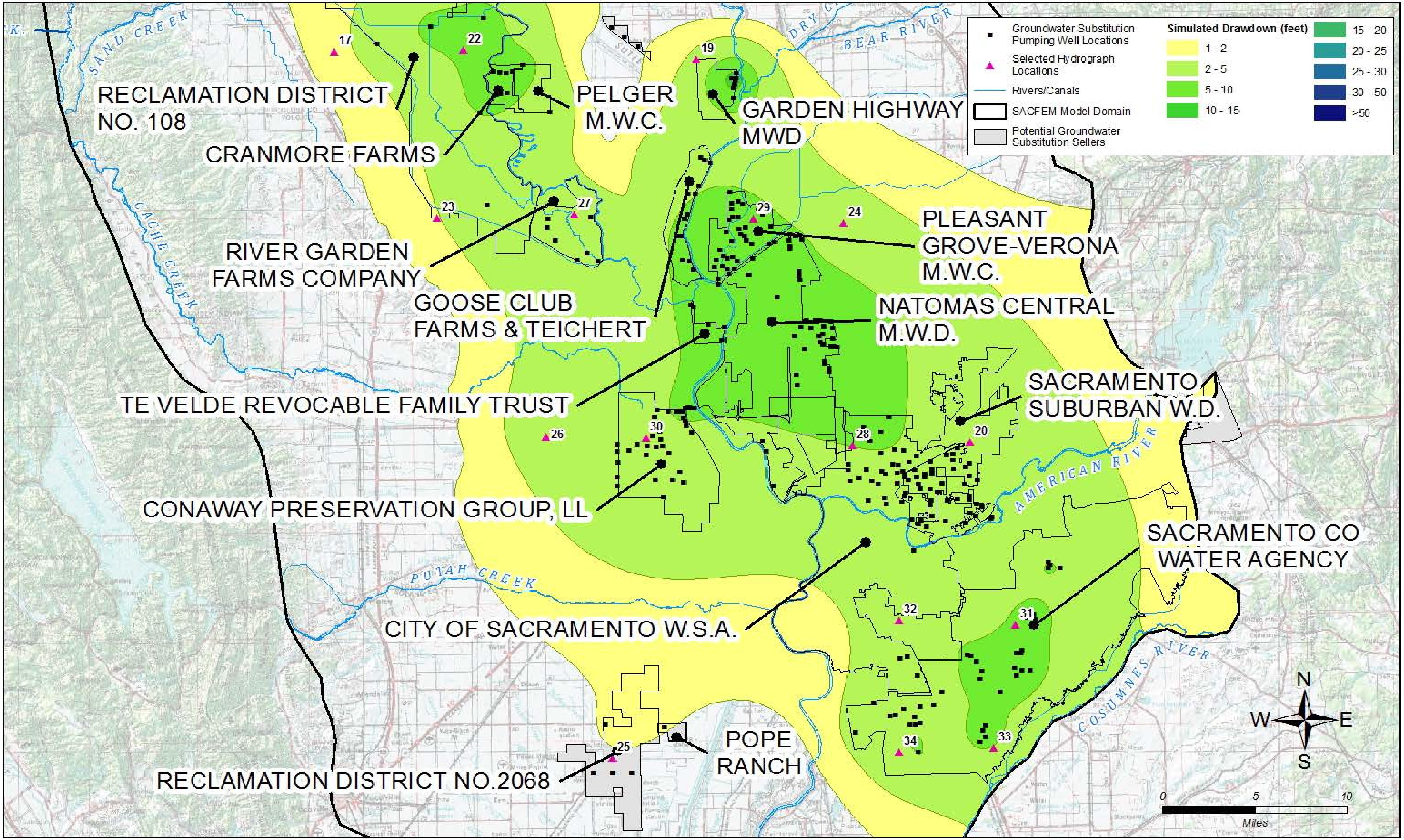

Figure 3.3-33c. Simulated Change in Groundwater Head (Aquifer Depth of Approximately 700 to 900 feet), Based on September 1990 Hydrologic Conditions

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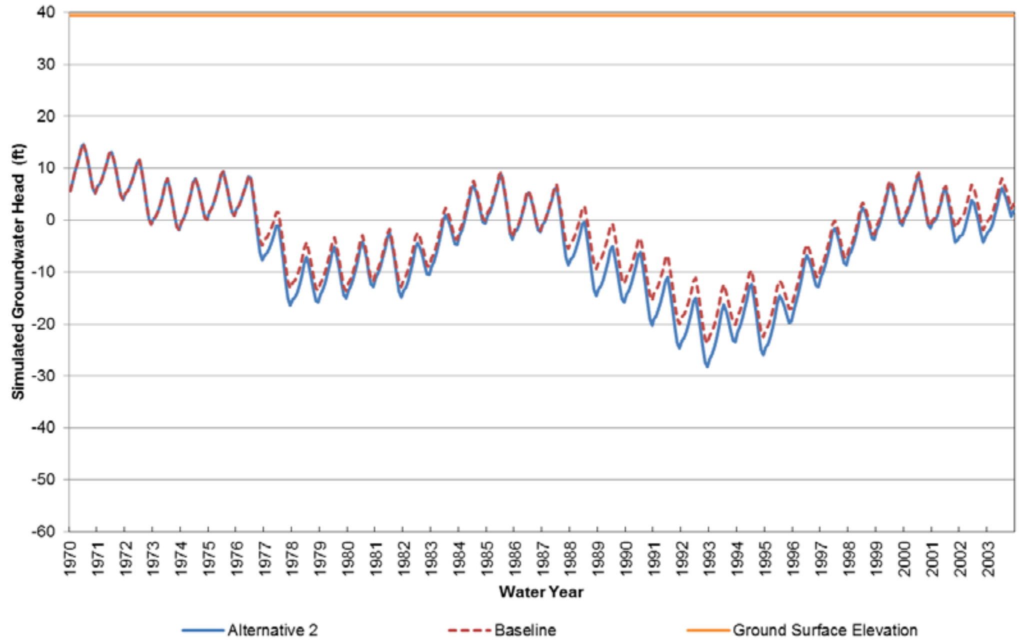


Figure 3.3-34a. Simulated Groundwater Head (Approximately 0-70 feet bgs) at Location 21

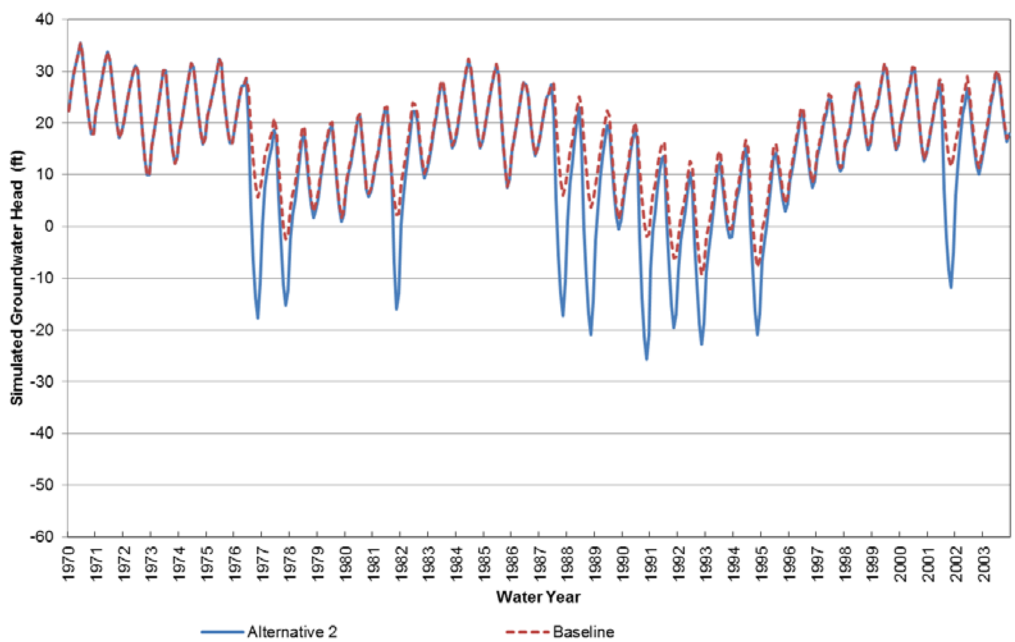


Figure 3.3-~~33.~~-34b. Simulated Groundwater Head (Approximately 690-910 feet bgs) at Location 21

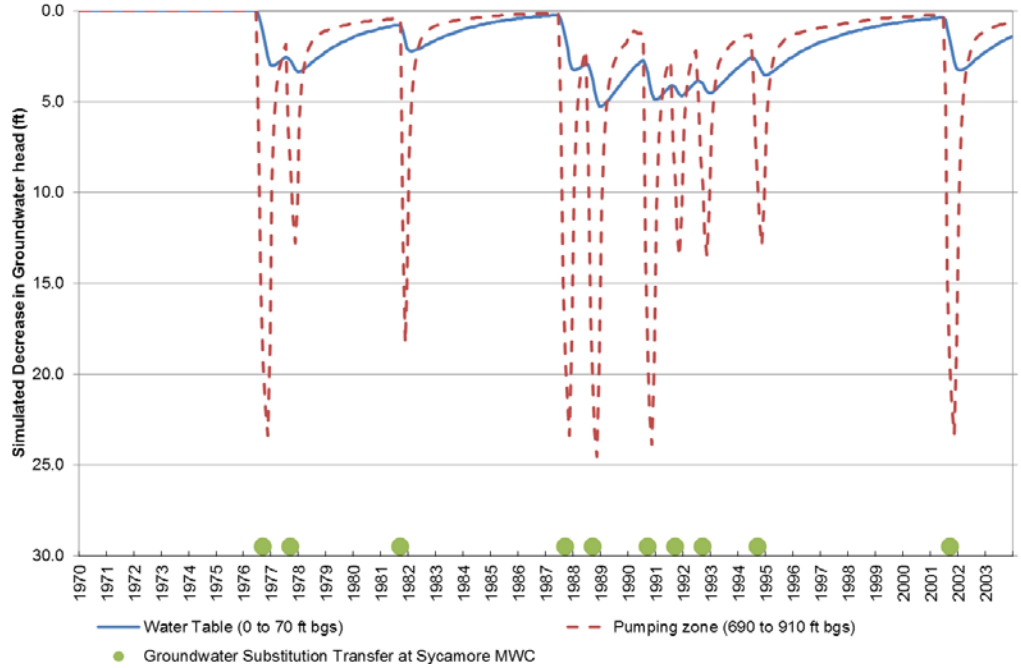


Figure 3.3-~~34.~~-34c. Simulated Change in Groundwater Head at Location 21

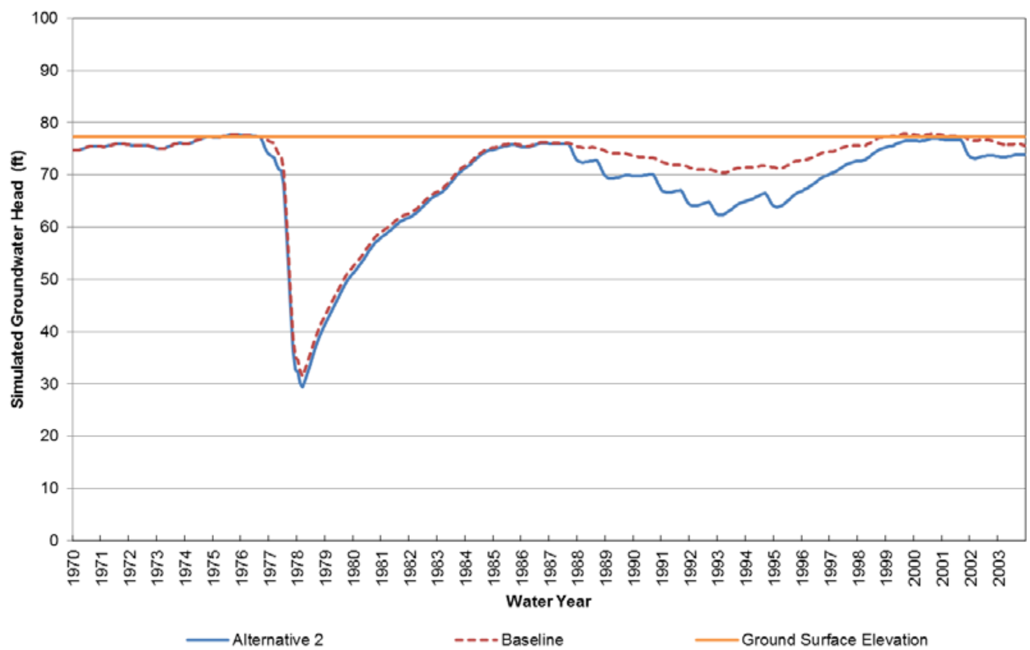


Figure 3.3-~~35.~~-35a. Simulated Groundwater ~~Table Elevation~~Head (Approximately 0 to 40 feet bgs) at Location 14

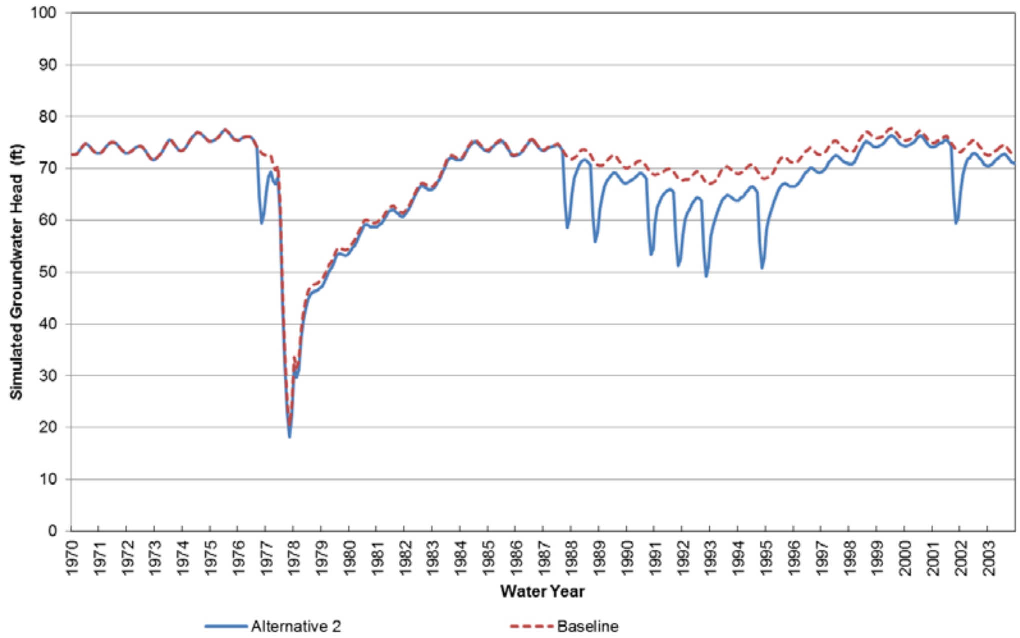


Figure 3.3-~~36.~~-35b. Simulated Groundwater Head (Approximately 310 to 420 feet bgs) at Location 14

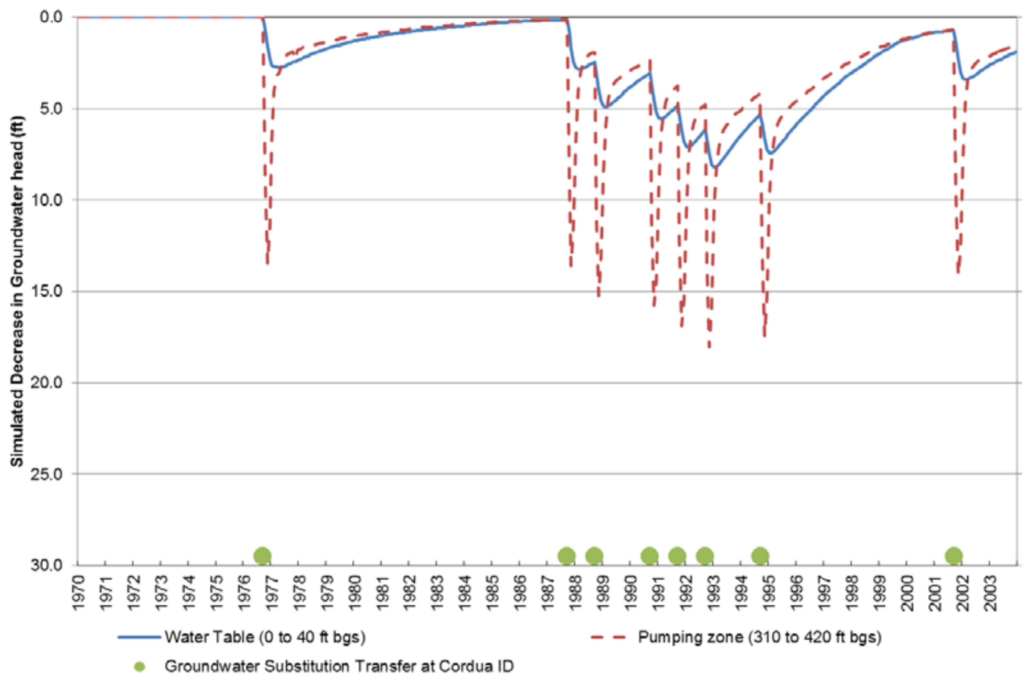


Figure 3.3-~~37.~~-35c. Simulated ~~change~~Change in Groundwater Head at Location 14

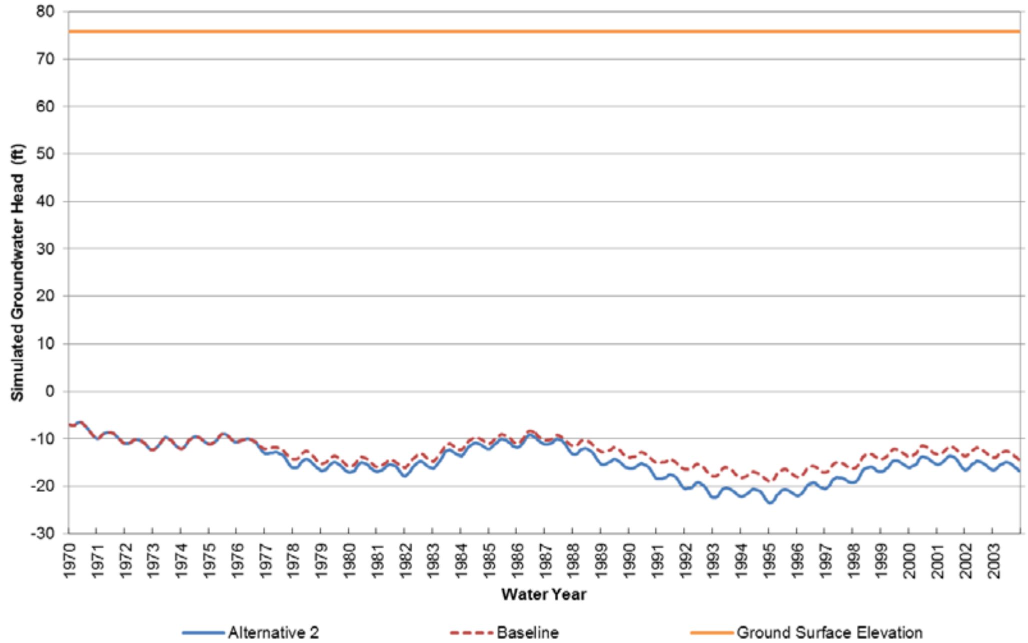


Figure 3.3-~~38.~~-36a. Simulated Groundwater ~~Table Elevation~~Head (Approximately 0 to 70 feet bgs) at Location 31

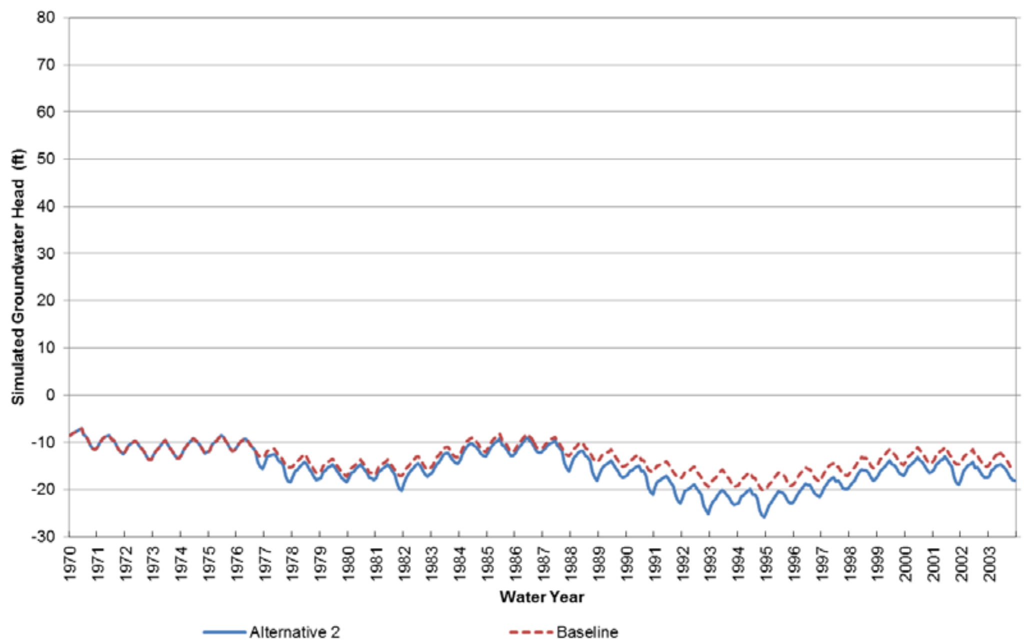


Figure 3.3-~~39.~~-36b. Simulated Groundwater Head (Approximately 200 to 330 feet bgs) at Location 31

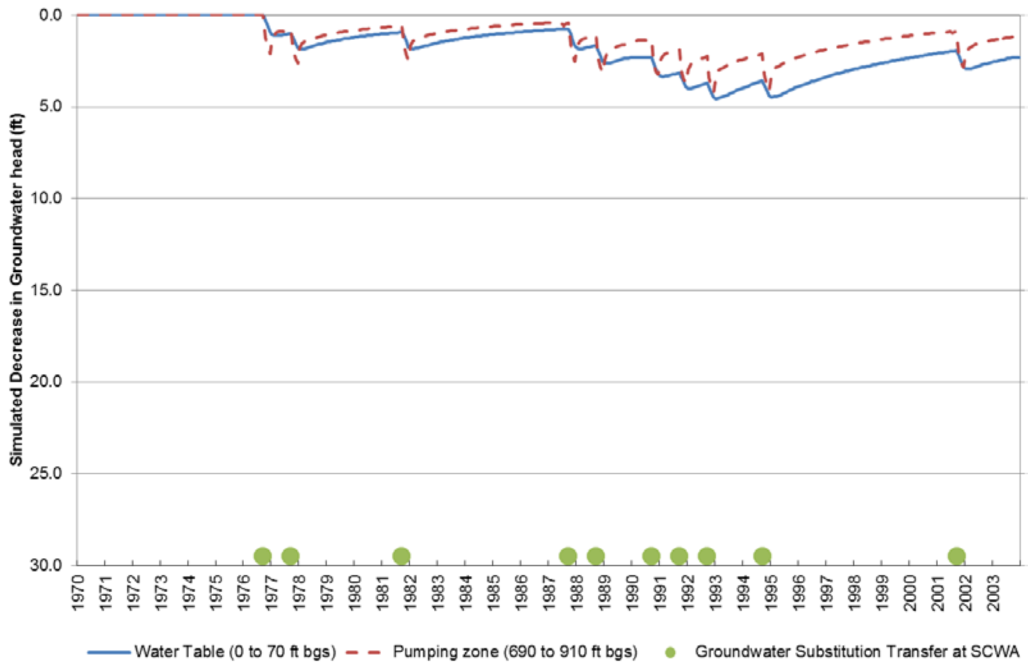


Figure 3.3-~~40.~~-36c. Simulated ~~change~~Change in Groundwater Head at Location 31

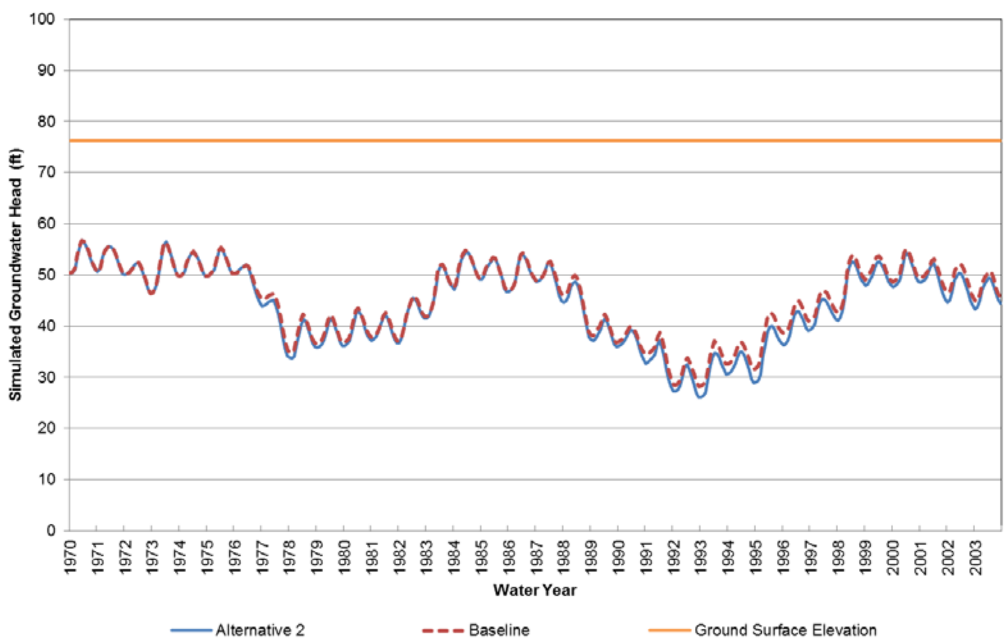


Figure 3.3-37a. Simulated Groundwater Head (Approximately 0 to 70 feet bgs) at Location 4

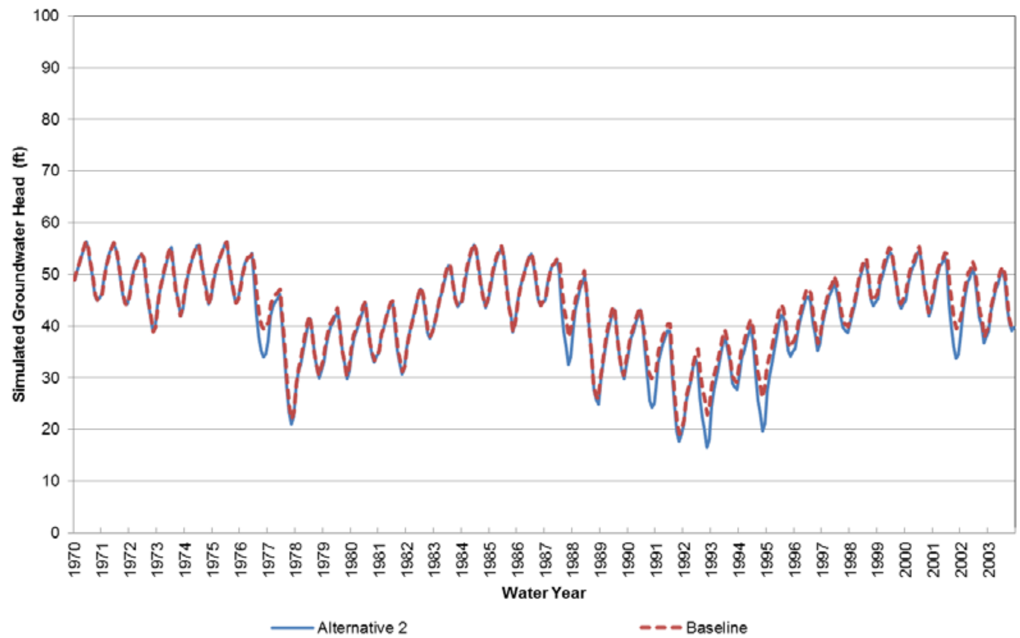


Figure 3.3-37b. Simulated Groundwater Head (Approximately 420 to 580 feet bgs) at Location 4

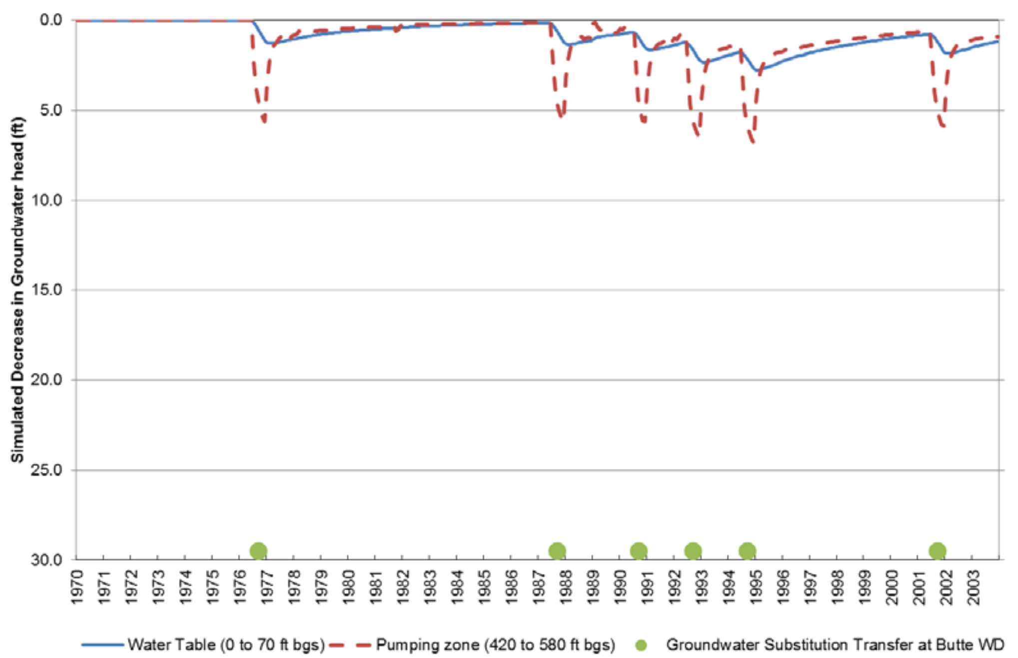


Figure 3.3-37c. Simulated Change in Groundwater Head at Location 4

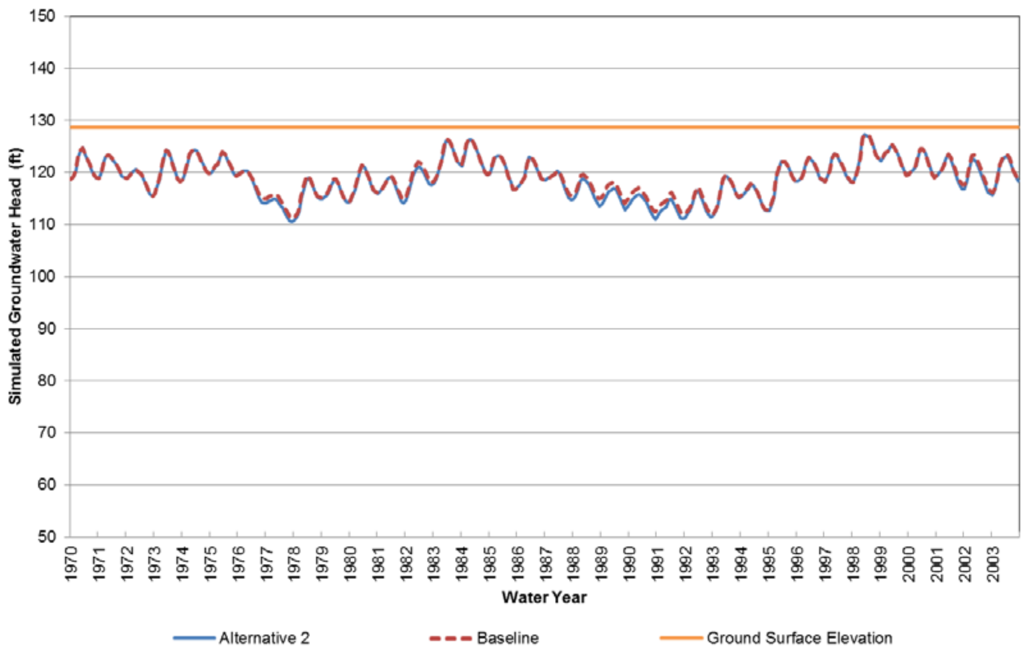


Figure 3.3-38a. Simulated Groundwater Head (Approximately 0 to 70 feet bgs) at Location 6

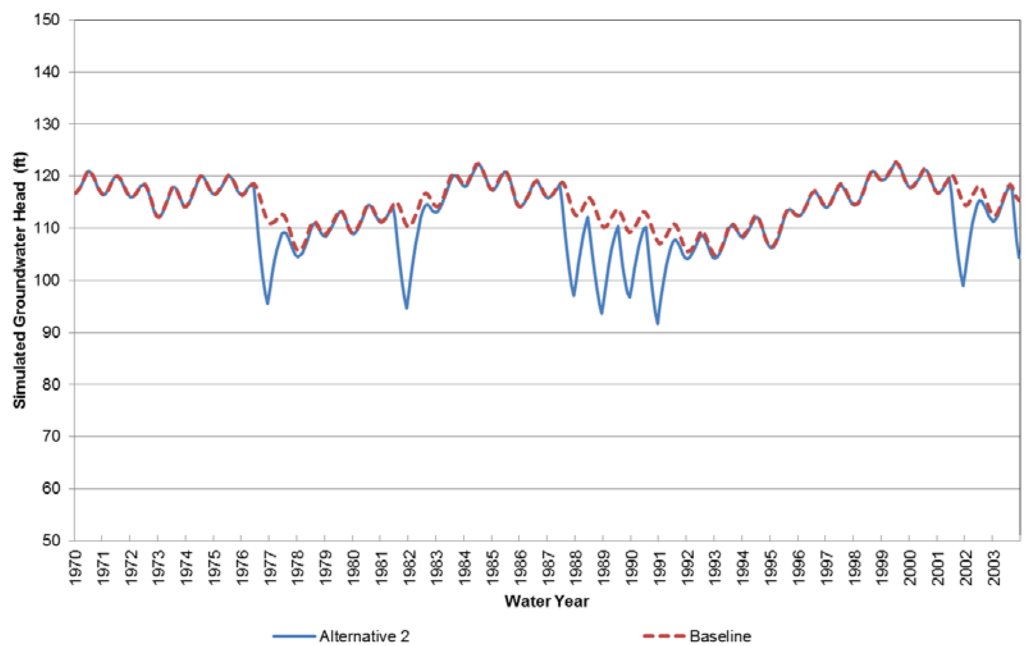


Figure 3.3-38b. Simulated Groundwater Head (Approximately 860 to 1290 feet bgs) at Location 6

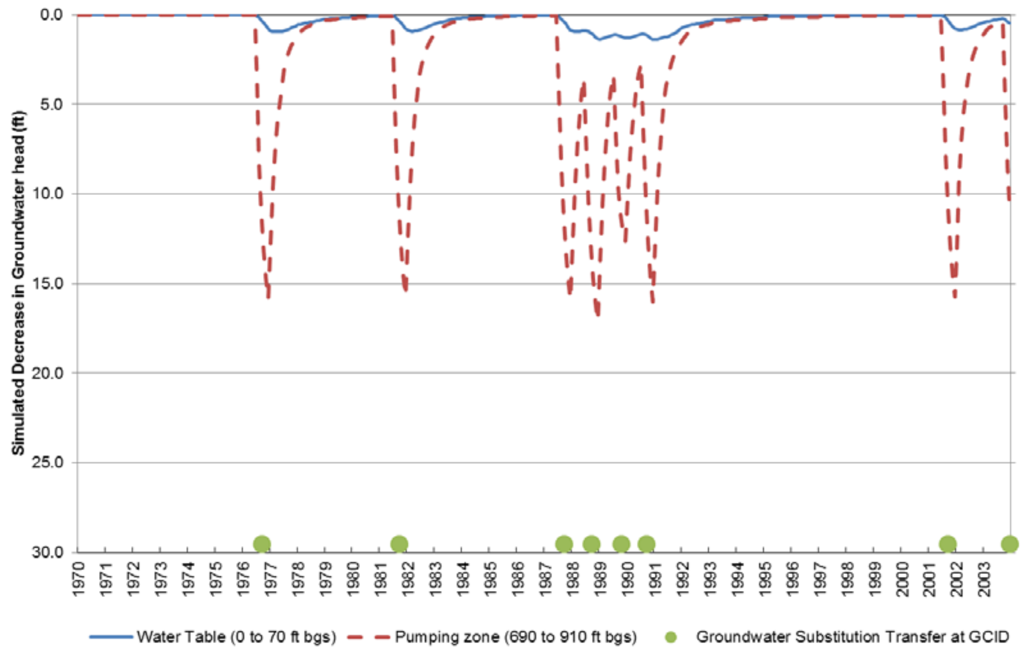


Figure 3.3-38c. Simulated Change in Groundwater Head at Location 6

As shown in Figure 3.3-26 through Figure 3.3-31, the maximum groundwater level declines resulting from substitution transfers within the Sacramento Valley Groundwater Basin range widely depending on the distance from the transfer groundwater pumping. The maximum groundwater level declines tend to be focused in the areas immediately surrounding the proposed groundwater substitution production wells. Seasonal groundwater level declines would be greater than the typical fluctuation when substitution pumping is included, indicating the potential for adverse effects. The potential for adverse drawdown effects would increase as the amount of extracted water increased. The potential for adverse effects would be higher during dry years, when baseline fluctuations would already be large and groundwater levels would likely be lower than normal.

Table 3.3-~~4~~6 shows the ~~number~~ depth range and average depth of domestic and irrigation wells within the areas of potential transferring agencies in the Sacramento Valley Groundwater Basin. On average, most wells in these areas are deeper than the levels that would result after potential drawdowns caused by groundwater substitution pumping; therefore, groundwater pumping would not cause them to go dry. However, groundwater level declines at the shallow wells could reduce the yield of these wells.

Groundwater substitution transfers could result in groundwater declines in excess of seasonal variation and these effects on non-transferring wells could be significant. To reduce these effects, the Mitigation Measure GW-1 (Section 3.3.4.1) specifies that transferring agencies establish monitoring and mitigation programs for groundwater substitution transfers. The programs would monitor groundwater level fluctuations within the local pumping area and if effects were reported or occurred, the participating seller agencies in the Sacramento basin would compensate for effects or reduce pumping until the groundwater basin recharges. Mitigation Measure GW-1 would reduce the impacts to less than significant.

Table 3.3-6. Well Depths in the Sacramento Valley Groundwater Basin

Groundwater Subbasin	Domestic Wells Depth Range (ft bgs)	Domestic Wells Average Depth (ft bgs)	Municipal/ Irrigation Wells Depth Range (ft bgs)	Municipal/ Irrigation Wells Average Depth (ft bgs)
Colusa	11 – 870	155	20 – 1,340	368
East Butte	25 – 639	101	35 - 983	285
North American	50 – 1,750	190	77 – 1,025	396
Solano	38 – 1,070	239	62 – 2,275	510
South American	87 – 575	247	41 – 1,000	372
Sutter	35 – 320	121	60 - 672	205
West Butte	15 – 680	136	40 - 920	321
Yolo	40 – 600	230	50 – 1,500	400

Source- DWR 2003
Key:
bgs = below ground surface
ft = feet

Groundwater extraction for groundwater substitution transfers would decrease groundwater levels, increasing the potential for subsidence. Most areas of the Sacramento Valley Groundwater Basin have not experienced land subsidence that has caused impacts to the overlying land. As shown in Figure 3.3-11, portions of Colusa and Yolo counties have experienced subsidence and subsidence has also been measured at Conaway Ranch (Yolo County). Table 3.3-~~5~~7 provides the simulated change in groundwater level due to transfer pumping at eight monitoring well locations shown in Figure 3.3-8 and Figure 3.3-9. The historic low groundwater level elevations were determined based on the monitored groundwater level data shown in Figure 3.3-8 and Figure 3.3-9. Based on the calculated historic low, groundwater levels since 2008 and the simulated change in groundwater level due to transfer pumping, there is potential for land subsidence at two of the eight monitoring wells (22N01E28J003M and 19N02W13J001M) presented in Table 3.3-7~~5~~. Additionally, the change in groundwater elevation at Conaway Ranch would be between the Proposed Action and the No Action Alternative ranges between 2.5-12 feet (Appendix E, Location 30 hydrograph). Therefore, the effect of potential land subsidence in the Seller Service Area could be significant. To reduce these effects, the Mitigation Measure GW-1 (Section 3.3.4.1) specifies that transferring agencies establish monitoring and mitigation programs for groundwater substitution transfers. This program will include periodic determination of land surface elevation in strategic locations throughout the transfer area. Mitigation Measure GW-1 would reduce the impacts to less than significant.

Table 3.3-7. Simulated Change in Groundwater Level at Monitoring Well Locations

Monitoring Well	Historic Low (preconsolidated heads)[1]	GWL in the last 7 years (2008 to Present)[1]	Maximum change in GWL under Proposed Action[2]	Average change in GWL under Proposed Action[2]
20N02E28N001M	110.5	116.8 - 112.1	-0.08	-0.03
22N01E28J003M*	119.8	145.2 - 119.8	-0.20	-0.07
19N04W12E001M	61.0	161.1 - 129.3	-0.90	-0.22
19N02W13J001M*	71.2	81.4 - 71.2	-0.34	-0.09
16N02W25B002M	25.7	45 - 32.4	-1.08	-0.39
11N02E20K004M	-22.6	33.2 - 20	-2.49	-0.69
12N05E12Q001M	20.5	NA	-1.56	-0.66
11N05E32R001M	-70.8	NA	-5.65	-2.03

Source: *DWR 2010b*
Note: NA= Data not available for period of record
* Wells with potential for land subsidence based on data presented in table
[1] Based on data ~~presented in **Figure 3.3-8** and~~
~~Figure 3.3-9~~
~~Figure 3.3-8 and Figure 3.3-9~~from DWR Water Data Library (DWR 2010b)
[2] Based on SACFEM2013 modeling results

Groundwater extraction for groundwater substitution transfers could cause migration of reduced quality water, agricultural use of reduced quality water, or the distribution of reduced quality water.

Migration of Reduced Quality Groundwater

Inducing the movement or migration of reduced quality water into previously unaffected areas ~~through~~due to groundwater ~~pumping~~substitution transfers is not likely to be a concern unless groundwater levels and/or flow patterns are substantially altered for a long period of time. Groundwater ~~extraction~~substitution pumping under the Proposed Action would be limited to short-term withdrawals during the irrigation season. Consequently, effects from the migration of reduced groundwater quality would be less than significant.

On-Farm Use of Reduced Quality Groundwater

Potential sellers that may participate in groundwater substitution transfers could experience changes in water quality as they switch from surface water to groundwater. Groundwater quality is good for most agricultural and municipal uses throughout the Sacramento Valley Groundwater Basin; therefore, potential regional impacts would be minimal and this impact would be less than significant.

Distribution of Reduced Quality Groundwater

Groundwater extracted could be of reduced quality relative to the surface water supply deliveries the seller districts normally receive; however, groundwater quality in the area is normally adequate for agricultural purposes. Distribution of groundwater for municipal supply is subject to groundwater quality monitoring and quality limits prior to distribution to customers. Therefore, potential impacts to the distribution of groundwater would be minimal and this impact would be less than significant.

Water transfers via cropland idling could decrease applied water recharge to the local groundwater system underlying the barren (idled) fields that could result in decline in groundwater levels. Table 3.3-~~6~~8 shows potential maximum water transferred via cropland idling.

Table 3.3-8. Maximum Annual Water Transfer from Cropland Idling under the Proposed Action

County	Rice (AF)	Alfalfa (AF)	Corn (AF)	Tomatoes (AF)	Total (AF)
Colusa, Glenn, Yolo	40,700	1,400	400	400	42,900
Butte, Sutter	10,770	600	800	400	12,570
Solano	-	3,000	1,500	-	4,500
Total	51,470	5,000	2,700	800	59,970

Cropland idling would eliminate the applied water on participating fields within the Seller Service Area. A portion of that applied water percolates into the groundwater aquifer; therefore, reducing applied water would result in a loss of recharge to the Sacramento Valley Groundwater Basin. Because only a small portion of the applied (i.e., transferred) water would have percolated to the groundwater table, the reduction in recharge is expected to be well below the 59,970 AF listed in Table 3.3-~~6~~8. This reduction in recharge would also be relatively small when compared to the total of amount of water that recharges the Sacramento Valley Groundwater Basin. A large portion of the total recharge to the basin occurs through precipitation and runoff over the spring and winter months.

Of the participating crops listed in Table 3.3-~~6~~8, rice represents the greatest amount of land idled for transfers. Rice farming practices include a constant supply of irrigation water that remains on rice fields during the growing season. The land used for rice production, however, is typically underlain by soils with low permeability (such as clay). A substantial portion of the water applied to rice fields does not percolate to the underlying aquifer because of the underlying soils, but rather discharges to the farmer's surface drainage system.

A reduction in applied water recharge because of cropland idling could have effects on groundwater recharge and levels; however, this action would not be likely to substantially reduce the amount of recharge for the basin. Consequently, the potential lowering of groundwater levels due to a reduction in groundwater recharge as a result of cropland idling would be less than significant.

Water Transfers via cropland idling may cause groundwater level declines that lead to permanent land subsidence or changes in groundwater quality. As discussed earlier in the section, cropland idling would not be likely to substantially lower groundwater levels in the basin causing land subsidence or changing groundwater quality. Consequently, subsidence and groundwater quality changes because of a reduction in groundwater recharge as a result of cropland idling would be less than significant.

3.3.2.4.3 Buyer Service Area

Decreased groundwater pumping in the Buyer Service Area may result in a temporary rise in groundwater levels in the Buyer Service Area. The Proposed Action ~~would~~may result in a reduced use of groundwater resources during periods of shortage by supplementing water supply with transferred water. Therefore, the impact of the Proposed Action on groundwater levels in the Buyer Service Area would be beneficial.

Decreased groundwater pumping in the Buyer Service Area would cause a decrease in water level declines thus, decreasing permanent land subsidence. The Proposed Action ~~would~~may result in a reduced use of groundwater resources during periods of shortage by supplementing water supply with transferred water. This potential decrease in the use of groundwater resources may result in a slowing of groundwater level decline or potentially cause an increase in groundwater levels. A slowed rate of decline or an increase in groundwater levels would help to slow the rate of subsidence. Therefore, the impact of the Proposed Action on potential land subsidence in the Buyer Service Area would be beneficial.

Changes in groundwater levels, or in the prevailing groundwater flow regime, could cause a change in groundwater quality. The Proposed Action would result in a reduced use of groundwater resources during periods of shortage by supplementing water supply with transferred water. Therefore, the impact of the Proposed Action on potential land subsidence in the Buyer Service Area would be beneficial.

3.3.2.5 Alternative 3: No Cropland Modifications

Alternative 3 involves transfers through groundwater substitution and no cropland idling. The impacts associated with the groundwater substitution transfers would be the same as the Proposed Action.

3.3.2.6 Alternative 4: No Groundwater Substitution

Alternative 4 involves transfers through cropland idling and no groundwater substitution. The impacts associated with the cropland idling transfers would be the same as the Proposed Action.

3.3.3 Comparative Analysis of Alternatives

Table 3.3-~~7~~9 summarizes the effects of each of the action alternatives. The following text supplements the table by describing the magnitude of the effects under the action alternatives and No Action/No Project Alternative.

Table 3.3-~~7~~9. Comparison of Alternatives

Potential Impact	Alternative(s)	Significance	Proposed Mitigation	Significance after Mitigation
Groundwater pumping within the Buyer Service Area in response to shortages could cause reduction in groundwater levels.	1	NCFEC	None	NCFEC
Groundwater pumping within the Buyer Service Area in response to shortages could cause subsidence.	1	NCFEC	None	NCFEC
Groundwater pumping within the Buyer Service Area in response to shortages could cause changes to groundwater quality.	1	NCFEC	None	NCFEC
Land idling that temporarily converts cropland to bare fields in response to shortages in the Buyer Service Area could cause reduction in groundwater levels due to decreased applied water recharge.	1	NCFEC	None	NCFEC
Groundwater substitution transfers could cause a reduction in groundwater levels in the Seller Service Area.	2, 3	S	GW-1	LTS
Groundwater substitution transfers could cause subsidence in the Seller Service Area.	2, 3	S	GW-1	LTS
Groundwater substitution transfers could cause changes to groundwater quality in the Seller Service Area.	2, 3	LTS	None	LTS
Cropland idling transfers could cause reduction in groundwater levels in the Seller Service Area due to decreased applied water recharge.	2, 4	LTS	None	LTS
Water transfers could reduce groundwater pumping during shortages in the Buyer Service Area, which could increase groundwater levels, decrease current rate of subsidence, and improve groundwater quality.	2, 3, 4	Beneficial	None	Beneficial

Key:
NCFEC: No change from existing conditions

S: Significant
LTS: Less than Significant

3.3.3.1 No Action/No Project Alternative

There would be no changes to groundwater levels, quality, or land subsidence in the Seller Service Area relative to existing conditions. In the Buyer Service Area, increased land idling and groundwater substitution transfers could occur in response to CVP shortages, which could cause a reduction in groundwater levels, a change in groundwater quality or subsidence. However, these actions to address shortages are already underway, and the No Action/No Project Alternative would not represent a change from existing conditions.

3.3.3.2 Alternative 2: Full Range of Transfers (Proposed Action)

Groundwater substitution transfers under the Proposed Action could decrease groundwater levels, potentially affecting non-transferring wells near participating substitution wells. Declining groundwater levels could also affect land subsidence and groundwater quality; however, these effects would be less than significant. Cropland idling transfers under the Proposed Action could reduce percolation to groundwater, but the reduction would be small because rice (the main crop proposed for idling) is typically grown on soils with low permeability. Potential effects on groundwater resources in the Seller Service Area under Proposed Action would be greater than the No Action/No Project Alternative. These effects could be reduced by Mitigation Measure GW-1 (Section 3.3.4.1).

In the Buyer Service Area, transfers would reduce the need to pump groundwater during shortages and could result in beneficial effects to groundwater levels, land subsidence, and groundwater quality.

3.3.3.3 Alternative 3: No Cropland Modification

The No Cropland Modification Alternative does not include cropland idling but would include groundwater substitution transfers. The effects in the Seller Service Area from Alternative 3 would be the same as those associated with groundwater substitution in the Proposed Action. These effects could be reduced by Mitigation Measure GW-1. Similar to the Proposed Action, transfers could improve groundwater levels, land subsidence, and groundwater quality in the Buyer Service Area by reducing groundwater pumping during shortages.

3.3.3.4 Alternative 4: No Groundwater Substitution

The No Groundwater Substitution does not include groundwater substitution transfers, but cropland idling transfers have the potential to reduce recharge to the groundwater basin. However, the reduction in percolation would be less than significant because rice is the primary crop and grown on soils with low permeability. Similar to the Proposed Action, transfers could increase groundwater levels, eliminate or minimize land subsidence, and improve groundwater quality in the Buyer Service Area by reducing groundwater pumping during shortages.

3.3.4 Environmental Commitments/Mitigation Measures

3.3.4.1 Mitigation Measure GW-1: Monitoring Program and Mitigation Plans

The *DRAFT Technical Information for Preparing Water Transfer Proposals* (Reclamation and DWR 2013) and Addendum (Reclamation and DWR 2014) provides guidance for the development of proposals for groundwater substitution water transfer proposals. The technical information and addendum informs the development of the monitoring and mitigation program for this projectthe range of potential transfer activities evaluated in this EIS/EIR, which and will be updated as appropriate based on the most current version of the technical paper each year of this long-term projectthe ten-year term of potential activities.

The objectives of the monitoring and mitigation plan areMitigation Measure GW-1 is: to mitigate avoid significant adverse environmental effects that and ensure prompt corrective action in the event unanticipated effects occur. The measure accomplishes this by monitoring groundwater and/or surface water levels during transfers to avoid potential effects. The objectives of this process are to:; (1) to minimize potential effects to other legal users of water; to (2) provide a process for review and response to reported effects to non-transferring parties; and (3)to assure that a local mitigation strategy is in place prior to the groundwater transfer; and (4) mitigate significant adverse environmental effects. Reclamation will verify that sellers adopt and implement these mitigation measures to avoid potentially significant adverse effects of transfer-related groundwater extraction. In addition, each entity participating in a groundwater substitution transfer will be required tomust confirm that the proposed groundwater pumping will be compatible with state and local regulations and GMPs. As GSPs are developed by Groundwater Sustainability Agencies, potential sellers must confirm that the proposed pumping is compatible with applicable GSPs. Reclamation's transfer approval process and groundwater mitigation measures set forth a framework that is designed to avoid and minimize adverse groundwater effects. Reclamation will verify that sellers adopt and implement these mitigation measures to minimize the potential for adverse effects related to groundwater extraction.

3.3.4.1.1 Well Review Process

Potential sellers will be required tomust submit well data for Reclamation and, where appropriate, DWR review, as part of the transfer approval process. Required information will be detailed in the most current version of the *DRAFT Technical Information for Preparing Water Transfer Proposals.*

3.3.4.1.2 Monitoring Program

Potential sellers ~~will be required to~~must complete and implement a monitoring program subject to Reclamation's approval that ~~must~~shall, at a minimum, include the following components:

Monitoring Well Network~~.~~

The monitoring program ~~will~~ shall incorporate a sufficient number of monitoring wells, as determined by Reclamation and the sellers in relation to local conditions, to accurately characterize groundwater levels and response in the area before, during, and after transfer pumping takes place. Depending on local conditions, additional groundwater level monitoring may be required near ecological resource areas.

Groundwater Pumping Measurements

All wells pumping to replace surface water designated for transfer shall be configured with a permanent instantaneous and totalizing flow meter capable of accurately measuring well discharge rates and volumes. Flow meter readings will be recorded just prior to initiation of pumping and at designated times, but no less than monthly and as close as practical to the last day of the month, throughout the duration of the transfer.

Groundwater Levels

Sellers will collect measurements of groundwater levels in both participating transfer wells and monitoring wells. Groundwater level monitoring will include measurements before, during and after transfer-related pumping. The ~~water transfer proponent~~seller will measure groundwater levels as follows:

- Prior to transfer: Groundwater levels will be measured monthly from March in the year of the proposed transfer-related pumping until the start of the transfer (where possible).
- Start of transfer: Groundwater levels will be measured on the same day that the transfer-related pumping begins, prior to the pump being turned on.
- During transfer-related pumping: Groundwater levels will be measured weekly throughout the transfer-related pumping period, unless site specific information indicates a different interval should be used.
- Post-transfer pumping: Groundwater levels will be measured weekly for one month after the end of transfer-related pumping, after which groundwater levels will be measured monthly through March of the year following the transfer.

Sellers thus monitor effects to groundwater levels that may result from the proposed transfer and avoid significant impacts. The primary criteria used to identify potentially significant impacts to groundwater levels are the BMOs set by GMPs. In the Sacramento Valley, several counties have established GMPs to provide guidance in managing the resource. The existing GMPs and BMOs are discussed in Section 3.3.1.2, Regulatory Setting.

In areas where quantitative BMOs do not exist, Reclamation, SLDMWA, and the potential seller(s) will coordinate closely with potentially impacted third parties to collect and monitor groundwater data. If a third party expects that it may be impacted by a proposed transfer, that party should contact Reclamation and the seller with its concern. The burden of collecting groundwater data will not be the responsibility of the third party. If warranted, groundwater level monitoring to address the third-party's concern may be incorporated in the monitoring and mitigation plans required by Mitigation Measure GW-1.

Additionally, to avoid significant effects to vegetation and allow sellers to modify actions before significant effects occur, sellers will monitor groundwater depth data to verify that significant adverse effects to deep-rooted vegetation are avoided. If monitoring data indicate that water levels have dropped below root zones (i.e., more than 10 feet where groundwater was 10 to 25 feet below ground surface prior to starting the transfer of surface water made available from groundwater substitution actions), the seller must implement actions set forth in the mitigation plan. If historic data show that groundwater elevations in the area of transfer have typically varied by more than this amount annually during the proposed transfer period, then the transfer may be allowed to proceed. If there is no deep-rooted vegetation (i.e., oak trees and riparian trees that would have tap roots greater than 10 feet deep) within one-half mile of the transfer wells or the vegetation is located along waterways that will continue to have water during the transfer, the transfer may be allowed to proceed. If no existing monitoring points exist in the shallow aquifer, monitoring would be based on visual observations of the health of these areas of deep-rooted vegetation. If significant adverse impacts to deep-rooted vegetation (that is, loss of a substantial percentage of the deep-rooted vegetation as determined by Reclamation based on site-specific circumstances in consultation with a qualified biologist) occur as a result of the transfer despite the monitoring efforts and implementation of the mitigation plan, the seller will prepare a report documenting the result of the restoration activity to plant, maintain, and monitor restoration of vegetation for 5 years to replace the losses.

Groundwater Quality

For municipal sellers, the comprehensive water quality testing requirements of Title 22 ~~should be~~are considered sufficient for the water transfer monitoring program. Agricultural sellers shall measure specific conductance in samples from each participating production well. Samples shall be collected when the seller first initiates pumping, monthly during the transfer period, and at the termination of transfer pumping.

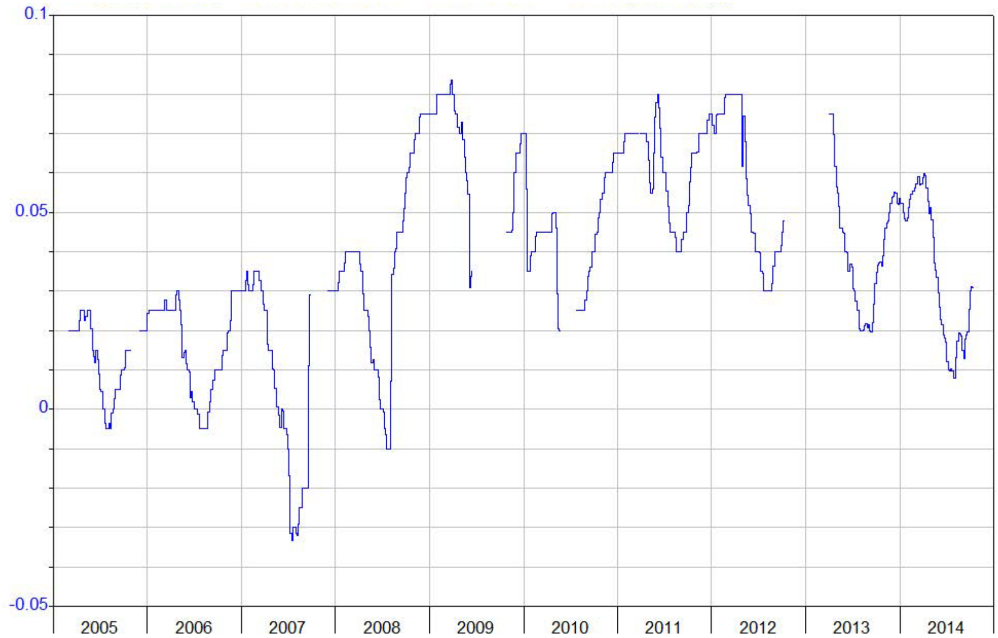
Land Subsidence

Subsidence monitoring will be required if groundwater levels decline below historic low levels during the proposed water transfer. Before a transfer, each seller will examine local groundwater conditions and groundwater level changes based on past pumping events or groundwater substitution transfers. This existing information will be the basis to estimate if groundwater levels are likely to decline below historic low levels, which would trigger land surface elevation measurements (as described below).

If the measured groundwater level falls below the historic low level, the seller must confirm the measurement within seven days. If the water level has risen above the historic low level, the seller may continue transfer pumping. If the measured groundwater level remains below the historic low level, the seller will stop transfer-related pumping immediately or begin determination of land surface elevation measurements in strategic locations within and/or near throughout the transfer-related pumping area. Measurements may include (1) extensometer monitoring, (2) continuous GPS monitoring, or (3) extensive land-elevation benchmark surveys conducted by a licensed surveyor. at the beginning and end of each transfer year. This data could be collected by the seller or from other sources (such as public extensometer data). Measurements must be completed on a monthly basis during the transfer.

If the land surface elevation survey indicates an elevation decrease between 0.1 foot and 0.2 foot from the initial measurement, the seller could have significant impacts and would need to start the process identified below in the Mitigation Plan (Section 3.3.4.1.3). The seller will also work with Reclamation to assess the accuracy of the survey measurements based on current limitations of technology, professional engineering/surveying judgment, and any other data available in or near the transferring area.

The threshold of 0.1 foot was chosen as this value is typical of the elastic (i.e., recoverable) portion of subsidence; the threshold of 0.2 foot was selected considering limitations of current land survey technology. This threshold is supported by a review of data from extensometers within the Sacramento Valley. Figure 3.3-39 shows the subsidence data from extensometer 22N02W15C002M, in Glenn County. This extensometer has not been identified as having long-term declining trends, but exhibits a small amount of movement (up to about 0.1 foot).



Source: DWR Water Data Library 2014

Figure 3.3-39. Measured Ground Surface Displacement (in feet) at Extensometer 22N02W15C002M in Glenn County

Coordination Plan

The monitoring program will include a plan to coordinate the collection and organization of monitoring data~~, and communication with the well operators~~. This plan will describe how input from third parties will be incorporated into the monitoring program, and will include a plan for communication with Reclamation as well as ~~and~~ other decision makers and third parties.

Evaluation and Reporting

The ~~proposed~~ monitoring program will describe the method of reporting monitoring data. At a minimum, sellers will provide data summary tables to Reclamation, both during and after transfer-related groundwater pumping. Post-program reporting will continue through March of the year following the transfer. ~~Water transfer proponents~~Sellers will provide a final summary report to Reclamation evaluating the effects of the water transfer. The final report will identify transfer-related ~~impacts~~ effects on groundwater and surface water (both during and after pumping), and the extent and significance, if any, of ~~impacts~~ effects on local groundwater users. It ~~should~~ shall include groundwater elevation contour maps for the area in which transfer operations are located, showing pre-transfer groundwater elevations, groundwater elevations at the end of the transfer, and recovered groundwater elevations in March of the year following the transfer. The summary report shall also identify the extent and significance, if any, of transfer-related effects to ecological resources such as fish, wildlife, and vegetation resources.

3.3.4.1.3 Mitigation Plan

Potential sellers ~~will also be required to~~must complete and implement a mitigation plan to avoid potentially significant groundwater impacts and ensure prompt corrective action in the event unanticipated effects occur. ~~If the seller's monitoring efforts indicate that the operation of wells for groundwater substitution pumping are causing substantial adverse impacts, the seller will be responsible for mitigating any significant environmental impacts that occur.~~ Mitigation actions ~~must be implemented to reduce impacts to a less than significant level and~~ could include:

- Curtailment of pumping until natural recharge corrects the issue.
- Lowering of pumping bowls in non-transferring wells affected by transfer pumping.
- Reimbursement for significant increases in pumping costs due to the additional groundwater pumping to support the transfer.
- Curtailment of pumping until water levels r~~a~~ise above historic lows if non-reversible subsidence is detected (based on local data to identify elastic versus inelastic subsidence).
- Reimbursement for modifications to infrastructure that may be affected by non-reversible subsidence.
- Other appropriate actions based on local conditions, as ~~appropriate~~determined by Reclamation.

As summarized above, the purpose of Mitigation Measure GW-1 is to monitor groundwater levels during transfers to avoid potentially significant adverse effects. The mitigation plan will describe how to avoid significant effects and address any significant effects that occur despite the monitoring efforts. The objectives of this process are to: (1) minimize potential effects to other legal users of water; (2) provide a process for review and response to reported effects; and (3) assure that a local mitigation strategy is in place prior to the groundwater transfer. Accordingly, t~~T~~o ensure that mitigation plans will be feasible, effective, and tailored to local conditions, the plan must include the following elements:

- A procedure for the seller to receive reports of purported environmental effects or effects to non-transferring parties;
- A procedure for investigating any reported effect;
- Development of mitigation options, in cooperation with the affected parties, for legitimate significant effects; and

- Assurances that adequate financial resources are available to cover reasonably anticipated mitigation needs.

The purpose of Mitigation Measure GW-1 is to monitor groundwater levels during transfers to avoid potential effects. If any effects occur despite the monitoring efforts, the mitigation plan will describe how to address those effects. The objectives of this process are to: (1) mitigate adverse environmental effects that occur; (2) minimize potential effects to other legal users of water; (3) provide a process for review and response to reported effects; and (4) assure that a local mitigation strategy is in place prior to the groundwater transfer.

Each potential seller will be required to confirm that the proposed groundwater pumping will be compatible with state and local regulations and GMPs. Reclamation's transfer approval process and groundwater mitigation measures set forth a framework that is designed to avoid and minimize adverse groundwater effects. Reclamation will verify that sellers adopt and implement these measures to minimize the potential for adverse effects related to groundwater extraction.

Mitigation to avoid potentially significant subsidence impacts and ensure prompt corrective action in the event that unanticipated effects occur is described by the following stages.

Stage 1: Groundwater Levels
Irreversible subsidence would not occur if groundwater levels stay above historic low levels for the entire transfer season. As groundwater is pumped from an aquifer, the pore water pressure in the aquifer is reduced. This reduction in pore water pressure increases the effective stress on the structure of the aquifer itself. This increase in effective stress can cause the aquifer structure to deform, or compress, resulting in the subsidence of the ground surface elevation. Subsidence can be irreversible if the reduced effective stress is lower than the historically low effective stress. Typically this would be the result of groundwater levels reaching levels lower than the historical low level.

Before a transfer, each seller will examine local groundwater conditions and groundwater level changes based on past pumping events or groundwater substitution transfers. This existing information will be the basis to estimate if groundwater levels are likely to decline below historic low levels as a result of the proposed transfer. If the pre-transfer assessment indicates that groundwater levels will stay above historic low levels, and this finding is confirmed by monitoring during the transfer-related pumping period, then no additional actions for subsidence monitoring or mitigation are necessary. Sellers would need to proceed to stage 2 for land surface elevation monitoring if the pre-transfer estimates indicate that groundwater levels are anticipated to decline below historic low levels. If monitoring during the transfer-related pumping period (confirmed by two measurements within seven days) indicates that groundwater levels have fallen below historic low levels, sellers must immediately stop pumping from transfer wells in the area that is affected or proceed to stage 2.

Stage 2: Ground Surface Elevations

Stage 2 includes monthly ground surface monitoring during transfer-related pumping if pumping could cause groundwater levels to fall below historic low levels, as described above in the Monitoring Plan. If ground surface elevations decrease between 0.1 and 0.2 foot, the seller will evaluate the accuracy of the information based on the current limitations of technology, professional engineering/surveying judgment, and other local data. If the elevations decline more than 0.2 foot, this change could indicate inelastic subsidence, which would trigger a shift to Stage 3.

Stage 3: Local Investigation

If the threshold of 0.2 foot of ground surface elevation change is exceeded, the seller shall cease groundwater substitution pumping for the transfer until one of the following occurs: (1) groundwater levels recover above historic low groundwater levels; (2) seller completes a more detailed local investigation identifying hydrogeologic conditions that could potentially allow continued transfer-related pumping from a subset of wells (if the seller can provide evidence that this pumping is not expected to cause additional subsidence); or (3) seller completes an investigation of local infrastructure that could be affected by subsidence (such as water delivery infrastructure, water supply facilities, flood protection facilities, highways, etc.) indicating the local threshold of subsidence that could be experienced before these facilities would be adversely affected. Any option should also consider the effect of non-transfer pumping that may be causing subsidence.

Stage 4: Mitigation

If subsidence effects to local infrastructure occur despite monitoring efforts, then the sellers must work with the lead agencies to determine ~~if~~whether the measured subsidence may be caused by transfer-related pumping. Any significant adverse subsidence effects caused by transfer pumping activities must be addressed. A contingency plan must be developed in the event that a need for further corrective action is necessary. This contingency plan must be approved by Reclamation before transfer-related pumping could continue after Stage 3.

Stage 5: Continued Monitoring

The sellers will continue to monitor for subsidence while groundwater levels remain below historic low levels. If the seller has ceased transfer-related pumping but groundwater levels remain below historic lows, subsidence monitoring will need to continue until the spring following the transfer. The results of subsidence monitoring will be factored into monitoring and mitigation plans for future transfers.

3.3.5 Potentially Significant Unavoidable Impacts

None of the alternatives would result in potentially significant unavoidable impacts after mitigation.

3.3.6 Cumulative Effects

The timeframe for the groundwater resources cumulative effects analysis extends from 2015 through 2024, a ten year period. The cumulative effects area of analysis for groundwater resources is the same as shown in Figure 3.3-1 above.

The projects considered for the groundwater resources cumulative condition are the SWP water transfers, Northern Sacramento Valley Integrated Regional Water Management Plan (NSV IRWMP), Tuscan Aquifer Investigation, Glenn-Colusa ID's Supplemental Supply Program, Davis-Woodland Water Supply Project and CVP M&I Water Shortage Policy (WSP), described in more detail in Section 4.3 in Chapter 4. SWP transfers could involve groundwater substitution transfers in the Seller Service Area and, therefore, could affect groundwater resources. The NSV IRWMP may also involve groundwater substitution transfers in the Seller Service Area. The WSP could reduce agricultural water deliveries and increase land idling in the Buyer Service Area. Effects of the WSP in the Seller Service Area would be minor as agricultural water supplies would not substantially change relative to existing conditions.

The following sections describe potential groundwater resources cumulative effects for each of the proposed alternatives.

3.3.6.1 Alternative 2: Full Range of Transfers (Proposed Action)

3.3.6.1.1 Seller Service Area

Groundwater substitution pumping and cropland idling transfers in the Seller Service Area under the Proposed Action in combination with other cumulative projects would contribute to groundwater level declines in the region. SWP transfers would include groundwater substitution, but the quantities of groundwater substitution transfers are very small (approximately 6,800 AF) in relation to overall transfers from the Seller Service Area. Some SWP groundwater substitution transfers could occur in Sutter County, which is included in the area of analysis for the Proposed Action. It is possible that the SWP transfers would compound the declines in groundwater levels in Sutter County.

The NSV IRWMP is a project that aims to provide a regional perspective to planning for water use in the northern Sacramento Valley, including Butte, Colusa, Glenn, Shasta, Sutter, and Tehama Counties. The plan is still under development; however, it is expected that the plan will help to provide management objectives that would be protective of the groundwater resources in the northern Sacramento Valley.

The Tuscan Aquifer Investigation project, conducted by the Butte County Department of Water and Resource Conservation, included numerous field data collection activities to allow for a more complete understanding of the Tuscan Aquifer. This project included the drilling of groundwater monitoring wells and the gaging of several streams in the Sierra Nevada foothills. Aquifer performance testing (i.e., pumping tests) was also performed at three existing production wells. The pumping associated with this project has been completed and would not contribute to cumulative effects. Information collection was primarily within Butte County, but the information about the Tuscan Aquifer could provide useful information about aquifer properties that would be useful in the other counties that are over the same aquifer (Glenn, Colusa, and Tehama Counties).

Glenn-Colusa ID's Supplemental Supply program proposes to operate ten groundwater wells (five existing wells and five proposed wells) to augment surface water diversions for use within Glenn-Colusa ID. These wells will be operated on an as needed basis during dry and critically dry water years and with an annual pumping volume not exceeding 28,500 AF. Glenn-Colusa ID's supplemental supply program and Glenn-Colusa ID's groundwater substitution pumping transfers are not expected to occur simultaneously (Thad Bettner, Personal Correspondence January 2014).

The Davis-Woodland Water Supply Project would reduce the City of Davis, City of Woodland and University of California Davis's reliance on regional groundwater supplies as a municipal water supply source. Dewatering operations may occur during the construction phase of this project that would result in localized and temporary declines of groundwater resources. This project will provide 12 million gallons per day (MGD) of surface water from the Sacramento River to Davis water customers and 18 MGD to Woodland customers. The project will divert up to 45,000 AF of water per year from the Sacramento River per water rights were granted in March 2011, and will be subject to conditions imposed by the state, including being limited during summer and other dry periods. The project also purchased a more senior water right for 10,000 AF from the Conaway Preservation Group to provide summer water supply.

The Proposed Action and these other projects in the basin could have significant cumulative effects on groundwater resources. The groundwater substitution pumping in the Proposed Action could result in significant effects to groundwater resources; however, implementation of Mitigation Measure GW-1 will reduce impacts from long-term transfers to less than significant. Therefore, with implementation of Mitigation Measure GW-1, the Proposed Action's incremental contribution to groundwater resources impacts would not be cumulatively considerable.

The increased pumping under the Proposed Action in combination with other cumulative projects could cause land subsidence. The groundwater substitution pumping associated with the SWP transfers would occur in an area that is historically not subject to significant land subsidence. In the overall area of analysis, land subsidence is occurring in several areas, as described in Section 3.3.1.3.2. This subsidence may be part of normal cropping cycles, when the soils below agricultural lands undergo shrinking and swelling. This subsidence would not likely result in substantial risk to life or property; however, the existing subsidence along with future increases in groundwater pumping in the cumulative condition could cause potentially significant cumulative effects. The impacts of the Proposed Action would be reduced through Mitigation Measure GW-1 (Section 3.3.4.1) to less than significant. Therefore, with implementation of Mitigation Measure GW-1, the Proposed Action's incremental contribution to subsidence impacts would not be cumulatively considerable.

Groundwater levels in the Seller Service Area may change under the Proposed Action in combination with other cumulative projects and cause the movement or mobilization of poorer quality groundwater into existing wells. SWP transfers and the Tuscan Aquifer Investigation Project would increase pumping within (or near) the Seller Service Area. However, as discussed in the Proposed Action, most of the Seller Service Area has high quality groundwater and changes in groundwater flow patterns should not cause migration of poor quality groundwater. Therefore, the Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact related to groundwater quality.

3.3.6.1.2 Buyer Service Area

The Proposed Action in combination with other cumulative past, present, and future projects could affect groundwater levels, land subsidence, and groundwater quality in the Buyer Service Area. As described in Section 3.3.1.3.2, groundwater pumping in the San Joaquin Valley has created some groundwater depressions over time. Additionally, some areas of the region have poor quality groundwater and have experienced land subsidence. The long-term historic pumping in the basin has contributed to locally significant cumulative impacts. The Proposed Action, however, would partially offset this cumulative impact by offsetting groundwater pumping during shortages. Therefore, the Proposed Action's incremental contribution to potentially significant cumulative groundwater impacts would not be cumulatively considerable.

3.3.6.2 Alternative 3: No Cropland Modification

The cumulative impacts of Alternative 3 would be the same as described for groundwater substitution in the Proposed Action in the Seller Service Area. Additionally, the cumulative effects of Alternative 3 in the Buyer Service Area would be the same as the Proposed Action.

3.3.6.3 Alternative 4: No Groundwater Substitution

Alternative 4 would not include groundwater substitution transfers; therefore, the contribution of this alternative to the groundwater cumulative condition would not be cumulatively considerable. The cumulative effects of Alternative 4 in the Buyer Service Area would be the same as the Proposed Action.

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Section 3.4
Geology and Soils

This section presents the existing conditions of geology and soils within the area of analysis and discusses potential effects on geology and soils from the proposed alternatives.

Because long-term water transfers would not involve the construction or modification of infrastructure that could be adversely affected by seismic events, seismicity is not discussed in this section. Further, the alternatives do not require construction activities; therefore, people and/or structures would not be exposed to geologic hazards such as ground failure or liquefaction. The focus of this section is on the chemical processes, properties, and potential erodibility of soils due to cropland idling transfers. This analysis considers how factors such as surface soil texture, wind velocity and duration, and shrink-swell potential may affect soils. Crop shifting, groundwater substitution, conservation, and stored reservoir release transfers are not expected to affect geology and soils, and thus are not further discussed in this section. Section 3.3, Groundwater Resources, evaluates groundwater substitution transfers in detail and discusses geomorphology and land subsidence. Section 3.2, Water Quality, discusses the potential for salts and other toxic substances to be transported by water or wind to adjacent fields.

3.4.1 Affected Environment/ Environmental Setting

3.4.1.1 Area of Analysis

Figure 3.4-1 shows the area of analysis for geology and soils. The area of analysis for geology and soils is composed of counties in the Seller Service Area in which cropland idling transfers could originate and counties in the Buyer Service Area where transferred water would be used for agricultural purposes. Counties in the Seller Service Area include Glenn, Colusa, Butte, Sutter, Yolo, and Solano counties and counties in the Buyer Service Area include San Joaquin, Stanislaus, Merced, San Benito, Fresno, and Kings counties.

Figure 3.4-1. Geology and Soils Area of Analysis

3.4.1.2 Existing Conditions

Potential geologic and soil effects associated with cropland idling water transfers are related to soil erosion and soil expansiveness.

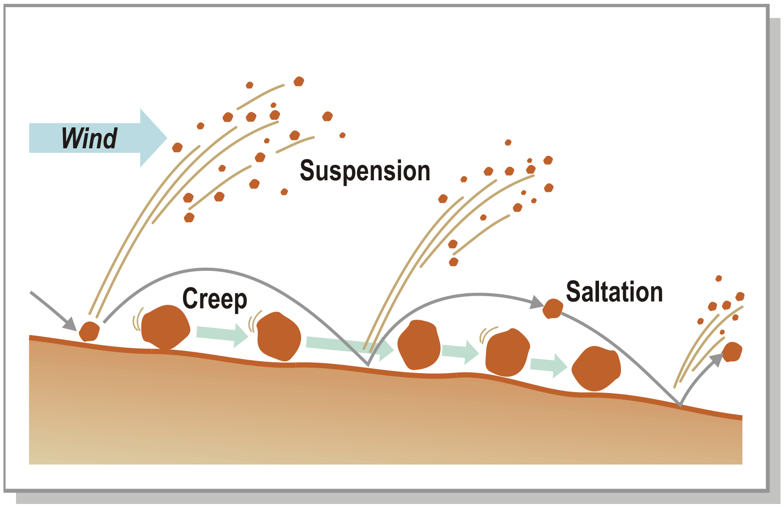
3.4.1.2.1 Soil Erosion by Wind

Soil erosion by wind is a complex process involving detachment, transport, sorting, abrasion, avalanching, and deposition of soil particles. Winds above a threshold velocity (13 miles per hour at one foot above ground) blowing over erodible soils can cause erosion in three ways (James et al. 2009, U.S. Department of Agriculture [USDA] Natural Resources Conservation Service [NRCS] 2009a):

- **Saltation:** Individual particles are lifted off the soil surface by wind; then they return and the impact dislodges other particles. Fifty to 80 percent of total transport is by saltation.

- **Suspension:** Dislodged particles, small enough to remain airborne for an extended period of time (less than 0.1 mm in diameter), are moved upward by diffusion. Suspension accounts for 20 to 60 percent of the total soil transport, depending on soil texture and wind velocity.

- **Surface creep**: Sand-sized particles are set in motion by the effect of saltating particles. During high winds, these sand sized particles creep slowly along the surface. Up to 25 percent of total transport may be from surface creep.



Source: James et al. 2009

Figure 3.4-2. Wind Erosion Processes

Figure 3.4-2 shows the wind erosion processes described above. Wind erosion and the release of windblown dust are influenced by soil erodibility, climatic factors, soil surface roughness, width of field, and the quantity of vegetative coverage. Soils most vulnerable to windblown erosion are coarser textured soils like sandy loams, loamy sands, and sands (USDA NRCS 2009a). Specifically, soils are vulnerable to wind erosion when (USDA NRCS 2009a):

- The soil is dry, loose, and finely granulated;
- The soil surface is smooth with little or no vegetation present;
- Fields are sufficiently large, and therefore, susceptible to erosion; and,
- There is sufficient wind velocity to move soil.

Wind erosion can also be a concern because it reduces soil depth and can remove organic matter and needed plant nutrients by dispersing the nutrients contained in the surface soils. Fields continually subjected to erosion can result in land that is incapable of returning to cropping (USDA NRCS 2009a). Increases in erosion from wind blowing across exposed nonpasture agricultural land results in particulate matter emissions. Section 3.5, Air Quality, discusses effects of fugitive dust emissions as a result of cropland idling.

3.4.1.2.2 Soil Erosion from Farming Practices

In addition to natural properties predisposing soils to erosion, land preparation activities, such as discing, and harvesting can cause soil particles to be broken down and can increase the potential for erosion. Much of the farm equipment used during the cropping season disturbs the soil and produces dust that contributes to soil loss. The following paragraphs describe common cropping practices for rice, processing tomatoes, field corn, and alfalfa, which are representative of crops that could be idled in water transfers.

Rice

During a typical calendar year of operation for rice production, farm equipment is required for preparing seedbeds, plowing and discing in March through May. Water seeding is the primary seeding method in California and most planting is done from April 20 to May 20, but can continue into June (University of California Cooperative Extension [UCCE] 2007).

Rice farmers apply herbicides and pesticides during May and June to control weeds and in May to control insects, algae, and shrimp. One pesticide application in the spring controls diseases from July through August that can attack the crop. The rice crop is harvested using a combine with a cutter-bar header (UCCE 2007).

Equipment used to grow rice includes tractors, bankout wagons, discs, mowers, pickup trucks, a triplane, and a V-ditcher (UCCE 2007).

Processing Tomatoes

Primary tillage of processing tomatoes, including laser leveling, discing, subsoiling, land planning, and listing beds is done from August through early November in the year preceding planting (UCCE 2008a).

Farmers spread planting over a three-month period from late March through early June. Beginning in January, weed spray is applied on the fallow beds to control emerged weeds. This process is repeated later to help control weeds. Before planting, the beds are cultivated twice to control weeds and to prepare the seedbed. A combination of hand weeding and mechanical cultivation is also used for weed control. During the cropping season, growers apply pesticides to combat various pests. Tomato harvest begins in early July and continues through mid-to-late October.

Equipment used to grow processing tomatoes includes tractors, crawlers, all-terrain vehicles (ATVs), bait applicators, bed shapers, cultivators, cultivators (sled), ditchers, incorporators, listers, mulchers, plows, rear blades, saddle tanks, spray booms, subsoilers, triplanes, vine diverters, and vine trainers.

Field Corn
Primary tillage for field corn includes laser leveling, discing, rolling, subsoiling, land leveling, and listing beds. Land preparation occurs in October of the year preceding planting. Farmers generally plant corn from late March through April (UCCE 2008b).

Fertilizers are applied throughout the growing season and irrigation is applied biweekly in April through July for a total of six post-plant irrigations. Herbicides are applied by airplane and tractor in February and May to control weeds. Insects are controlled by pesticide application using a tractor-mounted application in May. Mites, another common corn pest, can be a problem late in the season, and may be controlled by air application of pesticides in June.

The corn is harvested in August. Equipment used to grow field corn includes tractors, crawlers, ATVs, bait applicators, bankout wagons, combines with no header, corn headers, cultivators, ditchers, listers, planters, saddle tanks, scrapers, sprayer systems, subsoilers, and triplanes (UCCE 2008b).

Alfalfa
Stand establishment begins with laser leveling (when necessary) and then discing the fields to reduce the residue from the previous crop (UCCE 2008c). Alfalfa seed is planted in September and the stand life is four years. The field is harrowed and ring rolled after planting.

Fertilizer application occurs in September and can be sufficient for three years (UCCE 2008c). Water for seed germination is sprinkled immediately after planting and then again two weeks later. Herbicides are applied in December or January for weed control.

Alfalfa can be harvested seven times for hay: April, May, June, July (twice), August, and September. Equipment used to grow alfalfa includes ATVs, a tractor, a crawler, a seeder, a chisel, a cultipacker, discs, a pickup truck, and a triplane (UCCE 2008c).

3.4.1.2.3 Soil Erosion from Changes in River Flows
Increases in streamflow in the Seller Service Area could occur as a result of water transfers. The Sacramento and San Joaquin rivers and their tributaries, the Yuba, Feather, American, and Merced rivers, transport water as part of the Central Valley Project (CVP) and State Water Project (SWP). Each of these river channels has a maximum conveyance capacity as described in Section 3.17.1.3.1.

3.4.1.2.4 Expansive Soils
In addition to soil erosion, expansive properties, or linear extensibility, represent another soil attribute that could be affected by water transfers.

Expansive soils are soils with the potential to experience considerable changes in volume, either shrinking or swelling, with changes in moisture content.

Therefore, the expansive nature of soils is characterized by their shrink-swell capacity. Changes in soil volume are often expressed as a percent, and in soil surveys the percent represents the overall change for the whole soil.

Soils composed primarily of sand and gravel are not considered expansive (i.e., the soil volume does not change with a change in moisture content). Soils containing silts and clays may possess expansive characteristics. The magnitude of shrink-swell capacity in expansive soils is influenced by:

- Amount of expansive silt or clay in the soil;
- Thickness of the expansive soil zone;
- Thickness of the active zone (depth at which the soils are not affected by dry or wet conditions); and
- Climate (variations in soil moisture content as attributed to climatic or man-induced changes).

Soils are classified as having low, moderate, high, and very high potential for volume changes. The linear extensibility is expressed by percentages; the range of valid values is from 0 to 30 percent (USDA NRCS no date). Table 3.4-1 summarizes shrink-swell classes and the associated linear extensibility percentage. If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures (USDA NRCS no date).

Table 3.4-1. Shrink-Swell Class and Linear Extensibility

Shrink-Swell Class	Linear Extensibility (%)
Low	< 3
Moderate	3-6
High	6-9
Very High	≥ 9

Source: USDA NRCS no date.

3.4.1.2.54 Seller Service Area

This section describes the general soils, including soil erosion and shrink-swell properties, within the Seller Service Area that could be affected by cropland idling transfers. Data on expansive soils was obtained at the county level from the USDA NRCS's web soil survey soil reports.

Generalized soil textures for the counties in the Sellers Service Area are shown in Figure 3.4-3. Figure 3.4-4 shows the shrink-swell potentials of soils in these counties.

Glenn County
Soils in the western part of the Glenn County are largely gravelly loam, gravelly sandy clay loam, and gravelly sandy loam (USDA NRCS 2011a). These soil textures are also dominant in the northeastern part of the county. These soils generally have low erodibility and low shrink-swell potentials (USDA NRCS 2011b and 2011c).

The eastern part of the county is mainly composed of unweathered bedrock, clays, and silty clay loam (USDA NRCS 2011a). These soils have mid-range erodibility and low to high shrink-swell potentials (USDA NRCS 2011b and 2011c). Smaller portions of very gravelly sandy loam and loam border these dominant eastern soils. These soils have mid-range erodibility and low shrink-swell potential. The center of the county is defined by areas of loam, gravelly clay, gravelly clay loam, clay loam, and unweathered bedrock. These soils have mid-range erodibility and high shrink-swell potentials.

Colusa County
The western part of Colusa County is a mixture of areas of moderately decomposed plant material, silt loam, gravelly sandy loam, very gravelly loam, sandy loam, and gravelly loam (USDA NRCS 2009b). These soils have low to mid-range erodibility and low to moderate shrink-swell potentials (USDA NRCS 2009c and 2009d). The central part of the county is composed of clay loam and loam with some areas in the south central part of the county which are sandy clay loam. These soils have low erodibility and low shrink-swell potentials. In the eastern part of the county, there are two areas of land that have a combination of clay loam and sandy loam, one in the south of the county and one in the north. These soils have low to mid-range erodibility and low to moderate shrink-swell potentials. The remainder of the eastern part of the county is silty clay, silt loam, clay, and clay loam (USDA NRCS 2009b). The silty clay and clay soils have mid-range erodibility and high shrink-swell potentials. The clay loam soils have low erodibility and low shrink-swell potentials.

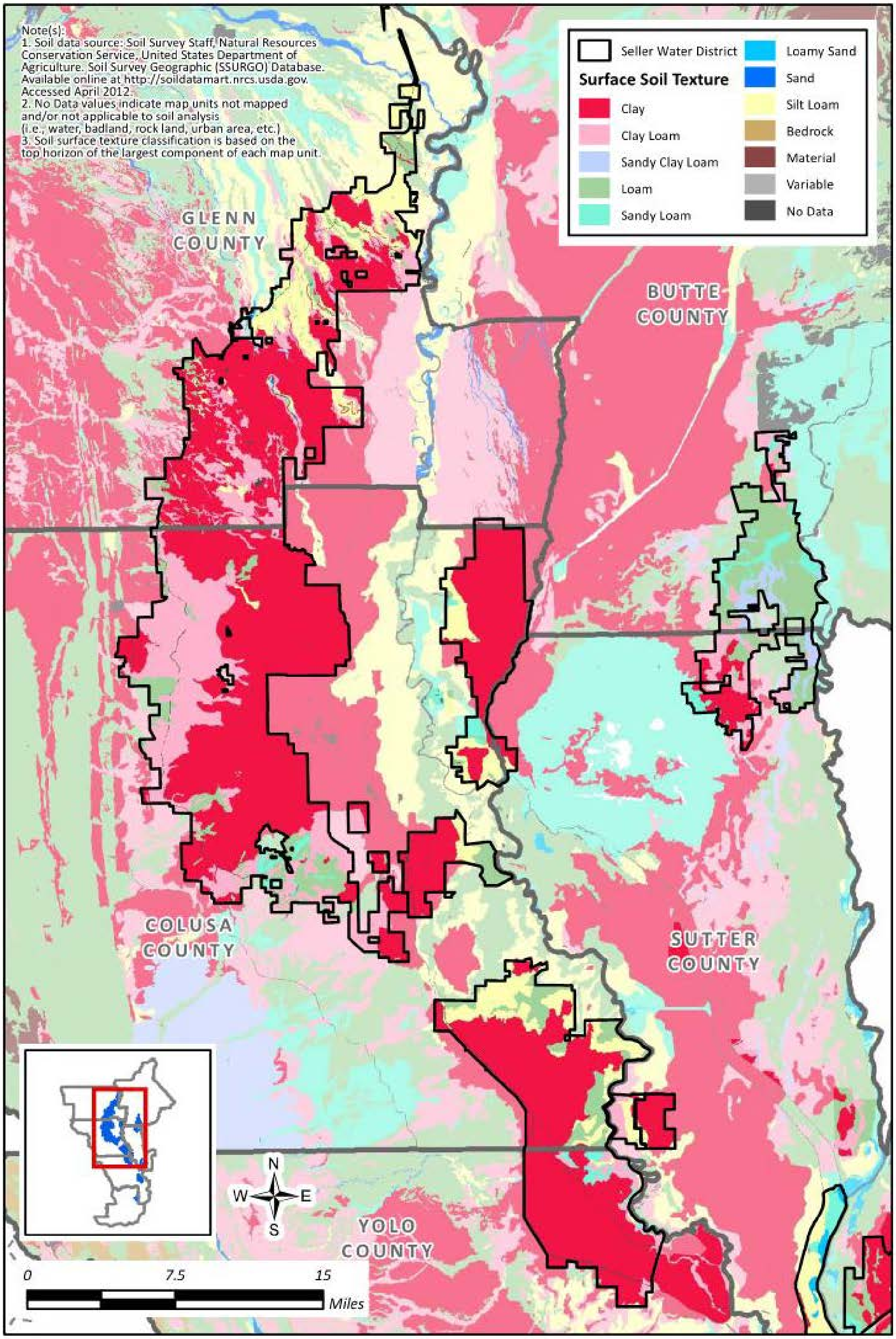


Figure 3.4-3a. Surface Soil Texture – Seller Service Area

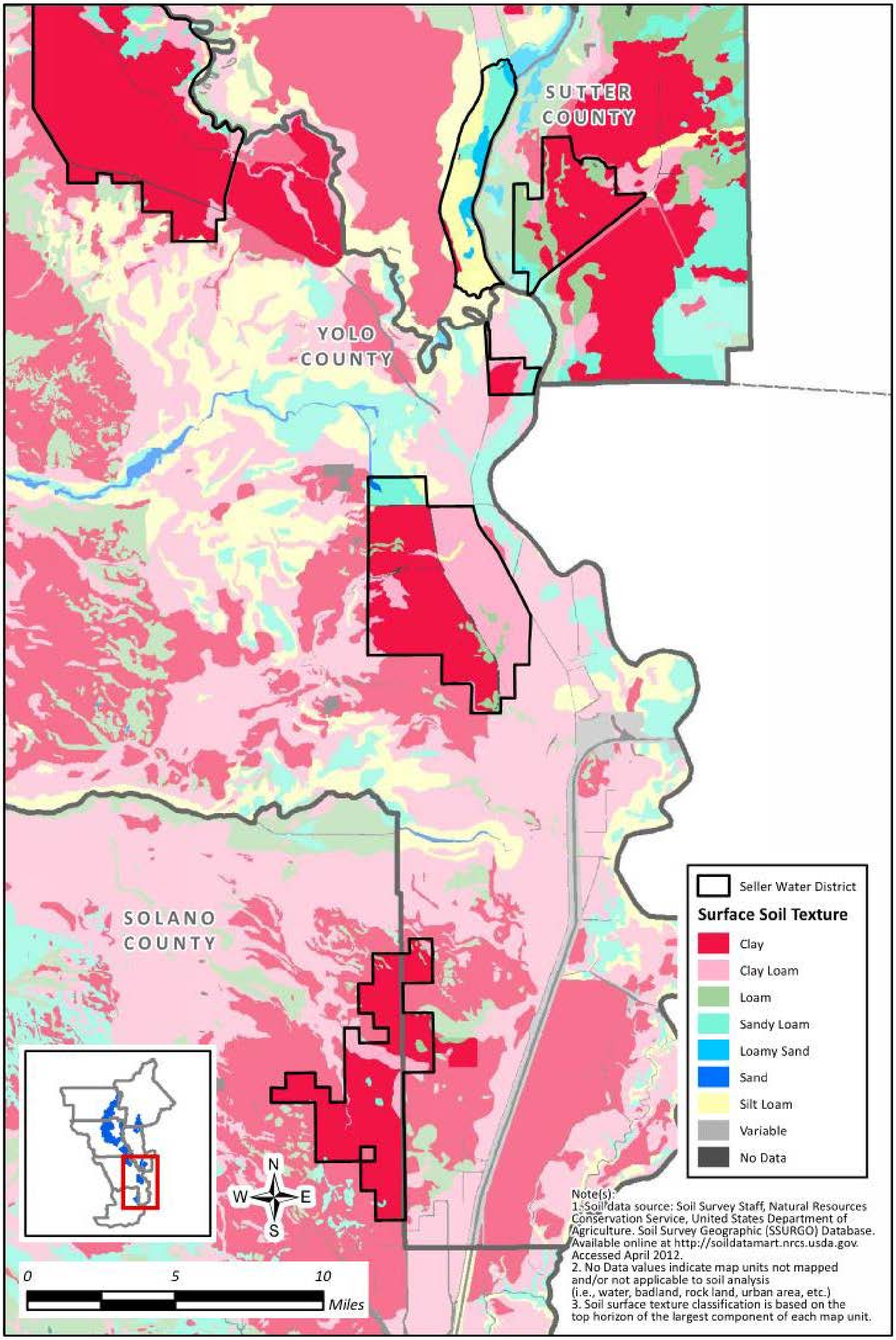


Figure 3.4-3b. Surface Soil Texture – Seller Service Area

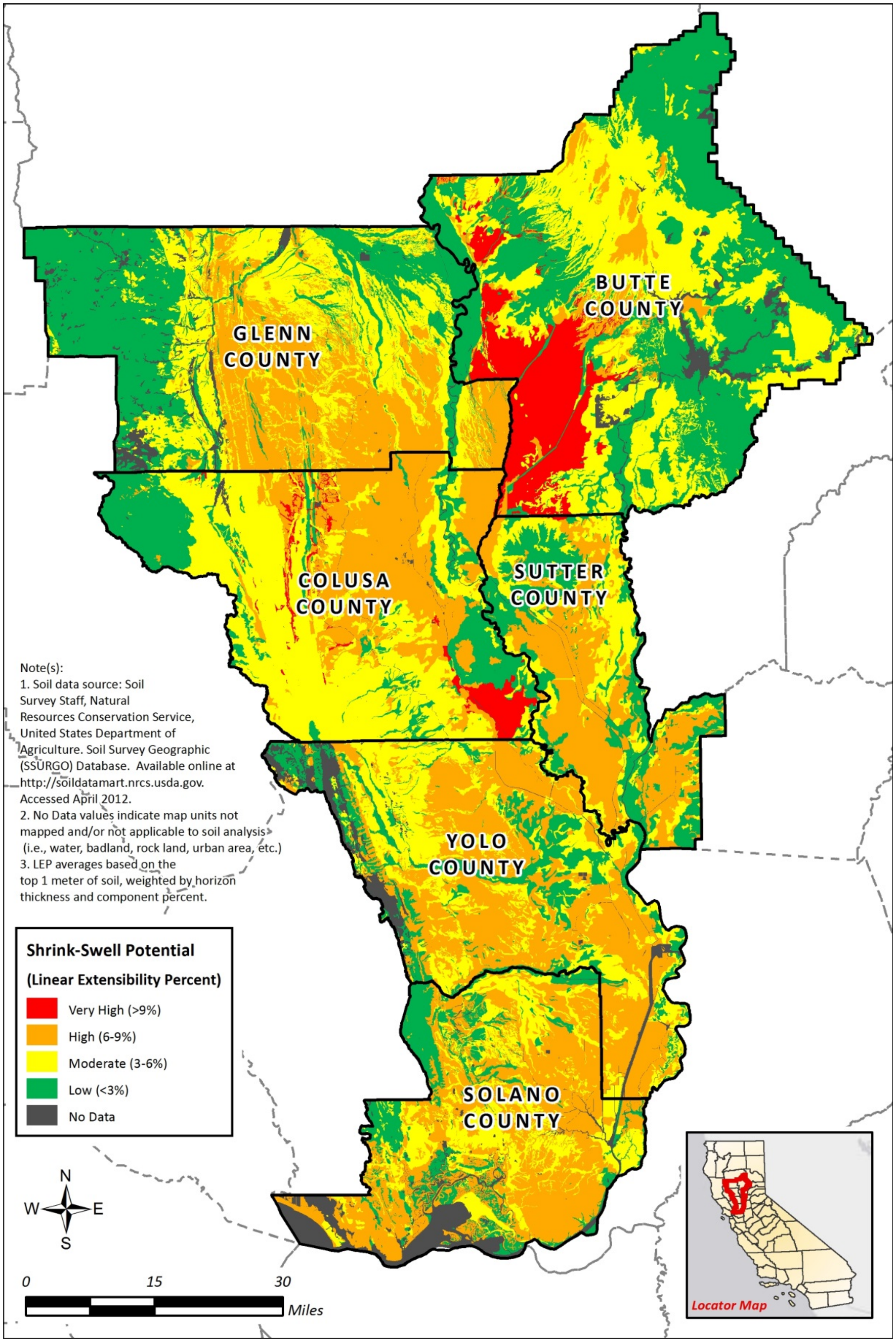


Figure 3.4-4. Shrink-Swell Potential – Seller Service Area

Butte County
The southwestern part of the county (where transfers could occur) is a mixture of loams, clay loam, sandy loam, and clay. These soils have low to mid-range erodibility and low to high shrink-swell potentials (USDA NRCS 2013a, 2013b, 2013c).

Sutter County
The eastern part of the county is a mixture of loams, clay loam, sandy loam, and an area of silty clay in the southeastern corner of the county. These soils have low to mid-range erodibility and low to high shrink-swell potentials. The western part of the county is largely comprised of clay, with a band of clay soils running down the mid-western area of the county. The western boundary of the county is defined by loam, silty clay, and silty clay loam. Clays in this area have mid-range erodibility and high shrink-swell potentials. Soils along the western boundary of the county have high to low erodibility and low shrink-swell potentials, with one area of high shrink-swell potential in the northwestern corner of the county (USDA NRCS 2009e, 2009f, 2009g).

Yolo County
The soils along the western boundary of Yolo County are a mixture of cobbly clay, clay, and silt loam (USDA NRCS 2012a). These soils have low erodibility and low shrink-swell potentials. The central part of the county is a diverse mixture of sandy loams, gravelly loams, gravelly sandy loam, silt loam, silty clay loam, and silty clay. Soils throughout the western part of the county have low erodibility and low to high shrink-swell potentials (USDA NRCS 2012b and 2012c). The eastern part of the county is mainly composed of silt loam, loam, and silty clay loam. These soils are also defined by low erodibility and low to high shrink-swell potentials. There are two areas of very fine sandy loam in the northeast and southeast parts of the county (USDA NRCS 2012a). These soil types have mid-range erodibility and high erosion potentials.

Solano County
Soils throughout the county are mainly clays and clay loams with some areas of sandy loam in the middle of the county. Clays have low erodibility and high shrink-swell potentials. Clay loams also have low erodibility, but have moderate shrink-swell potentials. Sandy loams in the central-north part of the county have high erodibility and low shrink-swell potentials (USDA NRCS 2007a, 2007b, 2007c). The eastern part of the county is largely made up of clays, clay loam, and silty clay loam (USDA NRCS 2007a). In addition to sandy loam, the middle portion of the county also contains gravelly loam and loam soils (USDA NRCS 2007a). These soils have low erodibility and low shrink-swell potentials. The western part of the county is a mixture of silty clay loam, clay loam, loam, and clay.

3.4.1.2.65 Buyer Service Area

This section describes the general topography, geology, and soils in the counties within the Buyer Service Area. Generalized soil textures for counties in the Buyer Service Area are shown in Figure 3.4-5. Figure 3.4-6 illustrates the shrink-swell potentials of soils in these counties.

San Joaquin County

Soil textures in the southwestern corner of the county consist mainly of loam and sandy loam (USDA NRCS 2013d). These soils have low to mid-range erodibilities and low shrink-swell potentials (USDA NRCS 2013e). To the east of this area, the soil texture transitions to clay and clay loam. These soils have low erodibility and moderate-to-high shrink-swell potentials (USDA NRCS 2013e). Soil textures in the other portions of the county also include bedrock, sandy clay loam, and loamy sand, but these areas do not include transfer buyers and do not have the potential to be affected.

Stanislaus County

Soil textures on the western side of the county consist mainly of loam, sandy loam, and sandy clay loam (USDA NRCS 2013f). These soils have low to mid-range erodibilities and low shrink-swell potentials (USDA NRCS 2013g). These soils transition to clay and clay loam to the east of this area, but transfer buyers are only on the west side of the San Joaquin River and would not affect these soil types.

Merced County

Soil textures in the western portion of the county consist mainly of fine sandy loam, fine sand, and loamy sand (USDA NRCS 2008a). These soils have high erosion potentials and low shrink-swell potentials (USDA NRCS 2008b and 2008c). Soils in the south of the county are dominated by loam, silt loam, and silt clay loam. These soils have low to mid-range erodibility and low shrink-swell potentials. The north-central area of the county is mainly fine sand and the south-central portion of the county contains clay loam. These soils generally have low erodibility and low to high shrink-swell potentials (USDA NRCS 2008a; 2008b; 2008c). Soils in the eastern part of the county are generally comprised of silt loam and gravelly loam. These soils have low erosion potentials and low shrink-swell ratings.

Fresno County

Soil textures in the eastern part of the county are dominated by gravelly loam, gravelly sandy loam, and sandy loam (USDA NRCS 2008d). These soils have low to mid-range erodibilities and low shrink-swell potentials (USDA NRCS 2008e and 2008f). In areas along the San Joaquin River and the Fresno Slough, the soil texture is sandy loam (USDA NRCS 2008a). Sandy loam has mid-range erodibility and high to very high shrink-swell potential. The western edge

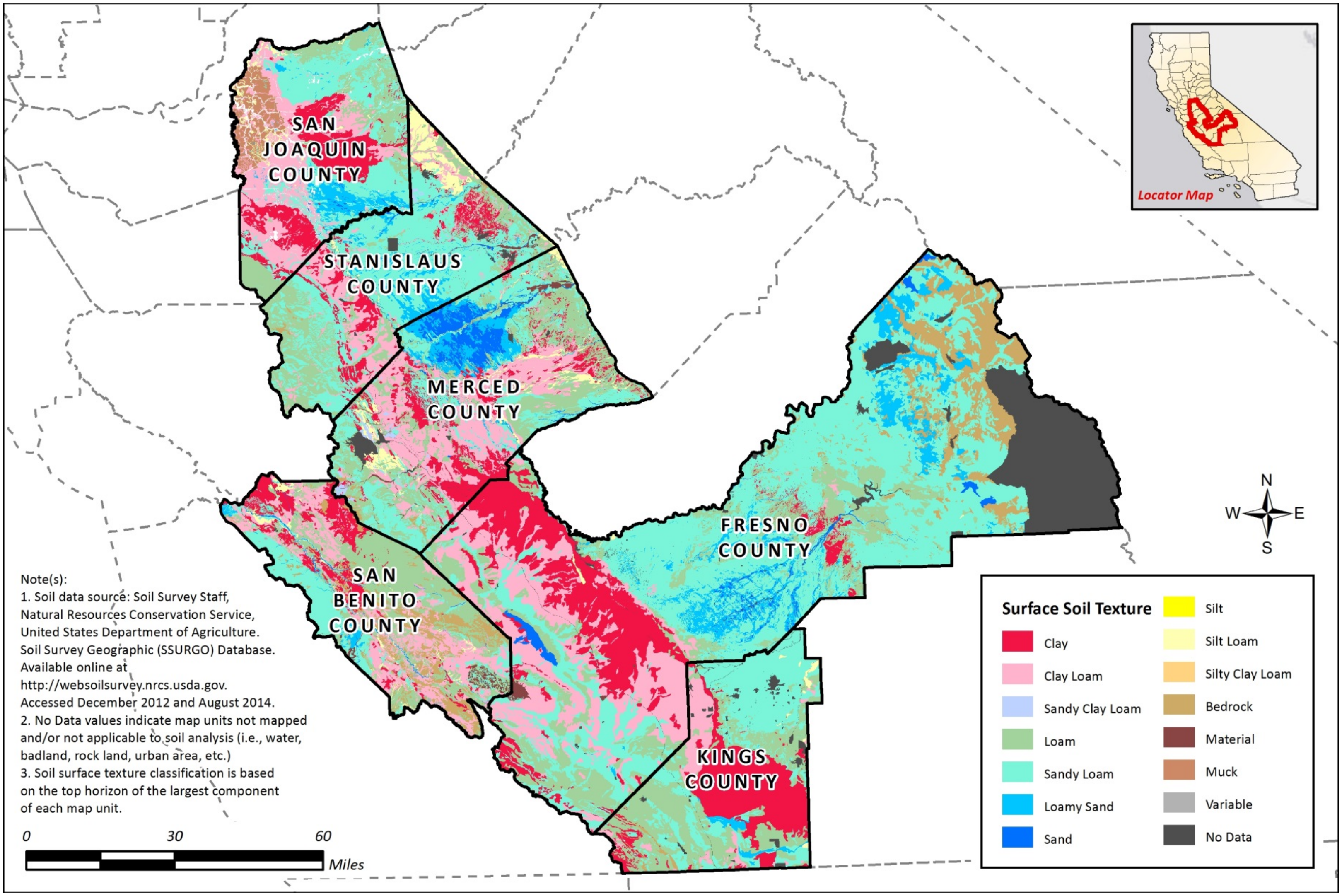


Figure 3.4-5. Soil Surface Texture – Buyer Service Area

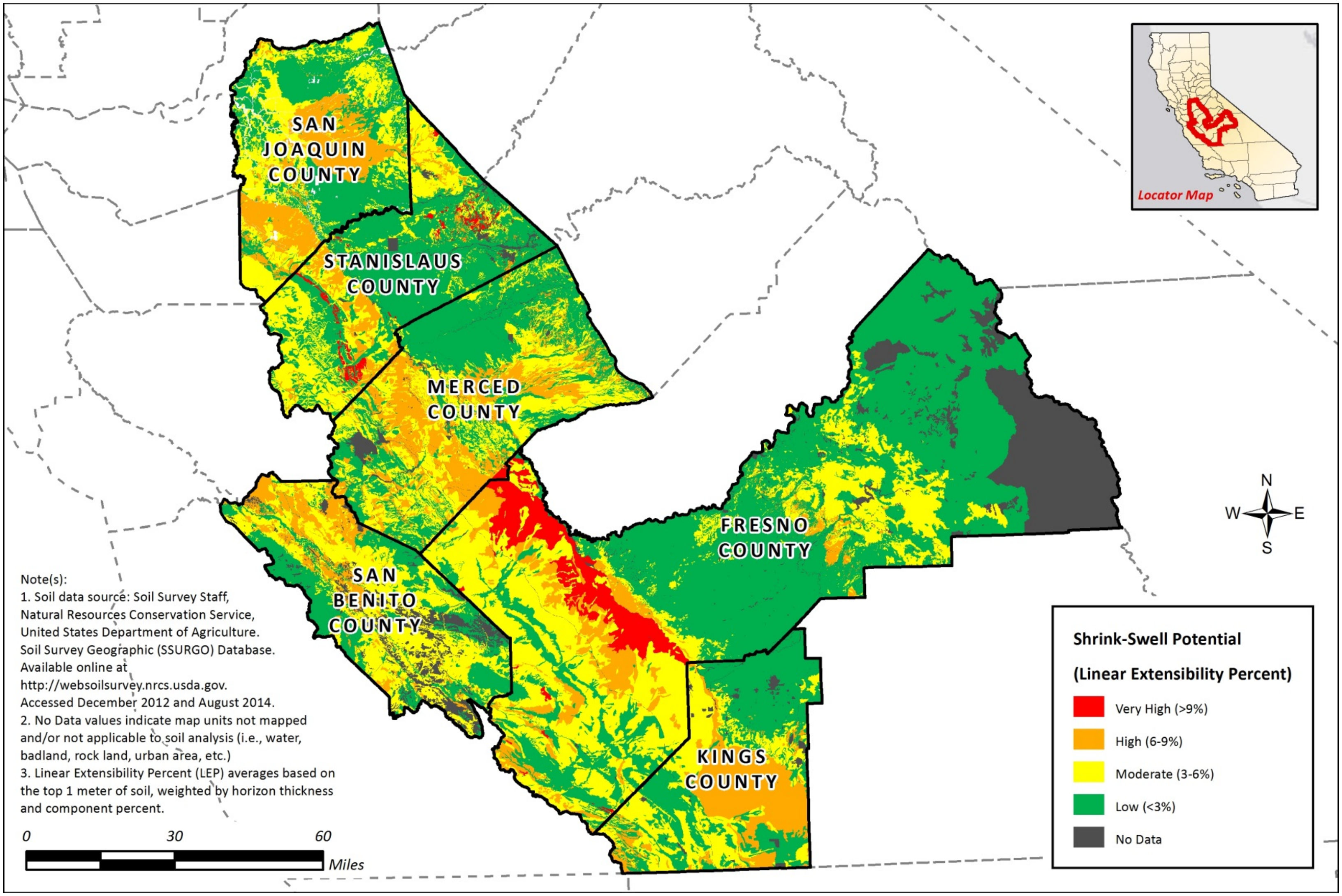


Figure 3.4-6. Shrink-Swell Potential – Buyer Service Area

of the county is defined by the Coast Ranges and consists mainly of clay loam, gravelly clay loam, loam, sandy loam, and silty clay loam (USDA NRCS 2006). The alluvial fans extending eastward into the valley are comprised of clay, clay loam, and sandy loam soils. Lands adjacent to the San Joaquin River include soils with clay and clay loam textures (USDA NRCS 2006).

San Benito County

Soils in the eastern part of the county are mainly comprised of clay, silty clay, and gravelly loam. These soils have low erodibility and low to moderate shrink-swell potentials. Soils in the northeastern part of the county have moderate to high shrink-swell potentials. In the central part of the county, the dominant soil textures are clay, clay loam, and bedrock. These soils have low erodibility and moderate shrink-swell potentials. The western part of the county is characterized by sandy clay loam and sandy loam soils. These soils have mid-range erodibility and low to high shrink-swell potentials.

Kings County

The northeastern part of the county is characterized by fine sandy loam, clay loam, and very fine sandy loam soils. These soils have high erosion potentials and low shrink-swell potential (USDA NRCS 2009h; 2009i; 2009j). Moving south, there is a band of loam soils that border the clay area of the Tulare Lake bed. These soils have low erodibility and low to high shrink-swell potentials. The northwestern edge of the county is predominantly comprised of clay loam soils with low erosion potential and moderate shrink-swell potential. The southwestern area of the county is largely loam with some areas of gravelly sandy loam, sandy loam, and coarse sandy loam. The areas of sandy loam and loam are characterized by mid-range erodibility and low shrink-swell potential. The loam, gravelly sandy loam, and coarse sandy loam areas in the southwestern corner of the county have low erodibility and low to high shrink-swell potential (USDA NRCS 2009h; 2009i; 2009j).

3.4.2 Environmental Consequences/Environmental Impacts

The following sections present the assessment methods to evaluate geology and soils effects and describe the environmental consequences/environmental impacts associated with the No Action/No Project Alternative and action alternatives.

3.4.2.1 Assessment Methods

Cropland idling is the only water transfer method with the potential to affect geology and soils. Cropland idling would create bare fields that could result in the following effects:

- Erosion of soils from wind blowing over fields with no vegetative cover.

- Changes in soil moisture and resulting shrinking and swelling from different irrigation patterns.

The potential for erosion and expansion are assessed qualitatively based on the general distribution of soil textures and the corresponding erosion and expansion properties related to the various soil textures. As described in more detail above in Section 3.4.1.2.1, soils become more erosive as their content of fine sand increases. Soils that contain greater percentages of larger diameter particles are less susceptible to erosion. This trend is somewhat reversed when it comes to the expansiveness of soils. Soils with more sands and gravel components are less affected by changes in moisture content, and therefore, do not expand as greatly as soils with higher silt and clay content.

3.4.2.2 Significance Criteria

Impacts related to geology and soils would be considered potentially significant if implementation of the alternative would:

- Result in substantial soil erosion.
- Result in a substantial risk to life or property due to location on an expansive soil.

This project does not involve construction of new structures; therefore, it does not include geology and soils significance criteria related to that type of construction (such as criteria related to seismic risk, landslides, or unstable soil).

3.4.2.3 Alternative 1: No Action/No Project

There would be no changes to soil erosion under the No Action/No Project Alternative. There would be no cropland idling transfers originating in the Seller Service Area; therefore, potential for soil erosion in the Seller Service Area would be the same as existing conditions.

Under the No Action/No Project Alternative, agricultural water users in the Buyer Service Area may increase the amount of land idled during the crop season in response to Central Valley Project (CVP) shortages, which would leave soils susceptible to erosion. Figure 3.4-5 shows surface soil textures in the counties in the Buyer Service Area. Agricultural lands in these counties are largely composed of clays and clay loam soils, which have low erodibility. Smaller areas also consist of loams, sandy loam, and loamy sand. These soils are slightly more erodible than clays.

Under normal farming practices, farmers leave fields idle during some cropping cycles and manage potential soil erosion impacts to avoid substantial loss of soils and to protect soil quality. Some examples include surface roughening tillage to produce clods, ridges, and depressions to reduce wind velocity and trap drifting soil; establishment of barriers at intervals perpendicular to wind direction; or, application of mulch (USDA NRCS 2009). Farmers would likely apply these same approaches to any increased crop acreage idled under the No Action/No Project Alternative to protect the soil quality and reduce erosion for future planting.

Since there would be no water transfers under the No Action/No Project Alternative, there would be no changes to streamflows and no impacts to stream and river bank erosion.

There would be no changes to shrinking or swelling of soils under the No Action/No Project Alternative. There would be no cropland idling transfers originating in the Seller Service Area; therefore, potential risks of soils shrinking and swelling in the Seller Service Area would be the same as existing conditions.

Under the No Action/No Project Alternative, there is a possibility for increased land idling in the Buyer Service Area as a result of CVP shortages. Figure 3.4-6 shows the shrink-swell potentials of soils in San Joaquin, Stanislaus, Merced, San Benito, Fresno, and Kings counties. Shrink-swell potential in these counties ranges from low to very high; however, the majority of soils have moderate shrink-swell potential.

Soil movement through shrinking and swelling can cause damage to structures and/or roads built on or near the expansive soils. Under existing conditions, agricultural soils shrink and swell in response to winter rains and irrigation cycles (soils are irrigated, then left to dry out, then irrigated again). Therefore, agricultural lands are subject to normal swelling and shrinkage during growing and harvesting cycles and structures and roads in the vicinity of the cropland are also subject to these changes. Thus, the shrinking and swelling of soils as a result of increased idling under the No Action/No Project Alternative would not damage structures or pose a risk to life or property.

3.4.2.4 Alternative 2: Full Range of Transfers (Proposed Action)

Cropland idling transfers in the Seller Service Area could result in temporary conversion of lands from cropland to bare fields, which could increase soil erosion. Table 3.4-2 shows potential maximum annual acreage for cropland idling in the Sellers Service Area.

Table 3.4-2. Maximum Annual Cropland Idling under the Proposed Action (Acres)

Region	Rice	Alfalfa[1]/ Sudan Grass	Corn	Tomatoes	Total
Sacramento River Region	40,704	1,400	400	400	42,904
Feather River Region	10,769	600	800	400	12,569
Delta Region	-	3,000	1,500	-	4,500
Total	**51,473**	**5,000**	**2,700**	**800**	**59,973**

[1] Alfalfa cannot be idled within the legal boundaries of the Delta

Rice fields are proposed for idling in Colusa, Glenn, Butte, Yolo, and Sutter counties. Rice is typically grown on clay soils that are less susceptible to erosion than sandy soils. The rice crop cycle also reduces the potential for erosion. The process of rice cultivation includes incorporating the residual rice straw into the soils after harvest. The fields are then flooded during the winter to aid in decomposition of the straw. If no irrigation water is applied to the fields after this point, the soils would remain moist until approximately mid-May. Once dried, the combination of the decomposed straw and clay soils produces a hard, crust-like surface. This surface texture would remain until the following winter rains if not disturbed. In contrast to sandy topsoil, this surface type would not be conducive to soil loss from wind erosion. Therefore, idled rice fields would not be conducive to soil loss from wind erosion.

Transfers could also include crops other than rice (Table 3.4-2) that have different cropping practices and can be planted on different soil types than clay. For purposes of this analysis, it is assumed that alfalfa, tomatoes, and corn are representative of the non-rice crops that could be idled for long-term water transfers.

As shown in Figures 3.4-3a and 3.4-3b, the soils in the Seller water district areas inCentral Valley agricultural areas in Glenn, Colusa, Butte, Sutter, Solano, and Yolo counties are primarily clay and clay loam with minor smaller portions of silt loam, loam, sandy loam, and sandy clay loam. In general, soils that contain some percentage of clay content, such as the predominant soils in counties in the Sellers Service Area, are less susceptible to erosion.

In the Sacramento River Region (Glenn, Colusa, and Yolo counties), there could be a combined maximum of 2,200 acres of alfalfa, corn, or tomato cropland idled. The sellers that expressed interest in participating in cropland idling transfers in these counties are located mainly on clay and clay loam soils that have low erodibility. The northeastern part of Glenn County has silt loam, loam, and sandy loam soils ((Figures 3.4-3a and 3.4-3b). Areas of loam and silt loam also exist along the eastern edge of Colusa County. The majority of the southeastern corner of Colusa County and the northeastern corner of Yolo County are composed of clay with small patches of loam, silt loam, and sand soils (Figure 3.4-3). It is possible that some idling could occur on the more erodible soil textures such as loam and silt loam. While these soils are more susceptible to wind erosion, the amount of potential acres idled is small, with a maximum of 2,200 acres of alfalfa, corn, and tomatoes in the three counties. Idling of this amount of crop acreage on sandy soils would not likely result in substantial soil erosion.

In the Feather River Region (Butte and Sutter counties), there is also potential for idling to occur on some of the loam or loamy sand soils located in south-central areas (Figures 3.4-3a and 3.4-3b). Idling in the Feather River Region is proposed for a maximum of 1,800 acres of non-rice crops. Because of the predominance of clay soils, it is likely that some of these crops included in a cropland idling transfer would be planted on clay soils. Idling of additional crops up to the maximum acreage on sandy soils would not likely result in substantial soil erosion.

Under the Proposed Action, idling of corn and sudan grass could occur on up to 4,500 acres in the Delta Region (northeastern Solano County). Soils in this area are mostly clay and clay loam; therefore, they are not susceptible to wind erosion.

Due to the primary clay soil textures in counties in the Seller Service Area as well as relatively small acreages of non-rice crops proposed for idling, substantial soil erosion as a result of idling non-rice crops is not expected. The acreages of corn, tomato, and alfalfa crops identified for idling in Table 3.4-3 represent maximum areas that would be idled; it is not likely that all of these fields would be idled at the same time or in each year.

Under normal farming practices, farmers leave fields fallow during some cropping cycles in order to make improvements such as land leveling and weed abatement or to reduce pest problems and build soils. As described under the No Action/No Project Alternative, farmers manage potential soil erosion impacts to avoid substantial loss of soils and to protect soil quality (USDA NRCS 2009). While farmers would not be able to engage in management practices that result in a consumptive use of water on an idled field, they could continue such erosion control techniques as surface roughening tillage to produce clods, ridges, and depressions to reduce wind velocity and trap drifting soil; establishment of barriers at intervals perpendicular to wind direction; or, application of mulch (USDA NRCS 2009). Therefore, cropland idling under the Proposed Action would not result in substantial soil erosion. Impacts would be less than significant.

Cropland idling water transfers could cause expansive soils to shrink due to the reduction in applied irrigation water. Under the Proposed Action, cropland idling transfers could occur in Glenn, Colusa, Butte, Yolo, Solano, and Sutter counties. As shown in Figure 3.4-4, these counties are largely characterized by moderate to high shrink-swell potentials with some smaller areas of low and very high shrink-swell potentials. Cropland idling may increase the extent of soil shrinkage due to lack of irrigation. As described under the No Action/No Project Alternative, because the proposed lands that could be idled are agricultural, they are subject to swelling and shrinkage under normal agricultural growing cycles. Thus, structures and roads in the vicinity of irrigated fields are subject to these changes in soils on a regular basis. The shrinking and swelling of soils due to cropland idling would not result in adverse effects on these structures or roads and would not pose a substantial risk to life or property. Therefore, potential impacts from soil instability under the Proposed Action would be less than significant.

Changes in streamflows in the Sacramento and San Joaquin Rivers and their tributaries as a result of water transfers could result in increased soil erosion. As described in Section 3.17, Flood Control, water transfers in the Proposed Action could increase flows in rivers and in the Delta during the period when water transfers are conveyed from the sellers to the buyers (April through October for East Bay MUD, July through September for transfers conveyed through the Delta). Table 3.17-2 in Section 3.17, Flood Control, shows changes in river flows on the major waterways in the Seller Service Area (Sacramento, Feather, American and Merced rivers). While there would be flow increases compared to the No Action/No Project Alternative, these increases would only be during the dry season of dry and critical years. Flows during these years are below normal and the increase resulting from water transfers would not increase streamflow to a level that would result in soil erosion impacts to stream and river banks. The impact would be less than significant.

Use of water from transfers on agricultural fields in the Buyer Service Area could reduce soil erosion. Water transfers to agricultural users in San Joaquin, Stanislaus, Merced, San Benito, Fresno, and Kings counties would reduce the amount of land idled relative to the No Action/No Project Alternative. Crop plantings would reduce the potential for soil erosion that occurs from winds blowing over bare fields. This would be a benefit of the Proposed Action. Farming practices would resume, which would cause some soil loss from discing, harvesting, and movement of farm equipment. These practices are normal on agricultural lands in the Buyer Service Area and would not result in significant soil erosion.

Use of water from transfers on agricultural fields in the Buyer Service Area could affect soil movement. Irrigation of previously idled fields in San Joaquin, Stanislaus, Merced, San Benito, Fresno, and Kings counties could result in soil swelling. These fields were irrigated in the past and soils have undergone shrinkage and swelling due to normal farming practices and land fallowing. Thus, structures and roads in the vicinity of irrigated fields are subject to these changes in soils on a regular basis. Irrigation as a result of water transfers would not change soil movement relative to what the land has experienced in the past. As a result, there would be no impacts to roads and structures from soil movement.

3.4.2.5 Alternative 3: No Cropland Modifications

Effects in the Buyer Service Area would be the same as the Proposed Action.

There would be no cropland idling under Alternative 3; therefore, there would be no ~~geology and soils~~ impacts in the Seller Service Area from cropland idling. ~~Effects in the Buyer Service Area would be the same as the Proposed Action.~~

Changes in streamflows in the Sacramento and San Joaquin Rivers and their tributaries as a result of water transfers could result in increased soil erosion. As described in Section 3.17, Flood Control, water transfers in Alternative 3 could increase flows in rivers and in the Delta during the period when water transfers are conveyed from the sellers to the buyers (April through October for East Bay MUD, July through September for transfers conveyed through the Delta). Table 3.17-4 in Section 3.17, Flood Control, shows changes in river flows on the major waterways in the Seller Service Area (Sacramento, Feather, American and Merced rivers). While there would be flow increases compared to the No Action/No Project Alternative, these increases would only be during the dry season of dry and critical years. Flows during these years are below normal and the increase resulting from water transfers would not increase streamflow to a level that would result in soil erosion impacts to stream and river banks. The impact would be less than significant.

3.4.2.6 Alternative 4: No Groundwater Substitution

Effects in the Buyer Service Area would be the same as the Proposed Action.

Cropland idling transfers in the Seller Service Area could result in temporary conversion of lands from cropland to bare fields, which could increase soil erosion. Table 3.4-3 shows the acreage and types of crops proposed for idling in each county in the Seller Service Area. Cropland idling transfers under Alternative 4 could idle up to 51,473 acres of rice, 5,000 acres of alfalfa, 2,700 acres of corn, and 800 acres of tomatoes in counties in the Seller Service Area.

Table 3.4-3. Maximum Annual Cropland Idling Acreages under Alternative 4

Region	Rice	Alfalfa[1]/ Sudan Grass	Corn	Tomatoes	Total
Sacramento River Region	40,704	1,400	400	400	42,904
Feather River Region	10,769	600	800	400	12,569
Delta Region	-	3,000	1,500	-	4,500
Total	**51,473**	**5,000**	**2,700**	**800**	**59,973**

[1] Alfalfa cannot be idled within the legal boundaries of the Delta

The potential land idling in Alternative 4 would be the same as analyzed in the Proposed Action. This analysis found that the low potential for erosion and small amounts of idling would reduce the potential for erosion. Therefore, cropland idling under Alternative 4 would not result in substantial soil erosion. Impacts would be less than significant.

Cropland idling water transfers could cause expansive soils to shrink due to the reduction in applied irrigation water. Impacts related to expansive soils would be the same as those described under the Proposed Action. The shrinking and swelling of soils due to cropland idling would not have adverse effects on structures or roads in the area of analysis and would not pose a substantial risk to life or property. Therefore, potential impacts from soil instability under Alternative 4 would be less than significant.

Changes in streamflows in the Sacramento and San Joaquin Rivers and their tributaries as a result of water transfers could result in increased soil erosion. As described in Section 3.17, Flood Control, water transfers in Alternative 3 could increase flows in rivers and in the Delta during the period when water transfers are conveyed from the sellers to the buyers (April through October for East Bay MUD, July through September for transfers conveyed through the Delta). Table 3.17-6 in Section 3.17, Flood Control, shows changes in river flows on the major waterways in the Seller Service Area (Sacramento, Feather, American and Merced rivers). While there would be flow increases compared to the No Action/No Project Alternative, these increases would only be during the dry season of dry and critical years. Flows during these years are below normal and the increase resulting from water transfers would not increase streamflow to a level that would result in soil erosion impacts to stream and river banks. The impact would be less than significant.

3.4.3 Comparative Analysis of Alternatives

Table 3.4-4 summarizes the effects of each of the action alternatives. The following text supplements the table by describing the magnitude of the effects under the action alternatives and No Action/No Project Alternative.

Table 3.4-4. Comparative Analysis of Alternatives

Potential Impact	Alternatives	Significance	Proposed Mitigation	Significance after Mitigation
Land idling that temporarily converts cropland to bare fields in response to CVP shortages in the Buyer Service Area could increase soil loss from wind erosion.	1	LTS	None	LTS
Cropland idling transfers in the Seller Service Area that temporarily convert cropland to bare fields could increase soil erosion.	2, 4	LTS	None	LTS
Land idling in response to CVP shortages in the Buyer Service Area could cause expansive soils to shrink due to the reduction of applied irrigation water.	1	LTS	None	LTS
Cropland idling water transfers could cause expansive soils in the Seller Service Area to shrink due to the reduction in applied irrigation water.	2, 4	LTS	None	LTS
Use of transfer water on agricultural fields in the Buyer Service Area could increase soil erosion.	2, 3, 4	LTS	None	LTS
Use of transfer water on agricultural fields in the Buyer Service Area could increase soil movement.	2, 3, 4	LTS	None	LTS

Potential Impact	Alternatives	Significance	Proposed Mitigation	Significance after Mitigation
Changes in streamflows in the Sacramento and San Joaquin Rivers and their tributaries as a result of water transfers could result in increased soil erosion.	2, 3, 4	LTS	None	LTS

Key:
LTS – less than significant

3.4.3.1 No Action/No Project Alternative

There would be no changes to geology and soils in the Seller Service Area relative to existing conditions. In the Buyer Service Area, increased land idling could occur in response to CVP shortages, which could affect soil erosion and soil stability. Farmers would continue to manage idled fields to control soil erosion impacts and protect the quality of soils for future plantings. Agricultural lands typically undergo shrinking and swelling with a normal planting and harvesting schedule. Thus, potential soil shrinkage under the No Action/No Project Alternative would not result in damage to nearby roads or properties.

3.4.3.2 Alternative 2: Full Range of Transfers – Proposed Action

Cropland idling transfers under the Proposed Action could increase soil erosion and affect soil stability that could damage nearby structures. Cropland idling transfers under the Proposed Action could idle up to 51,473 acres of rice, 5,000 acres of alfalfa, 2,700 acres of corn, and 800 acres of tomatoes in counties in the Seller Service Area. Soils in the area are largely composed of clays, which are less erodible soils. For rice crops, the natural crop cycle and field preparation involved in cultivation also reduces the probability of soil erosion when rice fields are idled (see Sections 3.4.2.3 and 3.4.2.4). Idling of maximum acreages of non-rice crops that may be planted on more sandy soils would not result in substantial soil erosion relative to the No Action/No Project Alternative. Further, farmers would continue to manage idled fields to control soil erosion impacts. Because agricultural lands typically undergo shrinking and swelling with a normal planting and harvesting schedule, there would not be risks to structures as a result of soil instability. Potential effects on expansive soils and soil erosion in the Seller Service Area under the Proposed Action would be greater than the No Action/No Project Alternative; however, impacts would still be less than significant. The Proposed Action would increase water supplies to agricultural users in the Buyer Service Area which would reduce potential soil erosion and effects to soil stability relative to the No Action/No Project Alternative.

3.4.3.3 Alternative 3: No Cropland Modification

The No Cropland Modification Alternative does not include cropland idling or crop shifting transfers. The potential effects on expansive soils and soil erosion from these actions as described under the Proposed Action would not occur under the No Cropland Modification Alternative.

3.4.3.4 Alternative 4: No Groundwater Substitution

As in the Proposed Action, cropland idling transfers could affect soil erosion and soil stability, but these effects would be less than significant. Effects in the Buyer Service Area would be the same as the Proposed Action.

3.4.4 Environmental Commitments/Mitigation Measures

There would be no significant impacts to geology and soils from implementation of the No Action/No Project Alternative or the action alternatives. Therefore, no environmental commitments/mitigation measures are proposed.

3.4.5 Potentially Significant Unavoidable Impacts

None of the action alternatives would result in potentially significant unavoidable impacts on geology and soils.

3.4.6 Cumulative Effects

The timeframe for the geology and soils cumulative effects analysis extends from 2015 through 2024, a ten-year period. The cumulative effects area of analysis for geology and soils is the same as shown in Figure 3.4-1. This section analyzes cumulative effects using the project method, which is further described in Chapter 4.

The projects considered for the cumulative condition are the State Water Project (SWP) water transfers~~, and~~ CVP Municipal and Industrial Water Shortage Policy (WSP), and refuge transfers, which are described in more detail in Chapter 4. SWP transfers could utilize cropland idling in the area of analysis and could therefore affect soils on agricultural fields. The WSP could reduce agricultural water deliveries and increase land idling in the Buyer Service Area. Effects of the WSP in the Seller Service Area would be minor as agricultural water supplies would not substantially change relative to existing conditions. A portion of refuge transfers could come from cropland idling transfers in the San Joaquin Valley near the Buyers Service Area. Idling fields for these transfers could affect soils on agricultural fields, but these changes would be very small and not directly within the Buyers Service Area.

The following sections describe potential geology and soils cumulative effects for each of the proposed alternatives.

3.4.6.1 Alternative 2: Full Range of Transfers

Cropland idling in the Seller Service Area under the Proposed Action in combination with other cumulative projects would contribute to existing soil *erosion in the region.* SWP transfers would include water made available through cropland idling; however, most of the transfers would originate in Butte County, where only minor actions could occur under the Proposed Action. Some SWP cropland idling transfers could also occur in Sutter County. SWP cropland idling would include similar crops as the Proposed Action.

The rice crop cycle and soil texture in which rice is planted reduces the potential for erosion, and a hard crust usually develops over the surface of the field. Idled rice fields would not be conducive to soil loss from wind erosion. The Proposed Action and SWP transfers would not result in significant cumulative soil erosion effects from idling rice.

Cropland idling under the Proposed Action could also occur on corn, tomato, and alfalfa fields. SWP transfers could also involve idling of these crops. However, it is likely that the majority of SWP cropland idling transfers would be rice fields and the amounts of non-rice crops to be idled would be similar to those in the Proposed Action. Farmers participating in cropland idling would manage their fields to reduce erosion and protect soil quality. Given the soil textures in the Sacramento Valley and their low to mid-range erodibility, soil erosion as a result of idling non-rice crops would be low, and would be minimized further by implementing normal soil erosion measures. Potential reductions in agricultural deliveries under the WSP would have minor effects on soil erosion in the Seller Service Area. Therefore, the Proposed Action in combination with other cumulative projects would not result in a cumulative significant impact on soil erosion.

Cropland idling in the Seller Service Area under the Proposed Action could cause expansive soils to shrink. Similar to the cropland idling under the Proposed Action, cropland idling as a result of SWP transfers would also occur on agricultural lands. As these agricultural lands undergo shrinking and swelling as part of the normal cropping cycle, shrinkage as a result of cropland idling would not result in substantial risk to life or property. The combination of idling under the Proposed Action with cropland idling under the SWP transfers would not increase the potential for damage to life or property from expansive soils. Therefore, the Proposed Action in combination with other cumulative projects would not result in a cumulative significant impact associated with the shrinkage of expansive soils.

Use of water from transfers on agricultural fields in the Buyer Service Area could reduce soil erosion. SWP transfers would increase water supply in the Buyer Service Area and reduce soil erosion. The WSP could reduce agricultural water supplies in dry and critical years, which could increase cropland idling and soil erosion. Similarly, refuge transfers could increase cropland idling in areas near the Buyers Service Area. However, CVP water transfers would offset some of these effects. The Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact related to soil erosion in the Buyer Service Area.

Use of water from transfers on agricultural fields in the Buyer Service Area could affect soil movement. SWP transfers would increase water supply in the Buyer Service Area. The WSP and Proposed Action would change agricultural water supplies and potentially affect soil movement. However, agricultural lands are typically subject to shrinking and swelling under normal farming practices. Roads and structures in the vicinity are also subject to this effect. The Proposed Action and WSP would not substantially change soil movement in the Buyer Service Area relative to normal farming practices. Therefore, the Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact related to soil movement in the Buyer Service Area.

3.4.6.2 Alternative 3: No Cropland Modification

Since there would be no cropland idling under Alternative 3, there would be no cumulative impacts to expansive soils or soil erosion in the Seller Service Area. Cumulative effects in the Buyer Service Area would be the same as the Proposed Action.

3.4.6.3 Alternative 4: No Groundwater Substitution

Cumulative impacts under Alternative 4 would be the same as those described under the Proposed Action.

3.4.7 References

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Section 3.5 Air Quality

This section presents the existing setting in relation to air quality within the area of analysis and discusses potential effects on air quality from the proposed alternatives. Appendix F, Air Quality Emission Calculations, provides detailed emission calculations.

Groundwater substitution and cropland idling transfers would affect air quality in the area of analysis. Implementation of conservation or stored reservoir purchase transfers would not affect air quality and are not further discussed in this section. Although some crops may be more energy intensive than others, crop shifting is a regular practice in the Seller and Buyer Service Areas and a quantitative analysis was not conducted for this transfer method.

3.5.1 Affected Environment/Environmental Setting

The following paragraphs provide a brief explanation of the regulatory setting for air quality. Sections 3.5.1.1 through 3.5.1.3 describe the factors that influence pollutant levels on a regional level, including geographical location, weather patterns, and pollutant sources.

3.5.1.1 Area of Analysis

The area of analysis for air quality includes counties where cropland idling could occur in the Seller Service Area, counties overlying groundwater basins where groundwater substitution transfers could occur, and counties where transferred water would be used for agricultural purposes in the Buyer Service Area. Figure 3.5-1 shows the air quality area of analysis.

Figure 3.5-1. Air Quality Area of Analysis

3.5.1.2 Regulatory Setting

Air quality management and protection responsibilities exist in federal, state, and local levels of government. The federal Clean Air Act (CAA) and California Clean Air Act (CCAA) are the primary statutes that establish ambient air quality standards and establish regulatory authorities to enforce regulations designed to attain those standards.

3.5.1.2.1 Federal

The U.S. Environmental Protection Agency (USEPA) is responsible for implementation of the CAA. The CAA was enacted in 1955 and was amended in 1963, 1965, 1967, 1970, 1977, 1990, and 1997. Under authority of the CAA, USEPA established National Ambient Air Quality Standards (NAAQS) for the following criteria pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), inhalable particulate matter with an aerodynamic diameter less than or equal to 10 microns (PM_{10}), fine particulate matter with an aerodynamic diameter less than or equal to 2.5 microns ($PM_{2.5}$), and sulfur dioxide (SO_2).

Table 3.5-1 presents the current NAAQS for the criteria pollutants. Ozone is a secondary pollutant, meaning that it is formed in the atmosphere from reactions of precursor compounds under certain conditions. Primary precursor compounds that lead to formation of O_3 include volatile organic compounds (VOC) and nitrogen oxides (NOx). $PM_{2.5}$ can be emitted directly from sources (e.g., engines) or can form in the atmosphere from precursor compounds. $PM_{2.5}$ precursor compounds in the area of analysis include sulfur oxides (SOx), NOx, VOC, and ammonia.

The Federal CAA requires states to classify air basins (or portions thereof) as either “attainment” or “nonattainment” with respect to criteria air pollutants, based on whether the NAAQS have been achieved, and to prepare State Implementation Plans (SIPs) containing emission reduction strategies to maintain the NAAQS for those areas designated as attainment and to attain the NAAQS for those areas designated as nonattainment. Table 3.5-2 summarizes the air basins and counties included in the area of analysis. Figure 3.5-2 identifies the air basins that would be affected by the alternatives.

Table 3.5-1. National Ambient Air Quality Standards

Pollutant	Averaging Time	NAAQS Primary	NAAQS Secondary
O_3	8 Hour	0.075 ppm (147 µg/m^3)	Same as Primary Standard
PM_{10}	24 Hour	150 µg/m^3	Same as Primary Standard
$PM_{2.5}$	24 Hour	35 µg/m^3	Same as Primary Standard
$PM_{2.5}$	Annual	12 µg/m^3	15 µg/m^3
CO	1 Hour	35 ppm (40 mg/m^3)	N/A
CO	8 Hour	9 ppm (10 mg/m^3)	N/A
NO_2	1 Hour	100 ppb[1] (188 µg/m^3)	N/A
NO_2	Annual	53 ppb (100 µg/m^3)	Same as Primary Standard
SO_2	1 Hour	75 ppb[2] (196 µg/m^3)	N/A
SO_2	3 Hour	N/A	0.5 ppm (1,300 µg/m^3)
SO_2	24 Hour	0.14 ppm (366 µg/m^3)[3]	N/A
SO_2	Annual	0.030 ppm (79 µg/m^3)[3]	N/A
Pb	Rolling 3-Month Average	0.15 µg/m^3	Same as Primary Standard

Source: California Air Resources Board (CARB) 2013a.

Notes:

[1] To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 100 parts per billion (ppb).

[2] To attain this standard, the 3-year average of the annual 99th percentile of 1-hour daily maximum concentrations must not exceed 75 ppb.

[3] On June 22, 2010, the 24-hour and annual primary SO_2 NAAQS were revoked (75 Federal Register [FR] 35520). The 1971 SO_2 NAAQS (0.14 parts per million [ppm] and 0.030 ppm for 24-hour and annual averaging periods) remain in effect until one year after an area is designated for the 2010 1-hour primary standard. CARB recommended that all of California be designated attainment for the 1-hour SO_2 NAAQS (CARB 2011a). Although the USEPA designated as nonattainment most areas in locations where existing monitoring data from 2009-2011 indicated violations of the 1-hour SO_2 NAAQS, they deferred action on all other areas. As a result, the USEPA has not yet finalized area designations for California (78 FR 47191).

Key:

µg/m^3 = micrograms per cubic meter; CAAQS = California Ambient Air Quality Standard; mg/m^3 = milligrams per cubic meter; N/A = not applicable; NAAQS = National Ambient Air Quality Standard; ppb = parts per billion; ppm = parts per million

Table 3.5-2. Area of Analysis – Air Basins

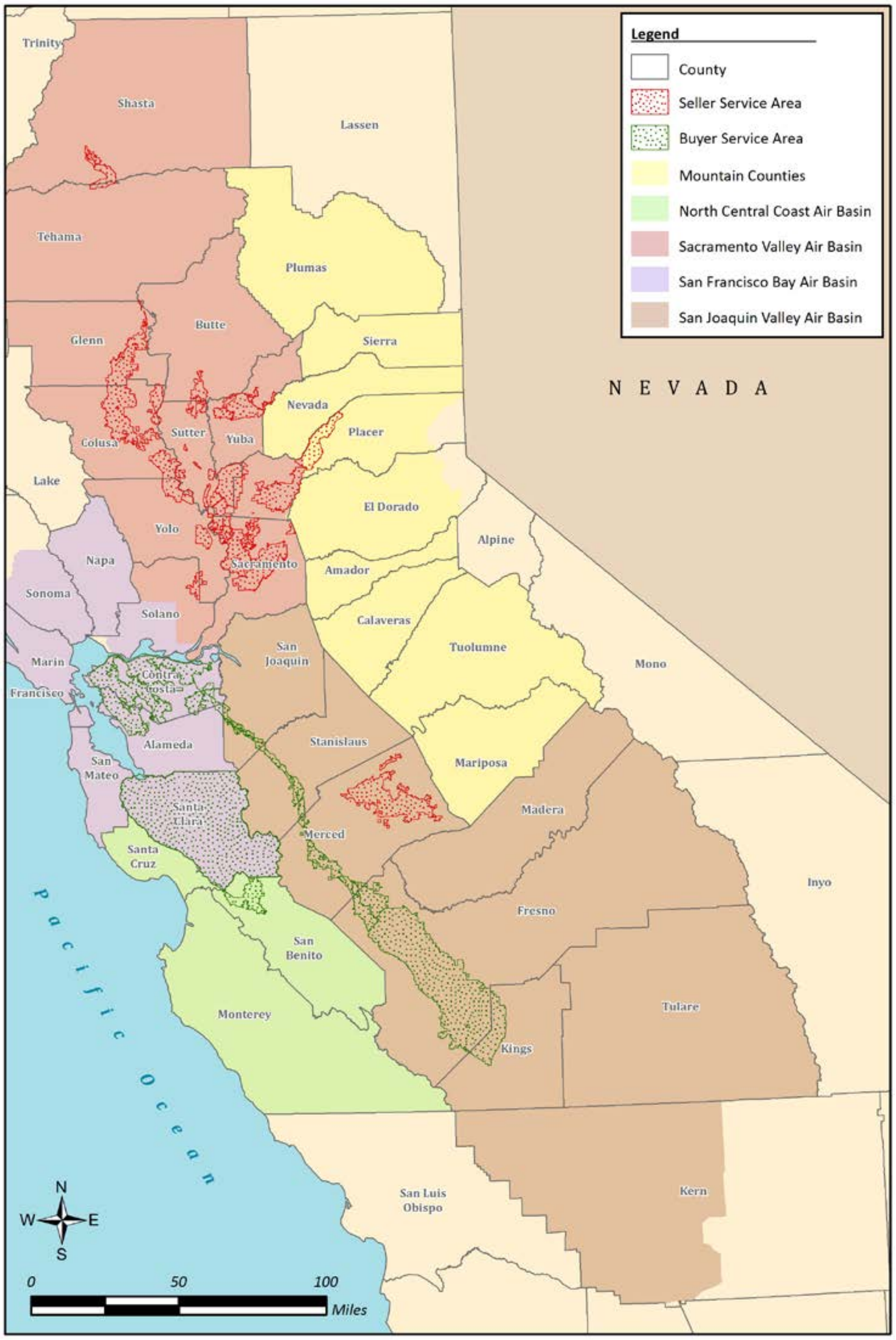
Agency Type	Air Basin	County
Sellers	Mountain Counties	Placer[1]
Sellers	Sacramento Valley	Butte
Sellers	Sacramento Valley	Colusa
Sellers	Sacramento Valley	Glenn
Sellers	Sacramento Valley	Placer[2]
Sellers	Sacramento Valley	Sacramento
Sellers	Sacramento Valley	Shasta
Sellers	Sacramento Valley	Solano[3]
Sellers	Sacramento Valley	Sutter
Sellers	Sacramento Valley	Tehama
Sellers	Sacramento Valley	Yolo
Sellers	Sacramento Valley	Yuba
Sellers	San Joaquin Valley	Merced
Buyers	North Central Coast	San Benito
Buyers	San Francisco Bay	Alameda
Buyers	San Francisco Bay	Contra Costa
Buyers	San Francisco Bay	Santa Clara
Buyers	San Joaquin Valley	Fresno
Buyers	San Joaquin Valley	Kings
Buyers	San Joaquin Valley	Merced
Buyers	San Joaquin Valley	San Joaquin
Buyers	San Joaquin Valley	Stanislaus

Notes:

[1] The portion of Placer County included in the Mountain Counties Air Basin is defined as “all of Placer County except that portion in the Lake Tahoe Air Basin, as defined in Section 60113(b), and that portion included in the Sacramento Valley Air Basin, as defined in Section 60106(k)” (17 California Code of Regulations [CCR] 60111(i)).

[2] The portion of Placer County included in the Sacramento Valley Air Basin is defined as “that portion of Placer County which lies west of Range 9 east, M.D.B. & M” (17 CCR 60106(k)).

[3] The portion of Solano County included in the Sacramento Valley Air Basin is generally defined as the eastern portion of the county. The full description is included in 17 CCR 60106(j).



Source: CARB 2010.

Figure 3.5-2. California Air Basins

General Conformity Section 176 (c) of the CAA (42 U.S. Code [USC] 7506(c)) requires any entity of the federal government that engages in, supports, or in any way provides financial support for, licenses or permits, or approves any activity to demonstrate that the action conforms to the applicable SIP required under Section 110 (a) of the Federal CAA (42 USC 7410(a)) before the action is otherwise approved. In this context, conformity means that such federal actions must be consistent with a SIP's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of those standards. Each federal agency must determine that any action proposed that is subject to the regulations implementing the conformity requirements will, in fact, conform to the applicable SIP before the action is taken. Long-term water transfers are subject to the general conformity rule because a federal agency, the Bureau of Reclamation, is approving Central Valley Project (CVP)-related transfers.

On April 5, 2010, the USEPA revised the general conformity regulations at 40 Code of Federal Regulations (CFR) 93 Subpart B for all federal activities except those covered under transportation conformity (75 Federal Register [FR] 17254). The revisions were intended to clarify, streamline, and improve conformity determination and review processes, and to provide transition tools for making conformity determinations for new NAAQS. The revisions also allowed federal facilities to negotiate a facility-wide emission budget with the applicable air pollution control agencies, and to allow the emissions of one precursor pollutant to be offset by the emissions of another precursor pollutant. The revised rules became effective on July 6, 2010.

The general conformity regulations apply to a proposed federal action in a nonattainment or maintenance area if the total of direct and indirect[1] emissions of the relevant criteria pollutants and precursor pollutants caused by the proposed action equal or exceed certain de minimis amounts, thus requiring the federal agency to make a determination of general conformity. A Federal agency can indirectly control emissions by placing conditions on Federal approval or Federal funding.

Table 3.5-3 presents the de minimis amounts for the area of analysis.

[1] Direct emissions are those that are caused or initiated by the Federal action, and occur at the same time and place as the Federal action. Indirect emissions are reasonably foreseeable emissions that are further removed from the Federal action in time and/or distance, and can be practicably controlled by the Federal agency on a continuing basis (40 CFR 93.152).

Table 3.5-3. General Conformity De Minimis Thresholds

Pollutant	Area	Federal Status	De Minimis (tpy)
VOC (as O_3 precursor)[1]	San Joaquin Valley Air Basin	Nonattainment (Extreme)	10
VOC (as O_3 precursor)[1]	Sacramento Valley Air Basin	Nonattainment (Severe)	25
VOC (as O_3 precursor)[1]	San Francisco Bay Air Basin	Nonattainment (Marginal)	100
NOx (as O_3 precursor)[2]	San Joaquin Valley Air Basin	Nonattainment (Extreme)	10
NOx (as O_3 precursor)[2]	Sacramento Valley Air Basin	Nonattainment (Severe)	25
NOx (as O_3 precursor)[2]	San Francisco Bay Air Basin	Nonattainment (Marginal)	100
CO	San Joaquin Valley Air Basin	Maintenance[3]	100
CO	Sacramento Valley Air Basin	Maintenance[4]	100
CO	San Francisco Bay Air Basin	Maintenance[5]	100
PM_{10}	San Joaquin Valley Air Basin	Maintenance	100
PM_{10}	Sacramento County	Maintenance	100
$PM_{2.5}$	San Joaquin Valley Air Basin	Nonattainment	100
$PM_{2.5}$	Sacramento Valley Air Basin[6]	Nonattainment	100
$PM_{2.5}$	San Francisco Bay Air Basin	Nonattainment	100
SO_2 (as $PM_{2.5}$ precursor)	See Footnote[7]	Attainment	100

Source: CARB 2011b; USEPA 2013a; 40 CFR 93.153.

Notes:

[1] As a precursor to $PM_{2.5}$, VOC also has a threshold of 100 tons per year (tpy). Because the thresholds for VOC as an O_3 precursor are more conservative, those values are used in the analysis.

[2] As a precursor to both NO_2 and $PM_{2.5}$, NOx also has a threshold of 100 tpy. Because the thresholds for NOx as an O_3 precursor are more conservative, those values are used in the analysis.

[3] Includes the urbanized portions of Fresno (Fresno County), Modesto (Stanislaus County), and Stockton (San Joaquin Valley); however, no water agencies are located in these areas.

[4] Includes the Chico Urbanized Area (Butte County) and the Sacramento area (portions of Placer, Sacramento, and Yolo County). No water agencies are located in the Chico Urbanized Area or the urbanized area of Yolo County, near the City of Davis.

[5] Includes the San Francisco-Oakland-San Jose urbanized area, which includes San Francisco County and portions of Alameda, Contra Costa, Marin, Napa, San Mateo, Santa Clara, Solano, and Sonoma Counties.

[6] Includes the Sacramento area (Sacramento County and portions of El Dorado, Placer, Solano, and Yolo Counties), the Yuba City-Marysville area (Sutter County and a portion of Yuba County), and the Chico Urbanized Area (Butte County). No water agencies are located in the Chico Urbanized Area.

[7] Although the area of analysis is an attainment area for SO_2, any precursors to nonattainment pollutants are also subject to de minimis thresholds; therefore, since SO_2 is a precursor to $PM_{2.5}$, which is in nonattainment for certain regions, it is subject to the given emissions threshold.

Key:

CO = carbon monoxide; NOx = nitrogen oxides; O_3 = ozone; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; SO_2 = sulfur dioxide; tpy = tons per year; VOC = volatile organic compounds

The general conformity regulations incorporate a stepwise process, beginning with an applicability analysis. According to USEPA guidance (USEPA 1994), before any approval is given for a proposed action to go forward, the regulating federal agency must apply the applicability requirements found at 40 CFR 93.153(b) to the proposed action. The guidance states that the applicability analysis can be (but is not required to be) completed concurrently with any analysis required under the National Environmental Policy Act (NEPA). If the regulating federal agency determines that the general conformity regulations do not apply to the proposed action (meaning the project emissions do not exceed the de minimum thresholds), no further analysis or documentation is required.

If the general conformity regulations apply to the proposed action, the regulating federal agency must next conduct a conformity evaluation in accord with the criteria and procedures in the implementing regulations, publish a draft determination of general conformity for public review, and then publish the final determination of general conformity. For a required action to meet the conformity determination emissions criteria, the total of direct and indirect emissions from the action must be in compliance or consistent with all relevant requirements and milestones contained in the applicable SIP (40 CFR 93.158(c)), and in addition must meet other specified requirements, such as:

- For any criteria pollutant or precursor, the total of direct and indirect emissions from the action is specifically identified and accounted for in the applicable SIP's attainment or maintenance demonstration (40 CFR 93.158(a)(1)); or

- For precursors of O_3, NO_2, or particulate matter, the total of direct and indirect emissions from the action is fully offset within the same nonattainment (or maintenance) area through a revision to the applicable SIP or a similarly enforceable measure that effects emission reductions so that there is no net increase in emissions of that pollutant (40 CFR 93.158(a)(2)); or

- For O_3 or NO_2, the total of direct and indirect emissions from the action is determined and documented by the State agency primarily responsible for the applicable SIP to result in a level of emissions which, together with all other emissions in the nonattainment (or maintenance) area, would not exceed the emissions inventory specified in the applicable SIP (40 CFR 93.158(a)(5)(i)(A)); or

- For O_3 or NO_2, the total of direct and indirect emissions from the action (or portion thereof) is determined by the State agency responsible for the applicable SIP to result in a level of emissions which, together with all other emissions in the nonattainment (or maintenance) area, would exceed the emissions inventory specified in the applicable SIP and the State Governor or the Governor's designee for SIP actions makes a written commitment to USEPA for specific SIP revision measures reducing emissions to not exceed the emissions inventory (40 CFR 93.158(a)(5)(i)(B)).

3.5.1.2.2 State

The CCAA substantially added to the authority and responsibilities of the State's air pollution control districts (APCDs). The CCAA establishes an air quality management process that generally parallels the Federal process. The CCAA, however, focuses on attainment of the California Ambient Air Quality Standards (CAAQS) that, for certain pollutants and averaging periods, are typically more stringent than the comparable NAAQS. The CAAQS are included in Table 3.5-4.

Table 3.5-4. California Ambient Air Quality Standards

Pollutant	Averaging Time	CAAQS
O_3	1 Hour	0.09 ppm (180 μg/m^3)
O_3	8 Hour	0.070 ppm (137 μg/m^3)
PM_{10}	24 Hour	50 μg/m^3
PM_{10}	Annual	20 μg/m^3
$PM_{2.5}$	Annual	12 μg/m^3
CO	1 Hour	20 ppm (23 mg/m^3)
CO	8 Hour	9.0 ppm (10 mg/m^3)
NO_2	1 Hour	0.18 ppm (339 μg/m^3)
NO_2	Annual	0.030 ppm (57 μg/m^3)
SO_2	1 Hour	0.25 ppm (655 μg/m^3)
SO_2	24 Hour	0.04 ppm (105 μg/m^3)
Pb	30-Day Average	1.5 μg/m^3

Source: CARB 2013a.
Key:
μg/m^3 = micrograms per cubic meter; CAAQS = California Ambient Air Quality Standard; mg/m^3 = milligrams per cubic meter; ppm = parts per million

The CCAA requires that the CAAQS be met as expeditiously as practicable, but does not set precise attainment deadlines. Instead, the act established increasingly stringent requirements for areas that will require more time to achieve the standards.

The air quality attainment plan requirements established by the CCAA are based on the severity of air pollution problems caused by locally generated emissions. Upwind APCDs are required to establish and implement emission control programs commensurate with the extent of pollutant transport to downwind districts.

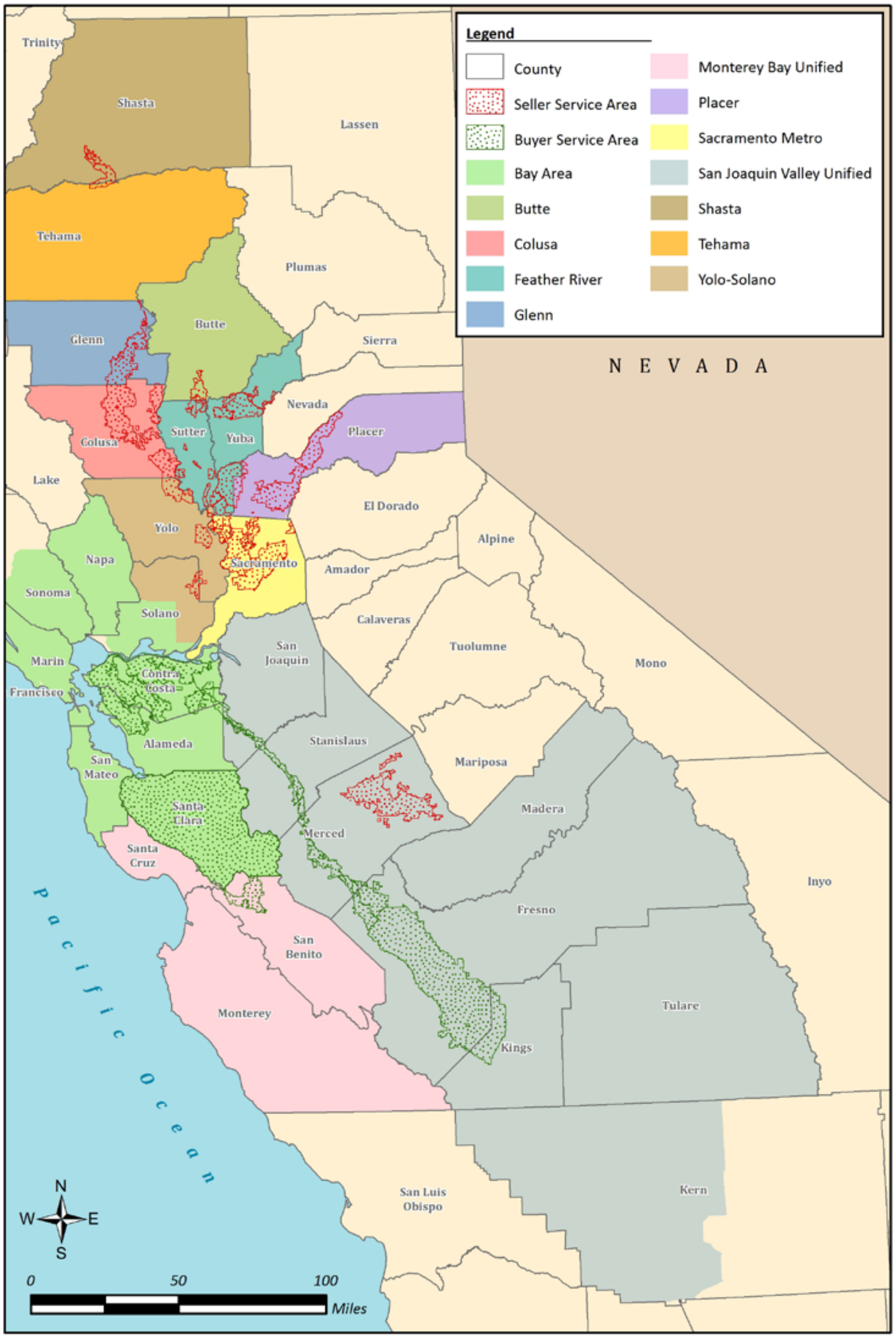
The California Air Resources Board (CARB) is responsible for developing emission standards for on-road motor vehicles and some off-road equipment in the state. In addition, CARB develops guidelines for the local districts to use in establishing air quality permit and emission control requirements for stationary sources subject to the local air district regulations.

3.5.1.2.3 Regional/Local

Multiple air quality management districts (AQMDs) and APCDs have jurisdiction over the O_3, PM_{10}, and $PM_{2.5}$ nonattainment areas. The following APCDs/AQMDs regulate air quality within the area of analysis:

- Bay Area AQMD
- Butte County AQMD
- Colusa County APCD
- Feather River AQMD
- Glenn County APCD
- Monterey Bay Unified APCD
- Placer County APCD
- Sacramento Metropolitan AQMD
- San Joaquin Valley APCD
- Shasta County AQMD
- Tehama County APCD
- Yolo-Solano APCD

Figure 3.5-3 depicts the location of each air district in relation to the Seller and Buyer Service Areas.



Source: CARB 2010.

Figure 3.5-3. Locations of APCDs and AQMDs

Air Toxic Control Measure Agricultural engines are subject to CARB's Airborne Toxic Control Measure (ATCM) for Stationary Compression Ignition Engines (17 California Code of Regulations [CCR] 93115). The ATCM contains emissions limits on diesel engines greater than 50 brake-horsepower (bhp), particularly for diesel particulate matter (DPM), based on the size and use of the engine. In addition to requiring the use of CARB diesel fuel[2] or an alternative fuel like biodiesel, the ATCM also contains schedules of required emission reductions that phase-in depending on engine use (e.g., agriculture, emergency, etc.) size (horsepower [hp]), and calendar year. In addition, the individual air districts may have their own rules and regulations governing implementation of the ATCM that must be followed. Rules adopted by the various APCDs and AQMDs related to the ATCM and permitting of stationary agricultural diesel engines are summarized below.[3]

Butte County AQMD

- Rule 441 – Registration Requirements for Stationary Compression Ignition Engines Used in Agricultural Operations
- Rule 1001 – ATCM for Stationary Compression Ignition Engines Used in Agricultural Operations

Colusa County APCD

- No additional rules

Feather River AQMD

- Rule 4.16 – Registration Permits for Compression Ignition Engines Used in Agricultural Operations
- Rule 7.14 – Registration Fees for Compression Ignition Engines Used in Agricultural Operations

Glenn County APCD

- No additional rules

Placer County APCD

- No additional rules

Sacramento Metropolitan AQMD

- No additional rules

[2] "CARB diesel fuel" is defined as diesel fuel that meets the specifications of vehicular diesel fuel, namely meeting a 15 parts per million (ppm) sulfur standard.

[3] Because only buyers are under the jurisdiction of the Bay Area AQMD and the Monterey Bay Unified APCD, the rules and regulations associated with these two air districts are not discussed further in this section because they do not participate in groundwater substitutions associated with the Proposed Action and alternatives.

San Joaquin Valley APCD

- No additional rules

Shasta County AQMD

- No additional rules

Tehama County APCD

- No additional rules

Yolo-Solano AQMD

- Rule 11.3 – Agricultural Engine Registrations

The ATCM requires new stationary diesel-fueled engines to meet certain specific emission standards unless they are remotely located. An engine is defined as a remotely located engine if it is in a Federal ambient air quality area that is designated as attainment for any of the particulate matter and O_3 NAAQS and is more than one-half mile from any residential area, school, or hospital. Assuming that the latter requirement is met (i.e., proximity to sensitive receptors), engines in Colusa, Glenn, Shasta, and Tehama counties are not subject to the ATCM.

For other counties, the emission rates specified in Table 3.5-5 for Noncertified ("Tier 0") Engines and in Table 3.5-6 for Tier 1- and 2-Certified Engines[4] are applicable. The different tables reflect the certification status of existing engines and the emission standard that must be met by the respective compliance dates. The ATCM generally requires that any new engines used for agricultural operations meet the current Tier 3 standard, which must then be subsequently replaced with Tier 4 engines at certain compliance dates.[5] As of 2010, any engines manufactured prior to 1996 (Tier 0 or noncertified engines) cannot continue to be operated unless they meet the emission standards summarized in Table 3.5-5 (equivalent to Tier 3 engines). Tier 1 or Tier 2 certified engines must meet the emission standards required for Tier 4 engines (see Table 3.5-6) starting in 2014 or by 12 years after the installation of the engine, whichever is later. Engines may either be retrofit or replaced to meet the applicable emission standards.

The ATCM does not expressly prohibit the use of diesel engines for agricultural purposes; therefore, diesel engines may be used for groundwater pumping associated with groundwater substitution transfers as long as they are replaced when required by the compliance schedule.

[4] A certified engine is defined as "a CI engine that is certified to meet the Tier 1, Tier 2, Tier 3, or Tier 4 Off-Road CI Certification Standards as specified in title 13, California Code of Regulations, section 2423." New engines must be certified by CARB for emission compliance before they are legal for sale, use, or registration in California. Certification is granted annually to individual engine families and is good for one model year.

[5] Existing engines may also retrofit with a Verified Diesel Emission Control Strategy to meet the applicable emission limits.

Table 3.5-5. Emission Standards for Noncertified Compression Ignition Agricultural Engines > 50 BHP

BHP Range	Compliance Date	DPM Not to Exceed (g/bhp-hr)[1,2]
50<hp<75	2011	0.30
75≤hp<100	2011	0.30
100≤hp<175	2010	0.22
175≤hp<750	2010	0.15
hp>750	2014	0.075

Source: 17 CCR 93115

Notes:

[1] The diesel PM standard indicates the emission limit that existing noncertified engines must meet by the given compliance date. The emission rates in the table reflect Tier 3 emission limits (13 CCR 2423). In other words, existing noncertified engines must be replaced with Tier 3 engines (or retrofit, if feasible) by the compliance date.

[2] If no limits have been established for an off-road engine of the same model year and maximum rated power, then the in-use stationary diesel-fueled engine used in an agricultural operation shall not exceed Tier 1 standards in title 13, CCR, section 2423 for an off-road engine of the same maximum rated power irrespective of model year.

Key:

CI = compression ignition
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
HC = hydrocarbons
NMHC = non-methane hydrocarbons
hp = horsepower

Table 3.5-6. Emission Standards for Tier 1- and 2-Certified Compression Ignition Engines > 50 BHP

BHP Range	Compliance Date	DPM Not to Exceed (g/bhp-hr)[1,2]
50<hp<75	2015 [3]	0.02
75≤hp<175	2015 [3]	0.01
175≤hp<750	2014 [3]	0.01
hp>750	2014 [3]	0.075

Source: 17 CCR 93115.

Notes:

[1] The diesel PM standard indicates the emission limit that existing Tier 1- or 2-certified engines must meet by the given compliance date. The emission rates in the table reflect Tier 4 emission limits (13 CCR 2423). In other words, existing Tier 1- or 2-certified engines must be replaced with Tier 4 engines (or retrofit, if feasible) by the compliance date.

[2] Or 12 years after the date of initial installation, whichever is later

[3] If no limits have been established for an off-road engine of the same model year and maximum rated power, then the in-use stationary diesel-fueled engine used in an agricultural operation shall not exceed Tier 1 standards in title 13, CCR, section 2423 for an off-road engine of the same maximum rated power irrespective of model year.

Key:

CI = compression ignition
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
HC = hydrocarbons
NMHC = non-methane hydrocarbons
hp = horsepower

3.5.1.3 Existing Conditions

The following sections describe the air basins within the Long-Term Water Transfers area of analysis, including CARB's estimated annual average daily emissions for agricultural sources. Emissions categories include farming operations (harvesting and tilling), fugitive windblown dust (non-pasture agricultural lands), agricultural burning, agricultural equipment, and irrigation pumps. Although there are other agricultural emissions categories that CARB includes in its inventories, only those categories that could be affected by the Proposed Action and alternatives were summarized. This section also summarizes existing monitoring data for the area of analysis.

The entire area of analysis is in attainment of the PM_{10}, NO_2, SO_2, CO[6], and Pb NAAQS. Table 3.5-7 summarizes the federal attainment status of counties in the area of analysis. Table 3.5-8 summarizes the attainment status for the CAAQS. The entire area of analysis has attained the CO, NO_2, SO_2, and Pb CAAQS.

Figure 3.5-4 shows the federal maintenance areas for the CO standard; Figure 3.5-5 shows the federal nonattainment areas for the 8-hour O_3 standard; Figure 3.5-6 shows the federal nonattainment areas for $PM_{2.5}$; and Figure 3.5-7 shows the federal maintenance areas for PM_{10}.

[6] Portions of the area of analysis are listed as maintenance areas of the CO NAAQS, meaning that they were previously in nonattainment, but have since been redesignated as attainment areas. The Sacramento Census Bureau Urbanized Area (portions of Placer, Sacramento, and Yolo Counties) is designated as a maintenance area for CO; however, no water agencies are located in the maintenance area in Yolo County (near the City of Davis). Additionally, the Chico Urbanized Area in Butte County is designated maintenance, but no water agencies are located in this area. The San Francisco-Oakland-San Jose Urbanized Area (portions of Alameda, Contra Costa, Marin, Napa, San Mateo, Santa Clara, Solano, and Sonoma Counties and all of San Francisco County) is also a maintenance area for CO.

Table 3.5-7. Federal Attainment Status for the Area of Analysis

Air Basin	County	O_3	PM_{10}	$PM_{2.5}$
Sacramento Valley	Butte	N[1]	A	N
	Colusa	A	A	A
	East Solano	N[2]	A	N
	Glenn	A	A	A
	Placer	N	A	N
	Sacramento	N[2]	M[5]	N
	Shasta	A	A	A
	Sutter (Sacramento Metro[3])	N[2]	A	N
	Tehama	A	A	A
	Yolo	N[3]	A	N
	Yuba	A	A	N
San Joaquin Valley	Fresno	N[4]	M	N
	Kings	N[4]	M	N
	Merced	N[4]	M	N
	San Joaquin	N[4]	M	N
	Stanislaus	N[4]	M	N
San Francisco Bay	Alameda	N[1]	A	N
	Contra Costa	N[1]	A	N
	Santa Clara	N[1]	A	N
North Central Coast	San Benito	A	A	A

Source: CARB 2011b; USEPA 2013a; 40 CFR 81.

Notes:

[1] 8-Hour O_3 classification = marginal

[2] 8-Hour O_3 classification: Severe 15

[3] The Sacramento Metro Area portion of Sutter County is defined as "portion south of a line connecting the northern border of Yolo County to the southwest tip of the Yuba County and continuing along the southern Yuba County border to Placer County." (40 CFR 81).

[4] 8-Hour O_3 classification: Extreme

[5] On October 23, 2013, the USEPA approved the *PM_{10} Implementation/Maintenance Plan and Redesignation Request for Sacramento County* (October 28, 2010) and redesignated the area as maintenance for PM_{10} (78 FR 59261).

[6] PM_{10} classification: Moderate

Key:

O_3 = ozone; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; N = nonattainment; A = attainment; M = maintenance

Table 3.5-8. State Attainment Status for the Area of Analysis

Air Basin	County	O_3	PM_{10}	$PM_{2.5}$
Sacramento Valley	Butte	N	N	N
	Colusa	A	N	A
	East Solano	N	N	A
	Glenn	A	N	A
	Placer	N	N	A
	Sacramento	N	N	A
	Shasta	N	N	A
	Sutter	N-T[1]	N	A
	Tehama	N	N	A[2]
	Yolo	N	N	A
	Yuba	N-T[1]	N	A
San Joaquin Valley	Fresno	N	N	N
	Kings	N	N	N
	Merced	N	N	N
	San Joaquin	N	N	N
	Stanislaus	N	N	N
San Francisco Bay	Alameda	N	N	N
	Contra Costa	N	N	N
	Santa Clara	N	N	N
North Central Coast	San Benito	N	N	A

Source: CARB 2014a; CARB 2011b; 17 CCR 60200-60210.

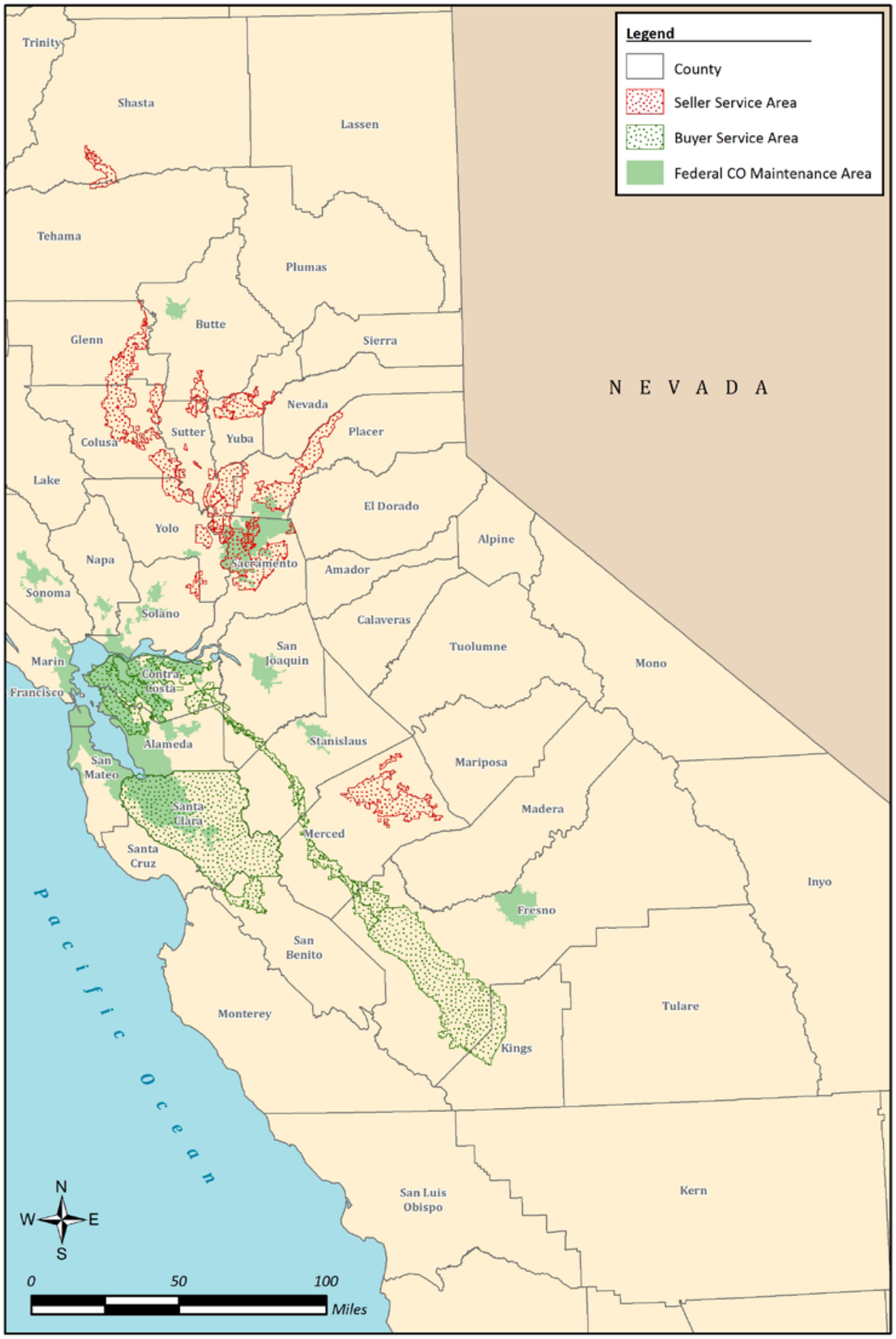
Notes:

[1] Nonattainment/transitional areas are defined as those areas that during a single calendar year, the State standards were not exceeded more than three times at any monitoring location within the district.

[2] Tehama County is "unclassified" for the $PM_{2.5}$ CAAQS, which generally means that insufficient monitoring data is available to make a designation. Such areas are typically treated as attainment areas.

Key:

O_3 = ozone; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; N = nonattainment; N-T = nonattainment-transitional; A = attainment

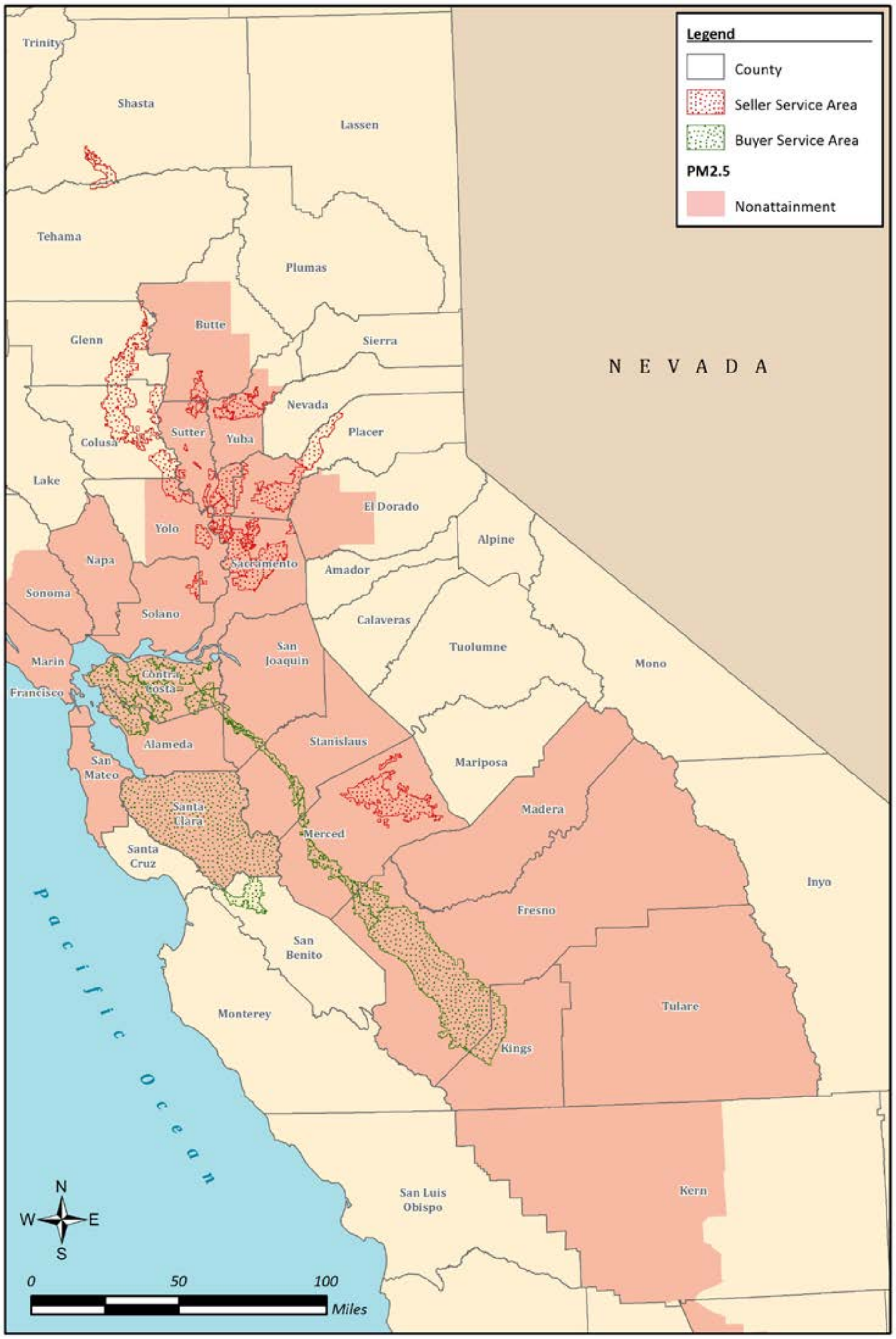


Source: USEPA 2013b.

Figure 3.5-4. Federal CO Maintenance Areas

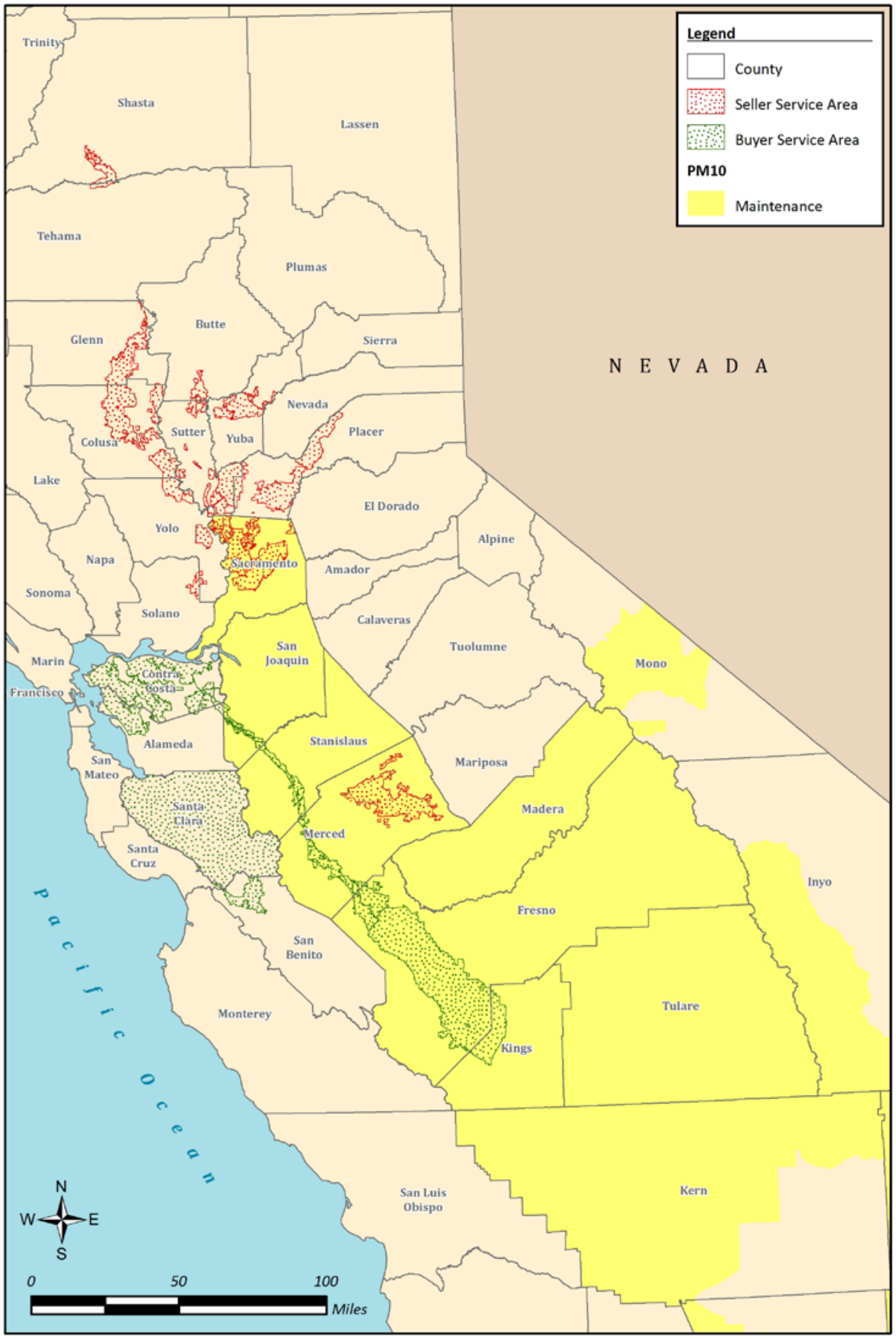
Source: USEPA 2013b.

Figure 3.5-5. Federal 8-Hour O_3 Nonattainment Areas



Source: USEPA 2013b.

Figure 3.5-6. Federal $PM_{2.5}$ Nonattainment Areas



Source: USEPA 2013b.

Figure 3.5-7. Federal PM_{10} Maintenance Areas

3.5.2 Environmental Consequences/Environmental Impacts

These sections present the assessment methods and significance criteria and describe the environmental consequences/environmental impacts associated with each alternative.

3.5.2.1 Assessment Methods

Groundwater substitution could increase air emissions in the Seller Service Area by increased exhaust emissions from groundwater pumping or by increased fugitive dust emissions by cropland idling. Cropland idling transfers could reduce vehicle exhaust emissions but increase fugitive dust emissions. This analysis estimates emissions using available emissions data and models and information on fuel type, engine size (hp), and annual transfer amounts included in the proposed alternatives. Existing emissions models used for the analysis include:

- Diesel engine emission standards established in 17 CCR 93115.8 and 13 CCR 2423
- Diesel engine emission factors from the USEPA's *Compilation of Air Pollutant Emission Factors* (AP-42), specifically from the following chapters:
  - Chapter 3.2: Natural Gas-Fired Reciprocating Engines (USEPA 2000)
  - Chapter 3.3: Gasoline and Diesel Industrial Engines (USEPA 1996)
- CARB Emission Inventory Documentation for the following categories:
  - Section 7.4: Agricultural Land Preparation (CARB 2003a)
  - Section 7.5: Agricultural Harvest Operations (CARB 2003b)
  - Section 7.12: Windblown Dust – Agricultural Lands (CARB 1997)
- CARB Size Fractions for particulate matter (CARB 2012)

All engines operated by the water agencies would operate in compliance with the ATCM, including any necessary retrofits or repowering. The emission standards applicable to a given engine's size and model year were used in this analysis. If the model year of an engine was not known, then the engine was assumed to be "noncertified" as defined by the ATCM. Appendix F details the assumptions (e.g., size, emissions tier, pump rate, and emission factors) used for each engine.

To estimate reduction in vehicle exhaust as a result of cropland idling transfers, this analysis uses available information in "Comparison of Summertime Emission Credits from Land Fallowing Versus Groundwater Pumping" (Byron Buck & Associates 2009). The study compared the relative reduction in emissions due to cropland idling activities versus groundwater substitution. Byron Buck & Associates (2009) estimated the gallons of fuel consumed by farm equipment that would be reduced per acre idled and the average quantity of fuel consumed by groundwater pumping. It was assumed that an agency would need 4.25 acre-feet (AF) of water produced by idling to offset the equivalent emissions of one AF of groundwater pumped (Byron Buck & Associates 2009). Using this ratio, the expected reductions in vehicular exhaust emissions from cropland idling were estimated. This ratio reflects the best information available to estimate emission reductions from cropland idling.

Appendix F presents the detailed calculations that were used to estimate the reduced vehicular exhaust emissions from cropland idling (see Table F-69). Specifically, ratios between emissions from individual water agencies and Pelger MWC were calculated to estimate the overall emissions reductions. Pumping emissions from Pelger MWC were selected because the engines used by the water agency are most reflective of those discussed in Byron Buck & Associates 2009.

This analysis summarizes emissions by air district and county. Analyzing air quality emissions is a complex undertaking and the specific sub-region in which emissions must be analyzed and the appropriate unit varies based on the subject matter. For example, local air districts typically have significance thresholds with units in pounds per day (lbs/day). Emissions must be assessed for the entire air district, which may be a multi-county area.

For the purposes of general conformity, the nonattainment or maintenance area is defined as an area designated as nonattainment or maintenance under section 107 of the CAA and described in 40 CFR 81.305 for California. The nonattainment area varies by pollutant and the area's designation and classification. The nonattainment and maintenance areas included in this analysis for the Sellers Service Area (defined in 40 CFR 81.305) are summarized below:

- CO Maintenance Area (Sacramento Census Bureau Urbanized Area): Parts of Placer, Sacramento, and Yolo Counties.
- PM_{10} Maintenance Area
  - Sacramento County
  - San Joaquin Valley: Includes Merced County

- 8-Hour O_3 Nonattainment Area
  - Sacramento Metro (Severe-15 Classification): Sacramento and Yolo Counties and parts of El Dorado, Placer, Solano, and Sutter Counties.
  - San Joaquin Valley (Extreme Classification): Includes Merced County
- $PM_{2.5}$ Nonattainment Areas
  - San Joaquin Valley (Annual and 24-Hour Averages): Includes Merced County
  - Sacramento Area (24-Hour Average): Sacramento County and parts of El Dorado, Placer, Solano, and Yolo Counties
  - Yuba City/Marysville (24-Hour Average): Sutter County and part of Yuba County.

Detailed calculations are provided in Appendix F, Air Quality Emission Calculations.

3.5.2.2 Significance Criteria

For California Environmental Quality Act (CEQA), impacts on air quality would be considered potentially significant if the transfers would:

- Conflict with or obstruct implementation of the applicable air quality plan.
- Violate any ambient air quality standard or contribute substantially to an existing or projected violation of any ambient air quality standard.
- Result in a cumulatively considerable net increase of any criteria pollutant for which the area of analysis is nonattainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for O3 precursors).
- Expose sensitive receptors to substantial pollutant concentrations.
- Create objectionable odors affecting a substantial number of people.

Changes in air quality are determined relative to existing conditions (for CEQA) and to the No Action/No Project Alternative (for NEPA). In addition to the general criteria provided above, individual air districts may establish significance criteria that would also be applicable. Additional significance criteria by air district are provided below. Significance criteria are only provided for the sellers in the area of analysis where potential air quality impacts from groundwater substitution and cropland idling transfers could occur.

3.5.2.2.1 Butte County AQMD

The Butte County AQMD has jurisdiction over facilities in Butte County. Water agencies subject to Butte County AQMD rules and regulations include the following:

1. Butte Water District (WD)[7]

The Butte County AQMD's *CEQA Air Quality Handbook* (2008) contains a thresholds table for evaluating significance from operational or construction impacts. The table contains various thresholds depending on the type of environmental document being prepared. In the case of an Environmental Impact Report (EIR), NOx, reactive organic gases (ROG),[8] or PM_{10} would be significant if emissions exceeded 137 lbs/day for either pollutant during operations.

3.5.2.2.2 Colusa County APCD

The Colusa County APCD has jurisdiction over facilities in Colusa County. Water agencies subject to Colusa County APCD rules and regulations include the following:

1. Eastside Mutual Water Company (MWC)
2. Glenn-Colusa Irrigation District (ID)[9]
3. Reclamation District (RD) 108[10]
4. RD 1004[11]
5. Sycamore MWC

The Colusa County APCD does not have significance thresholds for CEQA. As discussed previously, a criterion for determining significance is whether a proposed action or alternative could violate any air quality standard. The

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[7] A portion of Butte WD is also located in Sutter County; therefore, only the portion of the water authority located in Butte County would be subject to the rules and regulations of the Butte County AQMD.

[8] CARB uses the term "reactive organic gases," which is similar to the term "volatile organic compounds" used by the USEPA, but with different exempt compounds (CARB 2009). For this analysis, the terms are used interchangeably.

[9] A portion of the Glenn-Colusa ID is located in Glenn County; therefore, only irrigation pumps or idled croplands located in Colusa County are subject to the Colusa County APCD's significance thresholds.

[10] A portion of RD 108 is located in Yolo County; therefore, only irrigation pumps or idled croplands located in Colusa County are subject to the Colusa County APCD's significance thresholds.

[11] Portions of RD 1004 are located in Glenn and Sutter Counties; therefore, only irrigation pumps or idled croplands located in Colusa County are subject to the Colusa County APCD's significance thresholds.

threshold used to define a "major source" in the CAA (100 tons per year [tpy]) was used to evaluate significance.

3.5.2.2.3 Feather River AQMD

The Feather River AQMD has jurisdiction over facilities in Sutter and Yuba counties. Water agencies implementing cropland idling and/or groundwater substitution transfers subject to Feather River AQMD rules and regulations include the following:

1. Butte WD[12]
2. Cordua ID
3. Cranmore Farms
4. Garden Highway MWC
5. Gilsizer Slough Ranch
6. Goose Club Farms and Teichert Aggregates
7. Natomas Central MWC[13]
8. Pelger MWC
9. Pleasant Grove-Verona MWC
10. RD 1004[14]
11. Tule Basin Farms

The Feather River AQMD published *Indirect Source Review Guidelines* (2010) to assess the air quality impact of land use projects under CEQA. The Feather River AQMD has significant impact thresholds of 25 lbs/day for NOx and VOC and 80 lbs/day for PM_{10} (Feather River AQMD 2010). Although the significant impact thresholds are geared towards indirect source emissions (i.e., development projects that produce emissions from vehicular traffic to the site, rather than by direct emissions from the facility), the thresholds are assumed to be applicable to stationary source projects as well.

[12] A portion of Butte WD is also located in Butte County; therefore, only the portion of the water authority located in Sutter County would be subject to the rules and regulations of the Feather River AQMD.
[13] A portion of Natomas Central MWC is also located in Sacramento County; therefore, only the portion of the water authority located in Sutter County would be subject to the rules and regulations of the Feather River AQMD.
[14] Portions of RD 1004 are also located in Colusa and Glenn Counties; therefore, only the portion of the water authority located in Sutter County would be subject to the rules and regulations of the Feather River AQMD.

3.5.2.2.4 Glenn County APCD

The Glenn County APCD has jurisdiction over facilities in Glenn County. Water agencies subject to Glenn County APCD rules and regulations include the following:

1. Glenn-Colusa ID[15]

2. RD 1004[16]

As with the Colusa County APCD, the Glenn County APCD does not publish its own quantitative significance thresholds for air quality impacts. As a result, the major source permitting threshold of 100 tpy was also used to determine significance for each pollutant.

3.5.2.2.5 Sacramento Metropolitan AQMD

The Sacramento Metropolitan AQMD has jurisdiction over facilities in Sacramento County. Water agencies subject to Sacramento Metropolitan AQMD rules and regulations include the following:

1. City of Sacramento

2. Natomas Central MWC[17]

3. Sacramento County Water Agency

4. Sacramento Suburban WD

The Sacramento Metropolitan AQMD's *Guide to Air Quality Assessment in Sacramento County* (2009) contains a thresholds table for evaluating significance from operational or construction impacts. The thresholds table indicates that emissions of NOx and ROG would be significant if emissions exceeded 65 lbs/day for either pollutant during operations.

3.5.2.2.6 San Joaquin Valley APCD

The San Joaquin Valley APCD has jurisdiction over facilities in the San Joaquin Valley Air Basin. Water agencies subject to San Joaquin Valley APCD rules and regulations include the following:

1. Merced ID

[15] A portion of the Glenn-Colusa ID is located in Colusa County; therefore, only the portion of the water authority located in Glenn County would be subject to the rules and regulations of the Glenn County APCD.

[16] Portions of RD 1004 are also located in Colusa and Sutter counties; therefore, only the portion of the water authority located in Glenn County would be subject to the rules and regulations of the Glenn County APCD.

[17] A portion of Natomas Central MWC is also located in Sutter County; therefore, only the portion of the water authority located in Sacramento County would be subject to the rules and regulations of the Sacramento Metropolitan AQMD.

The San Joaquin Valley APCD's *Guide for Assessing and Mitigating Air Quality Impacts* (GAMAQI) (2002) contains provisions for evaluating significance under CEQA. The GAMAQI establishes O_3 precursor (ROG and NOx) emissions thresholds for project operation of 10 tpy for each O_3 precursor pollutant.

3.5.2.2.7 Shasta County AQMD

The Shasta County AQMD has jurisdiction over facilities in Butte County. Water agencies subject to Shasta County AQMD rules and regulations include the following:

1. Anderson-Cottonwood ID[18]

The *Shasta County General Plan (As Amended Through September 2004)* contains a thresholds table for evaluating significance from operational or construction impacts. The *Shasta County General Plan* has two significance threshold levels, Level "A" thresholds and Level "B" thresholds, with the Level "B" thresholds equal to 137 lbs/day for NOx, ROG, and PM_{10}. If the Level "A" thresholds are exceeded, then Standard Mitigation Measures and Best Available Mitigation Measures (BAMM) must be applied and special BAMM must be applied if Level "B" thresholds are exceeded. The Level "A" thresholds are 25 lbs/day for NOx and ROG and 80 lbs/day for PM_{10}. Because the Level "A" thresholds are the minimum levels are which mitigation would not be required, they were used as the significance threshold in this analysis.

3.5.2.2.8 Tehama County APCD

The Tehama County APCD has jurisdiction over facilities in Tehama County. Water agencies subject to Tehama County APCD rules and regulations include the following:

1. Anderson-Cottonwood ID[19]

The Tehama County APCD's *Planning & Permitting Air Quality Handbook* (2009) contains a thresholds table for evaluating significance from operational or construction impacts. The table contains various thresholds depending on the type of environmental document being prepared. In the case of an EIR, NOx, ROG, or PM_{10} would be significant if emissions exceeded 137 lbs/day for either pollutant during operations.

[18] A portion of Anderson-Cottonwood ID is also located in Tehama County; therefore, only the portion of the water authority located in Shasta County would be subject to the rules and regulations of the Shasta County AQMD.
[19] A portion of Anderson-Cottonwood ID is also located in Shasta County; therefore, only the portion of the water authority located in Tehama County would be subject to the rules and regulations of the Tehama County APCD.

3.5.2.2.9 Yolo-Solano AQMD

The Yolo-Solano AQMD has jurisdiction over facilities in Yolo County and the eastern portion of Solano County. Water agencies subject to Yolo-Solano AQMD rules and regulations include the following:

1. Conaway Preservation Group
2. Pope Ranch
3. RD 108[20]
4. RD 2068
5. River Garden Farms
6. Te Velde Revocable Family Trust

The Yolo-Solano AQMD's *Handbook for Assessing and Mitigating Air Quality Impacts* (2007) contains thresholds for determining the significance of project operations. The thresholds for ROG and NOx are 10 tpy each and the threshold for PM_{10} is 80 lbs/day.

3.5.2.3 Alternative 1: No Action/No Project

Cropland idling and groundwater pumping in the Buyer Service Area as a result of CVP water shortages could increase emissions. Under the No Action/No Project Alternative, agricultural water users in the Buyer Service Area would continue to face CVP shortages, similar to existing conditions. In response, farmers would leave some crops idle, which would leave bare soils susceptible to fugitive dust emissions from windblown dusts. Farmers would also continue to pump groundwater for irrigation, which releases emissions if diesel pumps are used. These actions in response to CVP shortages are similar to those that occur under existing conditions; therefore, there would be no change to emissions under the No Action/No Project Alternative.

3.5.2.4 Alternative 2: Full Range of Transfers (Proposed Action)

As described above, the Proposed Action would have three main effects to emissions:

1. Increased exhaust emissions from groundwater substitution;
2. Decreased fugitive dust and farm equipment engine exhaust emissions from reduced land preparation and harvesting activities; and

[20] A portion of RD 108 is also located in Colusa County; therefore, only the portion located in Yolo County is subject to the rules and regulations of the Yolo-Solano AQMD.

3. Increased fugitive dust emissions from wind erosion during crop idling activities.

This section evaluates each of these effects separately and combined.

3.5.2.4.1 Sellers Service Area

Increased groundwater pumping for groundwater substitution transfers would increase emissions of air pollutants in Sellers Service Area. Increased emissions from diesel- and natural gas-fired engines would occur within the area of analysis as pump activity for groundwater substitution transfers.

The only water agencies located in the Placer County APCD are the Placer County Water Agency and the South Sutter WD. Neither water agency is proposing to participate in groundwater substitution or cropland idling. There would be no air quality impacts associated with groundwater pumping and cropland idling in the Placer County APCD.

Merced ID is the only water agency located in the San Joaquin Valley APCD; additionally, Anderson-Cottonwood ID is the only water agency located in the Shasta County and Tehama County APCDs. Merced ID is only proposing stored reservoir water transfers that would not increase emissions. Anderson-Cottonwood ID exclusively operates electric engines; therefore, there would be no local criteria pollutant emissions resulting from the combustion of fossil fuels. Additionally, these water agencies are not proposing to participate in cropland idling or crop shifting. There would be no air quality impacts associated with groundwater pumping and cropland idling in the San Joaquin Valley, Shasta County, and Tehama County APCDs.

Although the Butte WD operates in Butte and Sutter Counties, the agency is only proposing to use wells located in Sutter County for groundwater pumping. As a result, because wells in Butte County would not be used, there would be no air quality impacts associated with groundwater pumping in the Butte County AQMD.

Engine exhaust emissions were estimated using AP-42 emission factors and diesel emission standards as summarized in Section 3.5.2.1, Assessment Methods. Estimated emissions from groundwater pumping that would occur in the Colusa County APCD, Feather River AQMD, Glenn County APCD, Sacramento Metropolitan AQMD, and Yolo-Solano AQMD are provided in Table 3.5-9 through Table 3.5-13. Significance was determined for individual water agencies. Detailed calculations are provided in Appendix F, Air Quality Emission Calculations.

Table 3.5-9. Annual Emissions from Groundwater Pumping for the Colusa County APCD (tpy)

Water Agency[1,2]	VOC	NOx	CO	SOx	PM_{10}	$PM_{2.5}$
Eastside MWC	<1	2	2	1	<1	<1
RD 1004	1	13	5	1	<1	<1
Significance Threshold	100	100	100	100	100	100
Significant?	No	No	No	No	No	No

Notes:
[1] Glenn-Colusa ID is not included in the table because no engines would operate in Colusa County.
[2] RD 108 and Sycamore MWC are not included on the table because only electric engines would operate in these water agencies and there would be no local criteria pollutant emissions.

Key:
CO = carbon monoxide; NOx = nitrogen oxides; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; SOx = sulfur oxides; VOC = volatile organic compounds

Table 3.5-10. Peak Daily Emissions from Groundwater Pumping for the Feather River AQMD (lbs/day)

Water Agency[1,2]	VOC	NOx	CO	SOx	PM_{10}	$PM_{2.5}$
Gilsizer Slough Ranch	10	**119**	26	8	2	2
Pelger MWC	1	17	23	6	1	1
Pleasant Grove-Verona MWC	**33**	**285**	126	31	8	8
Tule Basin Farms	4	**128**	10	<1	<1	<1
Air District Threshold	25	25	n/a	n/a	80	n/a
Significant?	**Yes**	**Yes**	n/a	n/a	No	n/a

Notes:
[1] Butte WD, Cordua ID, Cranmore Farms, Garden Highway MWC, Goose Club Farms and Teichert Aggregates, and Natomas Central MWC are not included on the table because only electric engines would operate in these water agencies and there would be no local criteria pollutant emissions.
[2] RD 1004 is not included in the table because no engines would operate in Sutter County.

Key:
CO = carbon monoxide; lbs/day = pounds per day; NOx = nitrogen oxides; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; SOx = sulfur oxides; VOC = volatile organic compounds

Table 3.5-11. Annual Emissions from Groundwater Pumping for the Glenn County APCD (tpy)

Water Agency[1]	VOC	NOx	CO	SOx	PM_{10}	$PM_{2.5}$
RD 1004	<1	2	<1	<1	<1	<1
Air District Threshold	100	100	100	100	100	100
Significant?	No	No	No	No	No	No

Notes:
[1] Glenn-Colusa ID is not included on the table because only electric engines would operate in these water agencies and there would be no local criteria pollutant emissions.

Key:
CO = carbon monoxide; NOx = nitrogen oxides; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; SOx = sulfur oxides; VOC = volatile organic compounds

Table 3.5-12. Peak Daily Emissions from Groundwater Pumping for the Sacramento Metropolitan AQMD (lbs/day)

Water Agency	VOC	NOx	CO	SOx	PM_{10}	$PM_{2.5}$
Sacramento Suburban WD	23	**788**	61	<1	2	2
Air District Threshold	65	65	n/a	n/a	n/a	n/a
Significant?	No	**Yes**	n/a	n/a	n/a	n/a

Notes:
[1] City of Sacramento, Natomas Central MWC, and Sacramento County Water Agency not included on the table because only electric engines would operate in these water agencies and there would be no local criteria pollutant emissions.

Key:
CO = carbon monoxide; lbs/day = pounds per day; NOx = nitrogen oxides; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; SOx = sulfur oxides; VOC = volatile organic compounds

Table 3.5-13. Peak Daily Emissions from Groundwater Pumping for the Yolo-Solano AQMD (lbs/day)

Water Agency[1]	VOC	NOx	CO	SOx	PM_{10}	$PM_{2.5}$
Peak Daily Emissions (lbs/day)						
Conaway Preservation Group	13	148	125	25	6	6
Air District Threshold	n/a	n/a	n/a	n/a	80	n/a
Significant?	n/a	n/a	n/a	n/a	No	n/a
Annual Project Emissions (tpy)						
Conaway Preservation Group	1	8	7	1	<1	<1
Air District Threshold	10	10	n/a	n/a	n/a	n/a
Significant?	No	No	No	No	No	No

Notes:
[1] Pope Ranch, RD 108, RD 2068, River Garden Farms, and Te Velde Revocable Family Trust are not included on the table because only electric engines would operate in these water agencies and there would be no local criteria pollutant emissions.

Key:
CO = carbon monoxide; lbs/day = pounds per day; NOx = nitrogen oxides; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; SOx = sulfur oxides; VOC = volatile organic compounds

As shown in the tables, criteria pollutant emissions would not exceed the significance criteria for the Colusa County APCD (Table 3.5-9), Glenn County APCD (Table 3.5-11), and Yolo-Solano AQMD (Table 3.5-13). Air quality impacts from groundwater pumping in these air districts would be less than significant.

As shown in Table 3.5-10, VOC emissions would exceed the significance criteria in Pleasant Grove-Verona MWC and NOx emissions would exceed the significance criteria in Gilsizer Slough Ranch, Pleasant Grove-Verona MWC, and Tule Basin Farms. As a result, groundwater pumping in the Feather River AQMD would result in a significant impact. Implementation of mitigation measure AQ-1 would reduce VOC and NOx emissions to less than significant. Table 3.5-24 summarizes mitigated emissions from groundwater pumping.

As shown in Table 3.5-12, NOx emissions exceed the significance criteria for the Sacramento Metropolitan AQMD. As a result, NOx emissions that would occur from groundwater pumping in Sacramento County would result in a significant impact under CEQA. Implementation of mitigation measures AQ-1 and AQ-2 would reduce emissions to less than significant. Table 3.5-20 summarizes mitigated emissions from groundwater pumping.

Water transfers via cropland idling could reduce vehicle exhaust emissions from reduced operations in the Sellers Service Area. Cropland idling reduces use of farm equipment that reduces criteria pollutant emissions from vehicle exhaust. Reduced vehicle exhaust emissions were estimated based on the proposed acreages of croplands that would be idled and consequently the amount of equipment that would be idled during the Proposed Action. Emissions were estimated for the upper limit of cropland that could be idled as part of the Proposed Action. It is likely that the individual water agencies would not choose to idle the upper limits proposed as part of the Proposed Action in every year; therefore, these reductions are a maximum reduction and would likely not occur in every year.

Table 3.5-14 summarizes daily emissions that would not occur from vehicle exhaust (i.e., emission reductions) in the area of analysis, while Table 3.5-15 summarizes annual emissions.

Table 3.5-14. Maximum Reduction in Daily Emissions from Vehicle Exhaust (Cropland Idling) (lbs/day)[1]

Water Agency	VOC	NOx	CO	SOx	PM_{10}	$PM_{2.5}$
Butte WD	(1)	(13)	(17)	(4)	(1)	(1)
Conaway Preservation Group	(1)	(23)	(31)	(8)	(2)	(2)
Cranmore Farms	(<1)	(3)	(4)	(1)	(<1)	(<1)
Glenn-Colusa ID	(4)	(72)	(95)	(24)	(6)	(6)
Goose Club Farms and Teichert Aggregates	(1)	(11)	(14)	(4)	(1)	(1)
Pelger MWC	(<1)	(3)	(4)	(1)	(<1)	(<1)
Pleasant Grove-Verona MWC	(1)	(10)	(13)	(3)	(1)	(1)
RD 108	(1)	(22)	(29)	(7)	(2)	(2)
RD 1004	(1)	(11)	(14)	(4)	(1)	(1)
RD 2068	(<1)	(8)	(11)	(3)	(1)	(1)
Sycamore MWC	(1)	(11)	(14)	(4)	(1)	(1)
Te Velde Revocable Family Trust	(<1)	(8)	(10)	(3)	(1)	(1)
Total	**(10)**	**(195)**	**(256)**	**(64)**	**(15)**	**(15)**

Notes:
[1] Emission reductions (beneficial impacts) are shown in parentheses.
Key:
CO = carbon monoxide; NOx = nitrogen oxides; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; SOx = sulfur oxides; VOC = volatile organic compounds

Table 3.5-15. Maximum Reduction in Annual Emissions from Vehicle Exhaust (Cropland Idling) (tpy)[1]

Water Agency	VOC	NOx	CO	SOx	PM_{10}	$PM_{2.5}$
Butte WD	(<0.1)	(0.8)	(1.1)	(0.3)	(0.1)	(0.1)
Conaway Preservation Group	(0.1)	(1.6)	(2.0)	(0.5)	(0.1)	(0.1)
Cranmore Farms	(<0.1)	(0.2)	(0.2)	(0.1)	(<0.1)	(<0.1)
Glenn-Colusa ID	(0.3)	(4.8)	(6.3)	(1.6)	(0.4)	(0.4)
Goose Club Farms and Teichert Aggregates	(<0.1)	(0.7)	(1.0)	(0.2)	(0.1)	(0.1)
Pelger MWC	(<0.1)	(0.2)	(0.2)	(0.1)	(<0.1)	(<0.1)
Pleasant Grove-Verona MWC	(<0.1)	(0.7)	(0.9)	(0.2)	(0.1)	(0.1)
RD 108	(0.1)	(1.5)	(1.9)	(0.5)	(0.1)	(0.1)
RD 1004	(<0.1)	(0.7)	(1.0)	(0.2)	(0.1)	(0.1)
RD 2068	(<0.1)	(0.5)	(0.7)	(0.2)	(<0.1)	(<0.1)
Sycamore MWC	(<0.1)	(0.7)	(1.0)	(0.2)	(0.1)	(0.1)
Te Velde Revocable Family Trust	(<0.1)	(0.5)	(0.7)	(0.2)	(<0.1)	(<0.1)
Total	**(0.7)**	**(12.9)**	**(17.0)**	**(4.2)**	**(1.0)**	**(1.0)**

Notes:
[1] Emission reductions (beneficial impacts) are shown in parentheses.
Key:
CO = carbon monoxide; NOx = nitrogen oxides; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; SOx = sulfur oxides; VOC = volatile organic compounds

As shown in the tables, cropland idling would result in reduced vehicle exhaust emissions for all pollutants, although the actual reduction would likely be less than indicated in the tables because the full amount of cropland idling would not occur every year. Air quality impacts from vehicle exhaust that would not occur during cropland idling in the area of analysis would be beneficial.

Water transfers via cropland idling would decrease fugitive dust emissions associated with land preparation and harvesting, but also increase fugitive dust emissions from wind erosion of bare fields in the Sellers Service Area. Cropland idling could result in reduced fugitive dust (PM_{10} and $PM_{2.5}$) emissions from land preparation and harvesting activities. Barren land, on the other hand, could consequently result in an increase in particulate matter emissions.

CARB has published emission inventory documentation that specifies the expected particulate matter emissions for land preparation and harvesting activities that would occur for various crops (CARB 2003a; CARB 2003b). Under cropland idling transfers, land preparation and harvesting activities would not occur; therefore, fugitive dust emissions would not be released. CARB also provides emission inventory documentation for windblown dust for agricultural lands (CARB 1997). These emissions would occur if the fields are left barren and subject to causing windblown dust. $PM_{2.5}$ emissions were estimated from PM_{10} emissions using CARB's published PM size fractions for agricultural tilling dust (profile no. 417) and agricultural windblown dust (profile no. 411) (CARB 2012). Table 3.5-16 summarizes daily fugitive dust emissions that would occur from cropland idling in the area of analysis while Table 3.5-17 summarizes annual fugitive dust emissions.

As shown in the tables, the combined effect of reduced dust emissions from absence of land preparation and harvesting with increased dust emissions from windblown dust would cause net PM_{10} and $PM_{2.5}$ emissions to be negative for all crops. As a result, fugitive dust emissions occurring from cropland idling in the area of analysis would be beneficial.

Table 3.5-16. Daily Fugitive Dust Emissions from Cropland Idling (lbs/day)[1]

Water Agency	PM_{10} Land Preparation/ Harvesting	PM_{10} Erosion	PM_{10} Total	$PM_{2.5}$ Land Preparation/ Harvesting	$PM_{2.5}$ Erosion	$PM_{2.5}$ Total
Butte WD	(158)	6	(152)	(24)	1	(22)
Conaway Preservation Group	(245)	18	(227)	(37)	4	(33)
Cranmore Farms	(65)	1	(64)	(10)	<1	(9)
Glenn-Colusa ID	(1,646)	416	(1,230)	(247)	83	(164)
Goose Club Farms and Teichert Aggregates	(260)	6	(254)	(39)	1	(38)
Pelger MWC	(66)	1	(65)	(10)	<1	(10)
Pleasant Grove-Verona MWC	(234)	5	(229)	(35)	1	(34)
RD 108	(371)	75	(296)	(56)	15	(41)
RD 1004	(253)	44	(209)	(38)	9	(29)
RD 2068	(46)	5	(41)	(7)	1	(6)
Sycamore MWC	(256)	66	(190)	(38)	13	(25)
Te Velde Revocable Family Trust	(80)	6	(74)	(12)	1	(11)
Total	**(3,680)**	**651**	**(3,029)**	**(552)**	**130**	**(421)**

Notes:
[1] Emission reductions (beneficial impacts) are shown in parentheses.
Key:
PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter

Table 3.5-17. Annual Fugitive Dust Emissions from Cropland Idling (tpy)[1]

Water Agency	PM_{10} Land Preparation/ Harvesting	PM_{10} Erosion	PM_{10} Total	$PM_{2.5}$ Land Preparation/ Harvesting	$PM_{2.5}$ Erosion	$PM_{2.5}$ Total
Butte WD	(14)	1	(14)	(2)	<1	(2)
Conaway Preservation Group	(22)	2	(20)	(3)	<1	(3)
Cranmore Farms	(6)	<1	(6)	(1)	<1	(1)
Glenn-Colusa ID	(148)	37	(111)	(22)	7	(15)
Goose Club Farms and Teichert Aggregates	(23)	1	(23)	(4)	<1	(3)
Pelger MWC	(6)	<1	(6)	(1)	<1	(1)
Pleasant Grove-Verona MWC	(21)	<1	(21)	(3)	<1	(3)
RD 108	(33)	7	(27)	(5)	1	(4)
RD 1004	(23)	4	(19)	(3)	1	(3)

Water Agency	PM_{10} Land Preparation/ Harvesting	PM_{10} Erosion	PM_{10} Total	$PM_{2.5}$ Land Preparation/ Harvesting	$PM_{2.5}$ Erosion	$PM_{2.5}$ Total
RD 2068	(4)	<1	(4)	(1)	<1	(1)
Sycamore MWC	(23)	6	(17)	(3)	1	(2)
Te Velde Revocable Family Trust	(7)	1	(7)	(1)	<1	(1)
Total	**(331)**	**59**	**(273)**	**(50)**	**12**	**(38)**

Notes:
[1] Emission reductions (beneficial impacts) are shown in parentheses.
Key:
PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter

3.5.2.4.2 Buyer Service Area

Use of water from transfers on agricultural fields in the Buyer Service Area could reduce windblown dust. Water transfers to agricultural users in Merced, San Benito, Fresno, and Kings Counties would reduce the amount of land idled relative to the No Action/No Project Alternative. Crop plantings would reduce the potential for fugitive dust emissions that occurs from winds blowing over bare fields. The air quality impacts in the Buyer Service Area would be beneficial.

3.5.2.4.3 General Conformity

Water transfers via groundwater substitution and cropland idling could exceed the general conformity de minimis thresholds. Counties located in federal nonattainment or maintenance areas must also demonstrate compliance with the general conformity provisions in 40 CFR 93 Subpart B. Glenn and Colusa counties are designated as attainment areas for all NAAQS and are therefore not considered further in terms of general conformity. Furthermore, several water agencies are not within the federal 8-hour O_3 attainment area of Sutter County and their emissions are excluded from the general conformity applicability analysis. The excluded water agencies are summarized below:

- Cranmore Farms
- Garden Highway MWC
- Gilsizer Slough Ranch
- Pelger MWC
- Pleasant Grove-Verona MWC
- Tule Basin Farms

Because the CEQA-related mitigation measures are fully enforceable under Cal. Pub. Res. Code §21081.6 and would be a requirement of project implementation, mitigated emissions for the Proposed Action were compared to the general conformity de minimis thresholds. Although sellers may be initially proposing to use both groundwater substitution and cropland idling, it is possible that they could opt to use only one method in the future. Because cropland idling would reduce criteria pollutant emissions, only emissions from groundwater substitution were compared to general conformity de minimis thresholds to provide a worst-case estimate of impacts. Table 3.5-18 summarizes the general conformity applicability analysis.

Mitigated emissions would be less than the general conformity de minimis thresholds; therefore, no further action would be required under general conformity. Detailed calculations are provided in Appendix F.

Table 3.5-18. General Conformity Applicability Evaluation for the Proposed Action (Annual Emissions, tons per year)

County/ Nonattainment Area	Sacramento Metro[1,5]	Sacramento Metro[1,5]	Sacramento Area[2]	Sacramento[3,4]	Yuba City-Marysville[6]	Sacramento Co.	Sacramento[4]	Yuba City-Marysville[6]
Pollutant	VOC	NOx	CO	SOx	SOx	PM_{10}	$PM_{2.5}$	$PM_{2.5}$
Classification	Severe	Severe	Maintenance	$PM_{2.5}$ Precursor	$PM_{2.5}$ Precursor	Maintenance	Nonattainment	Nonattainment
Sacramento	0.1	4.9	0.4	0.001	--	0.01	0.01	--
Solano[7]	0	0	--	--	--	--	--	--
Sutter	0.3	3.6	--	--	3.1	--	--	0.5
Yolo	0.7	7.9	--	--	--	--	--	--
Yuba[7]	--	--	--	--	0.0	--	--	0.0
Total	1.2	16.3	0.4	0.001	3.1	0.01	0.01	0.5
De Minimis Threshold (tpy)	25	25	100	100	100	100	100	100
Exceed Threshold?	No	No	No	No	No	No	No	No

Notes:

[1] The Sacramento Metro 8-hour O_3 nonattainment area consists of Sacramento and Yolo Counties and parts of El Dorado, Placer, Solano, and Sutter Counties. Emissions occurring within the attainment area of these counties are excluded from the total emissions.

[2] The Sacramento Area CO maintenance area is based on the Census Bureau Urbanized Area and consists of parts of Placer, Sacramento, and Yolo Counties. The general conformity applicability evaluation is based on emissions that would occur within the entire county to be conservative.

[3] All counties are designated as attainment areas for SO_2; however, because SO_2 is a precursor to $PM_{2.5}$, its emissions must be evaluated under general conformity.

[4] The 24-hour $PM_{2.5}$ nonattainment area for Sacramento includes Sacramento County and parts of El Dorado, Placer, Solano, and Yolo Counties. The general conformity applicability analysis assumes that all emissions that could occur within each county would occur within the Sacramento nonattainment area to be conservative.

[5] VOC and NOx emissions are excluded from Sutter County for Cranmore Farms, Garden Highway MWC, Gilsizer Slough Ranch, Pelger MWC, RD 1004, and Tule Basins Farms because they are located in areas designated as attainment for the federal 8-hour O_3 NAAQS.

[6] The Yuba City-Marysville $PM_{2.5}$ nonattainment area consists of all of Sutter County and part of Yuba County.

[7] Only electric-powered engines are proposed to operate in this county for groundwater substitution; therefore, emissions are equal to zero.

Key:

CO = carbon monoxide; n/a = not applicable; NOx = nitrogen oxides; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; SO_2 = sulfur dioxide; VOC = volatile organic compounds

3.5.2.5 Alternative 3: No Cropland Modifications

Alternative 3 would include transfers through groundwater substitution, but would not include any cropland idling or crop shifting transfers.

Increased groundwater pumping for groundwater substitution transfers would increase emissions of air pollutants. Groundwater substitution transfers that would occur under Alternative 3 would be identical to those that would occur under the Proposed Action. As a result, air quality impacts in the Colusa County APCD, Glenn County APCD, and Yolo-Solano AQMD and the would be less than significant (see Table 3.5-9, Table 3.5-11, and Table 3.5-13). Air quality impacts in the Feather River AQMD would be less than significant for NOx and VOC after implementation of mitigation measure AQ-1 (see Table 3.5-10). Air quality impacts in the Sacramento Metropolitan AQMD would be less than significant with implementation of mitigation measures AQ-1 and AQ-2 (see Table 3.5-12). There would be no air quality impacts in Placer County APCD, San Joaquin Valley APCD, Shasta County AQMD, and Tehama County APCD because groundwater pumping would use electric engines or would not occur in these areas.

Water transfers via groundwater substitution could exceed the general conformity de minimis thresholds. The general conformity evaluation was completed as described in Section 3.5.2.4.3 General Conformity. Since cropland idling would not be completed in Alternative 3, any emission reductions that would result from reduced land preparation and harvesting activities would not occur. Because the general conformity analysis for the Proposed Action only analyzed emissions from groundwater substitution, the impacts in Alternative 3 would be the same as those analyzed in the Proposed Action. As shown in Table 3.5-18 mitigated emissions would be less than the de minimis thresholds and no further action is required under general conformity.

3.5.2.6 Alternative 4: No Groundwater Substitution

Alternative 4 would include transfers through cropland idling and crop shifting, but would not include any groundwater substitution transfers.

Water transfers via cropland idling could reduce vehicle exhaust emissions from reduced operations in the area of analysis. Cropland idling reduces use of farm equipment that reduces criteria pollutant emissions from vehicle exhaust. The proposed acreages of cropland that would be idled during Alternative 4 would be the same as that idled during the Proposed Action. As a result, impacts would be the same as those shown in Table 3.5-14 and Table 3.5-15. Air quality impacts from reduced vehicle exhaust during cropland idling would be beneficial.

Water transfers via cropland idling would increase fugitive dust emissions from wind erosion of bare fields and decrease fugitive dust emissions associated with *land preparation and harvesting in the area of analysis.* Cropland idling could result in reduced fugitive dust (PM_{10} and $PM_{2.5}$) emissions from land preparation and harvesting activities. Barren land, on the other hand, could consequently result in an increase in particulate matter emissions. The proposed acreages of cropland that would be idled during Alternative 4 would be the same as that idled during the Proposed Action. As a result, impacts would be the same as those shown in Table 3.5-16 and Table 3.5-17. Air quality impacts from changes in fugitive dust emissions during cropland idling would be beneficial.

3.5.3 Comparative Analysis of Alternatives

Table 3.5-19 summarizes the effects of the action alternatives. The following text supplements the table by describing the magnitude of the effects under the action alternative and No Action/No Project Alternative.

Table 3.5-19. Comparison of Alternatives

Potential Impact	Alternatives	Significance	Proposed Mitigation	Significance After Mitigation
Cropland idling that temporarily converts cropland to bare fields from inadequate water supplies could increase fugitive dust emissions	1	NCFEC	None	NCFEC
Increased groundwater pumping for groundwater substitution transfers would increase emissions of air pollutants in the Sellers Service Area.	2, 3	S	AQ-1, AQ-2	LTS
Water transfers via cropland idling could reduce vehicle exhaust emissions from reduced operations in the Sellers Service Area.	2, 4	B	None	B
Water transfers via cropland idling would increase fugitive dust emissions from wind erosion of bare fields and decrease fugitive dust emissions associated with land preparation and harvesting in the Sellers Service Area.	2, 4	B	None	B
Use of water from transfers on agricultural fields in the Buyer Service Area could reduce windblown dust.	2, 3, 4	B	None	B
Water transfers via groundwater substitution and cropland idling could exceed the general conformity de minimis thresholds.	2, 3, 4	LTS	None	LTS

Key:
B = beneficial
LTS = less than significant
NCFEC = no change from existing conditions
S = significant

3.5.3.1 No Action/No Project Alternative

There would be no changes to the agricultural lands in the Seller Service Area relative to existing conditions. In the Buyer Service Area, increased land idling could occur in response to water shortages, which could then increase windblown dust emissions.

3.5.3.2 Alternative 2: Full Range of Transfers (Proposed Action)

Increased groundwater pumping could increase criteria pollutant emissions from engine exhaust. Cropland idling would increase fugitive dust emissions from wind blowing on bare fields. These emission increases would then be partially offset by reduced farm equipment exhaust and fugitive dust emissions from land preparation and harvesting activities that would no longer occur under the Proposed Action. Mitigation measures would reduce significant impacts to less than significant in the Feather River AQMD and the Sacramento Metropolitan AQMD.

3.5.3.3 Alternative 3: No Cropland Modification

The No Cropland Modification Alternative does not include cropland idling or crop shifting transfers. Impacts associated with groundwater pumping would be the same as those identified for the Proposed Action.

3.5.3.4 Alternative 4: No Groundwater Substitution

The No Groundwater Substitution Alternative does not include groundwater pumping to enable water transfers. Impacts associated with cropland idling would be the same as those identified for the Proposed Action.

3.5.4 Environmental Commitments/Mitigation Measures

Implementation of the various engine control measures (AQ-1) would substantially reduce NOx emissions; however, the extent of the reduction would vary based on the size (hp) and age of the existing engine. For example, a 250 hp engine may have different NOx emission standards than a 100 hp engine. As a result, the same emission reduction between the two different engines may not occur. Table 3.5-20 summarizes the expected daily emissions after mitigation for groundwater substitution. The following mitigation measures would reduce the severity of the air quality impacts.

Table 3.5-20. Mitigated Peak Daily Emissions from Groundwater Pumping (lbs/day)

Air District	VOC	NOx	CO	SOx	PM_{10}	$PM_{2.5}$
Feather River AQMD						
Gilsizer Slough Ranch	1	24	31	8	2	2
Pleasant Grove-Verona MWC	2	23	48	14	1	1
Tule Basin Farms	4	19	10	<1	<1	<1
Significance Threshold	25	25	n/a	n/a	80	n/a
Significant?	No	No	n/a	n/a	No	n/a
Sacramento Metropolitan AQMD						
Sacramento Suburban WD	2	54	4	<1	<1	<1
Significance Threshold	65	65	n/a	n/a	n/a	n/a
Significant?	No	No	n/a	n/a	n/a	n/a

Notes:
[1] Emission reductions (beneficial impacts) are shown in parentheses.
Key:
CO = carbon monoxide; lbs/day = pounds per day; NOx = nitrogen oxides; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; SOx = sulfur oxides; VOC = volatile organic compounds

Following mitigation, VOC and NOx emissions would be reduced to less than significant under CEQA.

3.5.4.1 Mitigation Measure AQ-1: Reduce Pumping at Diesel or Natural Gas Wells to Reduce Pumping Below Significance Levels

Selling agency would reduce pumping at diesel or natural gas wells to reduce emissions to below the thresholds. If an agency is transferring water through cropland idling and groundwater substitution in the same year, the reduction in vehicle emissions can partially offset groundwater substitution pumping at a rate of 4.25 AF of water produced by idling to one acre-foot of groundwater pumped. Agencies may also decide to replace old diesel or natural gas wells to reduce emission below the thresholds.

Any selling agencies with potentially significant emissions, as determined by this EIS/EIR, will be required to maintain recordkeeping logs that document the specific engine to be used for groundwater substitution transfers, the power rating (hp), and applicable emission factors. Emission calculations for daily emissions will be completed for comparison to the significance thresholds determined for each selling agency. The recordkeeping logs will be sent to Reclamation monthly for verification that emissions are within the allowable limits.

Reclamation will also work with the water agencies to inform individual growers of incentive funding available through the Natural Resources Conservation Service's Environmental Quality Incentives Program. Funded conservation practices including the replacement of internal combustion engines in irrigation pumps; therefore, the program may be used by growers to further reduce criteria pollutant emissions.

3.5.4.2 Mitigation Measure AQ-2: Operate Dual-Fired Wells as Electric Engines

Any engines operating in the area of analysis that are capable of operating as either electric or natural gas engines would only operate with electricity during any groundwater transfers. Any selling agencies with these dual engines will be required to maintain recordkeeping logs that document that only electricity is used for groundwater substitution transfers. The recordkeeping logs will be sent to Reclamation monthly for verification that the engines are operating in compliance with the mitigation measure.

3.5.5 Potentially Significant Unavoidable Impacts

None of the action alternatives would result in potentially significant unavoidable impacts on air quality.

3.5.6 Cumulative Effects

3.5.6.1 Alternative 2: Full Range of Transfers (Proposed Action)

Increased groundwater pumping for groundwater substitution transfers would increase criteria pollutant emissions from engine operation in the air districts. All counties affected by the Proposed Action are located in areas designated nonattainment for the PM_{10} CAAQS. Additionally, all counties are designated nonattainment for the O_3[21] CAAQS except Butte and Glenn Counties; Butte County, the San Joaquin Valley Air Basin, and the San Francisco Bay Air Basin are also designated nonattainment for the $PM_{2.5}$ CAAQS. Nonattainment status represents a cumulatively significant impact within the area. Because no single project determines the nonattainment status of a region, individual projects would only contribute to the area's designation on a cumulative basis.

The significance thresholds developed by the air districts serve to evaluate if a proposed project could either 1) cause or contribute to a new violation of a CAAQS or NAAQS in the area of analysis or 2) increase the frequency or severity of any existing violation of any standard in the area. Air districts recognize that air quality violations are not caused by any one project, but are a cumulative effect of multiple projects. Therefore, the air districts (including the Sacramento Metropolitan AQMD) have developed guidance that indicates a proposed project would be cumulatively considerable if the air quality impacts are individually significant.

[21] O_3 is a secondary pollutant, meaning that it is formed in the atmosphere from reactions of precursor compounds under certain conditions. Primary precursor compounds that lead to O_3 formation include VOCs and NOx; therefore, the significance thresholds established by the air districts for VOC and NOx are intended to maintain or attain the O_3 CAAQS and NAAQS.

Implementation of mitigation measures would reduce the Proposed Action's individual impacts to less than significant. Therefore, the Proposed Action's contribution to air quality impacts would not be cumulatively considerable.

Water transfers via cropland idling could reduce vehicle exhaust emissions from reduced operations in the different air districts. As described previously, counties affected by the Proposed Action are located in areas designated nonattainment for the O_3, PM_{10}, and $PM_{2.5}$ CAAQS. Because no single project determines the nonattainment status of a region, the nonattainment status represents a cumulatively significant impact within the area of analysis. Based on guidance published by the air districts, a proposed project would be cumulatively considerable if the air quality impacts are individually significant.

Cropland idling activities would reduce vehicle exhaust emissions from reduced operations, which would be a beneficial impact to air quality. As a result, the Proposed Action's contribution to air quality impacts would not be cumulatively considerable.

Water transfers via cropland idling could increase fugitive dust emissions from wind erosion of bare fields and decrease fugitive dust emissions associated with land preparation and harvesting in the different air districts. As described previously, counties affected by the Proposed Action are located in areas designated nonattainment for the O_3, PM_{10}, and $PM_{2.5}$ CAAQS. Because no single project determines the nonattainment status of a region, the nonattainment status represents a cumulatively significant impact within the area of analysis. Based on guidance published by the air districts, a proposed project would be cumulatively considerable if the air quality impacts are individually significant.

Cropland idling activities would have a net reduction in fugitive dust emissions from reduced operations, which would be a beneficial impact to air quality. As a result, the Proposed Action's contribution to air quality impacts would not be cumulatively considerable.

3.5.6.2 Alternative 3: No Cropland Modification

Cumulative effects under Alternative 3 would be the same as the groundwater pumping impacts described in the Proposed Action.

3.5.6.3 Alternative 4: No Groundwater Substitution

Cumulative effects under Alternative 4 would be the same as the cropland idling impacts described in the Proposed Action.

3.5.7 References

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Section 3.6 Climate Change

This section presents the existing setting in relation to greenhouse gas (GHG) emissions within the area of analysis and discusses potential effects in relation to climate change from the proposed alternatives. Appendix G, Climate Change Analysis Emission Calculations, provides detailed emission calculations.

GHG emissions associated with groundwater substitution and cropland idling transfers are evaluated in relation to climate change in the area of analysis. The effects of climate change on the alternatives were also analyzed. Implementation of conservation or stored reservoir purchase transfers would not affect GHG emissions in relation to climate change and are not further discussed in this section. Although some crops may be more energy intensive than others, crop shifting is a regular practice in the Seller and Buyer Service Areas and a quantitative analysis was not conducted for this practice.

3.6.1 Affected Environment/Environmental Setting

The United Nations Intergovernmental Panel on Climate Change (IPCC) predicts that changes in the earth's climate will continue through the 21st century and that the rate of change may increase significantly in the future because of human activity (IPCC 2013). Many researchers studying California's climate believe that changes in the earth's climate have already affected California and will continue to do so in the future. Climate change may seriously affect the State's water resources. Temperature increases could affect water demand and aquatic ecosystems. Changes in the timing and amount of precipitation and runoff could occur. Sea level rise could adversely affect the Delta and coastal areas of the State.

Climate change is identified in the 2009 update of the California Water Plan (Bulletin 160-09) as a key consideration in planning for the State's future water management (California Department of Water Resources 2009). The 2009 Water Plan update qualitatively describes the effects that climate change may have on the State's water supply. It also describes efforts that should be taken to evaluate climate change effects quantitatively for the next Water Plan update.

3.6.1.1 Area of Analysis

The area of analysis for climate change includes counties where cropland idling could occur in the Seller Service Area, counties overlying groundwater basins where groundwater substitution transfers could occur, and counties where transferred water would be used for agricultural purposes in the Buyer Service Area. Figure 3.6-1 shows the climate change area of analysis.

Figure 3.6-1. Climate Change Area of Analysis

3.6.1.2 Regulatory Setting

GHG emissions and global climate change are governed by several federal and state laws and policies described below.

3.6.1.2.1 Federal

Department of the Interior

In 2009, the Department of Interior (DOI) issued a Secretarial Order on climate change that expands DOI bureaus' responsibilities in addressing climate change (amended on February 22, 2010). The purpose of Secretarial Order No. 3289 is to provide guidance to bureaus and offices within the DOI on how to provide leadership by developing timely responses to emerging climate change issues. This Order replaces Secretarial Order No. 3226, signed on January 19, 2001, entitled "Evaluating Climate Change Impacts in Management Planning." It reaffirms efforts within DOI that are ongoing with respect to climate change. Among the requirements of the Order is one that requires each bureau and office of DOI to "consider and analyze potential climate change impacts when undertaking long-range planning exercises, setting priorities for scientific research and investigations, and/or when making major decisions affecting DOI resources."

The Reclamation *National Environmental Policy Act (NEPA) Handbook* (2012) recommends that climate change be considered, as applicable, in every NEPA analysis. The *NEPA Handbook* acknowledges that there are two interpretations of climate change in regards to Reclamation actions: 1) Reclamation's action is a potentially significant contributor to climate change and 2) climate change could affect a Reclamation proposed action. The *NEPA Handbook* recommends considering different aspects of climate change (e.g., relevance of climate change to the proposed action, timeframe for analysis, etc.) to determine the extent to which it should be discussed under NEPA.

Additionally, DOI Department Manual 523 (effective December 20, 2012) states that it is DOI policy to use best available science in decision-making water management planning including integrating adaptation strategies. It also states that climate change be considered in developing or revising management plans. Section B further states that "the Department will promote existing processes and when necessary, institute new processes to: 1) Conduct assessments of vulnerability to anticipated or current climate impacts, 2) Develop and implement comprehensive climate change adaptation strategies based on vulnerability and other factors, and 3) Include measurable goals and performance metrics."

Prevention of Significant Deterioration (PSD) and Title V GHG Tailoring Rule

On June 3, 2010, the U.S. Environmental Protection Agency (USEPA) issued a final rule to amend the applicability criteria that determine when new and modified stationary sources are subject to PSD and Title V permitting programs for GHG[1] emissions (75 Federal Register [FR] 31514). The tailoring rule applies a threshold for obtaining these permits for GHG emissions of 75,000 to 100,000 short tons per year (tpy) of carbon dioxide equivalent (CO_2e). [2]

The key elements of the tailoring rule were phased in starting on January 2, 2011. During that phase, only stationary sources that would already be subject to PSD permitting requirements were required to permit GHG emissions. Permitting was required for new sources that would emit 75,000 tpy CO_2e or for existing major stationary sources that had an emissions increase of 75,000 tpy CO_2e. During that phase of permitting, no source was subject to PSD

[1] For purposes of the tailoring rule, GHG is defined as the aggregate group of carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.

[2] CO_2e emissions are calculated by multiplying the mass amount of emissions for each pollutant (e.g., N_2O) by the gas's associated global warming potential (ratio of the time-integrated radiative forcing from the instantaneous release of one kilogram of a trace substance relative to that of one kilogram of the reference gas, CO_2 defined by 40 CFR 98 (Mandatory GHG Reporting).

permitting solely because of its GHG emissions. Beginning July 1, 2011, permitting is required for new stationary sources or for modifications that would increase CO_2e emissions by 100,000 tpy. This second phase of permitting applies to both PSD and Title V permitting programs.

NEPA

While there is currently no federal regulation in place to govern the effects of climate change and GHG emissions, the Council on Environmental Quality (CEQ) provided a draft memorandum in February 2010 that outlines how Federal agencies may better consider the effects of GHG emissions and climate change in their evaluation of NEPA documents. In that draft guidance, CEQ proposes the consideration of opportunities to reduce GHG emissions and adapt the actions to climate change impacts throughout the NEPA process.

In the context of NEPA, CEQ proposes that the following climate change issues be considered:

1. The GHG emissions effects of a proposed action and alternative actions; and

2. The relationship of climate change effects to a proposed action or alternatives, including the relationship to proposal design, environmental impacts, mitigation and adaptation measures.

For the GHG emission analysis, the CEQ draft guidance outlines when to evaluate GHG emissions and offers a protocol on how to evaluate GHG emissions. The draft NEPA guidance states that if a proposed action causes direct emissions of 25,000 metric tons or more of CO_2e emissions on an annual basis, then a quantitative and qualitative assessment should be completed in an Environmental Impact Statement (EIS). The draft CEQ guidance suggests that the following steps be taken to evaluate the effects of GHG emissions:

- Quantify cumulative emissions over the life of the project
- Discuss measures to reduce GHG emissions, including consideration of reasonable alternatives
- Qualitatively discuss the link between such GHG emissions and climate change

In the draft memorandum, CEQ recognizes that the discussion of climate change effects in NEPA documents may be discussed in varying detail depending on available data.

3.6.1.2.2 State

California Executive Order S-3-05
On June 1, 2005, former California Governor Arnold Schwarzenegger signed Executive Order S-3-05. This executive order established the following GHG emission reduction targets for California:

- By 2010, reduce GHG emissions to 2000 levels.
- By 2020, reduce GHG emissions to 1990 levels.
- By 2050, reduce GHG emissions to 80 percent below 1990 levels.

The order also requires the Secretary of the California Environmental Protection Agency (Cal/EPA) to report to the Governor and the State Legislature biannually on progress made toward meeting the GHG emission targets, commencing in January 2006. The Secretary of the Cal/EPA is also required to report about climate change impacts on water supply, public health, agriculture, the coastline, and forestry; mitigation and adaptation plans to combat these impacts must also be developed.

California GHG emissions were estimated to be 453.06 million tonnes of CO_2e in 2010, compared to 466.32 million tonnes of CO_2e in 2000 (California Air Resources Board [CARB] 2014). The GHG emissions inventory indicates that emissions decreased by over 13 million tonnes over the decade, representing a 3 percent decrease in statewide emissions. As a result, the State was successful in meeting the first milestone of S-3-05.

California Assembly Bill (AB) 32
California AB 32, the Global Warming Solutions Act of 2006, codifies the state's GHG emissions targets by requiring the state's global warming emissions to be reduced to 1990 levels by 2020 and directs the CARB to enforce the statewide cap that would begin phasing in by 2012. Former Governor Schwarzenegger signed and passed AB 32 into law on September 27, 2006. Key AB 32 milestones are as follows (CARB n.d.):

- January 1, 2009 – Scoping Plan adopted indicating how emissions will be achieved from significant sources of GHGs via regulations, market mechanisms, and other actions.

- During 2009 – CARB staff drafted rule language to implement its plan and held a series of public workshops on each measure (including market mechanisms).

- January 1, 2010 – Early action measures took effect.

- During 2010 – CARB conducted series of rulemakings, after workshops and public hearings, to adopt GHG regulations including rules governing market mechanisms.

- January 1, 2011 – Completion of major rulemakings for reducing GHGs including market mechanisms.

- January 1, 2012 – GHG rules and market mechanisms (e.g., cap-and-trade regulation) adopted by CARB took effect and are legally enforceable.

- December 31, 2020 – Deadline for achieving 2020 GHG emissions cap.

CARB has been proactive in its implementation of AB 32 and has met each of the milestones identified above that have already passed and is on track to meet the last milestone.

California Environmental Quality Act (CEQA) Guidelines
On March 18, 2010, the California Natural Resources Agency adopted amendments to CEQA Guidelines to include provisions for evaluating the significance of GHG emissions. The amended guidelines give the lead agency leeway in determining whether GHG emissions should be evaluated quantitatively or qualitatively, but requires that the following factors be considered when assessing the significance of impacts from GHG emissions (14 California Code of Regulations 15064.4):

- The extent to which the project may increase or reduce GHG emissions as compared to the existing environmental setting.

- Whether the project emissions exceed a threshold of significance that the lead agency determines applies to the project.

- The extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions.

The amended CEQA Guidelines also suggest measures to mitigate GHG emissions, including implementing project features to reduce emissions, obtaining carbon offsets to reduce, or sequestering GHG. The CEQA Guidelines also require energy use and conservation measures to be discussed, which are summarized in Section 3.16, Power.

3.6.1.2.3 Regional/Local
The following air pollution control districts (APCDs) and air quality management districts (AQMDs) regulate air quality within the area of analysis:

- Bay Area AQMD
- Butte County AQMD
- Colusa County APCD
- Feather River AQMD

- Glenn County APCD
- Monterey Bay Unified APCD
- Placer County APCD
- Sacramento Metropolitan AQMD
- San Joaquin Valley APCD
- Shasta County AQMD
- Tehama County APCD
- Yolo-Solano APCD

Section 3.5, Air Quality, depicts the location of each air district in the Seller and Buyer Service Areas. Although these air districts do not regulate GHG emissions directly, they may have GHG-specific significance criteria in their respective CEQA guidelines.

3.6.1.3 Existing Conditions

This section presents projections of the foreseeable affected environment for use as the basis against which the incremental effects of the alternatives are compared in Section 3.6.2 and to indicate the likely effect of climate change on the alternatives.

3.6.1.3.1 California Climate Trends and Associated Impacts

This discussion describes the data sources used for the analysis, the projected climate changes, and the associated impacts of those changes for the state of California and the study area.

Data Sources

Four reports were used as the main data sources for projected changes in climate for this evaluation. Each report is based on different global climate models (GCMs) and emission scenarios, as described below. Because each GCM/emission scenario pair has related uncertainty, it is important to consider results from various models to understand the possible outcomes (California Climate Change Center [CCCC] 2009a). For this analysis, the ranges of projected changes published in each report are presented.

- **"Climate Change Scenarios and Sea Level Rise Estimates for the California 2009 Climate Change Scenarios Assessment" (CCCC 2009a) –** This report provides projected climate data for California, including monthly temperature data, monthly precipitation data and snow water equivalent (the amount of water contained in snowpack). In addition to the report, the data is available through a series of interactive, web-based tools provided by the California Energy Commission (CEC). Four GCMs were used in the report; the National Center for Atmospheric Research (NCAR) Parallel Climate Model (PCM), the National Oceanic and Atmospheric Administration Geophysical Fluids Dynamics

Laboratory (GFDL) model (Version 2.1), the NCAR Community Climate System Model (CCSM), and the French Centre National de Recherches Meteorologiques (CNRM) models. Two emission scenarios from the IPCC Fourth Assessment were used; a low emissions scenario involving substantial reductions in emissions after 2050 (B1) and a medium-high emissions scenario assuming continued increased in emissions (A2). Two downscaling methods were used: 1) constructed analogues and 2) bias correction and spatial downscaling.

- **"Climate Change Impacts on Water Supply and Agricultural Water Management in California's Western San Joaquin Valley, and Potential Adaptation Strategies" (CCCC 2009b) –** This report provides estimated watershed runoff and agricultural and urban water demand projections for the Sacramento River basin and the Delta export region of the San Joaquin Valley. The Water Evaluation and Planning modeling system was used in conjunction with six GCMs: CNRM, GFDL, PCM, CCSM, the Center for Climate System Research, and the Max Planck Institute. Two emissions scenarios, B1 and A2, were evaluated.

- **"Climate Change Impacts in the United States: The Third National Climate Assessment" (Melillo, Richmond, and Yohe 2014) –** This report assesses current scientific findings about observed and projected impacts of climate change in the United States. The report draws from a large body of scientific peer-reviewed research published or in press by March 1, 2012.

- **"Global Climate Change Impacts in the United States" (Karl, Melillo, and Peterson 2009) –** This report was prepared by the United States Global Change Research Program, a consortium of 13 federal departments and agencies authorized by Congress in 1989 through the Global Change Research Act of 1990 (Pub. L. 101-606, 104 Stat. 3096, codified as amended at 15 U.S. Code [USC] 2921), and serves as the basis for "The Second National Climate Assessment." The foundation for this report is a set of 21 Synthesis and Assessment Products, as well as other peer-reviewed scientific assessments, including those of the IPCC, the United States Climate Change Science Program, the United States National Assessment of the Consequences of Climate Variability and Change, the Arctic Climate Impact Assessment, the National Research Council's Transportation Research Board report on the Potential Impacts of Climate Change on United States Transportation, and a variety of regional climate impact assessments.

Projected Changes in Climate

The projected changes in climate conditions are expected to result in a wide variety of impacts in the state of California and San Joaquin River area. In general, estimated future climate conditions include changes to:

- Annual temperature
- Extreme heat
- Precipitation
- Sea level and storm surge
- Snowpack and streamflow

These projected changes are discussed in detail in the following paragraphs.

Annual Temperature. GCM data exhibit warming across California under both a low emission scenario and medium-high emission scenario (CCCC 2009a). While the data contain variability, there is a steady, linear increase over the 21st century (CCCC 2009a). Projected increases are shown in Table 3.6-1.

Table 3.6-1. Projected Changes in Temperature Compared to the Historical Average (1961 to 1990)

Region	Mid-21st Century	End of 21st Century
California	+1.8 to 5.4°F	+3.6 to 9.0°F
Sacramento Area, California	---	+3.6 to 6.3°F

Sources: CCCC 2009a, CEC 2011.

Key:

--- = no data available

°F = degrees Fahrenheit

On a seasonal basis, the models project substantial warming in the spring and greater warming in the summer than in the winter. Summer (July to September) temperature changes range from 2.7 to 10.8 °F and winter (January to March) temperature changes range from 1.8 to 7.2 °F at the end of the 21st century when compared to the historical average (1961 to 1990) (CCCC 2009a). In addition, the models suggest that, during the summer, warming of interior land surfaces will be greater than that observed along the coast (CCCC 2009a).

Extreme Heat. The climate model results consistently show increases in frequency, magnitude and duration of heat waves when compared to historical averages (1961 to 1990). Historically, extreme temperatures typically occur in July and August. With climate change, these occurrences are likely to begin in June and continue through September (CCCC 2009a). Occurrences lasting five days or longer are projected to become 20 times or more prevalent in the last 30 years of the 21st century (CCCC 2009a).

For Sacramento, the closest area to the San Joaquin River for which data is available, GCM results show a more-than-threefold increase in the frequency of extreme heat and a significant increase in the intensity of hot days (CCCC 2009a). By 2100, the data show as many as 100 days per year with temperatures greater than 95°F in Sacramento (CEC 2011).

*Precipitation***.** On average, the climate model projections show little change in total annual precipitation in California (CCCC 2009a). Specifically, the Mediterranean seasonal precipitation pattern is expected to continue, with most precipitation falling between November and March from North Pacific storms and the prevalence of hot, dry summers (CCCC 2009a). In addition, past trends show a large amount of variability from month to month, year to year, and decade to decade. This high degree of variability is expected to continue in the next century (CCCC 2009a).

For Sacramento, several model simulations indicate a drying trend when compared to the historical average (1961 – 1990). Under the low emissions scenario, the 30-year mean precipitation is projected to be more than five percent drier by mid-21st century and 10 percent drier by late-21st century (CCCC 2009a). The model results showing the drying trend indicate a decline in the frequency of precipitation events, but do not show a clear correlation in the precipitation intensity (CCCC 2009a).

In the western San Joaquin Valley, model simulations suggest that there is a generally decreasing trend in precipitation as the 21st century progresses (CCCC 2009b). In addition, model results indicate that water shortages may be felt more acutely in the western San Joaquin Valley as Delta exports become more constrained (CCCC 2009b).

Sea Level and Storm Surge. By 2050, sea level rise is projected to be between 30 and 45 centimeters (cm) (12 to 18 inches), compared to 2000 levels (CCCC 2009a). Global models indicate that California may see up to a 140 cm (55 inch) rise in sea level by the end of the 21st century (CEC 2011). Combined with high tides and winter storms, sea level rise is projected to result in an increased rate of extreme high sea level events (CCCC 2009a).

Snowpack and Streamflow. Snowpack and streamflow amounts are projected to decline because of less late winter precipitation falling as snow and earlier snowmelt (Melillo, Richmond, and Yohe 2014). In California, snow water equivalent (the amount of water held in a volume of snow) is projected to decrease by 16 percent by 2035, 34 percent by 2070, and 57 percent by 2099, as compared to measurements between 1971 and 2000 (Melillo, Richmond, and Yohe 2014). By the end of the century, late spring streamflow could decline by up to 30 percent (CEC 2011).

Associated Impacts
The combined changes in climate result in various impacts for California and the study area. Potential impacts include changes to wildfire hazards, water supply and demand, natural resources, infrastructure, agriculture and livestock, and human health. Descriptions of the associated impacts are included below.

Wildfire Hazards. Prolonged periods of higher temperatures combined with associated drought will drive larger and more frequent wildfires in California (Melillo, Richmond, and Yohe 2014). The wildfires are projected to start earlier in the summer and last longer into the fall. In California, the risk of wildfire is projected to increase by up to 55 percent, depending on the level of emission reductions that can be achieved globally (CEC 2011). Changes to temperature and precipitation are also projected to change vegetation types and increase the spread of invasive species that are more fire-prone that, when coupled with more frequent and prolonged periods of drought, increase the risk of fires and reduce the capacity of native species to recover (CEC 2011).

Water Supply and Demand. The projected changes in climate will increase pressure on California's water resources, which are already fully utilized by the demands of a growing economy and population (CEC 2011). Although significant changes in annual precipitation are not projected, increasing temperatures, decreasing snowmelt and changes to spring streamflows will decrease the reliability of water supplies and increase the likelihood of more frequent short-term and long-term droughts and water shortages (Melillo, Richmond, and Yohe 2014). Water is also an important resource for creating hydroelectric power, which may be impacted by decreased supply (Karl, Melillo, and Peterson 2009).

Increasing temperatures will result in increased competition for water among agricultural, municipal, and environmental uses. Larger agricultural demands may lead to increased stress on the management of surface water resources and, potentially, the over exploitation of groundwater aquifers (CCCC 2009b). Agricultural areas could be significantly impacted, with California farmers losing as much as 25 percent of the water supply they need (CEC 2011).

Water supplies are also at risk from rising sea levels. An influx of saltwater would degrade California's estuaries, wetlands, and groundwater aquifers. In particular, saltwater intrusion would threaten the quality and reliability of the major state fresh water supply that is pumped from the southern edge of the Sacramento and San Joaquin River Delta (Delta) (CEC 2011). In addition, the entire Delta region is now below sea level, protected by more than a thousand miles of levees and dams, and catastrophic failure of those dams from an extreme high sea level event would greatly affect this resource (Karl, Melillo, and Peterson 2009).

Projected changes in the timing and amount of river flow, particularly in winter and spring, is estimated to more than double the risk of Delta flooding events by mid-century, and result in an eight-fold increase before the end of the century (Karl, Melillo, and Peterson 2009). Taking into account the additional risk of a major seismic event and increases in sea level due to climate change over this century, the California Bay–Delta Authority has concluded that the Delta and Suisun Marsh are not sustainable under current practices (Karl, Melillo, and Peterson 2009).

Natural Resources. Climate change will continue to affect natural ecosystems, including changes to biodiversity, location of species and the capacity of ecosystems to moderate the consequences of climate disturbances such as droughts (Melillo, Richmond, and Yohe 2014). In particular, species and habitats that are already facing challenges will be the most impacted by climate change (Melillo, Richmond, and Yohe 2014). Other impacts to natural resources include:

- Changing water quality of natural surficial water bodies, including higher water temperatures, decreased and fluctuating dissolved oxygen content, increased cycling of detritus, more frequent algal blooms, increased turbidity, increased organic content, color changes, and alkalinity changes (Karl, Melillo, and Peterson 2009).

- Decreased tree growth and habitat change in low- and mid-elevation forests from increased temperature and drought (Karl, Melillo, and Peterson 2009).

- Increased frequency and intensity of insect attacks due to increased temperatures and shorter winters (Melillo, Richmond, and Yohe 2014).

- Disruption of the coordination between predator-prey or plant-pollinator life cycles that may lead to declining populations of many native species (Karl, Melillo, and Peterson 2009).

- Changes in the tree canopy that affect rainfall interception, evapotranspiration, and infiltration of precipitation, affecting the quantity of runoff (Karl, Melillo, and Peterson 2009).

- Reduced ability to respond to flooding and increased stress on species populations due to changes in wetland and riparian zone plant communities and hydraulic roughness (Karl, Melillo, and Peterson 2009).

- Shifting distribution of plant and animal species on land, with some species becoming more or less abundant (Karl, Melillo, and Peterson 2009).

- Rare or endangered species may become less abundant or extinct (Melillo, Richmond, and Yohe 2014).

- Decreased recreation and tourism opportunities from ecosystems degradation (Karl, Melillo, and Peterson 2009).

Infrastructure. Existing infrastructure were designed based on past, stable climate trends and may not have the capacity to respond to rapid changes in climate that are projected for the future (Melillo, Richmond, and Yohe 2014). Impacts to infrastructure include:

- Changes to soil moisture (Karl, Melillo, and Peterson 2009), which may led to soil subsidence under structures.

- Increased energy demand for cooling, refrigeration and water transport (Karl, Melillo, and Peterson 2009).

- Buckling of pavement or concrete structures (Karl, Melillo, and Peterson 2009).

- Decreased lifecycle of equipment or increased frequency of equipment failure (Karl, Melillo, and Peterson 2009).

- Accelerated erosion when stormwater infrastructure capacity is exceeded (Melillo, Richmond, and Yohe 2014).

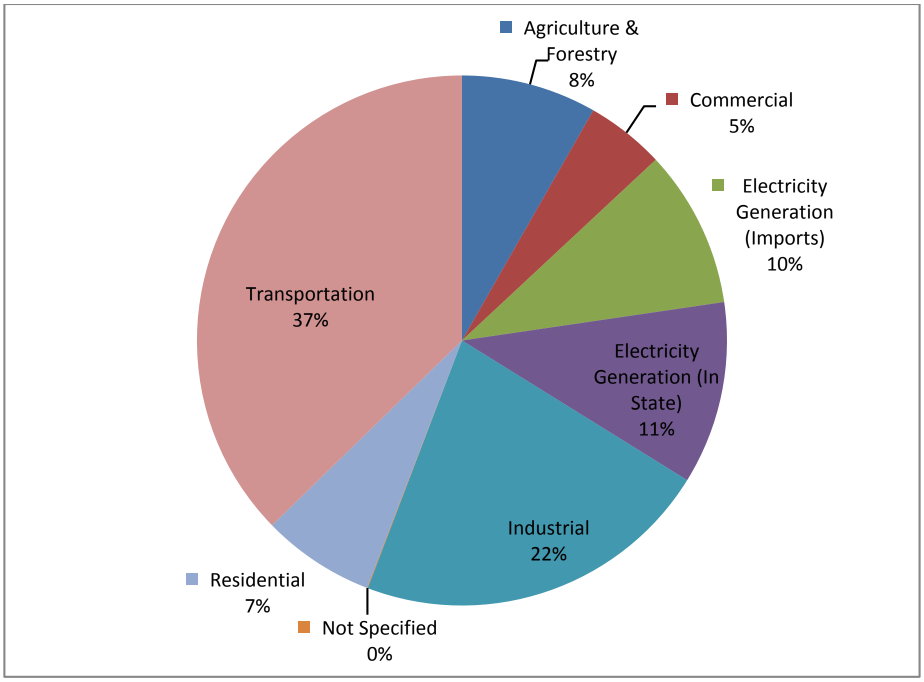
Agriculture and Livestock. Increased temperatures are projected to lengthen the growing season, although disruptions from extreme heat, drought, and changes to insects are also expected (Melillo, Richmond, and Yohe 2014). With adaptive actions, agriculture in the United States is expected to be resilient in the near-term, but yields of crops are expected to decline mid-century and late-century due to increased extremes in the climate (Melillo, Richmond, and Yohe 2014). California produces a large portion of the nation’s high-value specialty crops, which are irrigation dependent and vulnerable to extreme changes in temperature and moisture (Melillo, Richmond, and Yohe 2014). Increased frequency and duration of heat waves would also put stress on livestock.

Human Health. Extreme heat events, increased wildfires, decreased air quality caused by rising temperatures, and diseases transmitted by insects, food and water that are impacted by climate change are a threat to human health and well-being (Melillo, Richmond, and Yohe 2014).

3.6.1.3.2 GHG Emissions Sources and Inventory

California is the second highest emitter of GHG emissions in the states, only behind Texas; however, from a per capita standpoint, California has the 45th lowest GHG emissions among the states. Worldwide, California is the 20th largest emitter of carbon dioxide (CO_2) if it were a country; on a per capita basis, California would be ranked 38th in the world (CARB 2014a). As shown in Figure 3.6-2, transportation is responsible for 37 percent of the State’s GHG emissions, followed by the industrial sector (22 percent), electricity generation

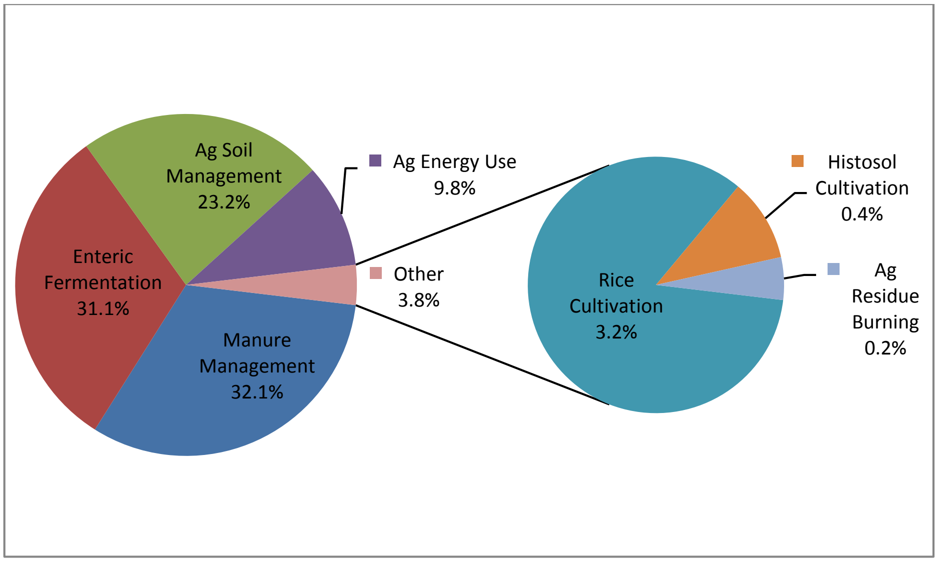
(21 percent), commercial and residential (12 percent), agriculture and forestry (8 percent) and other sources (0.04 percent). Emissions of CO_2 and nitrous oxide (N_2O) are largely byproducts of fossil fuel combustion. Methane (CH_4), a highly potent GHG, results largely from off-gassing associated with agricultural practices and landfills. California gross GHG emissions in 2012 (the last year inventoried) totaled approximately 459 million metric tons CO_2e (CARB 2014b).



Source: CARB 2014b.

Figure 3.6-2. California GHG Emissions in 2012

Agricultural emissions represented approximately 8 percent of California's emissions in 2012. Agricultural emissions represent the sum of emissions from agricultural energy use (from pumping and farm equipment), agricultural residue burning, agricultural soil management (the practice of using fertilizers, soil amendments, and irrigation to optimize crop yield), enteric fermentation (fermentation that takes place in the digestive system of animals), histosols (soils that are composed mainly of organic matter) cultivation, manure management, and rice cultivation. Agricultural emissions are shown in Figure 3.6-3.



Source: CARB 2014b.

Figure 3.6-3. California Agricultural GHG Emissions in 2012

3.6.2 Environmental Consequences/Environmental Impacts

These sections describe the environmental consequences/environmental impacts associated with each alternative.

3.6.2.1 Assessment Methods

This analysis estimates CO_2, CH_4, and N_2O emissions that would occur from groundwater substitution transfers and cropland idling transfers. The other two pollutant groups commonly evaluated in various GHG reporting protocols, hydrofluorocarbons and perfluorocarbons, are not expected to be emitted in large quantities as a result of the alternatives and are not discussed further in this section.

This analysis estimates emissions using available emissions data and information on fuel type, engine size (horsepower [hp]), and annual transfer amounts included in the proposed alternatives. Existing emissions data used in the analysis includes:

- Diesel and natural gas fuel emission factors from The Climate Registry (TCR 2014a)
- Electric utility CO_2 emission factors from TCR (2014b)
- Emissions & Generation Resource Integrated Database (eGRID) CH_4 and N_2O emission factors from USEPA (USEPA 2014)

- "Comparison of Summertime Emission Credits from Land Fallowing Versus Groundwater Pumping" (Byron Buck & Associates 2009)

In 2009, Byron Buck & Associates completed a comparison of the relative reduction in emissions due to cropland idling activities versus groundwater substitution. Byron Buck & Associates estimated the gallons of fuel consumed by farm equipment that would be reduced per acre idled and the average quantity of fuel consumed by groundwater pumping. It was assumed that an agency would need 4.25 acre-feet (AF) of water produced by idling to offset the equivalent emissions of one AF of groundwater pumped (Byron Buck & Associates 2009). Using this ratio, the expected reductions in vehicular exhaust emissions from cropland idling were estimated.

Each GHG contributes to climate change differently, as expressed by its global warming potential (GWP). GHG emissions are discussed in terms of CO_2e emissions, which express, for a given mixture of GHG, the amount of CO_2 that would have the same GWP over a specific timescale. CO_2e is determined by multiplying the mass of each GHG by its GWP.

This analysis uses the GWP from the IPCC Fourth Assessment Report (Forster et al. 2007) for a 100-year time period to estimate CO_2e. This approach is consistent with the federal GHG Reporting Rule (40 Code of Federal Regulations [CFR] 98), as effective on January 1, 2014 (78 FR 71904) and California's 2000-2012 GHG Inventory Report (CARB 2014a). The GWPs used in this analysis are 25 for CH_4 and 298 for N_2O.

Annual emissions were summarized by water agency. Detailed calculations are provided in Appendix G, Climate Change Analysis Emission Calculations.

3.6.2.2 Significance Criteria

The significance criteria described below were developed consistent with the CEQA Guidelines to determine the significance of potential impacts on climate change that could result from implementation of the alternatives. Individual air districts develop their own criteria for evaluating significance. Since climate change is a cumulative issue, GHG emissions were not separated by individual water agencies, counties, or air districts to evaluate significance. Rather, emissions that would occur as a result of the entire alternative were evaluated.

To determine the appropriate significance level to use, the GHG significance criteria for various air districts were evaluated. The review of the CEQA Guidelines was not restricted to only those counties that would be affected by the alternatives. Instead the CEQA Guidelines for air districts with known quantitative or qualitative guidance for GHG emissions were reviewed. Many of the air districts included in the area of analysis do not have published significance thresholds for GHG emissions and climate change. These air districts include the Butte County AQMD, Colusa County APCD, the Glenn

County APCD, Shasta County AQMD, Tehama County APCD and the Yolo-Solano AQMD.

Table 3.6-2 summarizes the various emissions thresholds used by air districts throughout California.

Table 3.6-2. Air District GHG Significance Thresholds

Air District	GHG Significance Threshold
Antelope Valley AQMD and Mojave Desert AQMD	Direct and indirect emissions in excess of 100,000 tpy or 548,000 pounds per day CO_2e
Bay Area AQMD	None[1]
Sacramento Metropolitan AQMD	Thresholds of significance for GHG emissions should be related to AB 32's GHG reduction goals.[2]
San Joaquin Valley APCD	Compliance with Best Performance Standards
San Luis Obispo County APCD	Consistency with a Qualified GHG Reduction Plan OR 1,150 metric tons CO_2e/year[3] OR 4.9 CO_2e/service population[4]/year
Santa Barbara County APCD	10,000 metric tons CO_2e/year (proposed)
South Coast AQMD	10,000 metric tons CO_2e/year[5]

Sources: Antelope Valley AQMD 2011; Bay Area AQMD 2012; Mojave Desert AQMD 2011; Sacramento Metropolitan AQMD 2011; San Joaquin Valley APCD 2009; San Luis Obispo County AQMD 2012; Santa Barbara County APCD 2011; and South Coast AQMD 2008.

Notes:

[1] The Bay Area AQMD previously recommended a GHG significance threshold of 10,000 metric tons CO_2e/year for industrial sources. On March 5, 2012, the Alameda County Superior Court issued a judgment finding that the Bay Area AQMD had failed to comply with CEQA when it adopted the thresholds. The Bay Area AQMD consequently struck the significance thresholds from its CEQA Guidelines (2012) and no longer recommends significance thresholds.

[2] For example, a possible significance threshold could be to determine whether a project's emissions would substantially hinder the State's ability to attain the goals identified in AB 32 (i.e., reduction of statewide GHG emission to 1990 levels by 2020). Additionally, another strategy is to determine if the project is consistent with the State's strategy to achieve the 2020 GHG emissions limit as outlined in the Scoping Plan (CARB 2008).

[3] Construction emissions are amortized and combined with operational emissions. The project life is assumed to be 50 years for residential projects and 25 years for commercial projects. This threshold would be most applicable to an industrial (i.e., stationary source) project.

[4] The service population is defined as the sum of residents and employees.

[5] Construction emissions are amortized and combined with operational emissions. Project lifetime is assumed to be 30 years if not known.

Although several air districts have a significance threshold of 10,000 metric tons per year (MT/yr), the threshold is specific to industrial, stationary source emissions. A “stationary source” is generally defined as “any building, structure, facility, or installation that emits or may emit any regulated air pollutant or any pollutant listed under section 112(b) of the [CAA]” (40 CFR 70.2). A facility can be further defined as any stationary equipment located on one or more contiguous or adjacent properties under common ownership and control (40 CFR 98.6). The stationary source threshold used by multiple air districts (i.e., 10,000 MT/yr) is not intended to cover stationary source emissions owned and operated by multiple parties; rather, it is applicable to individual pieces of equipment, or at most, an individual facility, rather than all equipment affected by the action alternatives. Because multiple facilities and owners are affected by the action alternatives, using the stationary source threshold as the significance threshold for the action alternatives would be overly onerous and is not recommended.

The significance threshold proposed by the Antelope Valley AQMD and the Mojave Desert AQMD (100,000 tons CO_2e per year) is identical to the PSD permitting threshold described previously. Because the intent of the PSD permitting program is to prevent the deterioration of air quality, the 100,000 tpy threshold is appropriate for evaluating significance for the proposed alternatives and was used for this analysis.

3.6.2.3 Alternative 1: No Action/No Project

Combined emissions from groundwater substitution and cropland idling transfers could increase emissions of GHG emissions. There would be no groundwater substitution transfers originating in the Seller Service Area; therefore, the potential for GHG emissions from engine exhaust would be the same as existing conditions.

Cropland idling and groundwater pumping in the Buyer Service Area as a result of Central Valley Project (CVP) water shortages could affect emissions. Under the No Action/No Project Alternative, agricultural water users in the Buyer Service Area would continue to face CVP shortages, similar to existing conditions. In response, farmers would leave some crops idle, which would reduce vehicle exhaust from farm equipment. Farmers would also continue to pump groundwater for irrigation, which releases emissions if diesel pumps are used. These actions in response to CVP shortages would continue under the No Action/No Project Alternative. There would be no change to emissions relative to existing conditions.

3.6.2.4 Alternative 2: Full Range of Transfers (Proposed Action)

3.6.2.4.1 Seller Service Area

Increased groundwater pumping for groundwater substitution transfers could increase emissions of GHGs. Table 3.6-3 summarizes direct annual emissions, as CO_2e that would occur from groundwater pumping by each water agency.

Table 3.6-3. Annual GHG Emissions from Groundwater Substitution Transfers (Proposed Action), metric tons CO_2e per year

Water Agency	CO_2	CH_4	N_2O	Total
Anderson-Cottonwood Irrigation District	164	<1	1	165
Butte Water District	356	1	1	358
City of Sacramento	483	1	2	485
Conaway Preservation Group	2,360	3	8	2,371
Cordua Irrigation District	496	1	2	499
Cranmore Farms	272	<1	1	274
Eastside Mutual Water Company	392	<1	1	394
Garden Highway Mutual Water Company	452	1	2	454
Gilsizer Slough Ranch	441	1	1	443
Glenn-Colusa Irrigation District	785	1	3	789
Goose Club Farms and Teichert Aggregates	341	1	1	342
Natomas Central Mutual Water Company	376	1	1	378
Pelger Mutual Water Company	283	<1	1	285
Pleasant Grove-Verona Mutual Water Company	1,890	2	6	1,898
Pope Ranch	119	<1	<1	120
Reclamation District 108	642	1	3	646
Reclamation District 1004	900	1	2	903
Reclamation District 2068	184	<1	1	185
River Garden Farms	326	1	1	327
Sacramento County Water Agency	1,427	2	5	1,434
Sacramento Suburban Water District	4,379	4	10	4,393
Sycamore Mutual Water Company	490	1	2	493
Te Velde Revocable Family Trust	202	<1	1	203
Tule Basin Farms	374	<1	1	375
Total (MT/yr)	18,134	23	57	18,215
Total (tpy)	**19,989**	**26**	**63**	**20,078**

Key:
< = less than
CH_4 = methane
CO_2 = carbon dioxide
MT/yr = metric tons per year
$MTCO_2e$/yr = metric tons carbon dioxide equivalent per year
N_2O = nitrous oxide
tpy = short tons per year

As shown in Table 3.6-3, GHG emissions would not exceed the significance criterion of 100,000 tpy and emissions would be less than significant.

Water transfers via cropland idling could reduce vehicle exhaust emissions from reduced operations in the study area. Reduced vehicle exhaust emissions were estimated based on the proposed acreages of rice that would be idled during the Proposed Action, as described in Section 3.6.2.1. Table 3.6-4 summarizes annual emissions, as CO_2e that would not occur from vehicle exhaust by water agency.

Table 3.6-4. Annual GHG Emissions Reductions from Cropland Idling Transfers (Proposed Action), metric tons CO_2e per year

Water Agency[1,2]	CO_2	CH_4	N_2O	Total
Butte Water District	205	<1	1	205
Conaway Preservation Group	380	<1	1	381
Cranmore Farms	44	<1	<1	45
Glenn-Colusa Irrigation District	1,174	1	3	1,178
Goose Club Farms and Teichert Aggregates	178	<1	1	179
Pelger Mutual Water Company	45	<1	<1	45
Pleasant Grove-Verona Mutual Water Company	160	<1	<1	161
Reclamation District 108	356	<1	1	357
Reclamation District 1004	178	<1	1	179
Reclamation District 2068	133	<1	<1	134
Sycamore Mutual Water Company	178	<1	1	179
Te Velde Revocable Family Trust	124	<1	<1	125
Total (MT/yr)	3,154	4	9	3,167
Total (tpy)	**3,477**	**4**	**10**	**3,490**

Notes:
1 The reduction in emissions due to cropland idling is shown.
2 The actual water agencies to participate in cropland idling may not be the water agencies shown in the table; however, these agencies were selected as representative agencies in the applicable counties.

Key:
< = less than
CH_4 = methane
CO_2 = carbon dioxide
MT/yr = metric tons per year
$MTCO_2e$/yr = metric tons carbon dioxide equivalent per year
N_2O = nitrous oxide
tpy = tons per year

As shown in Table 3.6-4, GHG emissions, as CO_2e, would not exceed the significance criterion. Additionally, if groundwater substitution emissions and cropland idling emissions occurred in the same year, then the reduced emissions occurring from cropland idling would offset the expected increase from groundwater substitution. As a result, the Proposed Action would result in a less than significant impact.

Changes to the environment from climate change could affect the Proposed Action. As described in the Section 3.6.1.3, changes to annual temperatures, extreme heat, precipitation, sea level rise and storm surge, and snowpack and streamflow are expected to occur in the future because of climate change. Because of the short-term duration of the Proposed Action (10 years), any effects of climate change on this alternative are expected to be minimal. Impacts to the Proposed Action from climate change would be less than significant.

3.6.2.4.2 Buyer Service Area

Use of water from transfers on agricultural fields in the Buyer Service Area could affect emissions. Water transfers to agricultural users in Alameda, Contra Costa, Fresno, Kings, Merced, San Benito, San Joaquin, Stanislaus and Santa

Clara Counties could temporarily reduce the amount of land idled relative to the No Action/No Project Alternative. This would increase use of farm equipment, which would increase vehicle exhaust emissions. Farmers may also pump less groundwater for irrigation, which would reduce emissions from use of diesel pumps. The total amount of agricultural activity in the Buyer Service Area relative to GHG emissions would not likely change relative to existing conditions and the impact would be less than significant.

3.6.2.5 Alternative 3: No Cropland Modifications

3.6.2.5.1 Seller Service Area

Increased groundwater pumping for groundwater substitution transfers could increase emissions of GHGs. Groundwater substitution transfers that would occur under Alternative 3 would be identical to those that would occur under the Proposed Action (Table 3.6-3). As a result, GHG impacts associated with groundwater substitution would be the same as those discussed for the Proposed Action. As a result, groundwater pumping would result in a less than significant impact.

Changes to the environment from climate change could affect Alternative 3. As described in the Section 3.6.1.3, changes to annual temperatures, extreme heat, precipitation, sea level rise and storm surge, and snowpack and streamflow are expected to occur in the future because of climate change. Because of the short-term duration of Alternative 3 (10 years), any effects of climate change on this alternative are expected to be minimal. Impacts to this alternative from climate change would be less than significant.

3.6.2.5.2 Buyer Service Area

Use of water from transfers on agricultural fields in the Buyer Service Area could affect emissions. Water transfers to agricultural users in Alameda, Contra Costa, Fresno, Kings, Merced, San Benito, San Joaquin, Stanislaus, and Santa Clara Counties could temporarily reduce the amount of land idled relative to the No Action/No Project Alternative. This would increase use of farm equipment, which would increase vehicle exhaust emissions. Farmers may also pump less groundwater for irrigation, which would reduce emissions from use of diesel pumps. The total amount of agricultural activity in the Buyer Service Area relative to GHG emissions would not likely change relative to existing conditions and the impact would be less than significant.

3.6.2.6 Alternative 4: No Groundwater Substitution

3.6.2.6.1 Seller Service Area

Water transfers via cropland idling could reduce vehicle exhaust emissions from reduced operations in the study area. Reduced vehicle exhaust emissions were estimated based on the proposed acreages of croplands that would be idled during Alternative 4, as described in Section 3.6.2.1. The proposed acreage of land to be idled in Alternative 4 would be equal to those proposed under the

Proposed Action (see Table 3.6-4). As a result, cropland idling would result in a less than significant impact.

Changes to the environment from climate change could affect Alternative 4. As described in the Section 3.6.1.3, changes to annual temperatures, extreme heat, precipitation, sea level rise and storm surge, and snowpack and streamflow are expected to occur in the future because of climate change. Because of the short-term duration of Alternative 4 (10 years), any effects of climate change on this alternative are expected to be minimal. Impacts to this alternative from climate change would be less than significant.

3.6.2.6.2 Buyer Service Area

Use of water from transfers on agricultural fields in the Buyer Service Area could affect emissions. Water transfers to agricultural users in Alameda, Contra Costa, Fresno, Kings, Merced, San Benito, San Joaquin, Stanislaus, and Santa Clara Counties could temporarily reduce the amount of land idled relative to the No Action/No Project Alternative. This would increase use of farm equipment, which would increase vehicle exhaust emissions. Farmers may also pump less groundwater for irrigation, which would reduce emissions from use of diesel pumps. The total amount of agricultural activity in the Buyer Service Area relative to GHG emissions would not likely change relative to existing conditions and the impact would be less than significant.

3.6.3 Comparative Analysis of Alternatives

Table 3.6-5 summarizes the effects of the action alternatives. The following text supplements the table by describing the magnitude of the effects under the action alternative and No Action/No Project Alternative.

Table 3.6-5. Climate Change Comparison of Alternatives

Potential Impact	Alternatives	Significance	Proposed Mitigation	Significance After Mitigation
Combined emissions from groundwater substitution and cropland idling transfers could increase emissions of GHG emissions.	1	NCFEC	None	NCFEC
Cropland idling and groundwater pumping in the Buyer Service Area as a result of CVP water shortages could affect emissions.	1	NCFEC	None	NCFEC
Increased groundwater pumping for groundwater substitution transfers could increase emissions of GHGs.	2, 3	LTS	None	LTS
Water transfers via cropland idling could reduce vehicle exhaust emissions from reduced operations in the study area.	2, 4	LTS	None	LTS

Potential Impact	Alternatives	Significance	Proposed Mitigation	Significance After Mitigation
Changes to the environment from climate change could affect the action alternatives.	2, 3, 4	LTS	None	LTS
Use of water from transfers on agricultural fields in the Buyer Service Area could affect emissions.	2, 3, 4	LTS	None	LTS

Key:
LTS = Less than Significant
NCFEC = no change from existing conditions

3.6.3.1 No Action/No Project Alternatives

There would be no changes to emissions in the Seller Service Area relative to existing conditions.

3.6.3.2 Alternative 2: Full Range of Transfers (Proposed Action)

Increased groundwater pumping could increase GHG emissions from engine exhaust. These emission increases would then be partially offset by reduced farm equipment exhaust emissions from land preparation and harvesting activities that would no longer occur under the Proposed Action. The effects associated with groundwater pumping and cropland idling would be less than significant.

3.6.3.3 Alternative 3: No Cropland Modifications

The No Cropland Modification Alternative does not include cropland idling or crop shifting transfers. Impacts associated with groundwater pumping would be the same as those identified for the Proposed Action.

3.6.3.4 Alternative 4: No Groundwater Substitution

The No Groundwater Substitution Alternative does not include groundwater pumping to enable water transfers. Alternative 4 would include cropland idling up to the same upper limits for acreage as the Proposed Action, but idling may occur more frequently because there are fewer other transfer types for buyers to choose from. Reductions in emissions as a result of cropland idling would be larger than reductions in emissions under the Proposed Action.

3.6.4 Environmental Commitments/Mitigation Measures

There would be no significant impacts to climate change from implementation of the No Action/No Project Alternative or the action alternatives. Therefore, no environmental commitments/mitigation measures are proposed.

3.6.5 Potentially Significant Unavoidable Impacts

None of the action alternatives would result in potentially significant unavoidable impacts on GHG emissions or energy use in relation to potential contributions to climate change.

3.6.6 Cumulative Effects

The timeframe for the Long-Term Water Transfers cumulative analysis extends from 2015 through 2024, a ten-year period.

3.6.6.1 Alternative 2: Full Range of Transfers (Proposed Action)

Combined emissions from groundwater substitution and cropland idling transfers in combination with other cumulative projects could increase emissions of GHG emissions. By its very nature, climate change is a cumulative impact from various global sources of activities that incrementally contribute to global GHG concentrations. Individual projects provide a small addition to total concentrations, but contribute cumulatively to a global phenomenon. The goals of AB 32 require GHG emission reductions from existing conditions. As a result, cumulative GHG and climate change impacts must be analyzed from the perspective of whether they would impede the state's ability to meet its emission reduction goals. As shown in Figure 3.6-2, transportation is responsible for 37 percent of the State's GHG emissions, followed by the industrial sector (22 percent), electricity generation (21 percent), commercial and residential (12 percent), agriculture and forestry (8 percent) and other sources (0.04 percent). It is reasonable to expect that these sectors would continue to contribute to GHG emissions in the future. Climate change therefore represents a significant cumulative effect for the entire State and could have a variety of meteorological and hydrologic implications.

Under the Proposed Action, increased groundwater pumping would increase GHG emissions from engine exhaust. These emissions would be partially offset by reductions in farm equipment exhaust emissions from cropland idling activities. GHG emissions that would occur under the Proposed Action are substantially less than the threshold of significance and would not result in a cumulatively considerable impact.

3.6.6.2 Alternative 3: No Cropland Modifications

Cumulative effects under Alternative 3 would be the same as the groundwater pumping impacts described in the Proposed Action.

3.6.6.3 Alternative 4: No Groundwater Substitution

Emissions from cropland idling transfers in combination with other cumulative projects could increase emissions of GHG emissions. Cumulative effects under Alternative 4 would be similar to those described in the Proposed Action. Cropland idling transfers would result in a reduction in emissions. GHG emissions that would occur under Alternative 4 would not result in a cumulatively considerable impact.

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Section 3.7 Fisheries

This section presents a description of the fishery resources within the study area. It includes a comparison of the impacts of the alternatives; a description of environmental commitments and mitigation measures that will be implemented to avoid, minimize and mitigate any impacts identified; a description of any remaining potentially significant, unavoidable impacts; and an evaluation of the cumulative effects of the project considering other existing and reasonably foreseeable actions within the area of analysis. The types of transfers most likely to affect fisheries resources (fish and their habitat) are groundwater substitution transfers, which may affect flows on small streams, and stored reservoir water transfers that may affect the value of fish habitat in the reservoirs supplying this water and affect flows on the rivers downstream of those reservoirs. Rice fields and upland crops do not provide suitable habitat for fish species of management concern. Conservation and cropland idling transfers would not likely affect fisheries resources because neither would substantially affect flows in natural waterways; therefore, they are not further discussed in this chapter.

3.7.1 Affected Environment/Environmental Setting

This section provides an overview of the area where the action alternatives have the potential to affect fishery resources, including special-status fish species. Vegetation and terrestrial wildlife species are discussed in Section 3.8.

3.7.1.1 Area of Analysis

The area of analysis includes the Seller Service Area and Sacramento San Joaquin Delta (Figure 3.7-1). Fisheries Resources in the Buyer Service Area would not be affected as described below.

3.7.1.1.1 Seller Service Area

This region includes potential seller lands within the Sacramento River and San Joaquin watersheds and downstream areas.

The action alternatives could affect major watersheds and numerous minor watersheds within the Sacramento River Basin that include the following water bodies:

- Sacramento River from Shasta Reservoir to the Sacramento San Joaquin Delta (Delta);

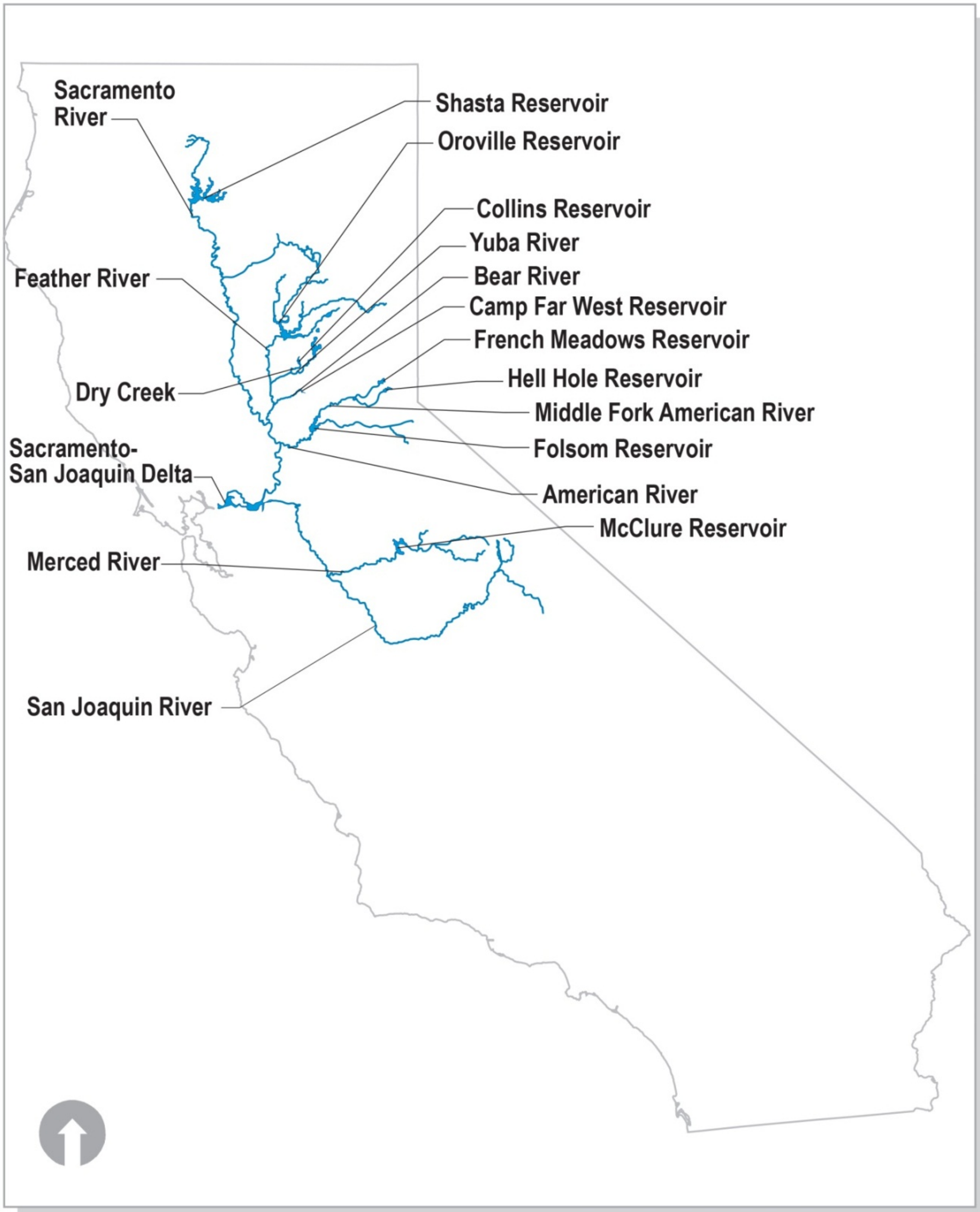


Figure 3.7-1. Major Rivers and Reservoirs in the Area of Analysis

- Feather River, including and downstream of Lake Oroville and its tributaries, the Yuba River including and downstream of New Bullards Bar Reservoir (although fish species evaluated here cannot access the river upstream of Englebright Dam), and the Bear River including and downstream of Camp Far West Reservoir;

- American River including and downstream of Folsom Reservoir and Lake Natoma (although fish species evaluated here cannot access the river upstream of Nimbus Dam);

- Middle Fork American River downstream of Hell Hole and French Meadows Reservoirs (although fish species evaluated here cannot access the river upstream of Nimbus Dam); and

- Numerous small tributaries to the Sacramento River, Feather River, Yuba River, and Bear River.

Within the San Joaquin River watershed, potentially affected water bodies in the Seller Service Area include:

- San Joaquin River downstream of the Merced River; and
- Merced River including and downstream of Lake McClure.

As described below, water transfer actions would not affect other tributaries of the San Joaquin watershed in the Seller Service Area.

Water transfers made under the alternatives would move through the Sacramento-San Joaquin Delta (Delta), and so resources within the Delta could be affected.

3.7.1.1.2 Buyer Service Area

The Buyer Service Area includes portions of Contra Costa County, Northwestern Alameda County, Santa Clara County, northwestern San Benito County, a small area of San Joaquin and Stanislaus counties, a small portion of western Merced County, and extends through western Fresno County into northwest Kings County. Water diversions from the Delta through the Banks and Jones Pumping Plants would be subject to the existing biological opinions (BOs) on the long-term operations of the Central Valley Project (CVP) and State Water Project (SWP), which included transfers in excess of the size considered in the alternatives in this Environmental Impact Statement/Environmental Impact Report (EIS/EIR).

San Luis Reservoir is the only water body in the Buyer Service Area that could be affected by the water transfers. San Luis Reservoir is an artificial environment and does not support a naturally evolved aquatic community. Fish species in San Luis Reservoir have either been directly introduced or transported into the reservoir via the California Aqueduct or Delta-Mendota Canal. It does not support primary populations of the fish species of management concern (see Section 3.7.1.3.2), nor does it support these species in downstream areas.

For Contra Costa Water District (WD) and East Bay Municipal Utility District (MUD), diversions would be subject to the BOs associated with their pumping stations and diversions. Water would be moved through existing conveyance facilities and would not affect natural water bodies.

As the project would not affect the fish species of primary management concern in the Buyer Service Area, the Buyer Service Area is not included in the area of analysis for fisheries resources.

3.7.1.2 Regulatory Setting

There are a number of federal, state and local regulations and policies that apply to fisheries resources within the area of analysis. Applicable requirements are discussed in greater detail in Appendix H, and include:

- Federal Endangered Species Act (ESA);
- Fish and Wildlife Coordination Act;
- Magnuson-Stevens Fisheries Act of 2006;
- Executive Order 11990 (Protection of Wetlands);
- California Endangered Species Act (CESA);
- California Natural Community Conservation Planning Act;
- Requirements of the 1995 Bay/Delta Plan Water Quality Control Plan and Decision 1641;
- California Water Code;
- Central Valley Project Improvement Act;
- Existing Natural Community Conservation Plans (NCCPs) and Habitat Conservation Plans (HCPs);
- Requirements stipulated in the various CVP water contracts between Reclamation and the various buyers and sellers, and their associated BOs of the United States Fish and Wildlife Service (USFWS) and

National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries). These documents specify the amount of water each contract holder can receive from the CVP and provide the terms and conditions about the delivery and use of that water, that are intended to protect fish and wildlife resources. Transfers made under long-term water transfer actions would adhere to these requirements;

- Requirements stipulated in previous consultations, BOs of USFWS and NOAA Fisheries Service, and subsequent and ongoing legal proceedings regarding the Long-Term Operations of the CVP and the SWP. These opinions provide various operating standards for the CVP and SWP, to which Reclamation and the California Department of Water Resources (DWR), respectively, must adhere, to minimize impacts to listed species.

3.7.1.3 Existing Conditions

The following section describes the fisheries resources, including special-status fish species, within the different regions of the area of analysis.

3.7.1.3.1 Seller Service Area

Riverine Habitats

The area of analysis lies within the Sacramento-San Joaquin Province[1], as described in Moyle (2002). Within this province, the action alternatives have the potential to affect fish assemblages occurring in the Central Valley sub-province.

In the Central Valley sub-province, the action alternatives have the potential to affect the California roach, pikeminnow-hardhead-sucker, and deep-bodied fish (e.g., tule perch [*Hysterocarpus traskii*]) assemblages. These assemblages are defined by areas at different elevations within the sub-province that are characterized by different flow, temperature and geomorphological characteristics and have a group of species that are typically located in these areas. These assemblages may overlap geographically at different times of years in response to changes in flow and temperature.

The California roach assemblage occurs in small, warm tributaries to larger streams that flow through open foothill woodlands of oak and foothill pine. These streams are usually intermittent during the summer months, and fish are often restricted to pools where temperatures may exceed 30 degrees Celsius (°C). In the winter and spring, flows in these streams can be high, resulting in high water velocities. The dominant native fish in this assemblage is California roach (*Hesperoleucus symmetricus*) due to their small size and tolerance of low

[1] A province, as used by Moyle (2002), is a geographic region that is geographically isolated from other geographic regions and in which an endemic assemblage of species has evolved. These provinces can be subdivided into sub-provinces, which have become isolated in the nearer term or which may have a lesser degree of isolation, and may contain one or more endemic species or sub-species.

oxygen levels and high temperatures. Sacramento suckers (*Catostomus occidentalis occidentalis*), Sacramento pikeminnow (*Ptychocheilus grandis*), and other native minnows may use these streams for spawning in the winter and spring (Moyle 2002). Predatory green sunfish (*Lepomis cyanellus*) have replaced California roach in some areas.

The pikeminnow-hardhead-sucker assemblage occurs in streams with average summer flows of more than ten cubic feet per second (cfs); deep, rocky pools; and wide, shallow riffles. These streams range in elevation from about 90 to over 1,500 feet in elevation. Streams within the pikeminnow-hardhead-sucker assemblage are generally characterized by high water quality (i.e., high clarity, low conductivity, high dissolved oxygen, and summer temperatures between 19 and 22°C) and high habitat complexity created by stream meanders and riparian vegetation (Moyle 2002). Some streams may become intermittent during the summer, concentrating fish in isolated pools, which may experience elevated water temperatures (greater than 25°C). Sacramento pikeminnows and Sacramento suckers tend to be the most abundant fishes in this assemblage. Hardhead (*Mylopharodon conocephalus*) are often confined to cooler waters in reaches with deep, rock-bottomed pools. However, they are abundant where they are found (Moyle 2002). Other native fishes occurring in these areas are tule perch-, speckled dace (*Rhinichthys osculus*), California roach, riffle sculpin (*Cottus gulosus*), and rainbow trout (*Oncorhynchus mykiss*). The cooler upstream areas of streams within this zone may support spawning and rearing of anadromous and resident salmonids.

The deep-bodied fish assemblage historically occupied the warm waterways of the valley floor, including slow moving river channels, oxbow and floodplain lakes, swamps, and sloughs (Moyle 2002). These habitat types have been substantially modified by human activities in the last 200 years by numerous dams, diversions, channelization with levees, filling of wetlands, elimination of riparian forests, and introduction of non-native fish species. The fish species that historically resided in this zone include deep-bodied fishes such as Sacramento perch (*Archoplites interruptus*), thicktail chub (*Siphatales crassicauda*), and tule perch, which used backwater habitats, and hitch (*Lavinia exilicauda*), Sacramento blackfish (*Orthodon microlepidotus*), and Sacramento splittail (*Pogonichthys macrolepidotus*), which used the main channel habitats. Human-induced modification of the habitat types used by this assemblage and the introduction of many exotic species has resulted in extirpation or reduction of native fish populations. Consequently, in many, but not all, locations in the Area of Analysis, dominant fishes currently occurring in these habitat types are now introduced species, including largemouth bass (*Micropterus salmoides*), white and black crappie (*Pomoxis annularis* and *P. nigromaculatus*), bluegill (*Lepomis macrochirus*), threadfin shad (*Dorosoma petenense*), striped bass (*Morone saxatilis*), bigscale logperch (*Percina macrolepida*), red shiner (*Cyprinella lutrensis*), inland silverside (*Menidia beryllina*), white catfish (*Ameiurus catus*), black and brown bullhead (*A. melas* and *A. nebulosus*), and common carp (*Cyprinus carpio*) (Moyle 2002). This area serves as a migration corridor for native anadromous ~~fish~~ salmonids moving between the ocean and their freshwater spawning and rearing habitats. Dominance by native versus non-native fish species in this assemblage is mediated by many factors, including flow regime, water temperature, and time of year (Brown and Bauer 2009, Kiernan et al. 2012, Sommer et al. 2014). For example, native fishes predominate early in the season on the Cosumnes River floodplain and Yolo Bypass when flooded, but is dominated by non-native species later in the season as water temperatures warm (Moyle et al. 2007, Sommer et al. 2014).

Fish species of primary management concern in the Seller Service Area include winter-, spring-, and fall-/late fall-run Chinook salmon (*Oncorhynchus tshawytscha*), Central Valley steelhead (*O. mykiss*), Sacramento splittail, American shad (*Alosa sapidissima*), striped bass, white sturgeon (*Acipenser transmontanus*), and green sturgeon (*A. medirostris*). These species are further described in Section 3.7.1.3.2.

Central Valley Reservoirs

All of the major rivers and many of their tributaries have dams and reservoirs intended to provide for water supply, power generation, and flood control. CVP and SWP reservoirs (Shasta, Oroville, and Folsom reservoirs) may be affected by water transfers due to additional water storage, reductions in downstream supply due to streamflow depletions, changes in project operations required to meet the requirements of the various contracts, regulations, and BOs associated with the operation of the projects when transfer water is being moved from Sellers to Buyers. Under all circumstances, the CVP and SWP will be operated in accordance with these requirements. The non-CVP/SWP project reservoirs (Camp Far West, Collins, French Meadows, Hell Hole, and McClure) would provide water stored in these reservoir for transfer. The non-project reservoirs operate under their own sets of operating requirements to provide for water supply, flood control and environmental needs, including the maintenance of flow and temperature in the rivers downstream of these reservoirs, and would be operated in accordance with those requirements.

Reservoirs operate within a wide range of storage volumes and associated water surface elevations and surface areas, as water is stored in the reservoirs during the wet portion of the year and released from the reservoir during the dry portion of the year. Reservoirs are typically drawn down by tens and often more than 100 feet each year. Most of the reservoirs that will be affected by the project are in the foothills just upstream of the valley floor, within the elevations typically associated with the pikeminnow-hardhead-sucker assemblage. French Meadows and Hell Hole Reservoirs are at higher elevations than the other reservoirs, in the elevation of rainbow trout assemblage.

With the exception of Hell Hole and French Meadows reservoirs, the remaining reservoirs often support warmwater fishes in the surface waters and around the edges of the reservoirs, and coldwater fishes in the deeper, cooler portions of the reservoir. Reservoirs are generally stocked with trout to support recreational fisheries. Introduced bass, sunfish, catfish, carp, and other species that were introduced to create recreational fisheries generally dominate these reservoirs. Native species may include Sacramento sucker, Sacramento pikeminnow, hardhead, hitch, and Tui chub (*Gila bicolor*). The populations of these native species have been greatly reduced or extirpated by the non-native fish in many reservoirs. Hell Hole and French Meadows reservoirs, which are at higher elevation than the other reservoirs, support populations of rainbow trout, brown trout (*Salmo trutta*), lake trout (*Salvelinus namaycush*), kokanee salmon (*Oncorhynchus nerka*), Tui chub, and Sacramento sucker (Placer County Water Agency 2011). None of the reservoirs support listed fish species or anadromous fish, as downstream dams create impassible barriers to the migration of these species. Consequently, any impacts of long-term water transfers on conditions in the reservoirs described above would not affect listed fish species. Most of the reservoirs discussed above (again with the exception of Hell Hole and French Meadows reservoirs), are operated in part to support special-status fish species in the downstream rivers and the Sacramento – San Joaquin Delta (Delta).

Sacramento – San Joaquin Delta

The Delta is a series of interconnected channels and islands lying near and upstream of the confluence of the Sacramento and San Joaquin rivers, near Antioch. The legal Delta is a triangular area extending from Freeport in the north to Vernalis in the south, to Antioch in the west. The waterways within the Delta are highly channelized by the levees protecting farms, homes, and towns on the islands. The Delta is strongly influenced by the tides, with water elevations and current direction being determined by the interaction of inflow, exports and tides. It serves as the hub of the State's water system and flow patterns through the Delta have been highly altered from historical patterns. The Delta includes a variety of habitats for fish including the mainstem rivers, sloughs, canals, natural and managed wetlands, and flooded islands. These habitats are affected by water diversions (both by the CVP and SWP as well as thousands of smaller local diversions), introduced fish, invertebrates, and plants, and environmental toxins from urban, municipal and farms.

Dozens of fish species use the Delta during some portion of their life. Six of these species are listed under federal or state ESAs. These include winter-run and spring-run Chinook salmon, Central Valley steelhead, and green sturgeon, all of which migrate through the Delta on their way to upstream spawning and rearing habitats, and when their offspring migrate to the ocean from these upstream habitats. Most of these species may rear for some period of time in the Delta on their way to the ocean, with this duration depending on the species and conditions in the Delta. Delta smelt (*Hypomesus transpacificus*) are endemic (they are not found anywhere else) to the Delta and spend their entire lives in the Delta or Suisun Bay. The longfin smelt (*Spirinchus thaleichthys*), a state-, but not federally-, listed fish species spawns in the Delta and rears in Suisun, San Pablo and San Francisco bays and nearshore marine ecosystems. A few of the non-listed native species that use the Delta include fall-run Chinook salmon, white sturgeon, and Sacramento splittail. A large number of non-native species also live in the Delta, including striped bass, largemouth bass, various sunfish and catfish, inland silversides, and threadfin shad.

3.7.1.3.2 Fish Species of Management Concern

Species of primary management concern were analyzed for impacts based upon legal status and their commercial and recreational importance (Table 3.7-1). Two types of species were analyzed: special-status species and other species of management concern. For the purposes of this document, special-status fish species are defined as those listed under the ESA or CESA. The federally-listed species within the area of analysis include winter-run Evolutionarily Significant Unit (ESU) and spring-run ESU Chinook salmon, Central Valley Distinct Population Segment (DPS) steelhead, southern DPS green sturgeon, delta smelt, and longfin smelt. The life history information for federally listed fish species is included in Section 3.7.1.3.3. Species listed by the State of California include: white sturgeon, Sacramento splittail, the fall/late-fall run ESU of Chinook salmon, and hardhead. Other species of management concern include non-listed recreationally or commercially important species: American shad and striped bass.

For native species described above that may be present in the affected area, but are not considered fish species of management concern, any impacts to the species would be less than significant under CEQA because they are not listed under California or federal Endangered Species Acts nor do they have recreational or commercial importance.

Table 3.7-1. Fish Species of Management Concern

Type	Species	Location (Area of analysis)	Primary Management Consideration[1]
Special- Status	Winter-run Chinook Salmon	Upstream and Delta areas	FE,SE
	Spring-run Chinook Salmon	Upstream and Delta areas	FT,ST
	Central Valley Steelhead	Upstream and Delta areas	FT, Recreation
	Green sturgeon	Upstream and Delta areas	FT,
	Delta smelt	Delta area	FT, SE
	Longfin smelt	Delta area	FC, ST
	Hardhead	Upstream and Delta areas	SSC
	Sacramento splittail	Upstream and Delta areas	SSC
	Fall/late-fall Chinook Salmon	Upstream and Delta areas	SSC, Commercial, Recreation
Other	Striped bass	Upstream and Delta areas	Recreation
	American shad	Upstream and Delta areas	Recreation
	White sturgeon	Upstream and Delta areas	Commercial, Recreation

[1] FE = federally endangered; SE = state endangered; FT = federally threatened; ST = state threatened; FC = federal candidate species; SSC = state species of concern

The spatial distribution of habitat use by these species in waters potentially affected by long-term water transfer actions is shown in Table 3.7-2 and discussed below. Fish species of management concern do not occur in reservoirs within the area of analysis, except as noted in Table 3.7-2. No field sampling information is available regarding the presence of special-status fish species in the following waterways: Seven Mile Creek, Elder Creek, Spring Valley Creek, North Fork Walker Creek, and Wilson Creek. Without further information, it was assumed that these streams could support special-status fish species and, therefore, further biological analyses were conducted in these waterways.

A review of field sampling data and reports in the following waterways indicates that there is no evidence of the presence of special-status fish species in the following waterways: ~~Seven Mile Creek,~~ Walker Creek, ~~North Fork Walker Creek, Wilson Creek,~~ French Creek, Willow Creek, South Fork Willow Creek, Funks Creek, Stone Corral Creek, Lurline Creek, ~~Spring Valley Creek,~~ Cortina Creek, Sand Creek, Sycamore Slough (Colusa County), Wilkins Slough Canal, Honcut Creek, North Honcut Creek, South Honcut Creek, and Dry Creek (tributary of Bear River). As a result, no further biological analysis was conducted in these waterways.

Table 3.7-2. Habitat Use by Fish Species of Management Concern within the Area of Analysis

Water Body	Listed Species						Other Evaluation Species					
	Winter-run Chinook Salmon	Spring-run Chinook Salmon	Central Valley Steelhead	Green Sturgeon	Delta Smelt	Longfin Smelt[1]	Fall/late-fall –run Chinook Salmon	Striped bass	American shad	Hardhead	Splittail	White sturgeon
Reservoirs												
Shasta Reservoir										S,R		R
Keswick Reservoir										S,R		
Lake Oroville										R,M		R
French Meadows Reservoir[2]												
Hell Hole Reservoir[2]												
Folsom Reservoir										R,M		
Lake Natoma[2]												
New Bullards Bar Reservoir										R,M		
Camp Far West Reservoir										R,M		
Lake McClure										R,M		
Rivers and Creeks												
Sacramento River Watershed												
Sacramento River from Keswick to Red Bluff	S,R,M	S,R,M	S,R,M	S,R,M			S,R,M	R	S,M	S,R		
Sacramento River from Red Bluff to the Delta	M	M	M	S,R,M	S,R,M	S,R,M	S,R,M	S,R,M	S,R,M	S,R	S,R	S,R,M
Deer Creek (Tehama County)		S,R,M	S,R,M				S,R,M			S,R		
Antelope Creek		S,R,M	S,R,M							S,R	S,R	
Paynes Creek										S,R	S,R	
Elder Creek[3]												
Mill Creek (Tehama County)		S,R,M	S,R,M				S,R,M			S,R	S,R	
Thomes Creek			S,R,M				R			S,R	S,R	
Mill Creek (tributary to Thomes Creek)										S,R		
Stony Creek		S,R,M	S,R,M				S,R,M			S,R		

Water Body	Listed Species						Other Evaluation Species					
	Winter-run Chinook Salmon	Spring-run Chinook Salmon	Central Valley Steelhead	Green Sturgeon	Delta Smelt	Longfin Smelt[1]	Fall/late-fall –run Chinook Salmon	Striped bass	American shad	Hardhead	Splittail	White sturgeon
Butte Creek		S,R,M	S,R,M				S,R,M			S,R		
Cache Creek							S,R,M			S,R		
Eastside/Cross Canal			R,M				R,M					
Auburn Ravine			S,R,M				S,R,M			S,R		
Coon Creek			S,R,M				S,R,M					
Colusa Basin Drain		R,M	R,M				R,M				S,R,M	
Freshwater Creek			S,R,M									
Putah Creek							S,R,M					
Big Chico Creek		S,R,M	S,R,M				S,R,M	S,R,M		S,R	S,R	
Little Chico Creek		S,R,M	S,R,M				R			S,R		
Salt Creek			S,R,M							S,R		
Feather River d/s of Lake Oroville		S,R,M	S,R,M	S,R,M			S,R,M	S,R,M	S,R,M	S,R		S,R,M
Yuba River		S,R,M	S,R,M				S,R,M	S,R,M	S,R,M	S,R		S,R,M
Bear River				S,R,M			S,R,M			S,R		S,R,M
American River d/s of Nimbus Dam	R	R	S,R,M	R			S,R,M	S,R,M	S,R,M		R,M	S,R,M
San Joaquin River Watershed												
Merced River			S,R,M				S,R,M	S,R,M		S,R		
San Joaquin River d/s of Merced River		M	S,R,M		S,R,M	S,R,M	R,M	S,R,M	S,R,M		S,R	S,R,M
Delta and Bays												
Delta	R,M	R,M	R,M	R,M	S,R,M	S,R,M	R,M	R,M	R,M		S,R	R,M
Suisun Bay	R,M	R,M	R,M	R,M	R	R,M	R,M	R,M	R,M		S,R	R,M
Suisun Marsh	R,M	R,M	R,M	R,M	S,R ,M	S,R,M	R,M	R,M	R,M		S,R	R,M

S = Spawning habitat; R = Rearing habitat; M = Migration corridor

[1] Longfin smelt is a federal candidate species and a state threatened species.

[2] There is no evidence that special-status fish species are found in this waterway.

[3] There is no information on the presence of special-status fish species in this stream, but critical habitat has been designated for Central Valley steelhead. Therefore, the stream was included for further analysis.

3.7.1.3.3 Federally and State Listed Fish Species Potentially Affected

Winter-Run Chinook Salmon

Winter-run Chinook salmon is federally-listed as endangered (59 Federal Register [FR] 440; 70 FR 37160) and state-listed as endangered (California Department of Fish and Game [CDFG] 2012). This ESU includes all naturally spawned populations of winter-run Chinook salmon in the Sacramento River and its tributaries in California and is represented by a single extant population (NOAA Fisheries 2008a).

Critical habitat for winter-run Chinook salmon has been designated within the Sacramento River from Keswick Dam to Chipps Island, and all waters between Chipps Island and the Golden Gate Bridge and to the north of the San Francisco and Oakland Bay Bridge (57 FR 36626). The lower reaches of the Sacramento River, the Delta, and the San Francisco Bay serve as migration corridors for both upstream migration of adults and downstream migration of juveniles (Table 3.7-2; NOAA Fisheries 2014). Juveniles may also spend some time rearing in these areas during emigration.

Adult winter-run Chinook salmon immigration occurs from December through July, peaking in March (Moyle 2002). They primarily spawn from late-April to early August, with the peak generally occurring from May through June (Moyle 2002). Spawning currently occurs on the mainstem of the Sacramento River upstream of Red Bluff Diversion Dam, although spawning historically occurred in the tributaries upstream of Shasta Reservoir. This is also the primary rearing area for fry and juveniles prior to emigration to the ocean. Emigration occurs between September and June (NOAA Fisheries 2014), with fish leaving their primary rearing areas and moving downstream. The Sacramento River downstream of Red Bluff Diversion Dam, the Delta, and the San Francisco Bay serve primarily as migration corridors for both upstream migration of adults and downstream emigration of juveniles (NOAA Fisheries 2014), although some rearing occurs in these areas during emigration. Winter-run Chinook salmon may use the lowest reaches of tributary streams for short periods as holding areas during emigration, but do not spend extensive time there.

Water transfers, which would occur from July through September, would coincide with the spawning period of winter-run Chinook salmon. However, spawning occurs upstream of the areas potentially affected by the transfers. Due in part to elevated water temperatures in these downstream areas during this period, ~~emigration~~ spawning and egg incubation would be complete before water transfers commence in July.

Water transfers could affect the timing of releases from Shasta Reservoir throughout the year, which could positively or negatively alter instream flows in the upper Sacramento River and, therefore, affect winter-run Chinook salmon spawning and rearing habitat. These potential effects are evaluated below.

Spring-Run Chinook Salmon

The Central Valley spring-run Chinook salmon ESU is listed as threatened by both the state of California and the federal government (65 FR 42422). This species' range historically included any accessible reach in the headwaters of all major river systems in the Central Valley (Yoshiyama et al. 1996). Today, because dams block most of the upper reaches of these river systems, this ESU exists only in the Sacramento River and its tributaries (Moyle 2002). Three extant natural viable populations persist on Mill, Deer, and Butte Creeks. The listed population also includes fish from Feather River Hatchery production (NOAA Fisheries 2008b). Spawning also occurs in small numbers and intermittently in several other rivers and smaller waterways throughout the Sacramento River watershed (Table 3.7-2). Spring-run Chinook salmon do not currently spawn in the San Joaquin River or its tributaries, as this run was extirpated by development throughout the watershed (NOAA Fisheries 2008b), although the USFWS released 54,000 hatchery produced juvenile spring-run Chinook salmon into the San Joaquin River in April 2014 (San Joaquin River Restoration Program [SJRRP] 2014). In their final rule, NOAA Fisheries designated these fish as a nonessential experimental population under the ESA and established take exceptions for particular activities, including CVP/SWP exports (78 FR 79622).

Designated critical habitat for Central Valley spring-run Chinook salmon ESU includes 1,158 miles of stream habitat in the Sacramento River basin and 254 square miles of estuary habitat in the San Francisco-San Pablo-Suisun Bay complex (70 FR 52488). Tributaries used by spring-run Chinook salmon for spawning and rearing include Deer, Butte, and Mill creeks, and the Feather River, all of which are located in the Seller Service Area upstream of the Delta (Table 3.7-2).

Upstream migration of adult spring-run Chinook salmon occurs from March through September with peak migration occurring from May through June (Moyle 2002). The fish occur in the Sacramento River upstream of the valley floor during the summer and spawn in suitable habitat adjacent to these areas from late August through October, with spawn peaking in mid-September (Moyle 2002). Eggs are deposited in gravel where fry remain until they emerge between November and March to seek shallow water with low velocity (Moyle 2002). After emergence, juveniles display two very distinct emigration patterns: some remain in the stream and others emigrate immediately to the Delta and the ocean beyond. Those that remain display a classic stream-type life history pattern until they emigrate the following year, typically during November and December (Moyle 2002). Stream flow changes and/or turbidity increases in the upper Sacramento River watershed are thought to stimulate juvenile emigration (Kjelson et al. 1982; Brandes and McLain 2001).

Water transfers, which would occur from July through September, would coincide with the spawning period of spring-run Chinook salmon. However, spawning occurs upstream of the areas potentially affected by the transfers. The bulk of upstream migration (March-September, peaking May-June) and emigration (November-June) would be complete before water transfers commence in July. After their reintroduction, spring-run Chinook salmon would occur on the San Joaquin River upstream of the Merced River during their spawning period (August-October), and consequently, would not be affected by water transfers during their spawning period. They would not be present in the area downstream for the Merced during the period when water transfers would occur, as temperatures would be too warm during that time of year. As described for spring-run Chinook salmon occurring on the Sacramento River, the bulk of upstream migration and emigration of spring-run reintroduced to the San Joaquin River system would be complete before water transfers commence in July.

Water transfers could affect the timing of reservoir releases throughout the year, which could positively or negatively alter instream flows below these reservoirs and, therefore, affect spring-run Chinook salmon spawning and rearing habitat. These potential effects are evaluated below.

Central Valley Steelhead

The Central Valley steelhead DPS (Central Valley [CV] steelhead) is federally listed as threatened (71 FR 834; 76 FR 50447). The DPS includes all naturally spawned populations of steelhead below natural and manmade impassable barriers in the Sacramento and San Joaquin rivers and their tributaries, including the Sacramento-San Joaquin Delta (63 FR 13347). Steelhead from San Francisco and San Pablo Bays and their tributaries, as well as two artificial propagation programs (the Coleman National Fish Hatchery and Feather River Hatchery steelhead hatchery programs) are excluded from the listing. Critical habitat was designated for this DPS on September 2, 2005 (70 FR 52488).

CV steelhead was historically well distributed throughout the Sacramento and San Joaquin rivers (Busby et al. 1996). Steelhead occur anywhere in the Central Valley where water temperatures are suitable, and where they can physically access habitat (i.e., where rivers are not blocked by dams and other obstacles). Spawning and rearing occurs on the upper Sacramento River and its major tributaries (e.g., Putah Creek, Little Chico Creek, and Cow Creek) (McEwan and Jackson 1996). Small self-sustaining populations also occur in the Stanislaus, and other streams previously thought to be devoid of steelhead in the San Joaquin River basin (McEwan 2001). Incidental catches and observations of steelhead juveniles also have occurred on the Tuolumne and Merced rivers, indicating that steelhead are widespread, throughout accessible rivers and creeks in the Central Valley (Table 3.7-2; Good et al. 2005).

CV steelhead are considered winter-run steelhead (ocean-maturing), though summer-run steelhead may have been present in this geographic region prior to construction of large dams (Moyle 2002). Winter-run steelhead enter streams from the ocean when winter rains provide large amounts of cold water for migration and spawning (Moyle 2002). These fish enter the Delta as early as

August, with a peak in late September to October. Migration to the main channels and tributaries for spawning occurs from December through April. They may remain in the main channels of the rivers until flows are high enough in tributaries to enter for spawning (Moyle 2002). Adult immigration in the San Joaquin River generally occurs until April (Moyle 2002).

In California, most steelhead spawn from December through April (McEwan and Jackson 1996). Spawning takes place in small, cool, well-oxygenated streams where water remains year-round. Eggs are laid in gravel and hatch in three to four weeks. The fry remain in the gravels for another two to three weeks before emerging (Moyle 2002). Juvenile steelhead may remain in freshwater habitats for one or more years before emigrating to the ocean to mature. Some fish may mature in streams, adopting a resident life history. Juveniles can be found in cool, clear, fast-flowing permanent rivers and creeks where there is a predominance of riffles, overhanging vegetation or banks, and ample invertebrate prey (Moyle 2002).

Steelhead may begin emigrating in the late fall, but the primary period of emigration is from December to May (Snider and Titus 2000; NOAA Fisheries Service 2004). CV steelhead use the lower reaches of the Sacramento River and the Bay-Delta for rearing and as a migration corridor to the ocean.

Summer rearing of CV steelhead would overlap with water transfers occurring in the Seller Service Area (~~July~~April-September), both in the Sacramento and San Joaquin River and their tributaries (see specific tributaries listed above). Thus water transfers have the potential to affect steelhead. The majority of rearing, however, would occur in the cooler sections of rivers and creeks (McEwan 2001)~~ above the influence for the water transfers~~.

Water transfers could affect the timing of reservoir releases throughout the year, which could positively or negatively alter instream flows below these reservoirs and, therefore, affect steelhead spawning and rearing habitat. These potential effects are evaluated below.

Green Sturgeon

The Southern DPS (consisting of coastal and Central Valley populations south of Eel River) of North American green sturgeon are listed as federally threatened (71 FR 17757-17766). Critical habitat was designated for this DPS on October 9, 2009 (74 FR 52300). Like other sturgeon, green sturgeon spawn in fresh water. However, they are one of only a few anadromous species of sturgeon.

Green sturgeon range from Mexico to Alaska in marine waters, and forage and migrate in estuaries and bays from the San Francisco Bay north to British Colombia (NOAA Fisheries 2012). The Southern DPS are believed to spawn regularly in the Rogue River, Klamath River Basin, and the Sacramento River

(NOAA Fisheries 2012), and they are not believed to use the San Joaquin River or its tributaries (71 FR 17757).

Adults migrate upstream between late February and late July (Moyle 2002). Spawning occurs upstream of the Delta, predominately in the upper Sacramento River and Feather River (71 FR 17757 17766), from March through July, with peak activity occurring from April to June (Moyle et al. 1995). Green sturgeon spend multiple years in freshwater prior to emigrating to the ocean (71 FR 17757 17766). During this rearing and holding period, they are found in the Sacramento, Feather, and Lower American rivers, and throughout the Delta, where they may be affected by water transfers (Table 3.7-2).

Delta Smelt

The delta smelt is a federally listed threatened species (58 FR 12854-12864); a petition to elevate the status of delta smelt from threatened to endangered under the federal ESA was warranted but precluded by other higher priority listing actions (75 FR 17667). The delta smelt is also listed as endangered by the State of California. Delta smelt are endemic to the upper San Francisco Estuary and occur from western San Pablo Bay and the Napa River landward to the freshwater reaches of the Bay-Delta (Bennett 2005). They occur in the Delta primarily below Isleton on the Sacramento River side and below Mossdale on the San Joaquin River side. A small proportion of individuals are found in the Cache slough area throughout the year (Sommer et al. 2011). They are found seasonally throughout Suisun Bay and in small numbers in larger sloughs of Suisun Marsh. Locations of the fish are dependent upon life cycle stage, salinity, and turbidity (Table 3.7-2; Feyrer et al. 2007).

Delta smelt inhabit open surface waters and shoal areas within the western Delta and Suisun Bay for the majority of their life span (59 FR 65256). They are primarily an annual species and most adult smelt die after spawning. Spawning occurs from January through June in sloughs and shallow, edge-waters of channels in the upper Delta. Larvae and juveniles are generally present in the Delta from March through June. Delta smelt have typically moved downstream towards Suisun Bay by July because elevated water temperatures and low turbidity conditions in the Delta are less suitable than those downstream (Nobriga et al. 2008). Some delta smelt reside year-round in and around Cache Slough (Sommer et al. 2011). Delta smelt in Suisun Bay and Cache Slough would be outside of the influence of the export facilities.

Longfin Smelt

The San Francisco Bay-Delta DPS of longfin smelt is a candidate species for listing under the Federal ESA (77 FR 19756) and the DPS is listed as threatened under CESA (CDFG 2009a). Environmental groups have petitioned the USFWS and the California Department of Fish and Wildlife (CDFW) to list the San Francisco Bay-Delta Population of longfin smelt as endangered citing their population decline over the last 20 years (Bay Institute, et al. 2007). The

USFWS has determined that listing is warranted but currently precluded by higher priority listing actions (77 FR 19756).

Longfin smelt are a short-lived fish species that live primarily in the San Francisco Bay and the Delta, but can sometimes be found in the nearshore ocean. Their primary habitat is open waters of estuaries, both in seawater and freshwater areas, and individuals are most abundant in San Pablo and Suisun bays (Moyle 2002).

Longfin smelt spend the early summer in San Pablo and San Francisco bays, generally moving into Suisun Bay in August. They migrate to suitable spawning habitat in estuaries between January and March and spawn in the Delta, downstream of Rio Vista (Moyle et al. 1995). Most spawning occurs from January through May (Moyle 2002) in fresh or slightly brackish water. After hatching, longfin smelt disperse widely throughout the estuary and some are swept downstream into more brackish parts of the estuary. The majority of adults die after spawning. Indices of longfin smelt abundance from the CDFW fall Midwater trawl sampling during January through June correlate positively with Delta outflow, although the mechanism(s) driving this correlation is(are) unknown (Kimmerer et al. 2009). Larvae are generally present in the Delta from February through May, while juveniles are present in March through June. Based on their life history timing, longfin smelt are unlikely to be present during water transfers.

3.7.2 Environmental Consequences/Environmental Impacts

3.7.2.1 Assessment/Evaluation Methods

This section describes the assessment methods used to identify and assess the potential environmental impacts to fisheries resources, including habitat and fish species of management concern that could potentially result from implementation of the long-term water transfer actions, including groundwater substitution and stored reservoir release. Specific species' biology and distribution, as described in Section 3.7.1 Affected Environment/Environmental Setting, are considered herein at a watershed level (i.e., the analysis assumes that if transfers affect conditions within a watershed, then transfers could affect any species that occurs within the watershed, unless the life history traits of a species indicate that the species would not be affected).

Development of the impact analysis involved literature review, review of known occurrences of special-status species based on the California Natural Diversity Database (CNDDB), USFWS regional species lists, information from NOAA Fisheries website, stream flow and biological monitoring data from previous years, and results of hydrologic modeling, as detailed below.

Each alternative, including the No Action/No Project Alternative, is discussed in terms of potential impacts on sensitive resources in the Seller Service Area, including the Delta.

The assessment methods specific to each transfer type are described below, followed by the assessment process for different habitat and species.

3.7.2.1.1 Groundwater Substitution Transfers

Under the action alternatives, there would be an increased use of groundwater to irrigate crops instead of diversion of water from rivers and creeks. This would entail increased groundwater pumping compared to the No Action/No Project Alternative to substitute for water usually provided from CVP supplies. This additional use of groundwater would reduce stream flows during and after a transfer as the groundwater aquifer refills. Increased subsurface drawdown would potentially affect fish habitats, such as riverine, riparian, seasonal wetland, and managed wetland habitats, which are reliant on groundwater for all or part of their water supply. Decreased amounts of surface water in these habitats could affect fish species of management concern. This change in the availability of surface water also could result in changes in flows in the Delta and could require some minor modifications in the operation of the CVP and SWP, including Shasta, Oroville and Folsom reservoirs, to meet various regulatory requirements.

Groundwater substitution transfers were modeled using the SACFEM2013 groundwater model to assess potential changes to groundwater and surface water. Groundwater substitution pumping was simulated as an additional pumping stress on the system, above the baseline pumping volume. The annual volume of transfers was determined by comparing the supply in the seller service area to the demand in the buyer service area. The availability of supplies in the seller service area was determined based on data provided by the potential sellers. The demand was estimated using demand data provided by East Bay MUD and Contra Costa WD as well as the available capacity at the Delta export pumps to convey transfers. The available export capacity was determined from CalSim II model results. The CalSim II model currently only simulates conditions through WY 2003. The available capacity for south of delta exports was typically more limiting than the south of delta water supply demand. Because CalSim II results are only available through 2003, the SACFEM2013 model simulation was truncated at the end of WY 2003.

The analysis of supply and demand resulted in the potential to export groundwater substitution pumping transfers through the Delta during 12 of the years from 1970 through 2003 (33 years, SACFEM2013 simulation period). Each of the 12 annual transfer volumes was included in a single model simulation. Including each of the 12 years of transfer pumping in one simulation rather than 12 individual simulations allows for the potential compounding effects from pumping from prior years. Appendix D, Groundwater Model Documentation, includes more information about the use of SACFEM2013 in this analysis.

The results of the SACFEM2013 analysis estimated streamflow depletion from groundwater substitution throughout the Sacramento Valley. These estimates were included in Transfer Operations Model simulations of the action alternatives. The Transfer Operations Model results are the basis for the determination of potential effects to fish and their habitats. Appendix B, Water Operations Assessment, includes more details about the transfer operations model.

3.7.2.1.2 Reservoirs

Water would be made available for transfers from Camp Far West, Collins, Hell Hole, French Meadows, and McClure reservoirs. These reservoirs would continue to operate in accordance with their existing regulatory requirements and other commitments. Water transfers from these reservoirs would result in decreasing their storage and associated elevation and surface area, during the period when transfers would be made (July through September), and the ongoing reduction in storage until the reservoirs are refilled. Shasta, Oroville, and Folsom reservoirs would not directly provide water for transfer, but their release patterns may be affected by the project because flows may be modified at compliance points in the mainstem rivers downstream of these reservoirs or in the Delta. This may result in more or less water being released from these reservoirs at different times of year. All reservoirs would continue to function under their existing operating requirements, including reservoir drawdown to targeted storage levels, and in meeting downstream flow, temperature, and other water quality requirements.

Reservoirs do not provide the primary habitat for the fish species of management concern. The approach to evaluating impacts as the result of changes in reservoir operations on downstream habitats is described in the next section.

3.7.2.1.3 Rivers and Creeks

As discussed in the preceding sections, water transfer actions would affect flows in the rivers and creeks within the Seller Service Area adjacent to and downstream of the areas where these activities would occur.

The analysis of potential impacts to stream flow focused on the frequency and magnitude of changes in mean monthly flow rates by water year types (wet, above normal, below normal, dry, and critically dry), as compared to existing conditions, based on the modeling results. For the purposes of this analysis, it is assumed that water temperatures vary inversely with flow rates in rivers and creeks, such that, at lower flows, water temperatures would be higher. This assumption was not used for in-Delta water temperatures, for which Wagner et al. (2011) found no relationship (maximum R^2=0.07) with Sacramento River flows and a low relationship (R^2=0.14) with San Joaquin River flows.

For smaller tributaries, the impact analysis compared modeled groundwater depletion flow rates to available mean monthly flow rates for the historical period of record and identified changes in flow rates that would result from water transfer actions. As described there, not every water body could be evaluated in the groundwater model; therefore, smaller water bodies adjacent to those modeled are assumed to respond in a similar way, with similar changes in flow magnitude and timing. Potential impacts to biological resources in these adjacent water bodies would be similar to those of the modeled streams. For the Full Range of Transfers and No Cropland Idling/Shifting alternatives, a screening analysis was conducted for smaller waterways for which groundwater modeling data were available to eliminate the need for biological analyses for streams in which substantial reductions in stream flow did not occur.

Historical stream flow information from the U.S. Geological Survey or the California Data Exchange Center (2012) for these streams were gathered where available and used as the measure of baseline flow. For locations for which historical flow data were limited or unavailable, a quantitative analysis was not possible; thus a qualitative discussion of potential impacts is included for these locations. No impacts would occur to groundwater in the No Action/No Project and No Groundwater Substitution alternatives and, therefore, this screening analysis did not apply.

For rivers and their major tributaries, including the Sacramento, American, Feather, Yuba, Bear, San Joaquin, and Merced rivers, transfer operations model outputs were used to assess impacts to surface water flows.

An action alternative could have an adverse impact on fish habitat if it resulted in decreased flows to a degree that would substantially affect riverine, riparian, or wetland habitats (as described in Section 3.8) in a river or stream, or interfere with fish movement or access to or from areas where the fish spawns. This degree of decreased flow is measured as both a ten percent change in mean flow by water year type and a minimum change in flow of one cfs where quantitative flow data were available. A qualitative assessment was applied in instances where quantitative data were not available.

The ten percent threshold was used to determine measurable flow changes based on several major legally certified environmental documents in the Central Valley related to fisheries (Trinity River Mainstem Fishery Restoration Record of Decision, December 19, 2000; San Joaquin River Agreement Record of Decision in March 1999; Freeport Regional Water Project Record of Decision, January 4, 2005; Lower Yuba Accord EIR/EIS). In these documents, there is consensus that differences in modeled flows of less than ten percent would be within the noise of the model outputs and beyond the ability to measure actual changes.

The one cfs minimum flow threshold was used as a conservative measure of detectability by a fish. The threshold was applied to each month during the entire modeled period, such that, if a change of greater than one cfs occurred in any one month during the modeled period, the waterway would be examined further for biological effects.

Combined, these two thresholds were used as an initial screening evaluation to determine whether further analyses were warranted to assess biological significant impacts because these two thresholds may not always translate into a significant biological effect on fisheries resources. Therefore, these further biological analyses included consideration of other physical and biological factors in addition to absolute and relative flow changes, including presence and timing of life stages of fish species, size of the waterway, timing of flow changes, and water year type.

3.7.2.1.4 Sacramento-San Joaquin Delta

The changes described above for rivers and streams would also apply downstream into the Delta. Additionally exports would vary in timing and magnitude with implementation of water transfers. These changes were modeled using the water transfer model. To assess the potential impacts of these changes on vegetation and wildlife resources in the Delta, the difference in Delta outflow and the location of X2, defined as the distance (in kilometers) up the axis of the estuary to the daily averaged near-bottom 2-practical salinity units (psu) isohaline (Jassby et al. 1995), were considered. Changes in these parameters were used to qualitatively assess the impacts of long-term water transfers on natural communities and special-status species. Diversions would be made using the same conditions imposed upon these facilities by the various contracts, agreements and BOs for these facilities and thus would not have additional impacts to fish species. Modeled changes in Delta outflow or X2 relative to existing conditions were considered substantial and required further analysis if they were greater than ten percent.

3.7.2.1.5 Species Impacts Assessment

The species impacts analysis includes an assessment of the direct and indirect impacts of implementing the action alternatives on fish species of management concern. The assessment evaluated the permanent and temporary impacts on fish species of management concern and is based on impacts to the aquatic habitats that the species use within the area of analysis, the timing of those impacts, and the species' geographic and temporal distribution.

For special-status fish species, species-habitat associations were developed and defined (see Appendix I) based on literature review and review of species databases, including the CNDDB and USFWS species lists. Fish use different areas for different parts of their life cycle (migration, spawning, rearing). Hydrologic impacts on fish habitat were assessed qualitatively based on extrapolation of groundwater and surface water modeling results, described above, to the species habitat requirements.

Direct and indirect impacts on fish species of management concern may include habitat degradation or removal, displacement of individuals, and habitat fragmentation leading to disruption of spawning, migrating, and/or rearing behaviors.

3.7.2.2 Significance Criteria

Consistent with the provisions of the California Environmental Quality Act (CEQA) and the CEQA Guidelines, an alternative would have a significant impact on fisheries resources if it would:

- Cause a substantial reduction in the amount or quality of habitat for target species.
  - Have a substantial adverse effect, such as a reduction in area or geographic range, on any riverine, riparian, or wetland habitats, or other sensitive aquatic natural community, or significant natural areas identified in local or regional plans, policies, regulations, or by CDFW, NOAA Fisheries, or USFWS that may affect fisheries resources;
  - Conflict with the provisions of an adopted HCP, NCCP, or other approved local, regional, or state habitat conservation plan;
- Cause a substantial adverse effect to any special-status species,
  - Have a substantial adverse effect, either directly or through habitat modifications, on any endangered, rare, or threatened species, as listed in Title 14 of the California Code of Regulations (sections 670.2 or 670.5) or in Title 50, Code of Federal Regulations. A significant impact is one that affects the population of a species as a whole, not individual members;
  - Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by CDFW, NOAA Fisheries, or USFWS, including substantially reducing the number or restricting the range of an endangered, rare, or threatened species;
  - Cause a substantial reduction in the area or habitat value of critical habitat areas designated under the federal ESA or essential fish habitat as designated under the Magnusson Stevens Fisheries Act;
  - Conflict substantially with goals set forth in an approved recovery plan for a federally listed species, or with goals set forth in an approved State Recovery Strategy (Fish & Game Code Section 2112) for a state listed species;

- Conflict with the provisions of an adopted HCP, NCCP, or other approved local, regional, or state habitat conservation plan; or
- Substantially fragment or isolate habitats or block movement corridors.

The significance criteria described above apply to fish habitats and fish species of management concern that could be affected by the alternatives. Changes in habitat quality are determined relative to existing conditions (for CEQA) and the No Action/No Project Alternative (for the National Environmental Policy Act).

3.7.2.3 Alternative 1: No Action/No Project Alternative

The assessment evaluates the effects of the No Action/No Project Alternative on fisheries resources (fish habitat and fish species of management concern) and separately for special-status fish species by including likely future conditions in the absence of the long-term water transfer and identifies a range of impacts associated with the No Action/No Project Alternative in comparison with existing conditions.

3.7.2.3.1 Fisheries Resources and Special-Status Fish Species

Reservoirs

The No Action/No Project Alternative would not affect reservoir storage and reservoir surface area. Under the No Action/No Project Alternative, storage volumes, reservoir surface area, and downstream releases from reservoirs would be the same as under existing conditions. Future climate change is not expected to alter conditions in any reservoir under the No Action/No Project Alternative because there will be limited climate change predicted over the ten year project duration (see Section 3.6, Climate Change/Greenhouse Gas).

Impacts on Fisheries Resources: The No Action/No Project Alternative would have no impact on fisheries resources in reservoirs, as reservoirs do not support primary populations of the fish species of management concern, including special-status fish species, and conditions would be the same as under existing conditions.

Impacts on Special-Status Fish Species: The No Action/No Project Alternative would have no impact on special-status fish species, as reservoirs do not support primary populations of special-status fish species, and conditions would be the same as under existing conditions.

Rivers and Creeks

The No Action/No Project Alternative would not cause flows of rivers and creeks in the Sacramento and San Joaquin river watersheds to be lower than under existing conditions. Under the No Action/No Project Alternative, the rate and timing of flows in rivers and creeks in the Sacramento and San Joaquin river watersheds would be similar to existing conditions. Future climate change is not expected to alter conditions in any river or creek under the No Action/No Project Alternative because there will be limited climate change predicted over the ten year project duration (see Section 3.6, Climate Change/Greenhouse Gas).

Impacts on Fisheries Resources: The No Action/No Project Alternative would have no impact on fisheries resources in rivers and creeks, as conditions would be the same as under existing conditions.

Impacts on Special-Status Fish Species: The No Action/No Project Alternative would have no impact on special-status fish species in rivers and creeks, as conditions would be the same as under existing conditions.

Delta

The No Action/No Project Alternative would not alter flows through the Delta compared to existing conditions. Under the No Action/No Project Alternative, flows into the Delta and diversions from the Delta would be the same as under existing conditions. All existing regulatory requirements would continue and would provide similar levels of protection to natural resources. Future climate change is not expected to alter conditions in the Delta under the No Action/No Project Alternative because there will be limited climate change predicted over the ten year project duration (see Section 3.6, Climate Change/Greenhouse Gas).

Impacts on Fisheries Resources: The No Action/No Project Alternative would have no impact on fisheries resources in the Delta, as conditions would be the same as under existing conditions.

Impacts on Special-Status Fish Species: The No Action/No Project Alternative would have no impact on special-status fish species in the Delta, as conditions would be the same as under existing conditions.

3.7.2.3.2 Special-Status Species Habitat

Under the No Action/No Project Alternative, conditions would be same as under existing conditions in terms of groundwater pumping, farming practices, reservoir operations, and river and stream flows. The No Action/No Project Alternative would not result in changes to existing water transfer practices. Special-status species habitat would not be impacted as a result of the No Action/No Project Alternative.

3.7.2.4 Alternative 2: Full Range of Transfers (Proposed Action)

3.7.2.4.1 Fisheries Resources and Special-Status Fish Species

Under the Proposed Action, water transfers could directly affect fisheries resources by changing the timing and volume of flows within rivers and creeks, or storage volumes in reservoirs. These changes are detailed in Section 3.8.2.4. This section summarizes changes to stream flows and reservoir operations, which are evaluated in the context of impacts to fisheries resources (fish habitat and fish species of management concern) and separately for special-status fish species.

Reservoirs
The Proposed Action could impact reservoir storage and reservoir surface area. Under the Proposed Action, modeled storage volumes, reservoir elevations and surface areas would change as described in Section 3.8.2.4.1. All reservoirs would continue to be operated according to their existing requirements and within their current range of operations. These reservoirs do not support primary populations of the fish species of management concern, including special-status fish species.

Impacts on Fisheries Resources: The Proposed Action would have no impact on fisheries resources in reservoirs, as reservoirs do not support primary populations of the fish species of management concern, including special-status fish species.

Impacts on Special-Status Fish Species: Proposed Action would have no impact on special-status fish species, as reservoirs do not support primary populations of special-status fish species.

Rivers and Creeks

Sacramento River Watershed
The Proposed Action could cause flows in rivers and creeks to be lower than under the No Action/No Project Alternative. Under the Proposed Action, mean monthly modeled flows would be reduced by less than ten percent on the Sacramento, Feather, Yuba, and American rivers. Based on the screening level criteria, these flow reductions are not considered substantial. Therefore, the effects of the Proposed Action on fisheries in these rivers would be less than significant. Existing regulatory requirements protecting fisheries resources (flow magnitude and timing, temperature, and other water quality parameters) would continue to be met. Among larger rivers, only Bear River flows would be reduced by more than ten percent by the Proposed Action and, therefore is discussed in detail below.

In addition, an initial screening evaluation was conducted on flows in several smaller creeks with special-status fish species (see Section 3.7.2.1 for details). The evaluation concluded that impacts in the following waterways are less than significant: Deer Creek (in Tehama County), Antelope Creek, Paynes Creek, Elder Creek, Mill Creek (in Tehama County), Thomes Creek, Mill Creek (Thomes Creek tributary), Butte Creek, Auburn Ravine, Freshwater Creek, Colusa Basin Drain, Putah Creek, and ~~Wilson~~ Big Chico Creek (Table 3.7-3).

Table 3.7-3. Screening Evaluation Results for Smaller Streams in the Sacramento River Watershed for Detailed Fisheries Impact Analysis for the Proposed Action.

Waterway	>1 cfs reduction?	>10% reduction?	Data Source
Deer Creek (Tehama County)	N	-	N/A
Antelope Creek	N	-	N/A
Paynes Creek	N	-	N/A
Elder Creek	N	-	N/A
Mill Creek (Tehama County)	N	-	N/A
Thomes Creek	N	-	N/A
Mill Creek (tributary to Thomes Creek)	N	-	N/A
Stony Creek	Y	Y	USGS Gage #11388000; Water Years 1976-2003
Butte Creek	Y	N	USGS Gage # 11390000; Water Years 1976-2003
Cache Creek	Y	Y	USGS Gage # 11452500; Water Years 1975-2013
Eastside/Cross Canal	Y	U	N/A
Auburn Ravine	N	-	N/A
Coon Creek	Y	Y	Bergfeld personal communication 2014
Colusa Basin Drain	Y	N	DWR Gage # WDL A02976; Water Years 1976-2003
Freshwater Creek	N	-	N/A
Putah Creek	Y	N	USGS Gage # 11454000; Water Years 1976-2003
Big Chico Creek	N	-	N/A
Little Chico Creek	Y	Y	DWR Gage # WDL A04280; Water Years 1976-1996
Salt Creek	Y	U	N/A

Y = Yes; N = No; U = Unknown; N/A = Not applicable

Note: Darkened rows indicate that a detailed analysis was not conducted because both criteria were not met.

Flows in Cache, Stony, Coon, and Little Chico Creeks would meet both criteria (Table 3.7-3) and the effects of the Proposed Action on fisheries in these creeks therefore are discussed in detail below.

Historical flow data was limited or not available for Eastside/Cross Canal, and Salt Creek. These streams have the potential for impacts on special-status fish species due to flow reductions under the Proposed Action although no data were available to determine the proportional reduction of base flows. Generally, these waterways are not immediately adjacent to groundwater substitution transfers, and other nearby small waterways are not experiencing flow decreases that are causing significant impacts to aquatic resources. ~~In addition, flow~~

~~reductions as the result of groundwater declines would be observed at monitoring wells in the region and adverse effects on riparian vegetation would be mitigated by implementation of Mitigation Measure GW-1 (See Section 3.3, Groundwater Resources), because it requires monitoring of wells and implementing a mitigation plan if the seller's monitoring efforts indicate that the operation of the wells for groundwater substitution pumping are causing substantial adverse impacts. The mitigation plan would include curtailment of pumping until natural recharge corrects the environmental impact.~~ Therefore, the impacts to fisheries resources would be less than significant in these streams.

Impacts on Fisheries Resources: Long-term water transfer actions under the Proposed Action would have a less than significant impact on fisheries resources in the following rivers and creeks within the Sacramento River Watershed: Sacramento River, Feather River, Yuba River, American River, ~~Butte Creek, Putah Creek, Colusa Basin Drain,~~ Deer Creek (in Tehama County), Antelope Creek, Paynes Creek, Elder Creek, Mill Creek (in Tehama County), Thomes Creek, Mill Creek (Thomes Creek tributary), Butte Creek, Auburn Ravine, Freshwater Creek, Colusa Basin Drain, Putah Creek, Big Chico Creek, Eastside/Cross Canal, and Salt Creek. As modeled, flow changes in these streams would be small and no substantial effect on water quality would result from implementing the Proposed Action.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the Proposed Action would have a less than significant impact on special-status fish species in the following waterways within the Sacramento River Watershed: Sacramento River, Feather River, Yuba River, American River, ~~Butte Creek, Putah Creek, Colusa Basin Drain,~~ Deer Creek (in Tehama County), Antelope Creek, Paynes Creek, Elder Creek, Mill Creek (in Tehama County), Thomes Creek, Mill Creek (Thomes Creek tributary), Butte Creek, Auburn Ravine, Freshwater Creek, Colusa Basin Drain, Putah Creek, Big Chico Creek, Eastside/Cross Canal, and Salt Creek. Flow changes would be small, and the habitat for these species would not be substantially affected by the Proposed Action, as described above.

As modeled, Cache Creek, Stony Creek, Coon Creek, Little Chico Creek, and the Bear River may experience a greater than ten percent change in mean monthly flows in at least one water year type and month of the year. Potential fisheries impacts in these waterways are discussed individually below.

Cache Creek

Groundwater substitution under the Proposed Action could cause Cache Creek flows to be lower than under the No Action/No Project Alternative. As detailed in Section 3.8.2.4, mean monthly flows in Cache Creek under the Proposed Action would not be greater than ten percent lower than the No Action/No Project Alternative when all water year types are combined in the mean calculation, but would be greater than ten percent lower in individual water year types within months between May and November. In most cases when flow reductions would exceed ten percent, reductions would be less than 20 percent (13 of 16 cases), but would be up to 31 percent (0.61 cfs) in critical water years during November. Because these flow changes exceed the ten percent screening criterion, they could affect fisheries resources.

Historical evidence indicates that Chinook salmon and steelhead spawned in Cache Creek (Shapovalov 1947 as cited in Yoshiyama et al. 1996). However, since 1947, there has been only one account of Chinook salmon, likely a fall-run individual, spawning in Cache Creek (in November 2000; Moyle and Ayers 2000) despite systematic fish surveys in the creek (e.g., Marchetti and Moyle 1998, Stillwater Sciences 2008). This is likely because of damming and agricultural diversions in the valley floor reaches over the past few decades combined with the natural porous geology of Cache Creek that has limited connection of the creek to the Sacramento River. Connectivity for migration of Chinook salmon only occurs in wet years (Stillwater Sciences 2008). In most years, Cache Creek dries out above the Cache Creek Settling Basin, precluding access by salmonids. Groundwater modeling results indicate that no substantial (greater than ten percent) changes to instream flows in Cache Creek would occur in wet years when Chinook salmon could be present. Therefore, there would be no effect of the Proposed Action on fall-run Chinook salmon.

Hardhead were reported in Cache Creek by Marchetti and Moyle (1998) but were not observed at any locations by Stillwater Sciences (2008). If hardhead are present in the creek, instream flow reductions may reduce hardhead habitat. However, because recent information indicates that hardhead are no longer present, this potential impact is unlikely. Therefore, the impacts would be less than significant.

Impacts on Fisheries Resources: Long-term water transfer actions under the Proposed Action would have a less than significant impact on fisheries resources within Cache Creek, as occurrence of fish species of management concern, including special-status fish species, is unlikely in this stream.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the Proposed Action would have a less than significant impact on special-status fish species in Cache Creek, because occurrence of special-status fish species is unlikely in this stream.

Stony Creek

Groundwater substitution under the Proposed Action could cause Stony Creek flows to be lower than under the No Action/No Project Alternative. Modeling results indicate that there would be one water year in one month (critical water years during October) in which flows would be reduced by 10.0 percent (3.3 cfs) under the Proposed Action. Spring-run and fall-/late fall-run Chinook salmon, steelhead, and hardhead reside in Stony Creek. Because spring-run and fall-/late fall-run Chinook salmon are not present in the creek during October, there would be no effects to these races. Stony Creek is used opportunistically by steelhead for spawning; spawning is possible only in years in which attraction flows are present, which are the wettest water years (H.T. Harvey & Associates et al. 2007). Because the 10.0 percent reduction occurs only in critical water years, steelhead would not likely be in Stony Creek. Juvenile steelhead and h

Hardhead could be present in the river and experience this reduction in flows. It is unknown exactly what the biological effect of a flow reduction of 10 percent on hardhead could be, but mortality of all or a substantial proportion of fish during this one water year type and month is very unlikely. Two potential impact mechanisms involve habitat availability and water temperatures.

There have been no studies to develop habitat-flow relationships for hardhead in Stony Creek. We assumed in this analysis that a reduction in flow would degrade conditions for these fish, although it is common to find that increased flow actually reduces usable salmonid habitat in Central Valley rivers along at least part of the flow range (e.g., USFWS 1997, Payne and Allen 2004, 2005, Gard 2009). Therefore, there is uncertainty in whether the 10.0 percent reduction would have adverse effects to habitat availability, as it is even possible that effects could be beneficial. In addition, hardhead are typically in the lower half of the water column and prefer slow moving pools (Moyle 2002). A reduction in flows would maintain the lower half of the water column and the number of slow moving pools in the river during February is not expected to decrease. Further, the frequency of the reduction would be low. Critical years would occur approximately once every five years within the period of analysis (1970-2003).

Although water temperature is a concern in Stony Creek, this concern appears to be primarily for salmonids, which are more intolerant of higher water temperatures than hardhead. Reclamation (1998), as cited in H.T Harvey and Associates et al. (2007), reported that mean water temperatures in Stony Creek below Black Butte Dam between 1975 and 1994 were 46 to 71 F. These temperatures are 7.8 F lower than the upper range of hardhead tolerance of 26 C (78.8 F) (Thompson et al. 2012). It is not likely that temperatures will rise 7.8 F due to a 10 percent reduction in flow during October of critical water years to a level that would be a concern to hardhead.

Based on the lack of evidence of effects on hardhead, this impact would be less than significant for all fish species.However, because this reduction occurs in only one month and one water year type in one month, it is not expected to have a substantial effect on the two species present in the creek. Therefore, it is concluded that effects to steelhead and hardhead would be less than significant.

Coon Creek
Groundwater substitution under the Proposed Action could cause Coon Creek flows to be lower than under the No Action/No Project Alternative. Although

existing baseline data is incomplete, the comparison of modeling results to Coon Creek stream gage flow data from 2003 to 2005 (Bergfeld personal communication 2014) indicates that, in a worst case scenario, there would be one water year in one month (above normal water years during April) in which flows could potentially be reduced by 13.9 percent (2.8 cfs) under the Proposed Action. This calculation represents a worst case scenario because baseline flows used in this calculation are at the low end (20 cfs) of existing flow data range (20 cfs to 40 cfs) during 2003-2005. If the calculation included the high end of the range (40 cfs) for baseline flows, the reduction due to Proposed Action would be 7.0 percent. Therefore, this flow reduction would likely occur less frequently than assumed. Flows in all other months and water year types would be reduced by less than ten percent of baseline flows. As a result, it is concluded that effects of the Proposed Action to fisheries resources in Coon Creek would be less than significant.

Little Chico Creek
Groundwater substitution under the Proposed Action could cause Little Chico Creek flows to be lower than under the No Action/No Project Alternative. As modeled, flows in Little Chico Creek would be reduced by more than ten percent in multiple water year types during July through October (up to 100 percent of instream flows). It is not uncommon for Little Chico Creek flows to be very low during these months. A review of existing stream gage data from Water Years 1976 to 199~~5~~6 reveals that flows would be less than 0.5 cfs during at least one month in 20 of 21 years and would be 0 cfs in 14 of 21 years. With the Proposed Action, there would be the same number of years with no flow or flows less than 0.5 cfs in at least month. In fact, flows would be less than 0.5 cfs under both the No Action/No Project Alternative and Proposed Action in the exact same months of the evaluated period except one (less than 0.5 cfs under the Proposed Action in August 1993) and there would be no flow in the exact same 27 months between the No Action/No Project Alternative and Proposed Action. Therefore, the Proposed Action would not increase the frequency of these low flow events relative to the No Action/No Project Alternative. Low flows during these months would cause increases in water temperatures and reduced dissolved oxygen levels to levels intolerable for over-summering adult spring-run Chinook salmon. Therefore, spring-run Chinook salmon would not be present in the creek during ~~this time of year~~these months. In addition, any juvenile steelhead and hardhead in the river would experience reductions in flows under the Proposed Action that would cause flows to be within the range of flows during the July through October period (generally less than 0.5 cfs). ~~Therefore~~In conclusion, the flow reduction of greater than ten percent, although large on a relative scale, would not have a substantial effect on fisheries resources in Little Chico Creek.

Bear River
The Proposed Action could cause Bear River flows to be lower than under the No Action/No Project Alternative. Under the Proposed Action, the only flow reduction greater than ten percent would occur in critical water years during

February (approximately 18 percent, or 45 cfs lower). Fish species of management concern that could be present in the Bear River during February would include fall-run Chinook salmon, green and white sturgeon, and hardhead.

An 18 percent reduction in flows in critical water years during February would not affect fall-run Chinook salmon. This reduction is limited to critical water years in one month of the year and is, therefore, infrequent (approximately 20 percent of years). More importantly, the timing of the reduction would be during a period that would least likely affect fall-run Chinook salmon. Water temperatures during February are typically well below critical temperature thresholds such that a reduction in flows would not likely increase water temperatures to a level that is stressful to fall-run Chinook salmon.

Green and white sturgeon are not typically found in the Bear River but are thought to enter the river during spring of most wet years and some normal years (USFWS 1995). There is no evidence of species presence in the Bear River during critical water years. Because substantial flow reductions would only be in critical years, no sturgeon are expected to be in the Bear River during reduced flow conditions. Therefore, the impact of reduced flows on green and white sturgeon in the Bear River would be less than significant.

The reduction in flows under the Proposed Action during critical years in February is not expected to have a substantial effect on hardhead habitat for several reasons. First, hardhead are typically in the lower half of the water column and prefer slow moving pools (Moyle 2002). A reduction in flows would maintain the lower half of the water column and the number of slow moving pools in the river during February is not expected to decrease. Second, the frequency of the reduction would be low. Critical years would occur approximately once every five years within the period of analysis (1970-2003). Third, due to a lack of flow-habitat relationships for hardhead in the Bear River and because it is common for flow reductions to increase habitat availability for at least part of the flow range (e.g., USFWS 1997, Payne and Allen 2004, 2005, Gard 2009), there is uncertainty in whether a flow reduction would have adverse effects to habitat availability, as it is even possible that effects could be beneficial. Fourth, the timing of the reduction would be during a period that would least likely affect hardhead. Water temperatures during February are already low such that a reduction in flows would not likely increase water temperatures to a level that is stressful to hardhead. In addition, hardhead typically spawn and fry are present during April through May, possibly later in smaller streams (Moyle 2002). Therefore, only juvenile and adult hardhead, the least sensitive life stages, are present in the Bear River during February. For these reasons, the impact to hardhead in the Bear River would be less than significant.

Average monthly flows would be higher, compared to the No Action/No Project Alternative, in critical water years during July (approximately 240 percent, 58 cfs), and dry years during August and September (219 percent, 27 cfs and 127 percent, 12 cfs, respectively) when water is released from Camp Far West Reservoir for transfer. These flow increases during the summer months could be beneficial to fish species present.

Impacts on Fisheries Resources: Long-term water transfer actions under the Proposed Action would have a less than significant impact on fisheries resources within Bear River for the reasons stated above.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the Proposed Action would have a less than significant impact on special-status fish species in Bear River for the reasons stated above.

San Joaquin River Watershed

San Joaquin River
The Proposed Action could cause San Joaquin River flows to be lower than under the No Action/No Project Alternative. Under the Proposed Action, flows in the San Joaquin River would be reduced by less than two percent relative to the No Action/No Project Alternative. Based on the screening level criteria, these flow changes would not be considered substantial.

Impacts on Fisheries Resources: Long-term water transfer actions under the Proposed Action would have a less than significant impact on fisheries resources occurring in the San Joaquin River, as flow reductions would be small and would continue to meet existing requirements established to protect fish.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the Proposed Action would have a less than significant impact on special-status fish species, occurring in the San Joaquin River, as flow reductions would be small and would continue to meet existing requirements established to protect fish.

Merced River
The Proposed Action could cause Merced River flows to be lower than under the No Action/No Project Alternative. Under the Proposed Action, flows from McClure Reservoir would be released under existing agreements. Under the Proposed Action, flows would generally be similar to or greater than flows under the No Action/No Project Alternative. Flow reductions would not exceed ten percent in any water year type or month. Flows would be higher compared to the No Action/No Project Alternative during April and May. The greatest relative increase in flow under the Proposed Action would occur in dry water years during April (approximately 38 percent, 85 cfs higher than existing conditions). Increased flows during April and May could be beneficial to biological resources, particularly in dry and critically dry water years.

Impacts on Fisheries Resources: Long-term water transfer actions under the Proposed Action would have a beneficial effect on fisheries resources occurring in the Merced River, because flows would be higher than under the No Action/No Project Alternative.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the Proposed Action would have a beneficial effect on special-status fish species occurring in the Merced River, as flows would generally be higher than under the No Action/No Project Alternative.

Delta

Delta Exports

The Proposed Action could cause Delta exports to be higher than under the No Action/No Project Alternative. Changes in mean monthly Delta exports under the Proposed Action relative to the No Action/No Project Alternative would generally be very small (less than five percent), except in the summer to fall months of dry and critically dry water years. At the CVP diversion facilities (Jones Pumping Plant), changes in exports would be less than three percent, except in July through September of dry and critical water years when transfers are being pumped (ranging from a three to 38 percent increase in exports, or 9,000 to 72,000 acre-feet [AF] per month). At the SWP diversion facilities (Banks Pumping Plant), changes in exports would be less than ten percent, except in dry and critical water years during July and August (ranging from a five to 55 percent increase in exports, or 10,000 to 30,000 AF per month).

Mean monthly exports at Contra Costa WD diversions would be similar in all water year types and months except dry and critical water years during July through September (12.7 to 32.3 percent increase or 2,500 to 4,300 AF per month).

Model outputs indicate that, at the East Bay MUD diversion facilities at Freeport, fairly substantial proportional increases in mean monthly exports would occur throughout the year under the Proposed Action relative to the No Action/No Project Alternative (up to 75.3 percent increase). However, flows in the Sacramento River at Freeport would not be reduced in any month or water year type by more than 422 cfs (0.8 percent). Regardless, all of these facilities would continue to be operated in accordance with their existing or future regulatory requirements and the terms and conditions specified in their BOs. Both BOs contain a Reasonable and Prudent Alternative (RPA) that, when implemented, would avoid jeopardy of ESA listed fish species. In addition, the State Water Resources Control Board's (SWRCB's) Water Rights Decision-1641 imposes flow and water quality objectives in the 1995 Bay-Delta Plan upon the SWP and CVP operations to assure protection of beneficial uses in the Delta. The SWP and CVP must comply with these and other regulatory requirements in order to operate. Because changes in flows in Delta channels are predicted to be small and there are additional protections for fisheries and aquatic resources already in place under the ESA and D-1641, these impacts would be less than significant.

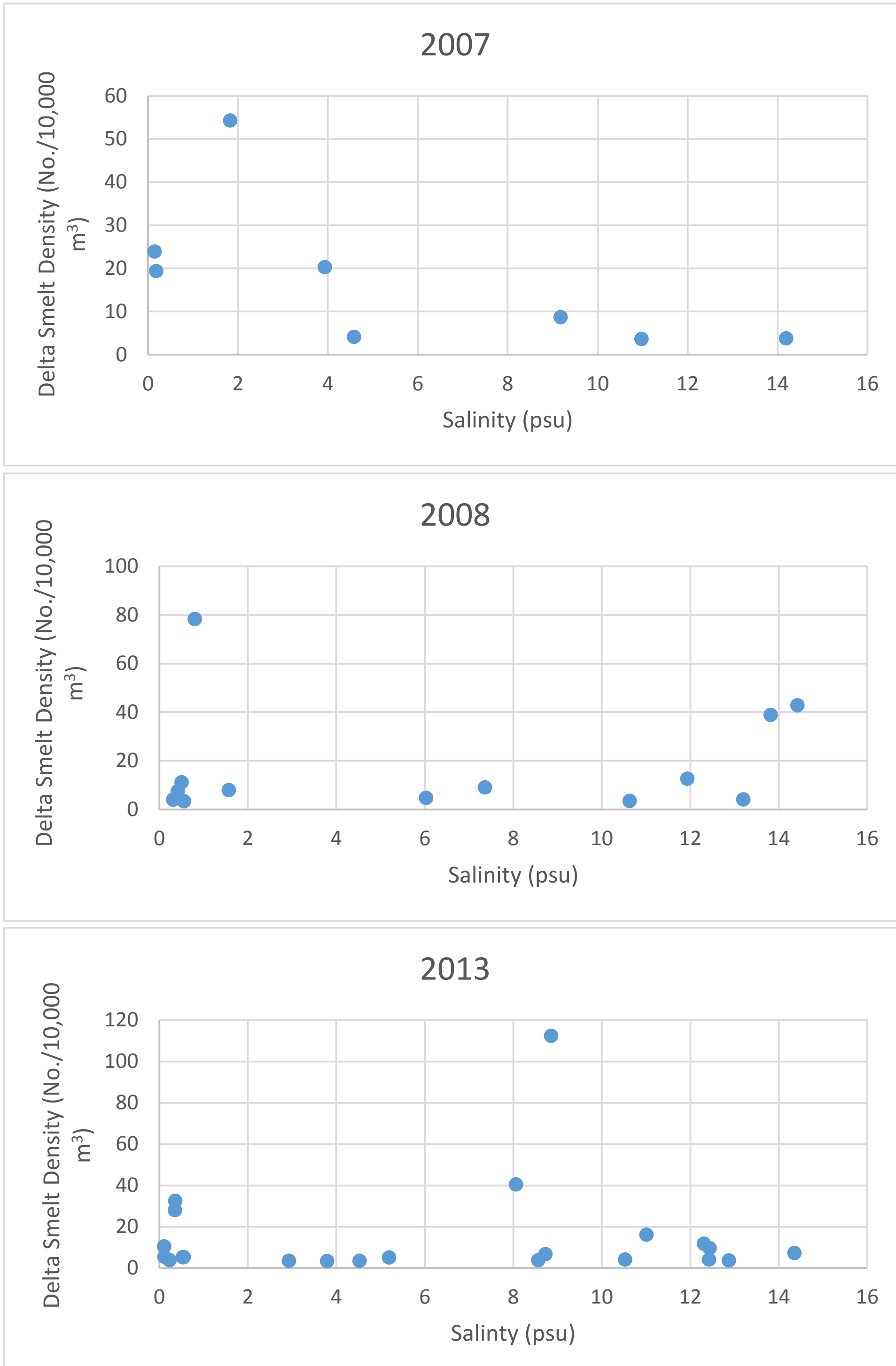
Collectively, the largest changes in Delta diversions relating to long-term water transfers would primarily occur from July through September. This is the period when through-Delta water transfers are allowed because it is the least sensitive period for fisheries resources. Longfin smelt are typically found in the bays and nearshore ocean during this time of year (Rosenfield 2010) and would be unaffected by the Proposed Action. Delta smelt have typically moved downstream towards Suisun Bay by this time of year because elevated water temperatures and low turbidity conditions in the Delta are less suitable than those downstream (Nobriga et al. 2008), although some delta smelt reside year-round in and around Cache Slough (Sommer et al. 2011) outside of the influence of the export facilities. An evaluation of CDFW summer tow net surveys in July and August of recent dry (2007, 2013) and critical (2008) water years supports the claim that delta smelt are not near the export facilities during these months[2] (CDFW 2014). There is no consistent pattern in delta smelt density relative to salinity (Figure 3.7-2), suggesting that there is no salinity range preference for the low salinity zone (~2 psu) by delta smelt juveniles during these months in these dry and critical water years. There is, however, a general lack of delta smelt caught in tows with water temperatures above ~22°C, indicating that the fish avoid areas with higher water temperatures (Figure 3.7-3). This suggests that the delta smelt, a species that is subject to the wide range of physical conditions typical of an estuary, will move to more suitable (lower) water temperature conditions despite being in a less suitable physiological habitat that is not the low salinity zone.

Delta outflow would not be reduced and, therefore, X2 location would not increase, during these months under the Proposed Action (see “Delta Outflow” section below). In fact, Delta outflow would increase under the Proposed Action in dry and critical years during July through September, although X2 location would change minimally (less than 1.3 percent). Consequently, potential increases in exports during this period would have limited, if any, effects on delta smelt.

Green and white sturgeon are rarely observed (only sporadically in low numbers; DWR and Reclamation unpublished salvage data) at the diversion facilities and, therefore, are not likely to be affected by these changes. The vast majority of juvenile Chinook salmon and steelhead would have emigrated from the Delta region by the end of June (NOAA Fisheries 2014) and are, therefore, unlikely to be affected by increases in exports. In addition, fish screens and monitoring at the East Bay MUD (currently conducted December through June when sensitive fish species are present) and Contra Costa WD (currently conducted year-round) facilities, as well as year-round fish salvage monitoring at SWP and CVP facilities, would further ensure that special-status fish species or other fish species of management concern are not affected by any increases in exports at their facilities. Reclamation is consulting frequently with USFWS

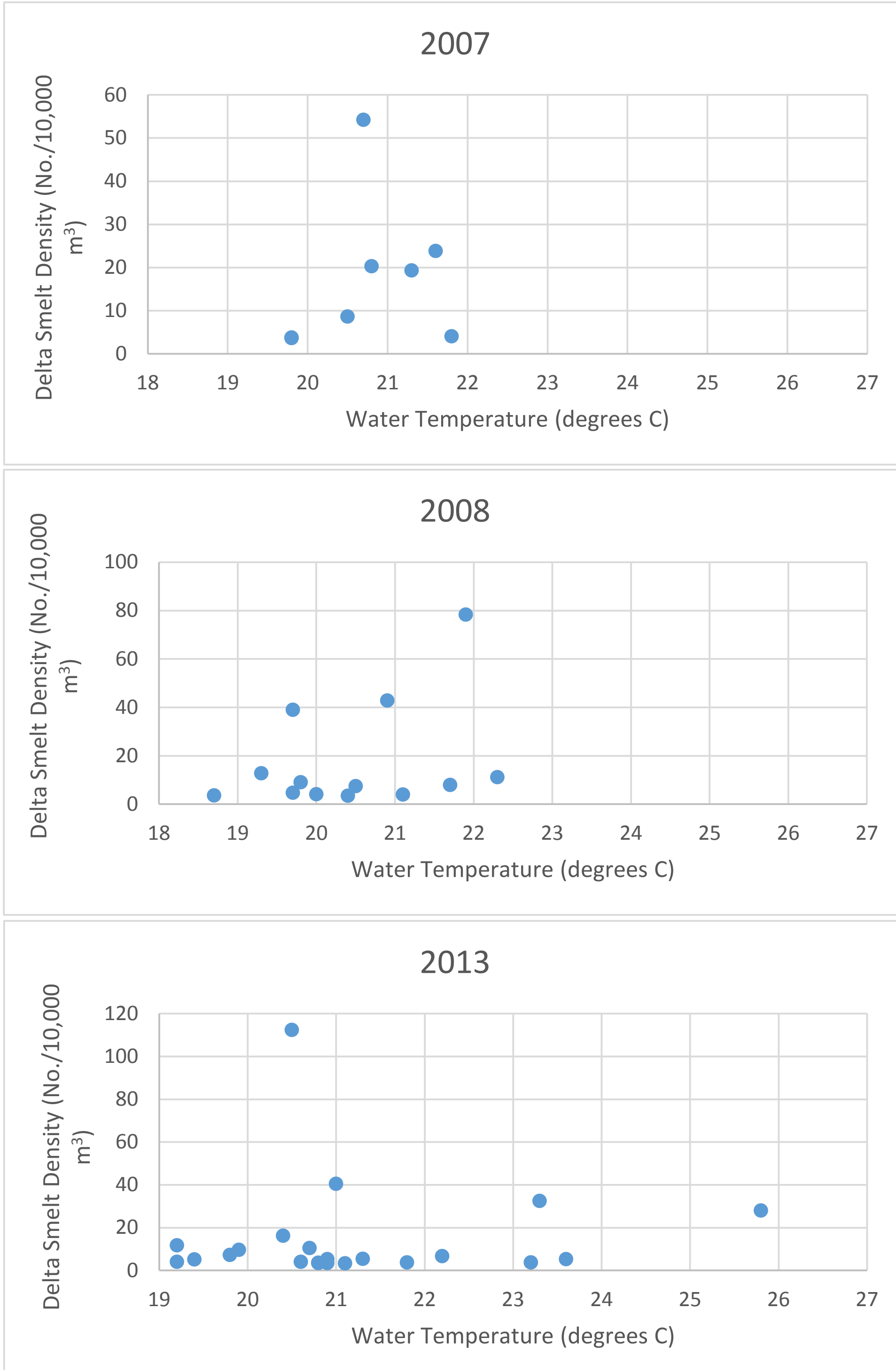
[2] Includes only tows in which fish were caught

and NOAA Fisheries on CVP and SWP operations relative to the BOs and special-status fish species in the Delta.



Source: CDFW 2014

Figure 3.7-2. Density of delta smelt as a function of salinity in recent dry and critical water years: 2007 (dry), 2008 (critical), and 2013 (dry).



Source: CDFW 2014

Figure 3.7-3. Density of delta smelt as a function of water temperature in recent dry and critical water years: 2007 (dry), 2008 (critical), and 2013 (dry).

Impacts on Fisheries Resources: Long-term water transfer actions under the Proposed Action would have a less than significant impact on fisheries resources that are influenced by Delta exports because occurrence of these species would be unlikely during the period of increased exports, species that are present are rarely observed at diversion facilities, and fish screens and monitoring at export facilities would further ensure that there would not be a substantial increase in the number of fish of a special-status species.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the Proposed Action would have a less than significant impact on special-status fish species that are influenced by Delta exports because occurrence of these species would be unlikely during the period of increased exports, species that are present are rarely observed at diversion facilities, and fish screens and monitoring at export facilities would further ensure that there would not be a substantial increase in the number of fish of a special-status species.

Delta Outflow

The Proposed Action could cause Delta Outflows to be lower than under the No Action/No Project Alternative. Under the Proposed Action, modeled mean Delta outflows would not be more than 1.3 percent (147 cfs) lower than flows under the No Action/No Project Alternative in any month or water year type. Outflow would be 12.2 percent (500 cfs) higher during July in critically dry water years. The maximum mean monthly upstream shift in X2 location would be 0.1 km (0.2 percent) upstream during periods of decreased flow, and 1.9 km (1.0 percent) downstream during periods of increased flow. Average daily fluctuations in outflow, and therefore X2 position, at Chipps Island due to tides are 170,000 cfs (DWR 1995). Therefore, a change of 500 cfs in Delta outflow would be 0.3 percent of the daily tidal change experienced in this area. These changes to Delta outflow, and resultant changes in X2 position, due to the Proposed Action would not have a substantial adverse impact on biological resources because either outflow reductions would be minimal (less than 1.3 percent) or the potential outflow increase of 12.2 percent could be beneficial.

Impacts on Fisheries Resources: Long-term water transfer actions under the Proposed Action would have a less than significant impact on fisheries resources that may be influenced by Delta outflow, as reductions in Delta outflow and increases in X2 location would be small (less than1.3 percent) in all months and water year types and would therefore not cause a substantial reduction in the number of fish of a special-status species. In addition, Delta outflow would increase by 12.2 percent under the Proposed Action in critical years during July, which could benefit fisheries resources.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the Proposed Action would have a less than significant impact on special-status fish species that may be influenced by Delta outflow, as reductions in Delta outflow and increases in X2 location would be small (less than 1.3 percent) in all months and water year types and would therefore not cause a substantial reduction in the number of fish of a special-status species. In addition, Delta outflow would increase by 12.2 percent under the Proposed Action in critical years during July, which could benefit special-status fish species.

3.7.2.4.2 Special-Status Species Habitat

The impacts of long-term water management actions on special-status species (listed or candidate species under the ESA, CESA or listed as a species of concern by the State of California), including winter-, spring-, and fall-/late fall-run Chinook salmon, Central Valley steelhead, delta smelt, longfin smelt, green sturgeon, hardhead, and Sacramento splittail were evaluated based on the impacts of these actions on fisheries habitats, specifically reservoirs, mainstem rivers, small tributaries to the Sacramento River, and the Delta. The distribution of special-status fish species is within these habitat types is provided in Table 3.7-2.

As described in the preceding sections, long-term water transfer actions would be carried out such that that all facilities would be operated consistent with their existing or future regulatory requirements. The most current flow and temperature requirements established by various regulating agencies including the USFWS, NOAA Fisheries, Federal Energy Regulatory Commission (FERC), and SWRCB, for the protection of downstream resources, including fish, would be met.

Reservoirs

Special-status fish species do not occupy the reservoirs that would be affected by long-term water transfer actions. These reservoirs are operated to maintain environmental conditions on the downstream rivers, as discussed in the next section.

Mainstem Rivers

~~Environmental Commitments would require that facilities affected by long-term water transfer actions continue to provide the existing protections for fish dependent on the mainstem rivers including the Sacramento, Feather, American, Yuba, Bear, Merced, and San Joaquin rivers~~Each of the special-status fish species use mainstem rivers, including the Sacramento, Feather, American, Yuba, Bear, Merced, and San Joaquin rivers, as habitat~~s~~ for some portion of their life history, with the exception of delta and longfin smelt, which use only those portions of the mainstream rivers in the Delta. Spawning, rearing, holding and migration habitat on these rivers would be maintained. While minor changes in flows and temperatures would occur, these would be within the normal ranges that would occur under the No Action/No Project Alternative.

Impacts to Special-Status Fish Species: The Proposed Action would have a less than significant impact on special-status fish species in mainstem rivers. Flows in all mainstem rivers would remain within their normal ranges and, therefore, there would be no substantial reduction in spawning, rearing, or migration habitat of special-status species.

Small Tributaries to the Sacramento River

Small tributaries to the Sacramento River could be impacted by groundwater substitution, which could reduce flows in these streams due the hydrologic connectivity between groundwater tables and these streams. The groundwater model results indicate that the effects of groundwater substitution on stream flow would be most pronounced during July through September when special-status fish species are unlikely to occur in the streams. In addition, these flow reductions would not be frequent or large enough to have a substantial effect on special-status fish species in the small tributaries during this period.

Impacts to Special-Status Fish Species: Groundwater substitution actions under the Proposed Action would have a less than significant impact on special-status fish species that could occur in small tributaries to the Sacramento River because there would be no substantial reduction in spawning, rearing, or migration habitat of special-status species.

Delta

All of the special-status fish species use the Delta for some portion of their life history. As previously described, the transfer operations model indicates that there would be very minor reductions in Delta outflow (less than 1.3 percent) as a result of the long-term water transfer actions and Delta outflow would improve by 12.2 percent in critical water years during July. Therefore, there would be no substantial reduction in spawning, rearing, or migration habitat of special-status species.

Impacts to Special-Status Fish Species: The Proposed Action would have a less than significant impact on special-status fish species in the Delta because there would be no substantial reduction in spawning, rearing, or migration habitat of special-status species. The transfer operations model indicates that there would be very minor reductions in Delta outflow (less than 1.3 percent) as a result of the long-term water transfer actions and Delta outflow would improve by 12.2 percent in critical water years during July.

3.7.2.5 Alternative 3: No Cropland Modifications Alternative

3.7.2.5.1 Fisheries Resources and Special-Status Fish Species

Under this alternative, water would not be made available through cropland idling or crop shifting. Water would be made available for transfer through groundwater substitution, stored reservoir releases, and conservation. The amount of water made available from each of these sources would be at the same levels as described for the Proposed Action. No additional water would be made available from these sources to offset the loss of water that would not be available from cropland idling/shifting.

Reservoirs

The No Cropland Modifications Alternative could impact reservoir storage and reservoir surface area. Under the No Cropland Modifications Alternative, modeled storage volumes, reservoir elevations and surface areas would change as described in Section 3.7.2.6.1. All reservoirs would continue to be operated according to their existing requirements and within their current range of operations. These reservoirs do not support primary populations of the fish species of management concern, including special-status fish species.

Impacts on Fisheries Resources: The No Cropland Modifications Alternative would have no impact on fisheries resources in reservoirs, as reservoirs do not support primary populations of the fish species of management concern, including special-status fish species.

Impacts on Special-Status Fish Species: The No Cropland Modifications Alternative would have no impact on special-status fish species, as reservoirs do not support primary populations of special-status fish species.

Rivers and Creeks

Sacramento River Watershed

The No Cropland Modifications Alternative could cause Sacramento River flows to be lower than under the No Action/No Project Alternative. As detailed in Section 3.7.2.6, under the No Cropland Modifications Alternative, mean monthly modeled flows would be reduced by less than ten percent on the Sacramento, Feather, Yuba, and American rivers. Based on the screening level criteria, these flow reductions are not considered substantial. Therefore, the effects of the No Cropland Modifications Alternative on fisheries in these rivers would be less than significant. Existing regulatory requirements protecting fisheries resources (flow magnitude and timing, temperature and other water quality parameter) would continue to be met. Among larger rivers, only Bear River flows would be reduced by more than ten percent by the No Cropland Modifications Alternative and therefore is discussed in detail below.

Flows in smaller streams are only affected by an alternative through changes to groundwater. Because the effects of Alternative 3 involve transfers through groundwater substitution only, impacts of Alternative 3 to smaller streams would be the same as the Proposed Action.

Impacts on Fisheries Resources: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on fisheries resources in the following rivers and creeks within the Sacramento River Watershed: Sacramento River, Feather River, Yuba River, American River, ~~Butte Creek, Putah Creek, Colusa Basin Drain,~~ Deer Creek (in Tehama County), Antelope Creek, Paynes Creek, Elder Creek, Mill Creek (in Tehama County), Thomes Creek, Mill Creek (Thomes Creek tributary), Butte Creek, Cache Creek, Auburn Ravine, Freshwater Creek, Colusa Basin Drain, Putah Creek, Stony Creek, Eastside/Cross Canal, Coon Creek, Big Chico Creek, Little Chico Creek, Salt Creek, and Willow Creek including the south fork. Flow changes in these streams would be small and no substantial effect on water quality would occur in these rivers and creeks.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on special-status fish species in the following waterways within the Sacramento River Watershed: Sacramento River, Feather River, Yuba River, American River, ~~Butte Creek, Putah Creek, Colusa Basin Drain,~~ Deer Creek (in Tehama County), Antelope Creek, Paynes Creek, Elder Creek, Mill Creek (in Tehama County), Thomes Creek, Mill Creek (Thomes Creek tributary), Butte Creek, Cache Creek, Auburn Ravine, Freshwater Creek, Colusa Basin Drain, Putah Creek, Stony Creek, Eastside/Cross Canal, Coon Creek, Little Chico Creek, Big Chico Creek, Salt Creek, and Willow Creek including the south fork. Flow changes would be small, and no substantial effect on water quality would result from this alternative, as described above.

Bear River would potentially experience a greater than ten percent change in mean monthly flows in at least one water year type and month of the year. The potential fisheries impacts in these waterways are discussed individually below.

Bear River
The No Cropland Modifications Alternative could cause Bear River flows to be lower than under the No Action/No Project Alternative. Under the No Cropland Modifications Alternative, the only flow reduction greater than ten percent would occur in critical water years during February (approximately 18 percent, or 45 cfs lower). These flow reductions would occur only in one month during critical water years. Fish species of management concern that could be present in the Bear River during February would include fall-run Chinook salmon, green and white sturgeon, and hardhead.

An 18 percent reduction in flows in critical water years during February would not affect fall-run Chinook salmon. This reduction is limited to critical water years in one month of the year and is, therefore, infrequent (approximately 20 percent of years). More importantly, the timing of the reduction would be during a period that would least likely affect fall-run Chinook salmon. Water temperatures during February are typically well below critical temperature thresholds such that a reduction in flows would not likely increase water temperatures to a level that is stressful to fall-run Chinook salmon.

Green and white sturgeon are not typically found in the Bear River but are thought to enter the river during spring of most wet years and some normal years (USFWS 1995). There is no evidence of species presence in the Bear River during critical water years. Because flows would be reduced only in critical years, no sturgeon are expected to be in the Bear River during reduced flow conditions. Therefore, the impact to green and white sturgeon in the Bear River would be less than significant.

The reduction in flows under the No Cropland Modifications Alternative during critical years in February is not expected to have a substantial effect on the habitat for several reasons. First, hardhead are typically in the lower half of the water column and prefer slow moving pools (Moyle 2002). A reduction in flows would maintain the lower half of the water column and the number of slow moving pools is not expected to decrease. Second, the frequency of the reduction would be low. Critical years would occur approximately once every five years within the period of analysis (1970-2003). Third, the timing of the reduction would be during a period that would least likely affect hardhead. Water temperatures during February are already low such that a reduction in flows would not likely increase water temperatures to a level that is stressful to hardhead. In addition, hardhead typically spawn and fry are present during April through May, possibly later in smaller streams (Moyle 2002). Therefore, only juvenile and adult hardhead, the least sensitive life stages, are present in the Bear River during February. As a result of these reasons, the impact to hardhead in the Bear River would be less than significant.

Average monthly flows under the No Cropland Modifications Alternative would be higher than flows under the No Action/No Project Alternative in critical water years during July and August (203 percent, 49 cfs and 88 percent, nine cfs, respectively), and dry years during August and September (219 percent, 27 cfs and 27 percent, 12 cfs, respectively) when water is released from Camp Far West Reservoir for transfer. These flow increases during the summer months may be beneficial to fish species present.

Impacts on Fisheries Resources: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on fisheries resources in the Bear River for the reasons stated above.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on special-status fish species in Bear River for the reasons stated above.

San Joaquin River Watershed

San Joaquin River
The No Cropland Modifications Alternative could cause San Joaquin River flows to be lower than under the No Action/No Project Alternative. Under the No Cropland Modifications Alternative, flows on the San Joaquin River would be reduced by less than two percent relative to the No Action/No Project Alternative. Based on the screening level criteria, these flow changes would not be considered substantial.

Impacts on Fisheries Resources: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on fisheries resources in the San Joaquin River, as flow reductions would be small and would not substantially reduce the number of fish of special-status species.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on special-status fish species in the San Joaquin River, as flow reductions would be small and would not substantially reduce the number of fish of special-status species.

Merced River

The No Cropland Modifications Alternative could cause Merced River flows to be lower and higher than under the No Action/No Project Alternative. Under the No Cropland Modifications Alternative, flow reductions on the Merced River would not exceed ten percent in any water year type or month. Flows would be higher compared to the No Action/No Project Alternative during April and May. The greatest relative increase in flow would occur in dry water years during April (approximately 38 percent, 85 cfs higher than existing conditions). Increased flows during April and May could be beneficial to biological resources, particularly in dry and critically dry water years. The flow reductions on the Merced River would not have a significant impact on fisheries resources.

Impacts on Fisheries Resources: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on fisheries resources in the Merced River. Reductions in river flow would be small relative to the No Action/No Project Alternative and would not substantially reduce the number of fish of special-status species.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on special-status fish species in the Merced River, as flow reductions would be small and would not substantially reduce the number of fish of special-status species.

Delta

Delta Exports

The No Cropland Modifications Alternative could cause Delta exports to be higher than under the No Action/No Project Alternative. Changes in Delta exports under the No Cropland Modifications Alternative relative to the No Action/No Project Alternative would generally be very small (less than five percent), except in the summer to fall months of dry and critically dry water years. At the CVP diversion facilities (Jones Pumping Plant), changes in exports would be less than five percent, except during July through September in dry (three to 15 percent increase in exports, or 6,600 to 33,800 AF per month) and critically dry (11 to 29 percent increase in exports, or 15,200 to 54,500 AF per month) water years. At the SWP diversion facilities (Banks Pumping Plant), changes in exports would be less than five percent, except during the transfer period of dry and critical water years (four to 21 percent increase in exports, or 8,100 to 20,900 AF per month).

Exports at Contra Costa WD diversions would be similar in all water year types and months except dry and critical water years during July and August (12.7-32.3 percent increase, or 2,500 to 4,300 AF per month).

At the East Bay MUD diversion facilities at Freeport, fairly substantial proportional increases in exports would occur throughout the year under the No Cropland Modifications Alternative relative to the No Action/No Project Alternative (up to 75 percent increase). However, flows in the Sacramento River at Freeport would not be reduced in any month or water year type by more than 422 cfs (0.8 percent). Regardless, all of these facilities would continue to be operated in accordance with their existing or future regulatory requirements and the terms and conditions specified in their BOs. Both BOs contain a Reasonable and Prudent Alternative (RPA) that, when implemented, would avoid jeopardy of ESA listed fish species. In addition, the SWRCB's Water Rights Decision-1641 imposes flow and water quality objectives in the 1995 Bay-Delta Plan upon the SWP and CVP operations to assure protection of beneficial uses in the Delta. The SWP and CVP must comply with these and other regulatory requirements in order to operate. Because changes in flows in Delta channels are predicted to be small and there are additional protections for fisheries and aquatic resources already in place under the ESA and D-1641, these impacts would be less than significant.

Collectively, the largest changes in Delta diversions relating to long-term water transfers would primarily occur from July through September. This is the period when through-Delta water transfers are allowed because it is the least sensitive period for fisheries resources.

Longfin smelt are typically found in the bays and nearshore ocean during this time of year (Rosenfield 2010) and would be unaffected by the Proposed Action. Delta smelt have typically moved downstream towards Suisun Bay by this time of year because elevated water temperatures and low turbidity conditions in the Delta are less suitable than those downstream (Nobriga et al. 2008), although some delta smelt reside year-round in and around Cache Slough (Sommer et al. 2011) outside of the influence of the export facilities. An evaluation of CDFW summer tow net surveys in July and August of recent dry (2007, 2013) and critical (2008) water years indicates that the delta smelt, a species that is subject to the wide range of physical conditions typical of an estuary, will move to more suitable (lower) water temperature conditions despite being in a less suitable physiological habitat that is not the low salinity zone (see discussion under Section 3.7.2.4 and Figure 3.7-2 and 3.7-3).

Delta outflow would not be reduced and, therefore, X2 location would not increase, during these months under Alternative 3 (see “Delta Outflow” section below). In fact, Delta outflow would increase under Alternative 3 in dry and critical years during July through September, although X2 location would change minimally (less than 1.3 percent). Consequently, potential increases in exports during this period would have limited, if any effects on delta or longfin smelt.

Green and white sturgeon are rarely observed (only sporadically and in low numbers; DWR and Reclamation unpublished salvage data) at the diversion facilities and, therefore, are not likely to be affected by these changes. The vast majority of juvenile Chinook salmon and steelhead would have emigrated from the Delta region by the end of June (NOAA Fisheries 2014) and are, therefore, unlikely to be affected by increases in exports. In addition, fish screens and monitoring at the East Bay MUD (currently conducted December through June when sensitive fish species are present) and Contra Costa WD (currently conducted year-round) facilities would further ensure that special-status fish species are not affected by any increases in exports at their facilities. Reclamation is consulting frequently with USFWS and NOAA Fisheries on CVP and SWP operations relative to the BOs and special-status fish species in the Delta.

Impacts on Fisheries Resources: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on fisheries resources that are influenced by Delta exports because occurrence of these species would be unlikely during the period of increased exports, species that are present are rarely observed at diversion facilities, and fish screens and monitoring at export facilities would further ensure that there would not be a substantial increase in the number of fish of a special-status species.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on special-status fish species that are influenced by Delta exports occurrence of these species would be unlikely during the period of increased exports, species that are present are rarely observed at diversion facilities, and fish screens and monitoring at export facilities would further ensure that there would not be a substantial increase in the number of fish of a special-status species.

Delta Outflow

The No Cropland Modifications Alternative could cause Delta Outflows to be lower than under the No Action/No Project Alternative. Under the No Cropland Modifications Alternative, Delta outflows would not be more than 1.3 percent (147 cfs) lower than flows under the No Action/No Project Alternative in any month or water year type. The maximum upstream shift in X2 location would be 0.1 km (0.2 percent) upstream during periods of decreased flow, and 0.6 km

(0.7 percent) downstream during periods of increased flow. Average daily fluctuations in outflow, and therefore X2 position, at Chipps Island due to tides are 170,000 cfs (DWR 1995). Therefore, a change of 500 cfs in Delta outflow would be 0.3 percent of the daily tidal change experienced in this area. These changes to Delta outflow, and resultant changes in X2 position, due to Alternative 3 would not have a substantial impact on biological resources because the change is minimal (less than ten percent).

Impacts on Fisheries Resources: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on fisheries resources that may be influenced by Delta outflow, as reductions in Delta outflow and increases in X2 location would be small (less than 1.3 percent) in all months and water year types and would therefore not cause a substantial reduction in the number of fish of a special-status species.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on special-status fish species that may be influenced by Delta outflow, as reductions in Delta outflow and increases in X2 location would be small (less than 1.3 percent) in all months and water year types and would therefore not cause a substantial reduction in the number of fish of a special-status species.

3.7.2.5.2 Special-Status Species Habitat

As described in the preceding sections, long–term water transfer actions would be carried out such that that all facilities would be operated consistent with their existing or future regulatory requirements. The most current flow and temperature requirements established by various regulating agencies including the USFWS, NOAA Fisheries, FERC, and SWRCB, for the protection of downstream resources, including fish, would be met.

Reservoirs

Special-status fish species do not occupy the reservoirs that would be affected by long-term water transfer actions. These reservoirs are operated to maintain environmental conditions on the downstream rivers, as discussed in the next section.

Mainstem Rivers

~~Environmental Commitments would require that facilities affected by long-term water transfer actions continue to provide the existing protections for fish dependent on the mainstem rivers including the Sacramento, Feather, American, Yuba, Bear, Merced and San Joaquin rivers~~Each of the special-status fish species use mainstem rivers, including the Sacramento, Feather, American, Yuba, Bear, Merced and San Joaquin rivers, as habitat~~s~~ for some portion of their life history, with the exception of delta and longfin smelt, which use only those portions of the mainstream rivers in the Delta. Spawning, rearing, holding and migration habitat on these rivers would be maintained. While minor changes in flows and temperatures would occur, these would be within the normal ranges that would occur under the No Action/No Project Alternative.

Impacts to Special-Status Fish Species: The No Cropland Modifications Alternative would have a less than significant impact on special-status fish species in mainstem rivers. Flows in all mainstem rivers would remain within their normal ranges and, therefore, there would be no substantial reduction in spawning, rearing, or migration habitat of special-status species.

Small Tributaries to the Sacramento River

Small tributaries to the Sacramento River could be impacted by groundwater substitution, which could reduce flows in these streams due the hydraulic connectivity between groundwater tables and these streams. The groundwater model results indicate that the effects of groundwater substitution on stream flow would be most pronounced during July through September when special-status fish species are unlikely to occur in the streams. In addition, these flow reductions would not be frequent or large enough to have a substantial effect on special-status fish species in the small tributaries during this period.

Impacts to Special-Status Fish Species: Groundwater substitution actions under the No Cropland Modifications Alternative would have a less than significant impact on special-status fish species that could occur in small tributaries to the Sacramento River.

Delta

All of the special-status fish species use the Delta for some portion of their life history. As previously described, the transfer operations model indicates that there would be very minor reductions in Delta outflow (less than two percent) as a result of the long-term water transfer actions. Therefore, there would be no substantial reduction in spawning, rearing, or migration habitat of special-status species.

Impacts to Special-Status Fish Species: The No Cropland Modifications Alternative would have a less than significant impact on special-status fish species in the Delta, because there would be no substantial reduction in spawning, rearing, or migration habitat of special-status species.

3.7.2.6 Alternative 4: No Groundwater Substitution

3.7.2.6.1 Fisheries Resources and Special-Status Fish Species

Reservoirs

The No Groundwater Substitution Alternative could impact reservoir storage and reservoir surface area. Under the No Groundwater Substitution Alternative, storage volumes, reservoir elevations and surface areas would change, but all reservoirs would continue to be operated according to their existing requirements and within their current range of operations. These reservoirs do not support primary populations of the fish species of management concern, including special-status fish species.

Impacts on Fisheries Resources: The No Groundwater Substitution Alternative would have no impact on fisheries resources in reservoirs, as reservoirs do not support primary populations of the fish species of management concern, including special-status fish species.

Impacts on Special-Status Fish Species: The No Groundwater Substitution Alternative would have no impact on special-status fish species, as reservoirs do not support primary populations of special-status fish species.

Rivers and Creeks

The following section provides a discussion of the impacts to fisheries resources of flow changes (timing and magnitude) for rivers, streams, and associated tributaries under the No Groundwater Substitution Alternative. These flow changes are detailed in Section 3.8.2.6. Alternative 4 does not include groundwater substitution; therefore, the flow decreases to rivers and creeks due to groundwater substitution do not occur. The modeled changes in the No Groundwater Substitution Alternative are caused by storing and moving transfer water made available through cropland idling/crop shifting, stored reservoir release, and conservation.

Sacramento River Watershed

The No Groundwater Substitution Alternative could cause flows in rivers and creeks to be lower than under the No Action/No Project Alternative. Under the No Groundwater Substitution Alternative, mean monthly modeled flows would be reduced by less than ten percent on the Sacramento, Feather, Yuba, and American rivers. Therefore, these flow reductions would not be considered substantial. Existing regulatory requirements protecting fisheries resources (flow magnitude and timing, temperature, and other water quality parameters) would continue to be met. Therefore, the effects of the No Groundwater Substitution alternative on fisheries in these rivers would be less than significant. Among larger rivers, only Bear River flows would be reduced by more than ten percent by the No Groundwater Substitution Alternative and therefore is discussed in detail below.

Smaller streams in the Sacramento River watershed in which special-status fish species are present (see Table 3.7-3 for list of streams) would not be impacted by transfers under the No Groundwater Substitution Alternative because groundwater substitution would not occur. Therefore, there would be no impacts of the No Groundwater Substitution Alternative on fisheries in these smaller streams in the Sacramento River watershed.

Impacts on Fisheries Resources: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on fisheries resources in the Sacramento, Feather, Yuba, and American rivers and no impact on fisheries resources in smaller streams in the Sacramento River watershed.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on fisheries resources in the Sacramento, Feather, Yuba, and American rivers no impact on special-status fish species occurring in small streams in the Sacramento River watershed.

Bear River
The No Groundwater Substitution Alternative could cause Bear River flows to be lower and higher than under the No Action/No Project Alternative. Under the No Groundwater Substitution Alternative, the only flow reduction greater than ten percent would occur in critical water years during February (approximately 18 percent, or 45 cfs lower). These flow reductions would occur only in one month during critical water years. Fish species of management concern that could be present in the Bear River during February would include green and white sturgeon and hardhead.

Green and white sturgeon are not typically found in the Bear River but are thought to enter the river during spring of most wet years and some normal years (USFWS 1995). There is no evidence of species presence in the Bear River during critical water years. Because flows would be reduced only in critical years, no sturgeon are expected to be in the Bear River during reduced flow conditions. Therefore, the impact to green and white sturgeon in the Bear River would be less than significant.

An 18 percent reduction in flows during critical years in February is not expected to have a substantial effect on hardhead habitat for several reasons. First, hardhead are typically in the lower half of the water column and prefer slow moving pools (Moyle 2002). A reduction in flows would maintain the lower half of the water column and may increase the number of slow moving pools. Second, the frequency of the reduction would be low. Critical years would occur approximately once every five years within the period of analysis (1970-2003). Third, the timing of the reduction would be during a period that would least likely affect hardhead. Water temperatures during February are already low such that a reduction in flows would not likely increase water temperatures to a level that is stressful to hardhead. In addition, hardhead typically spawn and fry are present during April through May, possibly later in smaller streams (Moyle 2002). Therefore, only juvenile and adult hardhead, the least sensitive life stages, are present in the Bear River during February. As a result of these reasons, the impact to hardhead in the Bear River would be less than significant.

Average monthly flows would be higher, compared to the No Action/No Project Alternative, in critical water years during July (approximately 240 percent, 58 cfs), and dry years during August and September (52 percent, 38 cfs and 22 percent, three cfs, respectively) when water is released from Camp Far West Reservoir for transfer. These flow increases during the summer months could be beneficial to fish species present.

Impacts on Fisheries Resources: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on fisheries resources within Bear River for the reasons stated above.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on special-status fish species in Bear River for the reasons stated above.

San Joaquin River Watershed

San Joaquin River
The No Groundwater Substitution Alternative could cause San Joaquin River flows to be lower and higher than under the No Action/No Project Alternative. Under the No Groundwater Substitution Alternative, flows would be reduced by less than ten percent on the San Joaquin River relative to the No Action/No Project Alternative. Based on the screening level criteria, these flow reductions would not be considered substantial. Further, the 15 percent increase in flows in dry water years during July may benefit fisheries resources.

Impacts on Fisheries Resources: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on fisheries resources occurring in the San Joaquin River, as flow reductions would be small and all facilities would continue to meet all environmental requirements governing their operation.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on special-status fish species occurring in the San Joaquin River, as flow reductions would be small and all facilities would continue to meet all environmental requirements governing their operation.

Merced River
The No Groundwater Substitution Alternative could cause Merced River flows to be lower and higher than under the No Action/No Project Alternative. Under the No Groundwater Substitution Alternative, flow releases from McClure Reservoir would be operated under existing agreements. Under the No Groundwater Substitution Alternative, flows in the Merced River would be reduced by less than ten percent relative to the No Action/No Project Alternative. Flows would be 124 percent (163 cfs) and 59 percent (70 cfs) higher compared to the No Action/No Project Alternative in dry and critical water years, respectively, during July. Increased flows during July could be beneficial to biological resources, particularly in dry and critically dry water

years. The flow reductions on the Merced River would not have a significant impact on biological resources.

Impacts on Fisheries Resources: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on fisheries resources occurring in the Merced River. Reductions in river flow would be small relative to the No Action/No Project Alternative and all facilities would continue to meet all environmental requirements governing their operation.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on special-status fish species occurring in the Merced River, as flow reductions would be small and all facilities would continue to meet all environmental requirements governing their operation.

Delta

Delta Exports

The No Groundwater Substitution Alternative could cause Delta exports to be higher than under the No Action/No Project Alternative. Changes in Delta exports under the No Groundwater Substitution Alternative relative to the No Action/No Project Alternative and the No Action/No Project Alternative would generally be very small (less than five percent), except in the summer to fall months of dry and critically dry water years. At the CVP diversion facilities (Jones pumping plant), changes in exports would be less than 2.6 percent, except in critical water years during July (27.7 percent, 52,500 AF) and August (11.9 percent, 22,500 AF). At the SWP facilities (Banks pumping plant), changes in exports would be less than less ten percent, except in dry water years during August (28.5 percent increase in exports).

Changes in exports would generally not occur at the Contra Costa WD diversion facilities under the No Groundwater Substitution Alternative, except during July through September in dry and critical water years (8.5 to 32.3 percent increase).

At the East Bay MUD diversion facilities at Freeport, fairly substantial proportional increases in exports would occur throughout the year under the No Groundwater Substitution Alternative relative to the No Action/No Project Alternative (up to 73.1 percent increase). However, flows in the Sacramento River at Freeport would not be reduced in any month or water year type by more than 234 cfs (0.4 percent).

All of these facilities would continue to be operated in accordance with their existing or future regulatory requirements and the terms and conditions specified in their BOs. Both BOs contain a Reasonable and Prudent Alternative (RPA) that, when implemented, would avoid jeopardy of ESA listed fish species. In addition, the SWRCB's Water Rights Decision-1641 imposes flow and water quality objectives in the 1995 Bay-Delta Plan upon the SWP and CVP operations to assure protection of beneficial uses in the Delta. The SWP and CVP must comply with these and other regulatory requirements in order to operate. Because changes in flows in Delta channels are predicted to be small and there are additional protections for fisheries and aquatic resources already in place under the ESA and D-1641, these impacts would be less than significant.

Collectively, the largest changes in Delta diversions relating to long-term water transfers would primarily occur from July through September. Through Delta water transfers are allowed at that time because it is the least sensitive period for fisheries resources.

Longfin smelt are typically found in the bays and nearshore ocean during this time of year (Rosenfield 2010) and would be unaffected by the Proposed Action. Delta smelt have typically moved downstream towards Suisun Bay by this time of year because elevated water temperatures and low turbidity conditions in the Delta are less suitable than those downstream (Nobriga et al. 2008), although some delta smelt reside year-round in and around Cache Slough (Sommer et al. 2011) outside of the influence of the export facilities. An evaluation of CDFW summer tow net surveys in July and August of recent dry (2007, 2013) and critical (2008) water years indicates that the delta smelt, a species that is subject to the wide range of physical conditions typical of an estuary, will move to more suitable (lower) water temperature conditions despite being in a less suitable physiological habitat that is not the low salinity zone (see discussion under Section 3.7.2.4 and Figure 3.7-2 and 3.7-3).

Delta outflow would not be reduced and, therefore, X2 location would not increase, during these months under Alternative 3 (see “Delta Outflow” section below). In fact, Delta outflow would increase under Alternative 3 in dry and critical years during July through September, although X2 location would change minimally (less than 1.3 percent). Consequently, potential increases in exports during this period would have limited, if any effects on delta or longfin smelt.

Green and white sturgeon are rarely observed (only sporadically in low numbers; DWR and Reclamation unpublished salvage) at the diversion facilities and, therefore, are not likely to be affected by these changes. The vast majority of juvenile Chinook salmon and steelhead would have emigrated from the Delta region by June (NOAA Fisheries 2014) and are, therefore, unlikely to be affected by increases in exports. In addition, fish screens and monitoring at the East Bay MUD (currently conducted December through June when sensitive fish species are present) and Contra Costa WD (currently conducted year-round) facilities would further ensure that special-status fish species are not affected by any increases in exports at their facilities. Reclamation is consulting frequently with USFWS and NOAA Fisheries on CVP and SWP operations relative to the BOs and special-status fish species in the Delta.

Impacts on Fisheries Resources: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on fisheries resources that are influenced by Delta exports.

Impac**ts on Special-Status Fish Species:** Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on special-status fish species that are influenced by Delta exports.

Delta Outflow

The No Groundwater Substitution Alternative could cause Delta Outflows to be higher than under the No Action/No Project Alternative. Under the No Groundwater Substitution Alternative, Delta outflows would not be more than one percent lower than outflows under the No Action/No Project Alternative in any month or water year type.

The maximum upstream shift in X2 location would be 0.1 km (0.1 percent) upstream during periods of decreased flow, and 0.6 km (0.5 percent) downstream during periods of increased flow. Average daily fluctuations in outflow, and therefore X2 position, at Chipps Island due to tides are 170,000 cfs (DWR 1995). Therefore, a change of 500 cfs in Delta outflow would be 0.3 percent of the daily tidal change experienced in this area. These changes to Delta outflow, and resultant changes in X2 position, due to Alternative 4 would not have a substantial impact on biological resources because the change is minimal (less than one percent).

Impacts on Fisheries Resources: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on fisheries resources that are influenced by Delta outflow, as reductions in Delta outflow and increases in X2 location would be small (less than one percent) in all months and water year types and would therefore not cause a substantial reduction in the number of fish of a special-status species. .

Impacts on Special-Status Fish Species: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on special-status fish species that may be influenced by Delta outflow, as reductions in Delta outflow and increases in X2 location would be small (less than one percent) in all months and water year types and would therefore not cause a substantial reduction in the number of fish of a special-status species.

3.7.2.6.2 Special-Status Species Habitat

As described in the preceding sections, long–term water transfer actions would be carried out such that that all facilities would be operated consistent with their existing or future regulatory requirements. The most current flow and temperature requirements established by various regulating agencies including the USFWS, NOAA Fisheries, FERC, and SWRCB, for the protection of downstream resources, including fish, would be met.

Reservoirs

Special-status fish species do not occupy the reservoirs that would be affected by long-term water transfer actions. These reservoirs are operated to maintain environmental conditions on the downstream rivers, as discussed in the next section.

Mainstem Rivers

~~Environmental Commitments would require that facilities affected by long-term water transfer actions continue to provide the existing protections for fish dependent on the mainstem rivers including the Sacramento, Feather, American, Yuba, Bear, Merced and San Joaquin rivers~~Each of the special-status fish species use mainstem rivers, including the Sacramento, Feather, American, Yuba, Bear, Merced and San Joaquin rivers, as habitat~~s~~ for some portion of their life history, with the exception of delta and longfin smelt, which use only those portions of the mainstream rivers in the Delta. Spawning, rearing, holding and migration habitat on these rivers would be maintained. While minor changes in flows and temperatures would occur, these would be within the normal ranges that would occur under the No Action/No Project Alternative.

Impacts to Special-Status Fish Species: The No Groundwater Substitution Alternative would have a less than significant impact on special-status fish species in mainstem rivers. Flows in all mainstem rivers would remain within their normal ranges and, therefore, there would be no substantial reduction in spawning, rearing, or migration habitat of special-status species.

Small Tributaries to the Sacramento River

As no groundwater substitution would occur under this alternative, the small tributaries to the Sacramento River would not be impacted by the No Groundwater Substitution Alternative.

Impacts to Special-Status Fish Species: The No Groundwater Substitution Alternative would have no impact on special-status fish species that could occur in small tributaries to the Sacramento River, as flows in these streams would not change and, therefore, there would be no substantial reduction in spawning, rearing, or migration habitat of special-status species.

Delta

As previously described, the transfer operations model indicates that there would be very minor changes in flow in the Delta (less than one percent) as a result of the long-term water transfer actions.

Impacts to Special-Status Fish Species: The No Groundwater Substitution Alternative would have a less than significant impact on special-status fish species in the Delta, as reductions to Delta outflow and increases in X2 positions would be minimal (less than one percent) and would not result in a substantial reduction in spawning, rearing, or migration habitat of special-status species.

3.7.3 Comparative Analysis of Alternatives

Table 3.7-4 summarizes the effects of each of the action alternatives. The following text supplements the table by describing the magnitude of the effects under the action alternatives ~~and~~ relative to the No Action/No Project Alternative.

Table 3.7-4. Comparative Analysis of Alternatives

Potential Impact	Alternatives	Significance[1]		Proposed Mitigation	Significance After Mitigation
		Fisheries Resources	Special-Status Fish Species		
Groundwater substitution could reduce stream flows supporting fisheries resources in small streams	2, 3	LTS	LTS	None	LTS
Transfer actions could alter flows in ~~large~~ rivers and creeks supporting fisheries resources in the Sacramento and San Joaquin river watersheds.~~, altering habitat availability and suitability associated with these rivers~~	2, 3, 4	LTS	LTS	None	LTS
Transfer actions could affect reservoir storage and reservoir surface area in reservoirs supporting fisheries resources	2, 3, 4	LTS	LTS	None	LTS
Transfer actions could alter hydrologic conditions in the Delta, altering associated habitat availability and suitability	2, 3, 4	LTS	LTS	None	LTS
Transfer actions could affect the habitat of special-status species associated with mainstem rivers, tributaries, and the Delta.	2, 3, 4	Not applicable	LTS	None	LTS

[1] LTS = Less than significant

3.7.3.1 Alternative 1: No Action/No Project Alternative

There would be no changes in agricultural use or water availability in the Seller Service Area relative to existing conditions. In the Buyer Service Area, increased land idling could occur in response to CVP shortages, which could affect habitat availability, but this would be similar to existing conditions. Conditions for natural communities and special-status species would remain the same as under existing conditions.

3.7.3.2 Alternative 2: Proposed Action

The Propose Action would include g~~G~~roundwater substitution and stored reservoir release transfers as mechanisms for transferring water. The analysis of this alternative indicates that there would be less than significant impacts to both fisheries resources and special-status species. ~~could affect the availability of water in the Seller Service Area and the availability and suitability of habitat. This could affect conditions for fisheries resources and special-status fish species relative to the No Action/No Project Alternative, but the effects with the implementation of the Environmental Commitments would be less than significant.~~ The Proposed Action would increase water supplies to agricultural users in the Buyer Service Area, but the amount of water would remain within the amount allowed under the Buyers CVP contract and the effects of using the water would be within that considered under that contract and its associated environmental documentation and BOs.

3.7.3.3 Alternative 3: No Cropland Modifications Alternative

The No Cropland Modifications Alternative would not include cropland idling/shifting as a mechanism for transferring water. Effects would continue to occur from groundwater substitution and stored reservoir release transfers at the same levels described for the Proposed Action, although this would result in less than significant impacts to both fisheries resources and special-status fish species. The No Cropland Modifications Alternative would increase water supplies to agricultural users in the Buyer Service Area, but the amount of water would remain within the amount allowed under the Buyers CVP contract and the effects of using the water would be within that considered under that contract and its associated environmental documentation and BOs.

3.7.3.4 Alternative 4: No Groundwater Substitution Alternative

The No Groundwater Substitution Alternative would not include groundwater substitution as a mechanism for transferring water. Effects would continue to occur from reservoir storage transfers at the same levels considered for the Proposed Action, although this would result in ~~. The effects of this alternative with the implementation of the Environmental Commitments would be~~ less than significant impacts to both fisheries resources and special-status fish species. The No Groundwater Substitution Alternative would increase water supplies to agricultural users in the Buyer Service Area, but the amount of water would remain within the amount allowed under the Buyers CVP contract and the effects of using the water would be within that considered under that contract and its associated environmental documentation and BOs.

3.7.4 Environmental Commitments/Mitigation Measures

Because impacts to fisheries resources and special-status species were found to be less than significant for all alternatives, no environmental commitments or mitigation measures are necessary.~~The environmental commitments described in Section 2.3.2.4 incorporated into the project will reduce or eliminate significant impacts to fisheries resources and fish species of management concern. No additional mitigation is required.~~

3.7.5 Potentially Significant Unavoidable Impacts

None of the action alternatives would result in potentially significant unavoidable impacts on fisheries.

3.7.6 Cumulative Impacts

The timeframe for the cumulative effects analysis extends from 2015 through 2024, a 10-year period. The cumulative effects area of analysis for fisheries is the same as the area of analysis shown in Figure 3.7-1 above. This section analyzes cumulative effects using the project method, which is further described in Chapter 4.

The projects considered for the fisheries cumulative condition are the SWP water transfers, CVP Municipal and Industrial (M&I) Water Shortage Policy (WSP), Lower Yuba River Accord, SJRRP, refuge transfers, and Exchange Contractors 25-Year Water Transfers.

The set of agreements of the Lower Yuba River Accord is designed to provide additional water to meet fisheries needs in the lower Yuba River. In addition, up to 60,000 AF of water per year would be made available for purchase by Reclamation and DWR for fish and environmental purposes. The long-term water transfer project would not affect the ability of the Accord to provide a benefit to environmental resources within its action area. Both efforts, however, could affect Delta exports.

The SJRRP would increase flows and improve habitat conditions in and along the San Joaquin River to support spring-run and fall-run Chinook salmon, steelhead and other native fish. The SJRRP would create additional habitat for fisheries resources by increasing flows and expanding floodplains.

The following sections describe potential fisheries resources cumulative effects for each of the proposed alternatives.

3.7.6.1 Alternative 2: Proposed Action

3.7.6.1.1 Fisheries Resources and Special-Status Fish Species

The Proposed Action could, in combination with other cumulative projects, cause flows in rivers and creeks in the Sacramento River watershed to be lower than under the No Action/No Project Alternative. The SWP transfers would make water available to transfer to a variety of sellers as described in Section 4.3. Up to 6,800 AF would be made available through groundwater substitution and up to 86,930 AF would be made available through cropland idling. The sellers for the SWP transfers are in the Feather River Basin and receive water from Lake Oroville. There would be minimal geographic overlap between this program and Long-Term Water Transfers.

The M&I WSP is primarily a policy development program and planning tool to clearly define water shortage conditions and what reductions in allocation CVP users should expect in the event of shortages. The WSP could reduce agricultural water deliveries and increase land idling in the Buyer Service Area. Effects of the WSP in the Seller Service Area would be minor as agricultural water supplies would not substantially change relative to existing conditions.

As modeled, Cache Creek, Stony Creek, Coon Creek, Little Chico Creek, and the Bear River may experience a greater than ten percent change in mean monthly flows in at least one water year type and month of the year. Fish species of management concern and special status fish species would not likely be present in these streams when flows would be reduced. In addition, historical flow data was limited or not available for Eastside/Cross Canal, and Salt Creek. Generally, these waterways are not immediately adjacent to groundwater substitution transfers, and other nearby small waterways are not experiencing flow decreases that are causing significant impacts to aquatic resources. ~~In addition, flow reductions as the result of groundwater declines would be observed at monitoring wells in the region and adverse effects on riparian vegetation would be mitigated by implementation of Mitigation Measure GW-1 (See Section 3.3, Groundwater Resources), because it requires monitoring of wells and implementing a mitigation plan if the seller's monitoring efforts indicate that the operation of the wells for groundwater substitution pumping are causing substantial adverse impacts. The mitigation plan would include curtailment of pumping until natural recharge corrects the environmental impact.~~ Therefore, the impacts to fisheries resources would be less than significant in these streams.

~~With implementation of Mitigation Measure GW-1, the~~The Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact related to groundwater quality.

The Proposed Action could, in combination with other cumulative projects, cause San Joaquin River flows to be lower than under the No Action/No Project Alternative. Under the Exchange Contractors 25-Year Water Transfers the

Exchange Contractors in the San Joaquin Valley would sell up to 150,000 AF to willing buyers, including many of the Buyers for the long-term water transfers. These transfers could include a small amount of groundwater pumping; however, this pumping would not be adjacent to the San Joaquin River. The SJRRP would increase flows and improve fisheries resources on the San Joaquin River; this program would have a beneficial effect. Refuge transfers, similarly, could have a beneficial effect on flows if transfers from Merced ID are conveyed to refuges by flowing down the San Joaquin River to the Delta.

Long-term water transfer actions under the Proposed Action would reduce flows by a small amount during reservoir refill, but this would occur during very wet periods when it would not likely affect fisheries resources. Therefore, the Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact on fisheries resources occurring in the San Joaquin River.

The Proposed Action could in combination with other cumulative projects cause Delta exports to be higher than under the No Action/No Project Alternative. All cumulative water operations projects affecting Delta exports would be required to meet Delta water quality standards (e.g., D-1641) and meet the requirements of the BOs and other current and future regulatory requirements for the long-term coordinated operations of the CVP and SWP. In addition, during the period of increased exports because of the Proposed Action, species that are present are rarely observed at diversion facilities, and fish screens and monitoring at export facilities would further ensure that there would not be a substantial increase in the number of fish of a special-status species. The Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact to fisheries resources associated with changing Delta exports.

The Proposed Action in combination with other cumulative projects could cause Delta outflows to be lower than under the No Action/No Project Alternative. Long-term water transfer actions under the Proposed Action would have a less than significant impact on fisheries resources that may be influenced by Delta outflow, as changes in Delta outflow and X2 location would be small (less than three percent) in all months and water year types. In addition, all cumulative water operations projects affecting Delta exports would be required to meet Delta water quality standards (e.g., D-1641) and meet the requirements of the USFWS and NOAA Fisheries BOs for the long-term coordinated operations of the CVP and SWP. Because changes in Delta outflow and X2 location are predicted to be small and there are additional protections for fisheries and aquatic resources already in place under the ESA and D-1641, these impacts would be less than significant. The Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact on fisheries resources related to changes in Delta outflow and X2 location.

3.7.6.1.2 Special-Status Species Habitat

All water operations related to SWP transfers, WSP, Yuba Accord, the SJRRP, refuge transfers, and the Exchange Contractors 25-Year Water Transfers would be carried out such that all facilities would be operated consistent with their existing or future regulatory requirements. The most current flow and temperature requirements established by various regulating agencies including the USFWS, NOAA Fisheries, FERC, and SWRCB, for the protection of downstream resources, including fish, would be met. Under the Proposed Action all these regulatory criteria would also be met and thus the Proposed Action would have a less than significant cumulative impact on special-status fish species in mainstem rivers because its effects would not be cumulatively considerable. Flows in all mainstem rivers would remain within their normal ranges and, therefore, there would be no substantial reduction in spawning, rearing, or migration habitat of special-status species.

Small tributaries to the Sacramento River could be affected by SWP water transfers, WSP, and the Proposed Action groundwater substitution transfers, which could reduce flows in these streams due the hydrologic connectivity between groundwater tables and these streams. The groundwater model results indicate that the Proposed Action's effects of groundwater substitution on stream flow would be most pronounced during July through September. During this time, flows in these small streams on the valley floor where flow reductions would occur are generally quite low and water temperatures are quite high. Thus, coldwater fish species, including salmon and steelhead, are unlikely to occur in these portions of the stream during these months. The Proposed Action's effects on flow-related special status fish habitat in small streams would not be cumulatively considerable, and the cumulative effect would be less than significant.

3.7.6.2 Alternative 3: No Cropland Modifications Alternative

The cumulative impacts of Alternative 3 would be the same as for groundwater substitution under the Proposed Action in the Seller Service Area. Additionally, the cumulative effects of Alternative 3 in the Buyer Service Area would be the same as the Proposed Action. The effects of the Proposed Action would not be cumulatively considerable.

3.7.6.3 Alternative 4: No Groundwater Substitution

The cumulative impacts of Alternative 4 would be the same as for crop idling/shifting under the Proposed Action in the Seller Service Area. The cumulative effects of Alternative 4 in the Buyer Service Area would be the same as the Proposed Action. The effects of the Proposed Action would not be cumulatively considerable.

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Section 3.8
Vegetation and Wildlife

Vegetation and wildlife resources within the area of analysis could be affected by any of the proposed water transfer types: groundwater substitution, reservoir release, cropland idling, crop shifting, and conservation transfers.

3.8.1 Affected Environment/Environmental Setting

This section describes the terrestrial natural communities, special-status species and their habitats occurring in the area of analysis with potential to be affected by water transfers.

3.8.1.1 Area of Analysis

Long-term transfers could affect portions of the Central Valley, the Sacramento-San Joaquin Delta (Delta), and portions of Contra Costa, Alameda, Santa Clara, and San Benito counties. Figure 3.8-1 shows the counties in the Seller Service Area and Buyer Service Area and the Sacramento Valley Groundwater Basin. Figure 3.8-2 shows major rivers and reservoirs in the Seller Service Area.

3.8.1.1.1 Seller Service Area

The Seller Service Area includes potential seller lands within the Sacramento River and San Joaquin watersheds. The Sacramento River watershed includes the Sacramento, Feather, Yuba, Bear, and American rivers, as well as numerous smaller tributaries to the Sacramento River including Deer, Mill, Butte, Putah, Cache, Stony, Stone Corral and other smaller creeks. The portion of the San Joaquin River watershed considered in this analysis includes the Merced and San Joaquin Rivers. Water transfer actions would not affect other tributaries in the Seller Service Area of the San Joaquin watershed.

The alternatives could affect watersheds within the Sacramento River Basin that include the following water bodies:

- Sacramento River from Shasta Reservoir to the Sacramento–San Joaquin Delta (Delta);

Figure 3.8-1. Vegetation and Wildlife Area of Analysis Counties and Sacramento Valley Groundwater Basin

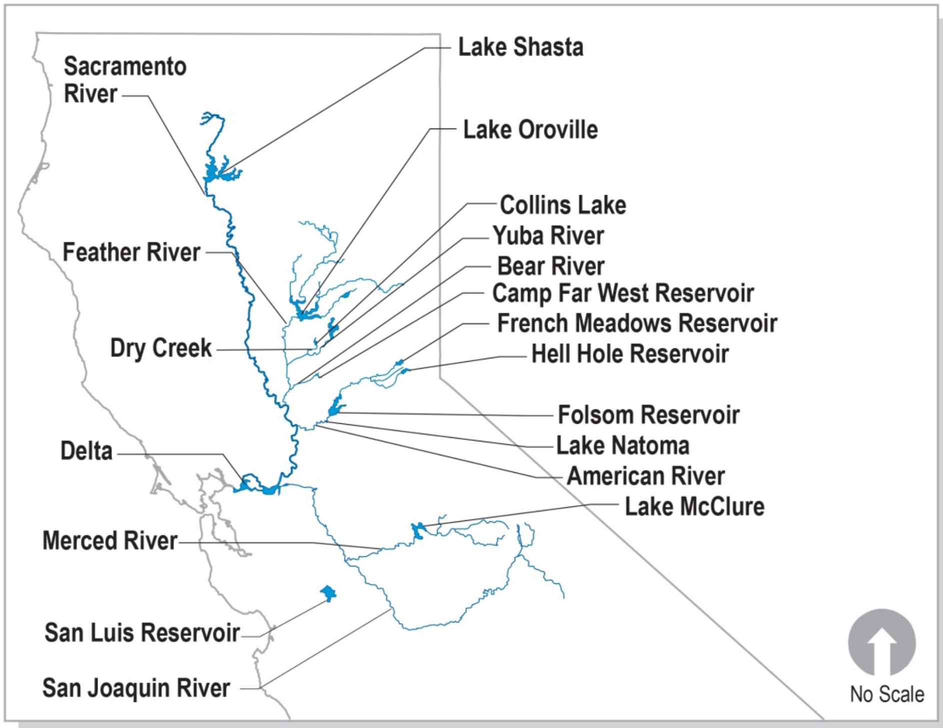

Figure 3.8-2. Vegetation and Wildlife Area of Analysis Major Rivers and Reservoirs

- Feather River and its tributaries, including and downstream of Lake Oroville, the Yuba River including and downstream of New Bullards Bar Reservoir, and the Bear River including and downstream of Camp Far West Reservoir;
- American River, including and downstream of Folsom Reservoir and Lake Natoma;
- Middle Fork American River downstream of Hell Hole and French Meadows Reservoirs; and
- Numerous small tributaries to the Sacramento River, Feather River, Yuba River, and Bear River.

Within the San Joaquin River watershed, potentially affected water bodies in the Seller Service Area include the:

- San Joaquin River from the Merced River to the Delta; and
- Merced River, including and downstream of Lake McClure.

Water transfers made under the alternatives would move through the legal Delta, roughly defined as the waterways within the “triangular area” demarcated by Freeport on the Sacramento River on the north, to Vernalis on the San Joaquin River on the south, and Antioch at the confluence of the two rivers on the west, and could affect vegetation and wildlife resources in the Delta.

3.8.1.1.2 Buyer Service Area

The Buyer Service Area includes portions of Contra Costa County, northwestern Alameda County, Santa Clara County, northwestern San Benito County, small portions of Merced, San Joaquin, and Stanislaus counties, and extends through western Fresno County into northwest Kings County.

Water transfers to the Buyer Service Area could potentially affect the San Luis Reservoir in Merced County.

3.8.1.2 Regulatory Setting

There are various federal, state and local regulations and policies that apply to vegetation and wildlife resources that occur within the area of analysis. Applicable requirements are itemized below and discussed in greater detail in Appendix H.

- Federal Endangered Species Act (ESA) of 1973;
- Fish and Wildlife Coordination Act of 1958;
- Federal Migratory Bird Treaty Act of 1972;
- Executive Order 11990 (Protection of Wetlands) (1977);
- California Endangered Species Act (CESA) of 1984;
- Fully Protected Species under the California Fish and Game Code;
- Protection of Birds and Raptors under the California Fish and Game Code;
- California Native Plant Protection Act (CNPPA) of 1977;
- California Natural Community Conservation Planning Act of 2003;
- California Water Code;
- Requirements stipulated in the various Central Valley Project (CVP), Sacramento River Settlement Contracts, and Water Service Contracts between Reclamation and the various buyers and sellers, and their associated biological opinions (BOs) with U.S. Fish and Wildlife Service (USFWS) and National Oceanic Atmospheric Administration Fisheries Service;

- Requirements stipulated in previous Consultations and USFWS BOs regarding the CVP Improvement Act and the State Water Project (SWP); and
- Existing Natural Community Conservation Plans (NCCPs) and Habitat Conservation Plans (HCPs).

3.8.1.3 Existing Conditions

The following section describes the natural communities present in the different regions of the area of analysis, followed by a discussion of the special-status plant and wildlife species with potential to be affected by long-term water transfers. The descriptions of the natural communities are generally based on the California Wildlife Habitat Relationships (CWHR) System (California Department of Fish and Game [CDFG] 2008) and Terrestrial Vegetation of California (Barbour et al. 2007), as well as those previously developed for other water system Environmental Impact Reports (EIRs).

The list of special-status species considered for analysis was based on a search of the California Department of Fish and Wildlife [CDFW] California Natural Diversity Database (CNDDB), USFWS species lists for the counties within the area of analysis, and active HCPs in the vicinity of the area of analysis. The complete list of special-status species evaluated is provided in Tables I-1 (fish and wildlife) and I-2 (plants) contained within Appendix I. Figure 3.8-3 shows Federal national wildlife refuges (NWRs) and State wildlife management areas in the area of analysis.

3.8.1.3.1 Natural Communities and Agricultural Habitats in the Seller Service Area

This section describes the natural communities in the Seller Service Area that could be affected by long-term water transfers. The Seller Service Area includes the Sacramento and San Joaquin rivers watershed. Although the Central Valley is dominated by agricultural land, remnant grassland, oak woodlands, riparian and wetland habitats remain (Central Valley Joint Venture 2006; Point Reyes Bird Observatory 2005).

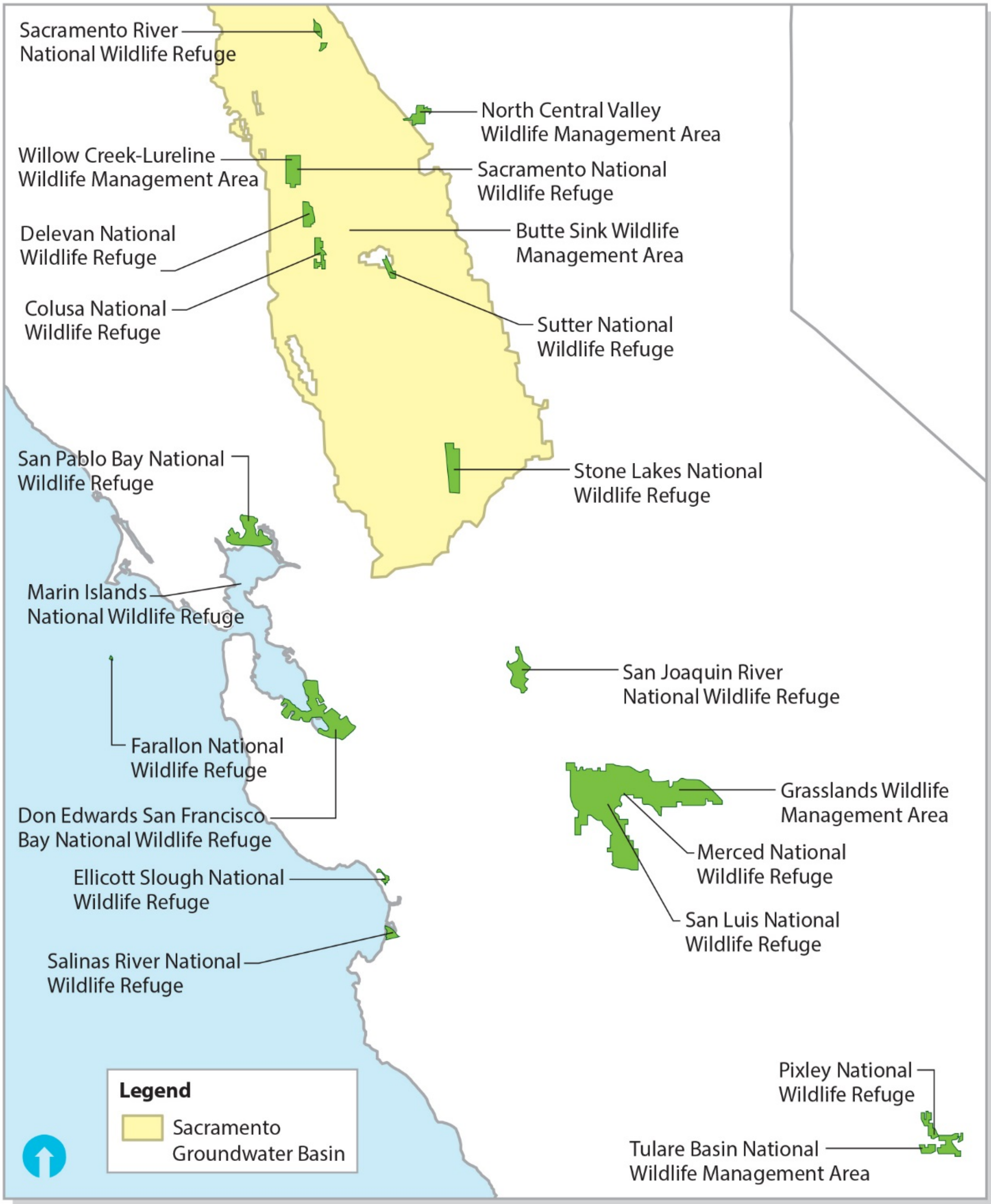

Figure 3.8-3. Federal NWRs and State Wildlife Management Areas

Tidal Perennial Aquatic Natural Community

The tidal perennial aquatic natural community is defined as deepwater aquatic (greater than ten feet deep from mean lower low water[1]), shallow aquatic (less than or equal to ten feet deep from mean lower low water), and unvegetated intertidal (tideflats) zones of estuarine bays, river channels, and sloughs.

Tidal perennial aquatic natural community occurs in open water including sloughs and channels in the Bay Delta and bays. Deep, open water areas are largely unvegetated; beds of aquatic plants occur in shallower open-water areas. Over 50 species of fish use tidal perennial aquatic habitat at some stage of their life cycle, and many spend their entire lives within this natural community. Shorebirds, wadingbirds, waterfowl, river otters (*Lutra canadensis*), and beavers (*Castor canadensis*) are some of the terrestrial species that use this natural community.

Saline Emergent Wetland Natural Community

Portions of San Francisco, San Pablo, and Suisun Bays and the Delta support emergent salt-tolerant or brackish-tolerant wetland plant species, collectively considered saline emergent wetland. This natural community is typically located within the intertidal zone or on lands such as diked wetlands that historically experienced tidal exchange (Reclamation and Department of Water Resources [DWR] 2004). Cordgrass (*Spartina* sp.), pickleweed (*Salicornia* sp.), bulrush (*Schoenoplectus* spp.), saltgrass *(Distichlis spicata*), arrowgrass (*Triglochin* sp.), seablite (*Suaeda* sp.), hairgrass (*Deschampsia* sp.), cattails (*Typha* spp.), common reed (*Phragmites australis*), and algae are common dominant plant species in this natural community.

Over 25 species of birds and mammals have been documented in saline emergent wetlands (CALFED 2000a). Over 220 species of birds, 45 species of mammals, 16 species of amphibians and reptiles, and over 40 fish species inhabit the Suisun Marsh environs (CDFG, USFWS, Reclamation 2011). Herons, egrets, ducks, hawks, and rodents are representative wildlife that occur in saline emergent wetlands.

Tidal Fresh Emergent Wetland Natural Community

The tidal fresh emergent wetland natural community includes portions of the intertidal zones of the Delta that support emergent wetland plant species that are not tolerant of saline or brackish conditions. Tidal fresh emergent wetlands and brackish-water emergent marsh natural communities occur on in-stream islands and along mostly unleveed, tidally influenced waterways. Tidal emergent marsh provides habitat for many special-status species. The dominant vegetation in the tidal freshwater emergent natural community includes California bulrush (*Schoenoplectus californicus*), river bulrush (*Bolboschoenus*

[1] Mean lower low water is the average height of the lowest tide recorded at a tide station each day during the recording period.

fluviatilis), big bulrush (*S. mucronatus*), tules (*Schoenoplectus acutus* var. *occidentalis*), cattails, and common reed.

Freshwater emergent wetlands are among the most productive wildlife habitats in California. They provide food, cover, and water for more than 160 species of birds as well as numerous mammals, reptiles, and amphibians (CDFG 2008). Over 50 species of birds, mammals, reptiles, and amphibians use freshwater emergent wetlands in the Delta (CALFED 2000a).

Non-tidal Fresh Emergent Wetland Natural Community

Non-tidal fresh emergent wetlands are scattered along the Sacramento River, typically in areas with slow-moving backwaters. Substantial portions of this natural community occur at the Colusa, Sutter, and Tisdale Bypasses, the Butte Sink, and at the Fremont Weir. Non-tidal fresh emergent wetland also occurs on the landward side of levees in the Delta, often in constructed waterways and ponds within agricultural lands. This natural community often occurs where soils are inundated or saturated for all or most of the growing season, such as around backwater areas.

Non-tidal fresh emergent wetland consists of permanent wetlands comprised of vegetation that is not tolerant of salt or brackish water, such as meadows (Barbour et al. 2007). These areas may be natural or managed. The dominant vegetation for this natural community includes thingrass (*Agrostis pallens*), spikerush (*Eleocharis* sp.), big leaf sedge (*Carex amplifolia*), bulrush, redroot nutgrass (*Cyperus erythrorhizos*), tules, cattails, common reed, and water grass (*Echinochloa oryzoides*).

Many wildlife species depend on non-tidal fresh emergent wetland for the entirety of their life cycles. In addition this natural community is seasonally important to migratory species. Over 50 species of birds, mammals, reptiles, and amphibians use this natural community in the Delta (CALFED 2000a). Examples of amphibians that occur within this natural community type include bullfrogs (*Rana catesbeiana*), western toads (*Bufo boreas*), and Pacific tree frogs (*Pseudacris regilla*). Birds typically found in non-tidal fresh emergent wetlands include herons, egrets, bitterns, mergansers, wood ducks (*Aix sponsa*), and yellow warblers (*Dendroica petechia*) (CDFG 2008).

Natural Seasonal Wetland Natural Community

The natural seasonal wetland natural community can be found scattered along the Sacramento and American Rivers, typically in areas with slow-moving backwaters. Substantial portions of these natural communities occur at the Colusa, Sutter, and Tisdale Bypasses, the Butte Sink, and at the Fremont Weir. Seasonal wetlands, including vernal pools, are interspersed with other natural communities throughout Merced County.

Natural seasonal wetlands encompass non-managed systems with natural hydrologic connections. Typically, ponded water or saturated soils are present for an extended period of time in these natural communities, supporting obligate or facultative herbaceous wetland species (Reclamation and DWR 2004). Dominant vegetation in this natural community type includes big leaf sedge, bulrush, and redroot nutgrass.

Shorebirds and waterfowl such as killdeer (*Charadrius vociferus*), western sandpiper (*Calidris mauri*), greater yellow-legs (*Tringa melanoleuca*), American coot (*Fulica americana*), American widgeon (*Anas americana*), gadwall (*Anas strepera*), mallard (*Anas platyrhynchos*), canvasback (*Aythya valisineria*), and common moorhen (*Gallinula chloropus*) utilize natural seasonal wetlands. These birds prey extensively on invertebrates in the wetlands. This natural community also supports large mammals as well as several species of reptiles and amphibians. Many special-status wildlife species are associated with natural seasonal wetlands, including vernal pool species, which have substantially declined due to impacts of various land practices (e.g., development, invasion of non-native species, flood control activities restricting water movement, and lowered groundwater levels (Barbour et al. 2007). Special-status species are discussed in greater detail in Section 3.8.1.3.3.

Managed Seasonal Wetland Natural Community

The managed seasonal wetland natural community occurs west of the Sacramento Deep Water Ship Channel, on the west side of the Sacramento River, between Willows and Dunnigan along the Colusa Basin Drain. Substantial portions of this natural community also occur at the Colusa, Sutter (including the Sutter Bypass Wildlife Area), Tisdale, and Yolo (including the Yolo Bypass Wildlife Area) Bypasses, at the Fremont Weir, and as a part of the Sacramento NWR Complex (six refuges totaling 38,486 acres). Privately managed wetlands occur in the Suisun Bay area, with water supplies provided by landowners' riparian or appropriative rights distributed by diversion from Delta channels and tributaries. Managed seasonal wetland natural communities on the east side of the Sacramento River generally occur along Butte Creek (Upper Butte Basin Wildlife Area) and along Angel Slough north of Butte City (Llano Seco Rancho Wildlife Area).

Managed seasonal wetland includes wetland areas that are flooded and drained by land managers in order to enhance habitat for wildlife species. Wetlands dominated by native or non-native herbaceous plants, as well as associated ditches and drains, are encompassed by this natural community type, excluding farmed croplands (California Waterfowl Association 2011).

The dominant vegetation in managed seasonal wetlands is comparable to that found in natural seasonal wetlands. Managed seasonal wetland natural communities are often managed for waterfowl such as mallards, northern pintails (*Anas acuta*), American widgeon, and Canada goose (*Branta canadensis*) and other geese. These natural communities also support a variety of wading birds and shorebirds, such as herons, egrets, terns, and gulls. Managed seasonal wetlands are of great importance to migratory waterfowl and shorebird populations during fall, winter, and spring, when bird populations in the Delta increase dramatically (USFWS 2007, California Waterfowl Association 2011). Many special-status species also utilize this natural community (CDFG 2008).

Lacustrine Natural Community

The lacustrine natural community consist of permanent or intermittent lakes and ponds, and may also include dammed river channels and large reservoirs (Grenfell Jr. 1988a, 1988b, 1988c,1988d). Low-lying areas historically supported this natural community, and some additional areas have been created due to dam, dike and levee construction. Dead end sloughs, forebays, and flooded islands are other examples of the lacustrine natural community that can be found throughout the Delta. The lacustrine natural communities in the Seller Service Area that would be potentially impacted by the alternatives include the following reservoirs: Shasta, Oroville, New Bullards Bar, Camp Far West, Collins, Folsom, Hell Hole, French Meadows, and McClure. Unlike lakes and ponds, the reservoirs have been designed for water supply, flood control, and/or hydroelectric power production, although not all reservoirs serve all of these functions. Reservoirs are characterized by fluctuations in water surface elevation each year.

A wide variety of birds, mammals, reptiles and amphibians use the margins of reservoirs for reproduction, food, water, and cover resources. Fish-eating terns, grebes, cormorants, herons, waterfowl, beaver, river otter, and muskrat (*Ondatra zibethicus*) are some of the resident species (CALFED 2000a; CDFG 2008).

Valley/Foothill Riparian Natural Community

Valley/foothill riparian natural community generally occurs along river and stream corridors on the east side of the Sacramento Valley and is found in narrow bands within the upper reach of the San Joaquin River. Historically, the Merced River likely also supported this habitat type (Barbour et al. 2007). Riparian vegetation is also scattered throughout the Delta on islands, along levees, in backwater areas and sloughs, and in thin bands along river channels. This habitat type is associated with low-gradient reaches of non-tidal streams and rivers (generally below an elevation of 300 feet) and is comprised of the successional stages of woody vegetation within the active and historical floodplains and may be associated with gravel bars and bare cut banks, shady vegetated banks, and sheltered wetlands such as sloughs, side channels, and oxbow lakes (Sacramento River Advisory Council 2001). Trees typically associated with the valley/foothill riparian natural community include willows (*Salix* spp.), Fremont cottonwood (*Populus fremontii*), valley oak (*Quercus lobata*), and western sycamore (*Platanus racemosa*) (Barbour et al. 2007). Shaded riverine aquatic, pool, riffle, run, unvegetated channel, sloughs, backwaters, overflow channels, and flood bypasses with hydrologic connection to stream and river channels are the aquatic habitats associated with the valley/foothill riparian natural community type (Barbour et al. 2007).

In California, over 225 species of birds, mammals, reptiles, and amphibians depend on riparian habitats. Cottonwood-willow riparian areas support more breeding avian species than any other comparable broad California habitat type (Sacramento River Advisory Council 2001, Stillwater Sciences 2002). Riparian habitat supports a myriad of invertebrates, such as wood-boring larvae. Woodpeckers, warblers, flycatchers, and owls are common inhabitants of this natural community, as are wintering and breeding raptors and passerines (Reclamation and San Joaquin River Group Authority 1999). Other wildlife species that use riparian habitats include western fence lizard (*Sceloporus occidentalis*), Pacific tree frog, western toad, bullfrog, western skink (*Eumeces skiltonianus*), western whiptail (*Cnemidophorus tigris*), southern alligator lizard (*Elgaria multicarinata*), racer (*Coluber constrictor*), gopher snake (*Pituophis catenifer*), king snake (*Lampropeltis* sp.), garter snake (*Thamnophis* sp.), northern Pacific rattlesnake (*Crotalus oreganus oreganus*), opossum (*Didelphis virginiana*), black-tailed jackrabbit (*Lepus californicus*), western gray squirrel (*Sciurus griseus*), ringtail (*Bassariscus astutus*), river otter, striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), beaver, mule deer (*Odocoileus hemionus*), and a number of bat species. Riparian areas serve as significant corridors for wildlife movement (Sacramento River Advisory Council 2001).

Montane Riparian Natural Community

The montane riparian natural community occurs in the floodplain of streams and rivers at elevations above approximately 300 feet (Reclamation and DWR 2004). Within the area of analysis, montane riparian natural community is found on the Yuba River northward from the Timbuctoo Bend, just upstream of Highway 20, as well as on the segment of American River located northeast of Folsom Reservoir. Montane riparian vegetation is dominated by black cottonwood (*Populus trichocarpa*) and Fremont cottonwood (at lower altitudes), white alder (*Alnus rhombifolia*), bigleaf maple (*Acer macrophyllum*), dogwood (*Cornus* sp.), box elder (*Acer negundo*), quaking aspen (*P. tremuloides*), western azalea (*Rhododendron* sp.), water birch (*Betula occidentalis*), and buttonbush (*Cephalanthus occidentalis*). Montane riparian natural community supports a diversity of wildlife species comparable to that of the valley/foothill riparian natural community.

Grassland Natural Community

Grasslands are most prevalent at the eastern and western edges of the Central Valley. Areas downstream of Lake Oroville along the Feather River and portions of the American River (Folsom Reservoir Shoreline) also contain the grassland natural community (Barbour et al. 2007). The grassland natural community occurs in many outlying areas surrounding the Delta, as well as on islands within the Delta region (Reclamation and DWR 2004). The Delta historically supported perennial grasslands associated with wetland and riparian areas, as well as in association with vernal pools at higher elevations in drier locations. Grasslands in the Delta estuary continue to decline due to land conversion, as well as invasion by non-native annual species.

Grasslands are an upland natural community often dominated by non-native annual species including wild oats (*Avena* sp.), soft chess (*Bromus hordeaceus*), brome (*Bromus* sp.), Italian ryegrass (*Festuca perennis*), mustards (Brassicaceae), foxtail (*Alopecurus* sp.), and barley *(Hordeum* sp.). Many grassland areas within the area of analysis are in active use as rangelands. Forbs commonly observed in this natural community include filarees (*Erodium* spp.), clovers (*Trifolium* spp.), popcorn flower (*Plagiobothrys* sp.), and mullein (*Verbascum* sp.). Wildlife species of the grassland natural community include western fence lizard, garter snake, rattlesnake, black-tailed jackrabbit, California ground squirrel (*Spermophilus beecheyi*), Botta's pocket gopher (*Thomomys bottae*), harvest mouse (*Reithrodontomys megalotis*), California vole (*Microtus californicus*), badger (*Taxidea taxus*), and coyote (*Canis latrans*). Bird species include western meadowlark (*Sturnella neglecta*), turkey vulture (*Cathartes aura*), and American kestrel (*Falco sparverius*) (Barbour et al. 2007; CDFG 2008).

Inland Dune Scrub Natural Community

Inland dune scrub natural community consists of vegetated, stabilized sand dunes associated with river and estuarine systems, such as that at Antioch Dunes NWR and Brannan Island State Park. The Antioch-Oakley areas, Delta marshes, and small isolated dunes on the eastern edge of the Delta also historically supported inland dune scrub (Reclamation and DWR 2004).

This natural community is dominated by mostly sensitive species (see Appendix I), but also contains common plants such as primrose (*Camissonia* sp.), wallflower (*Erysimum* sp.), buckwheat (*Eriogonum* sp.), elegant clarkia (*Clarkia unguiculata*), California poppy (*Eschscholzia californica*), California croton (*Croton californicus*), gumplant (*Grindelia* sp.), deerweed (*Acmispon* sp.), telegraph weed (*Heterotheca grandiflora*), California matchweed (*Gutierrezia* sp.), and silver bush lupine (*Lupinus albifrons*). Common wildlife species known to occur within the inland dune scrub natural community include mink (*Mustela vison*), desert cottontail (*Sylvilagus audubonii*), beaver, muskrat, opossum, weasel (*Mustela* sp.), striped skunk, gopher (*Thomomys* sp.), gray fox (*Urocyon cinereoargenteus*), California ground squirrel, coyote, black-tailed jackrabbit, raccoon, Townsend's mole (*Scapanus townsendii*), weasel (*Mustela* sp.), red fox (*Vulpes vulpes*), California legless lizard (*Anniella pulchra*), sideblotched lizard (*Uta stansburiana*), coast horned lizard (*Phrynosoma coronatum*), San Joaquin whipsnake (*Masticophis flagellum ruddocki*), glossy snake (*Arizona elegans*), western whiptail lizard (*Cnemidophorus tigris*), and western fence lizard.

Upland Scrub Natural Communities

Upland scrub natural communities in the area of analysis include mixed chaparral, sage scrub, saltbush scrub, and valley sink scrub. Mixed chaparral natural community occurs on steep south-facing slopes along the Middle and Lower North Forks of the American River and portions of Folsom Reservoir also provide upland scrub natural community (Placer County Development Resources Agency 2011; California State Parks 2007). In Contra Costa County, the surroundings of Los Vaqueros Reservoir support Diablan sage scrub, chaparral, and remnants of valley sink scrub natural community (Contra Costa Water District [WD] 2005; East Contra Costa Habitat Conservancy 2006). Common plant species observed in these natural communities include buckbrush (*Ceanothus* spp.), manzanita (*Arctostaphylos* spp.), bitter cherry (*Prunus emarginata*), oaks, poison oak (*Toxicodendron diversilobum*), coffee berry (*Frangula* sp.), California buckeye (*Aesculus californica*), toyon (*Heteromeles arbutifolia*), sugar sumac (*Rhus ovata*), chamise (*Adenostoma fasciculatum*), California saltbush (*Atriplex californica*), sagebrush (*Artemisia* sp.), and creosote bush (*Larrea tridentata*) (Barbour et al. 2007).

Upland scrub natural communities support many common wildlife species. Spotted towhee (*Pipilo maculatus*), California quail (*Callipepla californica*), California thrasher (*Toxostoma redivivum*), and red-tailed hawk (*Buteo jamaicensis*) are frequently observed in upland scrub. Common mammals occurring within this habitat include brush rabbit (*Sylvilagus bachmani*), blacktailed jackrabbit, and mule deer (CDFG 2008).

Seasonally Flooded Agriculture Habitat

Seasonally flooded agriculture is concentrated in the Sacramento Valley portion of the area of analysis. The central Delta also supports small grains croplands. Lands that fall within this habitat require seasonal flooding for at least one week at a time for irrigation or pest control purposes, and may include grain, rice (*Oryza* sp.), and other crops. Grain crops are typically post-harvest flooded in the winter season, which provides habitat for waterfowl and other wildlife.

Rice fields provide particularly important foraging habitat for a variety of wildlife species. Many species forage on post-harvest waste grain and other food found within the fields (Pitkin 2011; Central Valley Joint Venture 2006). Small birds and rodents that consume rice waste grain are a food source for raptors that forage in the seasonally flooded fields. Duckweed (*Lemna* sp.) and other moist soil plants, which may grow in fields where water level manipulation allows their germination, can provide high-quality food for waterfowl (California Waterfowl Association 2011). Fish are often entrained in the irrigation canals that supply water to the rice fields. Crayfish are found in the canal banks and berms of the rice fields. Other invertebrates and their larvae may be found in very shallow water, particularly during an early to midseason drawdown. Invertebrates found in these areas (e.g., bloodworms) are particularly important to shorebirds (California Waterfowl Association 2011).

Rice fields also provide resting, nesting, and breeding habitat similar to that in natural wetlands. Irrigation ditches can contain wetland vegetation such as cattails, which provide cover habitat for rails, egrets, herons, bitterns, marsh wrens (*Cistothorus palustris*), sparrows, and common yellowthroats (*Geothlypis trichas*). Rice fields provide pair, brood, and nesting habitat for birds such as mallard duck, northern pintail, and terns (Central Valley Joint Venture 2006, CDFG 2008).

Upland Cropland Habitat

Upland cropland areas are found throughout the Sacramento and San Joaquin valleys, as well as adjacent to most leveed waterways. This habitat is considered to include agricultural lands that are not seasonally flooded. Sacramento Valley croplands are dominated by cereal rye (*Secale cereale*), barley (*Hordeum vulgare*), wheat (*Triticum aestivum*), milo (*Sorghum* sp.), corn (*Zea mays*), dry beans, safflower (*Carthamus tinctorius*), sunflower (*Helianthus annuus*), alfalfa (*Medicago sativa*), cotton (*Gossypium* sp.), tomatoes (*Lycopersicon* sp.), lettuce (*Lactuca sativa*), Bermuda grass (*Cynodon dactylon*), Italian ryegrass, tall fescue (*Festuca arundinacea*), almonds (*Prunus dulcis*), walnuts (*Juglans* sp.), peaches (*Prunus persica*), plums (*Prunus* sp.), and grapes (*Vitis* sp.) and other fruits and vegetables. Most of these crops are annuals, planted in the spring and harvested during summer or fall. Wheat and other dryland grains are planted in the fall and harvested in the late spring, early summer. Sugar beets (*Beta vulgaris*) can also be left over winter and harvested in the spring.

Wildlife use of upland crop areas varies throughout the growing season with crop type, level of disturbance, and available cover. Upland crop fields provide important foraging habitat for a variety of wildlife species. Many species forage on crops (waste and otherwise) and other food found within the fields, such as invertebrates. Typically, various birds and rodents consume the crops and invertebrates and serve as a food source for predators. Irrigation ditches associated with upland cropland can contain wetland vegetation such as cattails, which provide cover habitat for rails, egrets, herons, bitterns, marsh wrens, sparrows, and common yellowthroats.

3.8.1.3.2 Natural Communities and Agricultural Habitats in the Buyer Service Area

This section describes the natural communities, agricultural habitats and associated plant and wildlife species that are present in the Buyer Service Area. The Buyer Service Area includes portions of Contra Costa and Alameda Counties (Contra Costa WD, East Bay Municipal Utility District), Santa Clara County (Santa Clara Valley WD), and northern San Benito County (San Benito County WD). The Buyer Service Area also includes the area that extends south from San Joaquin County to northwestern Kings County, which contains potential buyers that are member agencies of San Luis & Delta-Mendota Water Authority.

Lacustrine Natural Community
The lacustrine natural community in the Buyer Service Area occurs within San Luis Reservoir on the western edge of the San Joaquin Valley.

Wildlife species that may be found within the lacustrine natural community in the Buyer Service Area include belted kingfisher (*Megaceryle alcyon*), Caspian tern (*Hydroprogne caspia*), ring-billed gull (*Larus delawarensis*), Clark's grebe (*Aechmophorus clarkii*), western grebe (*Aechmophorus occidentalis*), pied-billed grebe (*Podilymbus podiceps*), osprey (*Pandion haliaetus*), great egret (*Ardea alba*), spotted sandpiper (*Actitis macularius*), and killdeer.

Valley/Foothill Riparian Natural Community
This natural community occurs in the Buyer Service Area along many of the segments of the San Joaquin River from Friant Dam through the Central Valley into the Delta and is comprised primarily of mixed oak, cottonwood, and willow. Valley/foothill riparian natural community is present at San Luis Reservoir in the form of sparse mule fat and willow patches. In addition to the plant species previously mentioned in the other regions, riparian habitats south of the Delta may support Northern California black walnut, a species considered sensitive by CDFW.

Common species that may occur in this vegetation community and associated aquatic habitat within the Buyer Service Area include black phoebe (*Sayornis nigricans*), red-winged blackbird (*Agelaius phoeniceus*), Brewer's blackbird (*Euphagus cyanocephalus*), ash-throated flycatcher (*Myiarchus cinerascens*), northern rough-winged swallow (*Stelgidopteryx serripennis*), western scrub jay (*Aphelocoma californica*), black-headed grosbeak (*Pheucticus melanocephalus*), California quail, Nuttall's woodpecker (*Picoides nuttallii*), oak titmouse (*Baeolophus inornatus*), California towhee (*Pipilo crissalis*), Merriam's chipmunk (*Tamias merriami*), mule deer, coyote, black bear (*Ursus americanus*), mountain lion (*Puma concolor*), and raccoon.

Grassland Natural Community
Substantial areas of non-native grassland are present in Contra Costa, Santa Clara, and Merced Counties. This includes lands surrounding San Luis Reservoir. Non-native grasses in these locations intergrade with native species including purple needle grass (*Stipa pulchra*), beardless wild rye (*Elymus triticoides*), and onion grass (*Melica* sp.).

Killdeer, white-throated swift (*Aeronautes saxatalis*), ring-necked pheasant (*Phasianus colchicus*), American crow (*Corvus brachyrhynchos*), rufous-crown sparrow (*Aimophila ruficeps*), rock wren (*Salpinctes obsoletus*), western meadowlark, red-tailed hawk, American kestrel, common loon (*Gavia immer*), Barrow's goldeneye (*Bucephala islandica*), savannah sparrow (*Passerculus sandwichensis*), California vole, black-tailed jackrabbit, California ground squirrel, coyote, foxes, badgers, skunk, western rattlesnake, southern alligator lizard, two-striped garter snake (*Thamnophis hammondii*), California mountain kingsnake (*Lampropeltis zonata*), and western fence lizard are some of the species that would commonly be observed within grasslands in the Buyer Service Area.

Oak Woodland Natural Community

Scattered blue oak (*Quercus douglasii*) woodlands occur on the western shore of the San Luis Reservoir. Remnant patches are often found at the edges of agricultural lands that were converted from woodland to cultivation, and occur in larger stands leading up to the Sierra Nevada foothills. The oak woodland natural community varies with respect to the mix of hardwoods, conifers or shrubs present, and also demonstrates a range of canopy densities. Valley oak, blue oak, interior live oak (*Quercus wislizeni*), coast live oak (*Q. agrifolia*), and foothill pine (*Pinus sabiniana*) are common dominant species (Barbour et al. 2007).

Acorn woodpecker (*Melanerpes formicivorus*), northern flicker (*Colaptes auratus*), wild turkey (*Meleagris gallopavo*), oak titmouse, black-tailed jackrabbit, American crow, California quail, western fence lizard, coyote, mule deer, western bluebird (*Sialia mexicana*), white-breasted nuthatch (*Sitta carolinensis*), and American kestrel are commonly observed wildlife species in oak woodland within the Buyer Service Area (CDFG 2008).

Upland Cropland Habitat

Upland cropland areas are found throughout the San Joaquin Valley. Major crops in this area include alfalfa, almonds, corn, cotton, grapes, rice, and tomatoes (County of Fresno Department of Agriculture 2010; Merced County Department of Agriculture 2010; San Joaquin County 2010). These crops support common species, and may be important to common and sensitive wildlife, especially during irrigation periods. For example, cotton is known to harbor mourning doves (*Zenaida macroura*) and house mice (*Mus musculus*) and may also support species such as killdeer, American pipit (*Anthus rubescens*), and horned lark (*Eremophila alpestris*) (CDFG 2008). San Joaquin kit fox (*Vulpes macrotis mutica*), a federally endangered species, has been known to utilize croplands for forage as well (USFWS 1998). Ditches associated with intensive cropland are often chemically treated and therefore are less likely to serve as suitable habitat for wildlife species.

3.8.1.3.3 Special-Status Plant and Wildlife Species

Wildlife and plant species addressed in this section have been selected through the following process. First, all species identified in database records searches went through an evaluation to identify what are considered “special-status species” in relationship to the federal ESA and CESA compliance. For the purpose of this assessment, “special-status species” are those species that meet one or more of the following criteria:

- Species that are listed or proposed for listing as threatened or endangered under ESA (50 Code of Federal Regulations [CFR] 17.11

[listed animals]; 50 CFR 17.12 [listed plants]; and various notices in the Federal Register [FR]).

- Species that are candidates for possible future listing as threatened or endangered under ESA (75 FR 69222, November 10, 2010).
- Species that are listed or proposed for listing by the State of California as threatened or endangered under CESA (14 California Code of Regulations [CCR] 670.5).
- Species that meet the definitions of rare or endangered under the California Environmental Quality Act (CEQA) (State CEQA Guidelines Section 15380).
- Plants listed as rare under the CNPPA (CDFW Commission 1900 et seq.).
- Plants listed by California Native Plant Society (CNPS) as plants about which more information is needed to determine their status and plants of limited distribution, which may be included as special-status species on the basis of local significance or recent biological information.
- Animals listed as California Species of Special Concern (SSC) to the CDFW (Shuford and Gardali 2008 [birds]; Williams 1986 [mammals]; and Jennings and Hayes 1994 [amphibians and reptiles]).
- Animals that are fully protected in California (CDFW Commission 3511 [birds], 4700 [mammals], 5050 [amphibians and reptiles], and 5515 [fish]).
- Birds of Conservation Concern (USWFS 2008).

The selection process resulted in an initial list of 257 special-status plant and wildlife species. Tables I-1 and I-2 in Appendix I provide information on all 257 special-status species known from, or with potential to occur in the area of analysis, including common and scientific name, listing status (Federal, State, Global Rank, and/or State Rank), suitable habitat characteristics, distribution in California, and potential for occurrence in the area of analysis.

Not all of these species have the potential to be affected by long-term water transfers. Many of the 257 species are not expected to occur in the natural communities and agricultural habitats that would be affected by the action alternatives (e.g., riverine, riparian, natural and managed wetlands, rice fields, and irrigation/drainage channels), or impacts to those species would be avoided because of the environmental commitments that are incorporated in the alternatives. Consequently, the action alternatives have the potential to affect only a limited number of these special-status species.

For each plant and wildlife species, the likelihood that water transfers would affect the species is assigned a category in the last column and the rationale for that categorization is provided. Those species in Tables I-1 and I-2 (Appendix I) which are known to occur in the area of analysis, but would not be affected by the action alternatives are not addressed further in this analysis. Based on these considerations, the initial list of species potentially present was reduced to 14 species that could be affected. These 14 species are listed in Table 3.8-1 along with HCP/NCCPs that are adopted or in preparation which cover the species and may have additional requirements for species conservation within their plan areas. Special-status plants and terrestrial wildlife species potentially affected by the action alternatives are discussed below. Potentially affected special-status fish species are discussed separately in Section 3.7.

Table 3.8-1. Potentially Affected Special-Status Plant and Wildlife Species in the Area of Analysis

	Status	Species	Status[1]	Conservation Plan Coverage[2]										
				BRCP	BDCP	ECCC HCP/NCCP	NB HCP	PCCP	SJMSCP	SCV HCP/NCCP	SMSHCP	SSHCP	YNHP	YS NCCP/HCP
Plants	California Rare Plant Rank	Ahart's dwarf rush	RPR 1B.2	X				X				X		X
		Sanford's arrowhead	RPR 1B.2						X					
		Red Bluff dwarf rush	RPR 1B.1	X				X	X					
		Saline clover	RPR 1B.2											
Wildlife	State or Federally Listed	Giant garter snake	FT, ST	X	X	X	X	X	X		X	X	X	X
		San Joaquin kit fox	FE, ST		X	X			X	X				
		Greater sandhill crane	ST, FP	X	X				X			X		X
	Species of Special Concern	Black tern	SSC/WL											
		Long-billed curlew	SSC						X					
		Pacific pond turtle	SSC		X	X	X		X	X		X	X	X
		Purple martin	SSC										X	

	Status	Species	Status[1]	Conservation Plan Coverage[2]										
				BRCP	BDCP	ECCC HCP/NCCP	NB HCP	PCCP	SJMSCP	SCV HCP/NCCP	SMSHCP	SSHCP	YNHP	YS NCCP/HCP
		Tricolored blackbird	SSC	X	X	X	X	X	X	X	X	X	X	X
		White-faced ibis	WL				X		X					
		Yellow-headed blackbird	SSC											

[1] Status:
FE-federally listed endangered
FP-fully protected under California Fish and Game Code
FT-federally listed threatened
RPR 1B.1-California Rare Plant Rank 1B.1 = Plants rare, threatened, or endangered in California and elsewhere. Seriously threatened in California (over 80 percent of occurrences threatened / high degree and immediacy of threat)
RPR 1B.2-California Rare Plant Rank 1B.1 = Plants rare, threatened, or endangered in California and elsewhere. Fairly threatened in California (20 to 80 percent occurrences threatened / moderate degree and immediacy of threat)
ST-state-listed threatened
SSC-California Species of Special Concern
WL- species that were previously designated as SSC but no longer merit SSC status or which do not meet SSC criteria but for which there is concern and a need for additional information to clarify status.
[2] Conservation plan
BDCP – Bay-Delta Conservation Plan (under development)
BRCP – Butte Regional Conservation Plan (under development)
ECCCHCP/NCCP – East Contra Costa County HCP/NCCP (adopted)
NBHCP – Natomas Basin HCP (adopted)
PCCP – Placer County Conservation Plan (under development)
SCVHCP/NCCP – Santa Clara Valley HCP/NCCP (adopted)
SJMSCP – San Joaquin County Multi-Species Habitat Conservation and Open Space Plan (adopted)
SMSHCP-Solano Multispecies HCP (under development)
SSHCP – South Sacramento HCP (under development)
YNHP – Yolo Natural Heritage Program (under development)
YSNCCP/HCP – Yuba-Sutter NCCP/HCP (under development)

Ahart’s Dwarf Rush
Ahart’s dwarf rush (*Juncus leiospermus* var. *ahartii*) is a California Rare Plant Rank (RPR) 1B.2 species known from Butte, Calaveras, Placer, Sacramento, Tehama, and Yuba counties, and previous observations exist within the Seller Service Area. This species has generally been documented at mesic locations within valley and foothill grassland between 30 and 229 meters above mean sea level (amsl). It may also occur in disturbed areas including agricultural fields and locations with gopher digging activity. Ahart’s dwarf rush typically blooms between March and May. Development is the major threat to this species.

Sanford’s Arrowhead
Sanford’s arrowhead (*Sagittaria sanfordii*) is a California RPR 1B.2 perennial rhizomatous herb found in the Central Valley in freshwater marsh, shallow stream areas, and ditches between zero and 650 meters amsl. Previous observations exist within the Seller Service Area. Sanford’s arrowhead typically blooms between May and August.

Threats to Sanford’s arrowhead include grazing, development, recreational activities, non-native plants, road widening, and alteration of channels.

Red Bluff Dwarf Rush
Red Bluff dwarf rush (*Juncus leiospermus* var. *leiospermus*) is a California RPR 1B.1 species that occurs within Butte, Placer, Shasta, and Tehama counties. Red Bluff dwarf rush is known from vernally mesic sites in chaparral, valley and foothill grassland, cismontane woodlands, and vernal pools from 30 to 1,020 meters amsl. It may also be found in intermittent drainages and areas of pocket gopher and ground squirrel activity (Butte County Association of Governments 2011). The typical bloom period for Red Bluff dwarf rush is March through May. Suitable habitat for this species occurs within the area of analysis and occurrences have been documented within the Seller Service Area.

Some of the recognized threats to Red Bluff dwarf rush include: development, grazing, vehicles, industrial forestry, and agricultural activities.

Saline Clover
Saline clover (*Trifolium hydrophilum*) is a California RPR 1B.2 species known from California’s central coast and Bay Area. Previous observations exist within both the Buyer and Seller Service Areas. This species has generally been documented in marshes and swamps, valley and foothill grassland, and vernal pool habitats from zero to 300 meters amsl. It is often found in mesic or alkaline areas. Saline clover blooms from April through June.

The status of many saline clover populations is not known. Development, trampling, road construction, and vehicles are considered some of the major threats to the species.

Giant Garter Snake

Giant garter snake (*Thamnophis gigas*) is listed as threatened under both the ESA and CESA (58 FR 54053). A Draft Recovery Plan for giant garter snake was completed in 1999, but no critical habitat has been designated for this species (USFWS 1999). One of the largest garter snakes, the giant garter snake reaches up to 64 inches in length, with females generally slightly longer and heavier than males (Hansen 1980).

Giant garter snake historically occupied wetlands throughout the Sacramento and San Joaquin Valleys, as far north as Chico, and as far south as Buena Vista Lake, near Bakersfield (Hansen and Brode 1980). The current known distribution of giant garter snakes is patchy, extending from near Chico, Butte County, south to Mendota Wildlife Area, Fresno County. Giant garter snakes are not known from the northern portion of the San Joaquin Valley north to the eastern fringe of the Sacramento-San Joaquin River Delta, where the floodplain of the San Joaquin River is limited to a relatively narrow trough (Hansen and Brode 1980, Federal Register 58:54053–-54066).

The giant garter snake inhabits marshes, sloughs, ponds, small lakes, low gradient streams, other waterways and agricultural wetlands such as irrigation and drainage canals and rice fields, and the adjacent uplands. Essential habitat components consist of (1) adequate water during the snake's active period (i.e., early spring through mid-fall) to provide a prey base and cover; (2) emergent, herbaceous wetland vegetation, such as cattails and bulrushes, for escape cover and foraging habitat; (3) upland habitat for basking, cover, and retreat sites; and (4) higher elevation uplands for cover and refuge from flood waters (USFWS 1999). Another key requirement of the giant garter snake includes maintenance of connectivity between habitats. giant garter snake rely on canals and ditches as movement corridors. These corridors provide important habitat, and are used during daily movement within a home range. Recent work by the U.S. Geological Survey (Halstead et al. 2010) suggests that giant garter snake primarily occurs in areas with dense networks of canals among rice agriculture and wetlands. Giant garter snake are less likely to be found in areas with high stream density. More recent work suggests that giant garter snake are most likely to occur within areas of historic tule marsh, and the likelihood of encountering them drops substantially with distance from these areas of historic habitat (Halstead et al. 2014).

Giant garter snake typically forage and shelter within cattail, bulrush, or other emergent herbaceous wetland vegetation, using grassy banks and openings at the water’s edge for basking. Rice fields in particular may be important nursery and feeding habitat, providing prey that are absent from other permanent aquatic areas (USFWS 1999). Wintering habitat consists of higher elevation upland areas with vegetation, burrows or other underground refugia (Hansen 1988). Studies of marked snakes indicated that individuals typically move about 0.25 to 0.5 miles per day. Individuals have been documented to move five to eight miles over the course of a few days. Giant garter snake home range size is highly variable, with an average size of about 0.1 square miles (USFWS 2010). During the winter months, when the snakes are inactive, small mammal burrows and other soil or rock crevices may be used for hibernation, and also provide refuge from hot conditions during the snake's active season (Hansen and Brode 1993; USFWS 1999). Giant garter snake have been documented using burrows as much as 165 feet from marsh edges to shelter from heat during the active season, and up to 820 feet away during the winter (Wylie et al. 2000).

Numerous observations of giant garter snake have been documented within the Sacramento Valley portion of the Seller Service Area. Records also exist within the Buyer Service Area, including near Mendota, in the Central Valley (CNDDB 2014; Halstead et al. 2014).

San Joaquin Kit Fox

San Joaquin kit fox is federally-listed as endangered under the ESA (USFWS 1967) and state-listed as threatened under CESA (Swick 1971). No critical habitat has yet been designated for the species.

San Joaquin kit foxes occur in some areas of suitable habitat on the floor of the San Joaquin Valley and in the surrounding foothills of the Coast Ranges, Sierra Nevada, and Tehachapi Mountains from Kern County north to Contra Costa, Alameda, and San Joaquin Counties (USFWS 1998). Since 1998, the population structure has become more fragmented, with some resident satellite populations having been locally extirpated, and frequented by dispersing kit foxes rather than resident animals (USFWS 2010:15). The largest extant populations of kit fox are in Kern County (Elk Hills and Buena Vista Valley) and San Luis Obispo County in the Carrizo Plain Natural Area (USFWS 1998). Natural habitats for San Joaquin kit fox include alkali sink, alkali flat, and grasslands. San Joaquin kit foxes may use agricultural lands such as row crops, orchards, and vineyards to a limited extent but kit foxes are unable to occupy farmland on a long-term basis (USFWS 2010:19–21.) San Joaquin kit foxes usually prefer areas with loose-textured soils suitable for den excavation (Orloff et al. 1986:62) but are found on virtually every soil type (USFWS 1998:129). Where soils make digging difficult, kit foxes may enlarge or modify burrows built by other animals, particularly those of California ground squirrels (Orloff et al. 1986:63; USFWS 1998:127). Structures such as culverts, abandoned pipelines, and well casings may also be used as den sites (USFWS 1998:127).

San Joaquin kit fox are active throughout the year, and are generally active during twilight. The kit fox's home range may vary from less than 2.6 square kilometers (km^2) to 31 km^2 (Morrell 1972; Zoellick et al. 2002, Spiegel and Bradbury 1992; White and Ralls 1993). The breeding season begins during September and October when adult females begin to clean and enlarge natal or pupping dens. Mating and conception occur between late December and March, and litters of two to six pups are born between late February and late March (USFWS 1998:126).

Growth of agricultural and urban areas is cited as the primarily threat to San Joaquin kitfox. Land conversion displaces populations, may reduce preferred prey abundance, prohibits movement throughout the landscape, and may also result in direct or indirect mortality of kit foxes (Constable et al. 2009; USFWS 1998). Intensive grazing, use of pesticides and rodenticides, and predation by coyote and red fox are other notable stressors on San Joaquin kit fox populations (Bell et al. 1994; USFWS 1998).

Greater Sandhill Crane

The Central Valley population of greater sandhill crane (*Grus canadensis tabida)* is a state-listed threatened and fully protected species. This species uses a variety of habitats including non-tidal fresh emergent wetland, natural seasonal wetland, and managed seasonal wetland. They will also utilize upland habitats such as grassland and upland crop areas. As a result of the loss of a large proportion of wetlands in the Sacramento Valley, greater sandhill cranes are increasingly associated with managed seasonal wetland environments and seasonally flooded agriculture, particularly rice fields.

Formerly a common breeder in California, the species now breeds only in Siskiyou, Modoc, Lassen, Sierra Valley, Plumas and Sierra counties (Zeiner et al. 1988); during the summer, the birds are found near wet meadows, shallow lacustrine and fresh emergent wetland habitats. Greater sandhill crane is known to winter in the Sacramento and San Joaquin valleys, within the Butte Sink (from Chico in the north to the Sutter Buttes in the south and from Sacramento River in the west to Highway 99 in the east), where birds forage in annual and perennial grassland habitats, moist croplands with rice and corn stubble, and emergent wetlands. Cranes migrate to the Central Valley between September and November, and depart between March and May (Reclamation and DWR 2004); however the California breeding population winters chiefly in the Central Valley (Zeiner et al. 1988). Sandhill cranes mate for life and have high site fidelity; the pair will return to the same territory each year (USFWS 1987).

Food, cover, and nesting requirements for greater sandhill cranes are closely associated with water in the form of some type of wetland. The loss and degradation to riverine and wetland ecosystems is an important threat to sandhill crane populations. For the migratory populations, this is of greatest concern in foraging and wintering areas (USGS 2006). Additional threats include development pressures and human disturbance when nesting.

Black Tern

The black tern (*Chlidonias niger*) is designated as a California SCS. Within California, black terns typically occur as migrants and summer residents between mid-April and mid-October (Shuford and Gardali 2008) where they breed in flooded rice fields and freshwater marshes, including lakes and ponds with marsh edges (Shuford et al. 2001). In the Central Valley, black terns nest on small dirt mound-islands in rice fields (Shuford et al. 2001) and are known to build nests on masses of dead floating vegetation, or on mounds within marsh habitat (Shuford and Gardali 2008). The species may also nest on dikes or levees (Reclamation and DWR 2004). The remainder of the year, the terns migrate to bays, rivers, and pelagic waters (Reclamation and DWR 2004).

The black tern was once a common visitor to emergent wetlands of the Central Valley, but its numbers have declined due to habitat losses, especially the widespread loss of freshwater marshes. In California, the terns have been known to breed in the Central Valley, Klamath Basin, and the Modoc Plateau (Shuford et al. 2001). Due to lack of suitable freshwater habitat in most NWRs and State Wildlife Areas during the summer, black tern breeding sites in the Sacramento Valley are primarily flooded rice fields (Technology Associates 2009a). In 2001, Shuford et al. reported that rice fields supported 90 percent of the Central Valley breeding population. Surveys in the late 1990s found breeding black terns to be widespread in Sacramento Valley rice fields, with the largest concentration in the northern Colusa Basin. This species only has two known regular breeding locations in the San Joaquin Valley, in rice fields in Merced and Fresno counties (Shuford and Gardali 2008).

Black terns are considered to be an area-dependent species with specific breeding and foraging requirements. Because black terns have a limited distribution and are dependent upon flooded rice fields for breeding, conversion of rice fields to other crops, or to dry land rice, pose a threat to the migrant population (Technology Associates 2009a). Additional threats to the species include water management of rice fields (i.e. rapid lowering of water exposes nests to predators) and effects from exposure to pesticides (Technology Associates 2009a).

Pacific Pond Turtle

The Pacific pond turtle (*Actinemys marmorata*) is the only native box turtle widely distributed in the western United States, occurring from Baja California north into the State of Washington. Historically, the turtle once inhabited the vast permanent and seasonal wetlands of the Central Valley. Pacific pond turtle is considered a SSC by CDFW and its status is currently under review by USFWS.

Pacific pond turtle is associated with nontidal fresh emergent wetland, managed seasonal wetland, valley/foothill riparian, and lacustrine habitats. They may also utilize upland habitats including grassland and scrub (Holland 1994). Its preferred habitat is slow moving or quiet water, with emergent vegetation and undercuts for refuge. Protected, grassy uplands with a clay/silt soil are the preferred nesting sites. Irrigation ditches, drains, and rice fields provide suitable habitat for Pacific pond turtle foraging, with basking areas on adjacent levees. The turtles are active during the spring, summer, and fall when rice preparation, growing, and harvesting are performed, respectively.

The draining of wetlands for agriculture and urban development has greatly reduced this species’ habitat. Other causes of population decline include increased predation and collecting by humans. Poor reproductive success due to predation and nest destruction also hamper the turtle's recovery. Reduced vegetative cover, such as in heavily maintained ditches, may increase predation on females and juveniles moving between aquatic habitats and nest sites between May and October (Holland 1988).

The CNDDB reports several occurrences spread throughout the area of analysis in Sacramento, San Joaquin, and Contra Costa counties.

Purple Martin

Purple martin (*Progne subis*) is a passerine bird species and is considered by the CDFW to be a SSC. Purple martin occur in eastern North America, west to the Pacific Coast and south into Central Mexico. In the arid west, its distribution is concentrated in the southern Rocky Mountains and the Sonoran Desert (Shuford and Gardali 2008). In California, purple martins are summer residents, typically observed between mid-March and mid-August (Shuford and Gardali 2008). They have been documented in forest and woodland areas, generally at lower elevations, and the most robust populations are known from conifer forests on the north coast and the foothills of the Sierra Nevada Mountains. Only a small breeding population occurs in the Central Valley.

Purple martins prefer breeding areas with numerous nesting cavities and locally sparse canopy cover. They require access to open foraging areas that support their insect prey, particularly wetlands or other water bodies. Purple martins may nest as single pairs or in larger groups.

Non-native European starlings (*Sturnus vulgaris*) compete with purple martins for nest sites. Additional threats include loss of suitable nesting sites due to habitat conversion by human activity or events such as stand-replacing fires (Shuford and Gardali 2008).

Long-Billed Curlew

The long-billed curlew (*Numenius americanus*) is designated as a CDFW Watch List species and a Bird of Conservation Concern by the USFWS (USFWS 2008). The long-billed curlew is a migratory bird that breeds east of the Cascade Mountains, including northeastern California, through the western Great Plains (Zeiner et al. 1988). It winters from Central and Imperial Valleys, coastal California to southwestern United States. and is found as a winter migrant in the San Joaquin Valley.

Long-billed curlews are found in grasslands, meadows, pastures, and fallow agricultural fields, as well as tidal flats, beaches, and salt marshes in winter. The most highly preferred habitat is natural marshes, grassland, irrigated pasture, and alfalfa fields (San Joaquin County Multi-Species Habitat Conservation and Open Space Plan 2000) and preferred winter habitat includes large coastal estuaries, upland herbaceous areas, and croplands (Zeiner et al. 1988). A small number of nonbreeders remain in coastal habitat in summer and a larger number of birds remain in some years in the Central Valley (Zeiner et al. 1988). In California, long-billed curlew nest on elevated interior grasslands and wet meadows, usually adjacent to bodies of water, such as lakes or marshes (Zeiner et al. 1988).

The conversion of natural lands to agriculture has greatly diminished available forage for wintering birds (Zeiner et al. 1988); wintering habitat in California wetlands has declined by 90 percent (Dugger and Dugger 2002). Continuing threats to long-billed curlews include habitat loss owing both to development and projected effects of climate change and effects of pesticide spraying indirectly reducing the birds' prey items (Dugger and Dugger 2002). The species has previously been proposed as a candidate for Federal Endangered status.

Tricolored Blackbird

The tricolored blackbird (*Agelaius tricolor*) is a medium-sized passerine bird, which is very similar in appearance to red-winged blackbird (*Agelaius phoeniceus*). It is designated by the CDFW as an SSC and is designated as a Bird of Conservation Concern by the USFWS (USFWS 2008). The species forms the largest colonies of any North American passerine bird, often with tens of thousands of breeding pairs (Beedy and Hamilton 1999).

Nearly all tricolored blackbird populations occur within California. While no major changes in their overall geographic distribution have been noted, large gaps in the occupied range now exist due to loss of habitat (e.g., Kings, San Joaquin, Riverside, and San Bernardino counties) and populations have significantly declined (Kyle and Kelsey 2011). Most individuals are year-round residents in the Central Valley, although some birds overwinter elsewhere, including in the Sacramento-San Joaquin Delta (Beedy 2008).

This species typically breeds in areas with access to open water and protected nesting sites, often including flooded, thorny, or spiny vegetation. Historically, tricolored blackbirds nested in freshwater marsh habitat in vegetation including tules, cattails, willows, thistles or nettles. Nests may also be concentrated in grain fields, giant reed (*Arundo donax*), and riparian scrubland and forest areas (DeHaven et al. 1975; Kyle and Kelsey 2011). Birds may forage as much as eight miles from nest sites (Beedy and Hamilton 1999) in areas that support insect prey. Pasturelands, alfalfa and rice crops, dairies, grassland, and shrubland habitats may be used in lieu of natural flooded habitat (Beedy and Hamilton 1999).

Tricolored blackbird colonies are sensitive to habitat loss, predation, and human activities. When water is withdrawn from marshes, nests become more susceptible to predation, such as by coyotes (*Canis latrans*) (Technology Associates 2009b). Chemical application in agricultural areas may reduce survivorship and disturbance associated with urbanization, including noise, pet and human presence, may result in nest abandonment (Beedy and Hamilton 1999).

White-Faced Ibis

White-faced ibis (*Plegadis chihi*) is considered a Species of Concern by USFWS and an SCC by CDFW. Historically, the ibis was a locally common summer resident in California and its breeding distribution was centered in the San Joaquin Valley. Currently, the species occurs in California as an uncommon, localized breeder and summer resident. It is a mobile species and shifts in range usually coincide with changing water levels and water quality. The ibis is found in shallow, emergent wetlands with high quality fresh and brackish water. Muddy grounds of wet meadows, irrigated or flooded pastures, flooded pond edges and shallow lacustrine water, and wet cropland such as rice fields are suitable foraging habitat. Ibises typically prefer large emergent wetlands with islands of dense emergent vegetation for nesting (CDFG 2008).

White-faced ibis is a colonial breeder and builds shallow nests in thick emergent vegetation such as tule and cattail, in shrubs, or in low trees (Ryder and Manry 1994). It breeds in scattered locations in the San Joaquin Valley, and has established breeding colonies in the Sacramento Valley. Significant breeding colonies have been reported in the Mendota Wildlife Area and the Colusa NWR (Natomas Basin HCP 2003). The species winters primarily in the San Joaquin and Imperial Valleys with a concentrated wintering population near Los Banos in Merced County (Zeiner et al. 1990a).

Populations of white-faced ibis have declined in California and stopped breeding regularly as a result of loss or deterioration of extensive marshes in the Central Valley, which are required for nesting. Elsewhere in its range, pesticides have caused decline in numbers (Zenier 1988).

Yellow-Headed Blackbird

The yellow-headed blackbird (*Xanthocephalus xanthocephalus*) is a small to medium-sized passerine which is a California SSC. This species winters in the western United States; in California it has been documented east of the Cascade Range and Sierra Nevada Mountains, within the Imperial, Colorado River, and Central Valleys, as well as localized areas of the Coast Range west of the Central Valley (Twedt *et al*. 1991). It is fairly common in winter in the Imperial Valley, but its distribution is concentrated mainly in the western portion of the valley (CDFG 2008).

Yellow-headed blackbirds forage along emergent wetland and moist, open areas near croplands and grasslands, in addition to muddy shores of lacustrine habitat (CDFG 2008). They mainly feed on seeds and cultivated grains, although aquatic insects may make up a large part of their diet during the breeding season (Twedt et al. 1991; Twedt and Crawford 1995). Rice fields near freshwater marshes often support breeding colonies (Twedt and Crawford 1995).

In California, yellow-headed blackbirds are found year-round, but breed and winter in different locations and habitat. Water levels are a very important factor in reproduction success. This species breeds in fresh emergent wetland with dense vegetation (e.g. cattails and tules) and deep water, generally along lake and pond borders (Picman et al. 1993). They only breed where large insects are abundant and nesting is timed with maximum emergence of aquatic insect prey (Zeiner et al. 1990).

Throughout its range, the primary threat to the yellow-headed blackbird is the conversion of wetlands to croplands and urban land uses. The species' population has declined in California as a result of habitat loss and competitive exclusion from great-tailed grackles (*Quiscalus mexicanus*), as well as other mammalian and avian predators. Agricultural pesticides and herbicides have also negatively affected the species (Technology Associates 2009b).

3.8.1.3.4 Migratory Birds

Managed wetlands and flooded agriculture within the Seller Service Area provide critical nesting and wintering habitat for millions of migratory birds, particularly waterfowl, that migrate to the Sacramento Valley. These open water habitats and associated vegetation provide food, cover, and resting sites for migrating birds. The Sacramento Valley is considered the most important wintering site for migratory birds on the Pacific Flyway, supporting nearly 50 percent of wintering shorebirds and over 60 percent of wintering waterfowl using the Pacific Flyway. Flooded agriculture within the Sacramento Valley accounts for approximately 57 percent of food resources available to waterfowl (Petrie and Petrick 2010). Although these species are not considered special-status wildlife species, they are protected under the Migratory Bird Treaty Act. Potential effects on migratory birds are discussed below for each Action Alternative.

3.8.2 Environmental Consequences/Environmental Impacts

Within each alternative, the analysis focuses on biological resources of concern: natural communities, vegetation and wildlife, and special-status wildlife and plant species. Terrestrial biological resources associated with streams and reservoirs upstream of the area of analysis are not discussed in this section because the long-term water transfers would not affect terrestrial biological resources in those areas.

3.8.2.1 Assessment/Evaluation Methods

The effects analysis assumes that if transfers affect the natural community, then transfers could affect any species associated with that community, unless the life history traits of a species indicate that the species would not be affected.

Development of the long-term water transfer impact analysis involved literature review, review of known occurrences of special-status species based on

CNDDB, CNPS Inventory records, USFWS regional species list, CWHR, review of information obtained from species experts, and results of hydrologic modeling, as detailed below.

Each alternative, including the No Action/No Project Alternative, is discussed in terms of potential impacts on sensitive resources in the Seller Service Area (including the Delta Region) and Buyer Service Area.

The assessment methods specific to each transfer type are described briefly below. This is followed by the impact assessment for different natural communities and species.

3.8.2.1.1 Groundwater Substitution Transfers

As a part of the Full Range of Transfers Alternative (Proposed Action), there would be an increased use of groundwater to irrigate crops instead of diversion of water from rivers, creeks, and other streams. This would entail increased groundwater pumping compared to existing conditions to substitute water usually obtained from surface water supplies, which could result in a reduction in levels of groundwater in the vicinity of pumps.

Modeled changes in groundwater elevations over time were used to assess the potential impacts of groundwater depletion on stream flows in small tributaries and associated natural communities. Appendix D includes more information about SACFEM2013, which was used to model groundwater substitution-related changes to groundwater and surface water. The groundwater modeling results indicate that shallow groundwater is typically deeper than 15 feet in most locations under existing conditions, and often substantially deeper. This is substantially below the rooting depth of typical vegetation associated with upland communities (e.g., grassland and scrubland habitats). Some tree species, such as valley oak, can have root depths in excess of 20 feet and upward of 80 feet, and rely on groundwater at such a depth during months of low rainfall. However, these species have further adapted to California's Mediterranean climate of wet winters and hot, dry summers by diversifying their rooting structure to take advantage of multiple sources of water. Valley oak trees, for example, typically lose their long taproot by the time they are 40 years old, having developed a complex root system that often extends nearly twice as far as the tree's dripline within the first several meters of the ground surface (Bolsinger 1988).

Riparian habitats are structurally and compositionally diverse, providing a variety of food resources and shelter not found in adjacent upland habitat (Palmer and Bennett 2006, Kirkpatrick et al. 2007). Depth of groundwater has been shown to be an important driver of riparian tree species presence, abundance, and health (Merritt et al. 2010). Merritt et al. showed that riparian tree species are more common in areas with shallow groundwater (less than 4.5 feet below surface level). The maintenance of riparian forests that support complex habitat requires perennial streamflow to maintain elevated groundwater tables during the growing season (Stromberg et al. 2007; Merritt and Poff 2010). Because of the interaction of surface flows and groundwater flows in riparian systems, including associated wetlands, enables faster recharge of groundwater, these systems are less likely to be impacted by groundwater drawdown as a result of the action alternatives.

The frequency of occurrence of riparian forest cover vegetation decreases with the lowering of groundwater levels (Merritt et al. 2010) until the vegetation transitions into communities dominated by upland species less reliant on groundwater levels. In wetland and riparian habitats, groundwater could be much shallower than 15 feet below ground surface, ranging from eight feet to just below the ground surface (Faunt, ed. 2009).

In a few locations in the North Delta, groundwater elevations under existing conditions are less than 15 feet below ground surface and natural communities reliant on groundwater are more likely to be impacted.

The impact of groundwater substitution on natural communities is based on impacts to upland habitats, and those dependent on stream flows. The impact assessment method for stream flow dependent species is discussed in Section 3.8.2.1.4. This impact was evaluated based on the magnitude and frequency of groundwater depletion relative to existing conditions models.

The potential impacts of groundwater substitution on natural communities in upland areas was considered potentially significant if it resulted in a consistent, sustained depletion of water levels that were accessible to overlying communities (groundwater depth under existing conditions was 15 feet or less). A sustained depletion would be considered to have occurred if the groundwater basin did not recharge from one year to the next.

In addition to changing groundwater levels, groundwater substitution transfers could affect stream flows. As groundwater storage refills during and after a transfer, it could result in reduced availability of surface water in nearby streams and wetlands. Assessing the potential effects of these changes on terrestrial resources is discussed further in Section 3.8.2.1.4.

3.8.2.1.2 Cropland Idling/Crop Shifting Transfers

Cropland idling/crop shifting would make water available for transfer that would have been used for agricultural irrigation without the transfer. Cropland idling/crop shifting transfers would occur in the Sacramento River watershed area of analysis. The irrigation season for this area generally lasts from April through September. Rice has been the crop idled most frequently in previous transfer programs. For crop shifting transfers, water is made available when farmers shift from growing higher water use crop to a lower water use crop. Cropland idling/crop shifting would potentially affect some wildlife species that depend on cropland for foraging and/or depend on habitat associated with cropland and managed agricultural lands, including surrounding supply and return water canals. Crop shifting would potentially affect habitat value for various wildlife species. These farming practices may also have an effect on downstream habitat dependent upon agricultural flow returns.

Cropland idling/shifting transfers would be done in accordance with the environmental commitments described in Section 2.3.2.4.

Croplands (except cotton) generally provide forage, resting, and nesting habitat for a variety of wildlife. Many species rely on agro-ecosystems to meet their lifecycle requirements. Vegetable crops (e.g., tomatoes, onions, melons, and sugar beets), grain crops (e.g., corn, rice, etc.), and alfalfa generally provide forage for wildlife both pre- and post-harvest. The value of a crop to wildlife as habitat and for forage varies greatly between crops (from corn and wheat—highly beneficial to wildlife; cotton—limited to no benefits to wildlife) and species to species. Seasonally flooded agriculture, specifically rice fields, and its associated uplands, drainage ditches, irrigation canals, and dikes, provide potentially suitable habitat for many species including giant garter snake, Pacific pond turtle, and a variety of water birds including, but not limited to egrets, herons, ducks, and geese. Upland crop habitat, such as wheat and corn, provide potentially suitable foraging habitat for many species, including migratory birds and San Joaquin kit fox.

Waste products (grain, fruits, or foliage) remaining in fields after harvest also serve as a food resource for wildlife species, including many special-status species associated with upland cropland (see Section 3.8.2.3.3 for further details). A reduction in the availability of waste products as forage to wildlife could result in significant effects to those species dependent upon waste grain for a large portion of their forage, primarily birds and rodents (primary consumers). These species may also provide a prey base for predators, such as hawks or foxes, and a reduction in the numbers primary consumers could affect predator condition and abundance.

Rice fields in particular provide important foraging habitat for many wildlife species found within the Seller Service Area; not only do the wildlife forage on post-harvest waste grain, but they will also forage on small fish, amphibians, small mammals, and invertebrates that live in the flooded fields. Invertebrates, such as crayfish, can be found on canal banks and berms that separate the rice patties. Shallow water also attracts aquatic insects and other invertebrates, which can provide a source of prey for many wildlife species, such as long-billed curlew. Rice fields also provide resting, nesting, and breeding habitat similar to natural wetlands.

Associated with seasonally flooded agriculture idling is the potential loss of water within adjacent agricultural irrigation and return ditches, when crops are idled/shifted. Agricultural canals and ditches can contain wetland vegetation such as cattails, which provide cover for animals, and these canals and ditches provide forage, resting, nesting habitat and movement corridors for a variety of species (e.g., Pacific pond turtle, giant garter snake, tricolored blackbird, waterfowl, and wading birds), and could serve as migration corridors for various species of wildlife. The potential reduction in flows resulting from idling or shifting of seasonally irrigated crops could reduce habitat for those species that rely on habitat dependent agricultural return flows, with potentially significant impacts on to those species.

Cropland idling would result in fallow fields, which do not provide the same type of habitat as farmed fields, nor the forage base for animals, but which do provide habitat for early successional plants and the species that depend upon them, as well as providing areas that are relatively undisturbed, providing space for nests and burrows. Studies show that fallow fields and inactive farmland may provide suitable foraging, nesting, and/or dispersal habitat for many species of birds (Woodbridge 1998; California Rice Commission 2011).

Cropland idling/shifting has the potential to contribute to fragmentation and isolation of suitable wildlife habitat. Habitat fragmentation can have a significant negative impact to wildlife, by preventing species from moving or dispersing between areas. In the case of animals, different areas may be used for different life history needs, such as trees for nesting and grain fields for foraging, which may or may not overlap in time. The ability to move between different types of habitat or from one area of habitat to another area of similar habitat, on a seasonal or daily basis, is critical to the species success.

Cropland idling/shifting under long-term water transfer would occur in addition to standard farming practices, which include rotation of crops and fallowing of fields in response to market conditions and water availability, and to maintain soils and reduce problems with pests and disease. Because crop rotation and idling are standard practices, species that reside in agricultural areas adjust to these types of activities.

The distribution of these water year types within the action period is unknown. Additionally, the exact locations of cropland idling/shifting actions would not be known until the spring of each year, when water acquisition decisions are made.

The effects of cropland idling/shifting are evaluated on a qualitative analysis based on the proportional of the total acreage idled/shifted, the frequency with which cropland idling/shifting is expected to occur, the value of that cropland to special-status species, and the degree of habitat fragmentation that would likely occur. This evaluation includes consideration of the environmental commitments which are intended to avoid or minimize the potential impacts of this activity.

The effects of idling/shifting of upland crops (those crops that do not require seasonal inundation) are evaluated based on the representative crops of corn, alfalfa and tomatoes, although other upland crops could also be idled. The effects of idling/shifting seasonally flooded crops is represented by rice, which has historically been the crop most idled, but may also include other field crops that require seasonal flooding for at least one week as a management practice, or those which are flooded seasonally to enhance habitat values for a specific wildlife species (e.g., waterfowl).

For purposes of analyzing effects of cropland idling on the availability of habitat for assemblages of wildlife that are wide-ranging throughout the Sacramento Valley (i.e., migratory birds), reductions in crop production (in acres) were compared against baseline acreages for each crop type. Baseline crop acreages consisted of averages over a 5 year period (2008 – 2012) that included wet, below normal, dry, and critically dry water years.

3.8.2.1.3 Reservoirs

Water would be made available for transfers from Camp Far West, Collins, Folsom, Hell Hole, French Meadows, and McClure reservoirs. These reservoirs would continue to operate in accordance with their existing regulatory requirements and other commitments. Water transfers from these reservoirs would result in decreasing their storage and associated elevation and surface area, during the period when transfers would be made (July through September), and the ongoing reduction in storage until the reservoirs are refilled. Shasta, Oroville, New Bullards Bar, and Folsom reservoirs would not provide water for transfer, but their release patterns may be affected, in that the project may modify flows at compliance points in the mainstem rivers downstream of these reservoirs or in the Delta. Additionally, they could store water made available early in the season (April through June) before capacity is available to move the water through the Delta. Transfers could result in more or less water being released from these reservoirs at different times of year. All reservoirs would continue to function under their existing operating requirements, including reservoir drawdown to targeted storage levels, and in meeting downstream flow, temperature, and other water quality requirements.

Reservoirs are distinct from lakes and ponds in that they are artificial environments designed for use for water supply, flood control, and/or hydroelectric power production, although not all reservoirs serve all of these functions. These reservoirs are generally filled during periods of high runoff during the winter and spring, and emptied during the drier times of year to provide water for human and environmental needs. Depending on hydrologic conditions and downstream water needs, these reservoirs may not reach either their maximum storage elevation or be drawn down to their lowest allowed operating elevation (minimum pool) every year. A large proportion of the reservoirs' volume is filled and drained each year, however, resulting in large changes in water surface elevation of tens to over a hundred feet between the spring and fall of a single year. Because the reservoir does not provide a reliable supply of water near their maximum elevations, natural communities around reservoirs typically consist of upland vegetation types that are not dependent on the reservoir for water. Species and natural communities requiring more substantial amounts of water may become established along riparian corridors tributary to the reservoirs or in areas along the margins of the reservoirs where water is retained when the reservoir water levels decline. Within the high water line of the reservoir, the annual cycle of inundation and desiccation prevents permanent vegetation from becoming established. This area may support ruderal species that can establish quickly when this habitat becomes available. This area is unlikely to support substantive cover or other habitat features suitable for wildlife immediately adjacent to the water. Wildlife that utilize reservoir habitats would typically use the nearshore areas on both the aquatic and terrestrial side of the water line. Open water areas are used infrequently and do not provide primary habitat.

The impacts of changes in reservoir storage in the Seller Service Area were evaluated based on the results of the transfer operations model which predicted changes in storage volume, elevation, and surface area on a monthly timestep. Substantial, systematic or prolonged changes in reservoir levels as a result of long-term water transfer storage and releases, particularly those that occur outside of the normal range of operation for that reservoir, could impact vegetation and wildlife species associated at or near water surface and within the drawdown zone, where water may be held longer or released sooner than it would have been under existing conditions. Changes in reservoir operations would also affect downstream riverine habitat, the effects of which are considered in Section 3.8.2.1.4.

These effects were evaluated against the existing conditions during the corresponding time period, considering the change in elevation and the value of the existing habitat to natural communities and special–status species associated with the reservoir.

3.8.2.1.4 Rivers and Creeks

As discussed in the preceding sections, water transfers would affect flows in the rivers and creeks within the Seller Service Area adjacent to and downstream of the areas where these activities would occur. There are no anticipated changes in conditions in the rivers and creeks in the Buyer Service Area. Changes in stream flows in the Seller Service Area could potentially affect natural communities, such as riverine, riparian, seasonal wetland, and managed wetland natural communities, which are reliant on groundwater for all or part of their water supply. These changes could propagate downstream and affect areas downstream of the location where pumping occurs, which may extend to the Sacramento River and Delta. To meet regulatory requirements, some minor modifications in the operation of the CVP and SWP may be required, which may affect storage and flow releases in some reservoirs within the area of analysis.

Groundwater substitution transfers were modeled using the SACFEM2013 groundwater model to assess potential changes to groundwater and surface water. Groundwater substitution pumping was simulated as an additional pumping stress on the system, above the baseline pumping volume. The annual volume of transfers was determined by comparing the supply in the seller service area to the demand in the buyer service area. The availability of supplies in the seller service area was determined based on data provided by the potential sellers. The demand was estimated using demand data provided by East Bay MUD and Contra Costa WD as well as the available capacity at the Delta export pumps to convey transfers. The available export capacity was determined from CalSim II model results. The CalSim II model currently only simulates conditions through WY 2003. The available capacity for south of delta exports was typically more limiting than the south of delta water supply demand. Because CalSim II results are only available through 2003, the SACFEM2013 model simulation was truncated at the end of WY 2003.

The analysis of supply and demand resulted in the potential to export groundwater substitution pumping transfers through the Delta during 12 of the years from 1970 through 2003 (33 years, SACFEM2013 simulation period). Each of the 12 annual transfer volumes was included in a single model simulation. Including each of the 12 years of transfer pumping in one simulation rather than 12 individual simulations allows for the potential compounding effects from pumping from prior years. Appendix D, Groundwater Model Documentation, includes more information about the use of SACFEM2013 in this analysis.

The results of the SACFEM2013 analysis estimated streamflow depletion from groundwater substitution throughout the Sacramento Valley. These estimates were included in Transfer Operations Model simulations of the action alternatives. The Transfer Operations Model results are the basis for the determination of potential effects to fish and their habitats. Appendix B, Water Operations Assessment, includes more details about the transfer operations model.

The analysis of potential impacts to stream flow in the Seller Service Area focused on the frequency and magnitude of changes in mean monthly flow rates by water year types (wet, above normal, below normal, dry, and critical), as compared to existing conditions, based on the modeling results. As discussed there, not every water body could be evaluated in the groundwater model; therefore, smaller water bodies adjacent to those modeled are assumed to respond in a similar way, with similar changes in flow magnitude and timing. Potential impacts to biological resources in these adjacent water bodies would be similar to those of the modeled streams.

For the Proposed Action and No Cropland Modifications Alternative, a screening analysis was conducted for smaller waterways for which groundwater modeling data were available to eliminate the need for biological analyses for streams in which substantial reductions in stream flow did not occur. If the flow reduction caused by implementing the transfer action would be less than one cubic feet per second (cfs) and less than ten percent change in mean flow by water year type, then no further analysis was required, because the effect was considered too small to have a substantial effect on terrestrial species.

The ten percent threshold was used to determine measurable flow changes based on several major legally certified environmental documents in the Central Valley (Trinity River Mainstem Fishery Restoration Record of Decision, December 19, 2000; San Joaquin River Agreement Record of Decision in March 1999; Freeport Regional Water Project Record of Decision, January 4, 2005; Lower Yuba Accord Final EIR/EIS). In these documents, there is consensus that differences in modeled flows of less than ten percent would be within the noise of the model outputs and beyond the ability to measure actual changes.

The one cfs minimum flow threshold was applied to each month during the entire modeled period, such that, if a change of greater than one cfs occurred in any one month during the modeled period, the waterway would be examined further for biological effects.

Combined, these two thresholds were used as an initial screening evaluation to determine whether further analyses were warranted to assess biological significant impacts because these two thresholds may not always translate into a significant biological effect on plant and wildlife species. Therefore, these further biological analyses included consideration of other physical and biological factors in addition to absolute and relative flow changes, including presence and timing of life stages of species, size of the waterway, timing of flow changes, and water year type.

Historical stream flow information from the USGS or the California Data Exchange Center for these streams were gathered where available and used as the measure of baseline flow. For locations for which historical flow data were limited or unavailable, a quantitative analysis was not possible; thus a qualitative discussion of potential impacts is included for these locations. No impacts would occur to groundwater in the No Action/No Project and No Groundwater Substitution alternatives and, therefore, this screening analysis did not apply.

For rivers and their major tributaries, including the Sacramento, American, Feather, Yuba, Bear, San Joaquin, and Merced rivers, transfer operations model outputs were used to assess impacts to surface water flows.

The evaluation of potential impacts to natural communities and special-status vegetation and wildlife considered the magnitude and frequency of streamflow depletion in small streams, both as depicted by the groundwater model. These changes are evaluated for small streams, as CVP and SWP operations could not be altered to offset any changes in these streams. The impacts of groundwater substitution on the larger rivers and CVP and SWP reservoirs are carried from the groundwater model to the transfer operations model, but this model also incorporates other changes in hydrology associated with cropland idling/shifting, reservoir releases, and water conservation, so the combined effect of all these activities are evaluated concurrently for these water bodies.

The impact analysis assumes that an action alternative would have an adverse effect on vegetation and associated wildlife within each river system if it resulted in: a substantially reduced source water for natural communities (e.g., loss of seasonal inundation of adjacent floodplain); flow changes impacting/affecting wildlife movement, foraging pattern, breeding, or predation risks; flow changes altering vegetation communities (e.g., increased in stream flow causing erosion of stream banks resulting in the loss of shaded riverine habitat); flow changes impacting/affecting vegetation recruitment or establishment, or changes in the timing of flows such that natural geomorphic processes do not occur.

3.8.2.1.5 Sacramento-San Joaquin Delta

The changes described above for rivers and streams would be also apply downstream into the Delta. Additionally, exports would vary in timing and magnitude with implementation of water transfers. These changes were modeled using the Transfers Operations Model. To assess the potential impacts of these changes on vegetation and wildlife resources in the Delta, the difference in Delta outflow and the location of X2, defined as the distance (in kilometers) up the axis of the estuary to the daily averaged near-bottom 2-practical salinity units (psu) isohaline (Jassby et al. 1995), were considered. Changes in these parameters were used to qualitatively assess the impacts of long-term water transfers on natural communities and special-status species. Modeled changes in Delta outflow or X2 relative to existing conditions were considered substantial and required further analysis if they were greater than ten percent.

3.8.2.1.6 Natural Community Impacts

The natural community impacts assessment included an analysis of impacts on wetlands and upland habitat types. Natural communities that qualify as wetlands are tidal perennial aquatic, saline emergent wetland, tidal freshwater emergent wetland, non-tidal fresh emergent wetland, natural seasonal wetland, managed seasonal wetland, natural seasonal wetland, valley/foothill riparian habitat, and montane riparian habitat. Natural upland communities include grassland, inland dune scrub, upland scrub, and upland cropland habitat.

The impacts of water transfer actions on natural communities were assessed qualitatively based on possible changes in the distribution and extent of the natural communities affected, either through conversion to other habitat types or through change in quality relative to existing conditions. This assessment was conducted by assessing the types of natural communities that would potentially occur in areas where various water transfer activities, as described above, would occur. The type, frequency, magnitude and duration of these transfer activities, as described in the preceding section, were assessed relative to the needs of those natural communities. This approach was used to assess whether these activities would be likely to fragment existing natural communities, disrupt important wildlife management areas, or reduce habitat patch size.

3.8.2.1.7 Species Impacts Assessment

The species impacts analysis includes an assessment of the direct and indirect impacts of implementing the long-term water transfer actions on terrestrial species. The assessment evaluated permanent and temporary impacts on terrestrial natural resources, including special-status species, and is based on impacts on natural communities that the species use within the area of analysis, the species' geographic distribution, and records for these species in the area of analysis maintained in the CNDDB, and from other sources. This analysis included consideration of the way in which the habitat is used by different species, e.g., breeding, foraging, or dispersal habitat. It is important to note that although wildlife species are associated with certain natural communities, it does not necessarily indicate that wildlife species are restricted to those areas. The analysis indicates that habitat areas have a higher probability of species occurrence compared with areas identified as non-habitat. The analysis does not incorporate microhabitat conditions and other site-specific variables that may further restrict a species use within a natural community.

Plant Species

For plant species, species-habitat associations were defined (Table I-2, Appendix I) and the extent of potential permanent and/or temporary impacts on individual special-status species was based upon the impacts on their associated natural community types. Plants are often associated with specific microhabitats within the natural community and generally have localized occurrences in the region and in their suitable habitat. The analysis does not analyze the impacts of long-term water transfers at the microhabitat level; any loss or alteration of a natural community associated with a plant species is assumed to be a loss of suitable habitat for the species.

Impacts to plant species were assessed qualitatively, based on predicted changes to land use or water availability that could affect species distribution. Direct and indirect impacts of implementing transfers could include the alteration of species composition, establishment of invasive species, and changes to natural communities that result in removal, conversion, or fragmentation of the community.

Wildlife Species

For wildlife species, species-habitat associations were developed and defined (Table I-1, Appendix I) based on literature and review of species databases, including CNDDB and CWHR. Wildlife species and natural communities' relationships are generally not as specific as for plant species. Wildlife species generally occur in several habitat types and move among them. Thus, where necessary, the analysis evaluates the impacts to wildlife species both on a natural community and species level. Hydrologic impacts on wildlife species were assessed qualitatively based on extrapolation of groundwater and surface water modeling results to the species habitat requirements.

Direct and indirect impacts on wildlife communities may include habitat degradation or removal, displacement of wildlife, project-related impacts on adjacent habitat (e.g., changes in hydrology in adjacent areas), and habitat fragmentation leading to disruption of breeding, dispersal, and/or foraging behaviors.

3.8.2.2 Significance Criteria

Consistent with CEQA and the CEQA Guidelines, an alternative would have a significant impact on terrestrial biological resources if it would:

- Cause a substantial reduction in the size or distribution of any natural community.
  - Have a substantial adverse effect, such as a reduction in area or geographic range, on any riparian natural community, other sensitive natural community, or significant natural areas identified in local or regional plans, policies, regulations, or by CDFW or USFWS;
  - Substantially adversely affect federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) either individually or in combination with the known or probable impacts of other activities through direct removal, filling, hydrological interruption, or other means;
  - Substantially decrease the size of important native upland wildlife habitats or wildlife use areas;
  - Conflict with the provisions of an adopted HCP, NCCP, or other approved local, regional, or state habitat conservation plan.
- Cause a substantial adverse effect on any special-status species.
  - Cause a substantial adverse effect on, either directly or through habitat modifications, any endangered, rare, or threatened species, as listed in 14 CCR Sections 670.2 or 670.5; or in 50 CFR. A significant impact is one that affects the population of a species as a whole, not individual members;
  - Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by CDFW or USFWS, including substantially

reducing the number or restricting the range of an endangered, rare, or threatened species;

- Cause a reduction in the area or habitat value of critical habitat areas designated under the federal ESA;

- Conflict substantially with goals set forth in an approved recovery plan for a federally listed species, or with goals set forth in an approved State Recovery Strategy (California Fish and Game Code Section 2112) for a state listed species;

- Conflict with the provisions of an adopted HCP, NCCP, or other approved local, regional, or state habitat conservation plan;

- Substantially fragment or isolate wildlife habitats or movement corridors, especially riparian and wetland habitats, or impede the use of wildlife nurseries.

The significance criteria described above apply to all natural communities and common and special-status plant and wildlife species that could be affected by the alternatives. Changes in habitat quality are determined relative to existing conditions (for CEQA) and the No Action/No Project Alternative (for NEPA).

3.8.2.3 Alternative 1: No Action/No Project

The assessment evaluates the No Action/No Project Alternative by including likely future conditions in the absence of long-term water transfers and identifies the impacts associated with the No Action/No Project Alternative.

3.8.2.3.1 Seller Service Area

Groundwater Levels

There would be no impacts to groundwater levels under the No Action/No Project Alternative and therefore there would be no impacts on natural communities that rely on groundwater.

Impacts on Natural Communities: Because there would be no increase in the amount of groundwater pumped for agricultural uses under the No Action/No Project Alternative, there would be no impacts to natural communities that rely on groundwater for all or part of their water supply.

Impacts on Special-Status Species: Because there would be no increase in the amount of groundwater pumped for agricultural uses under the No Action/No Project Alternative, there would be no impacts to special-status species.

Reservoirs

The No Action/No Project Alternative would not impact reservoir storage, elevation, and reservoir surface area.

Impacts on Natural Communities: The No Action/No Project Alternative would not result in changes to reservoir storage, elevation, or surface area relative to existing conditions. The No Action/No Project Alternative would have no impact on surrounding lacustrine communities along reservoirs within the area of analysis.

Impacts on Special-Status Wildlife: The No Action/No Project Alternative would have no impact on special-status wildlife species associated with lacustrine communities along these reservoirs, as there would be no impact to natural communities.

Rivers and Creeks
The No Action/No Project Alternative would not change flows of rivers and creeks in the Sacramento and San Joaquin river watersheds relative to existing conditions.

Impacts on Natural Communities: The No Action/No Project Alternative would have no impact on surrounding natural communities in rivers and creeks in the Sacramento and San Joaquin river watersheds, because flows would not be changed from existing conditions.

Impacts on Special-Status Wildlife: The No Action/No Project Alternative would have no impact on special-status species that are associated with the rivers and creeks in the Sacramento and San Joaquin river watersheds, because flows would not be changed from existing conditions.

Delta
The No Action/No Project Alternative would not alter flows through the Delta Region compared to existing conditions.

Impacts on Natural Communities: The No Action/No Project Alternative would have a no impact on surrounding Delta natural communities, as there would be no change in the volume or timing of inflows or exports relative to existing conditions.

Impacts on Special-Status Wildlife: The No Action/No Project Alternative would have no impact on special-status species that are associated with Delta habitat, as there would be no change in their habitat.

Cropland Idling/Crop Shifting
There would be no cropland idling/shifting under the No Action/No Project Alternative and no effects to suitable habitat relative to existing conditions.

Impacts on Natural Communities: The No Action/No Project Alternative would have no impact on natural communities as a result of cropland idling/crop shifting, as these practices would remain the same as under existing conditions.

Impacts on Special-Status Wildlife: The No Action/No Project Alternative would have no impact on special-status species that are associated with upland cropland habitat and seasonally flooded agriculture.

3.8.2.3.2 Buyer Service Area

Reservoirs
The No Action/No Project Alternative would not impact San Luis Reservoir storage and surface area. Storage levels in the reservoirs would be the same as under existing conditions.

Impacts on Natural Communities: The No Action/No Project Alternative would have no impact on surrounding lacustrine communities or wetland habitat around San Luis Reservoir, as it would not result in changes to reservoir storage, elevation, or surface area relative to existing conditions.

Impacts on Special-Status Wildlife: The No Action/No Project Alternative would have no impact on special-status wildlife species associated with lacustrine communities and wetland habitat, as it would have no impact on natural communities.

Effects of Water Use
Cropland idling/shifting under the No Action/No Project Alternative would not decrease suitable habitat relative to existing conditions.

Upland Cropland Habitat & Seasonally Flooded Agriculture
Agricultural land uses in the Buyer Service Area would be similar to those under existing conditions and land use practices would be similar to recent levels. Farmers would be expected to continue current practices of idling some land temporarily, depending on crop rotation patterns or soil maintenance purposes.

Impacts on Natural Communities: The No Action/No Project Alternative would have no impact on natural communities, relative to existing conditions, as land use practices would remain the same.

Impacts on Special-Status Plants and Wildlife: The No Action/No Project Alternative would have no impact on special-status species that are associated with upland cropland habitat in the Buyer Service Area.

3.8.2.3.3 Special-Status Species Habitat
The No Action/No Project Alternative would not impact special-status species in the area of analysis through modification of suitable lacustrine, wetland, riverine, and upland habitat. Under the No Action/No Project Alternative, conditions would be the same as the existing conditions in terms of groundwater pumping, farming practices, reservoir operations, and river and stream flows. Special-status species, including Pacific pond turtle, giant garter snake, greater sand hill crane, black tern, long-billed curlew, purple martin, tricolor blackbird,

white-faced ibis, yellow-headed blackbird, and San Joaquin kit fox would not be impacted as a result of the No Action/No Project Alternative.

Impacts on Special-Status Plants and Wildlife: The No Action/No Project Alternative would not result in changes to existing water transfer practices. Therefore, no impacts would occur to special-status plants and wildlife as a result of the No Action/No Project Alternative.

3.8.2.3.4 Migratory Bird Habitat

The No Action/No Project Alternative would not impact migratory birds in the area of analysis through modification of suitable lacustrine, wetland, riverine, and upland habitat. Under the No Action/No Project Alternative, conditions would be the same as the existing conditions in terms of groundwater pumping, farming practices, reservoir operations, and river and stream flows. Migratory bird habitat would not be impacted as a result of the No Action/No Project Alternative.

Impacts on Migratory Birds: The No Action/No Project Alternative would not result in changes to existing water transfer practices. Therefore, no impacts would occur to migratory birds as a result of the No Action/No Project Alternative.

3.8.2.4 Alternative 2: Full Range of Transfers (Proposed Action)

3.8.2.4.1 Seller Service Area

Groundwater Levels

Groundwater substitution under the Proposed Action could decrease available groundwater for natural communities relative to the No Action/No Project Alternative. As a part of the Proposed Action, there would be an increased use of groundwater to irrigate crops. This would entail increased groundwater pumping compared to the No Action/No Project Alternative, which would result in a reduction in levels of groundwater in the vicinity of pumps.

As discussed in the Assessment Methods, if groundwater levels are more than 15 feet below ground surface, a change in groundwater levels would not likely affect overlying terrestrial resources. In a few locations in the North Delta associated with wetlands, groundwater elevations under existing conditions are less than 15 feet below ground surface and natural communities reliant on groundwater are more likely to be impacted. In these areas, the maximum reductions would be 0.3 to 0.8 feet, with full recharge. These increases in subsurface drawdown would be too small to affect natural communities such as riverine, riparian, seasonal wetland, and managed wetland habitats, which rely on groundwater for all or part of their water supply. Plants within these communities would be able to adjust to the small reductions in groundwater levels because the draw down is expected to occur slowly through the growing season, allowing plants to adjust their root growth to accommodate the change.

In addition, groundwater levels are likely to be shallower than 15 feet below ground along rivers and creeks and terrestrial vegetation in these areas could be affected by changes in the groundwater and surface water interactions. Further analysis of the groundwater substitution effects on natural communities due to changes in stream flow are discussed below under Rivers and Creeks.

Impacts on Natural Communities: The Proposed Action would have a less than significant effect on natural communities because increases in drawdown would be too small to cause a substantial effect on vegetation that relies on ~~shallow~~ groundwater. Because groundwater modeling shows that shallow groundwater levels are more than 15 feet deep in most locations that could be affected by groundwater substitution, potential impacts on natural communities are expected to be less than significant. Implementation of Mitigation Measure GW-1 (See Section 3.3, Groundwater Resources) would further minimize potential impacts to natural communities in areas with shallow groundwater because it requires monitoring of wells and implementing a mitigation plan if the seller's monitoring efforts indicate that the operation of the wells for groundwater substitution pumping are causing substantial adverse impacts.

Impacts on Special-Status Plants: Because the natural communities where special-status plants occur would not be significantly affected, impacts to special-status plants would be less than significant. Impacts to special-status wildlife as a result of groundwater substitution transfers are discussed further under Rivers and Creeks.

Impacts on Wildlife: Because the natural communities where special-status wildlife occur would not be significantly affected, impacts to special-status wildlife would be less than significant. Impacts to special-status wildlife as a result of groundwater substitution transfers are discussed further under Rivers and Creeks.

Reservoirs

The Proposed Action could impact reservoir storage and reservoir surface area. Under the Proposed Action, model output predicts that there would be no substantial (more than ten percent) decrease in end-of-month storage volume, reservoir elevation, or surface area relative to existing conditions in Shasta, Oroville, and Folsom reservoirs.

Table 3.8-2 shows the modeled changes in average end-of-month storage for the non-Project reservoirs that could participate in reservoir release transfers. Storage changes in Merle Collins Reservoir and Lake McClure would be less than ten percent of the reservoir volume.

Table 3.8-2. Changes in Non-Project Reservoir Storage between the No Action/No Project Alternative and the Proposed Action (in 1,000 AF)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Camp Far West Reservoir												
W	-0.4	-0.4	-0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-2.5	-2.5	-2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	-2.3	-2.5
C	-3.6	-3.6	-3.6	-3.6	-1.1	-0.7	-0.7	-0.7	-0.7	-4.3	-4.3	-4.3
Merle Collins Reservoir												
W	-0.4	-0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	-0.8	-0.8	-0.8	-0.8	-0.2	0.0	0.0	0.0	0.0	-1.1	-1.7	-1.7
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hell Hole and French Meadows Reservoirs												
W	-6.1	-6.1	-4.1	-1.8	-0.7	-0.6	-0.6	-1.2	-0.4	-0.4	-0.3	-0.1
AN	-22.3	-22.3	-22.3	-13.9	-1.8	0.2	0.2	0.2	0.2	0.2	0.1	0.1
BN	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	-16.6	-16.7	-16.7	-13.4	-11.4	-7.9	-1.1	-4.9	-8.5	-12.5	-16.8	-20.4
C	-28.2	-28.5	-29.0	-29.0	-29.0	-29.0	-28.9	-34.5	-39.5	-44.5	-49.8	-55.2
Lake McClure												
W	-2.3	-2.3	-2.3	-2.3	0.0	0.0	-3.3	-4.8	-3.5	-2.0	-0.8	-0.2
AN	-15.0	-15.0	-15.0	-15.0	-15.0	-10.0	-17.7	-20.9	-12.8	-9.3	-6.4	-5.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	-9.1	-15.0	-15.0	-15.0	-15.0	-15.0
D	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-15.7	-21.9	-19.9	-17.8	-16.1	-15.2
C	0.0	0.0	0.0	0.0	0.0	0.0	-6.7	-10.3	-8.6	-6.6	-5.1	-4.5

Note: Negative numbers indicate that the Proposed Action would decrease reservoir storage compared to the No Action/No Project Alternative; positive numbers indicate that the Proposed Action would increase reservoir storage.

Key: Year Type = Sacramento watershed year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

At Camp Far West Reservoir, average end-of-month storage would be 4,300 acre-feet (AF) (10.8 to 21.9 percent) lower under the Proposed Action relative to existing conditions in critical water years during July through September. This change in storage would reduce reservoir elevations by up to 8.5 feet, or up to 3.8 percent relative to existing conditions, during September of critically dry years, but the reservoir would still be within the operating range experienced under existing conditions.

The reduction in storage would lead to reductions in the surface area of the reservoir during critical years during August and September (86.1 to 97.8 acres, or 12.4 to 18.2 percent). Surface area would change by less than ten percent during the remaining months and water year types.

Up to 47,000 AF of water could be made available for transfer from PCWA's Hell Hole and French Meadows reservoirs. The reservoirs are operated under license by the Federal Energy Regulatory Commission (FERC) and associated

401 Water Quality Certification conditions by the State Water Resources Control Board and 4(e) conditions from the U.S. Forest Service. Transfers would be made under the terms and conditions of this license, which includes measures to protect natural resources within the reservoirs and in the downstream rivers. Water elevations and storage levels during transfers would occur within the normal range of operations of these reservoirs under existing conditions.

Overall, under the Proposed Action, all reservoirs would continue to be operated according to their existing requirements and within their current range of operations.

Impacts on Natural Communities: Long-term water transfer actions under the Proposed Action would have a less than significant impact on natural communities associated with reservoirs because the changes caused would occur within the normal range of operations for the reservoirs.

Impacts on Special-Status Wildlife: Long-term water transfer actions under the Proposed Action would have a less than significant impact on special-status wildlife species associated with reservoirs because the changes caused would be within the normal range of operations for the reservoirs.

Rivers and Creeks

Sacramento River Watershed

The Proposed Action could cause flows in rivers and creeks in the Sacramento River watershed to be lower than under the No Action/No Project Alternative. The following section provides the impacts to natural communities and special-status species as a result of changes in timing and flow rate for rivers, streams, and associated tributaries under the Proposed Action.

Under the Proposed Action, transfers could directly impact natural communities by changing the timing and volume of flows within rivers.

Under the Proposed Action, mean monthly modeled flows would be reduced by less than ten percent on the Sacramento, Feather, Yuba, and American rivers. Based on the screening level criteria, these flow reductions are not considered substantial. Existing stream flow requirements (flow magnitude and timing, temperature, and other water quality parameters) would continue to be met. Among larger rivers, only the Bear River flows would be reduced by more than ten percent by the Proposed Action and, therefore the Bear River is discussed in detail below.

In addition, an initial screening evaluation of modeled flows in several smaller creeks was conducted (see Section 3.8.2.1 for details). The evaluation concluded that impacts to terrestrial species in the following waterways are less than significant: Deer Creek (in Tehama County), Antelope Creek, Paynes

Creek, Seven Mile Creek, Elder Creek, Mill Creek (in Tehama County), Thomes Creek, Mill Creek (Thomes Creek tributary), Butte Creek, Auburn Ravine, Honcut Creek, Freshwater Creek, Colusa Basin Drain, Upper Sycamore Slough, Funks Creek, Putah Creek, Spring Valley Creek, Walker Creek, North Fork Walker Creek, Wilson Creek, Stone Corral Creek, Big Chico Creek, Little Chico Creek, and the South Fork of Willow Creek (Table 3.8-3).

Table 3.8-3. Screening Evaluation Results for Smaller Streams in the Sacramento River Watershed for Detailed Vegetation and Wildlife Impact Analysis for the Proposed Action

Waterway	>1 cfs reduction?	>10% reduction?	Data Source
Deer Creek (Tehama County)	N	-	N/A
Antelope Creek	N	-	N/A
Paynes Creek	N	-	N/A
Seven Mile Creek	N	-	N/A
Elder Creek	N	-	N/A
Mill Creek (Tehama County)	N	-	N/A
Thomes Creek	N	-	N/A
Mill Creek (tributary to Thomes Creek)	N	-	N/A
Stony Creek	Y	Y	USGS Gage 11388000; Water Years 1976-2003
Butte Creek	Y	N	USGS Gage #-11390000; Water Years 1976-2003
Cache Creek	Y	Y	USGS Gage #-11452500; Water Years 1975-2013
Eastside/Cross Canal	Y	U	N/A
Auburn Ravine	N	-	N/A
Coon Creek	Y	Y	Bergfeld personal communication 2014
Dry Creek (tributary to Bear River)	Y	U	N/A
Honcut Creek	N	-	N/A
South Fork Honcut Creek	Y	U	N/A
North Fork Honcut Creek	Y	U	N/A
Colusa Basin Drain	Y	N	DWR Gage # WDL A02976; Water Years 1976-2003
Lower Sycamore Slough	Y	U	N/A
Upper Sycamore Slough	N	-	N/A
Wilkins Slough Canal	Y	U	N/A
Sand Creek	Y	U	N/A
Cortina Creek	Y	U	N/A
Lurline Creek	Y	U	N/A

Waterway	>1 cfs reduction?	>10% reduction?	Data Source
Stone Corral Creek	N	Y	USGS Gage #11390672; Water Years 1976-2003
Funks Creek	N	-	N/A
Freshwater Creek	N	-	N/A
Putah Creek	Y	N	USGS Gage # 11454000; Water Years 1976-2003
Big Chico Creek	N	-	N/A
Little Chico Creek	Y	Y	DWR Gage # WDL A04280; Water Years 1976-1996
Salt Creek	Y	U	N/A
Willow Creek (nr Williams)	Y	U	N/A
South Fork Willow Creek	N	Y	USGS Gage #11390655; Water Years 1976-2003
French Creek	N	-	N/A
Spring Valley Creek	N	-	N/A
Walker Creek (Willow Creek tributary)	N	-	N/A
North Fork Walker Creek	N	-	N/A
Wilson Creek	N	-	N/A

Y = Yes; N = No; U = Unknown
Note: Darkened rows indicate that a detailed effects analysis was not conducted because both criteria were not met.

Reductions in flows in Cache, Stony, Coon, and Little Chico creeks would be greater than ten percent and greater than one cfs (Table 3.8-3) and, therefore, the effects of the Proposed Action on vegetation and wildlife along these creeks are discussed in detail below.

Historical flow data are limited or not available for Eastside/Cross Canal, Dry Creek (tributary to Bear River), South Fork Honcut Creek, North Fork Honcut Creek, Lower Sycamore Slough, Wilkins Slough Canal, Sand Creek, Cortina Creek, Lurline Creek, Salt Creek, and Willow Creek. The percentage change in flow in these streams due to the Proposed Action could not be determined. Flow reductions as the result of groundwater declines would be observed at monitoring wells in the region and adverse effects on riparian vegetation would be mitigated by implementation of Mitigation Measure GW-1 (See Section 3.3, Groundwater Resources), because it requires monitoring of wells and implementing a mitigation plan if the seller's monitoring efforts indicate that the operation of the wells for groundwater substitution pumping are causing substantial adverse impacts. ~~The mitigation plan would include curtailment of pumping until natural recharge corrects the environmental impact. Implementation of these measures would reduce potentially significant effects on vegetation and wildlife resources associated with small streams for which no historical flow data are available to less than significant.~~

Impacts on Natural Communities: Long-term water transfer actions under the Proposed Action would have a less than significant impact on surrounding natural communities (such as non-tidal fresh emergent wetlands, natural seasonal wetland, managed seasonal wetlands, valley/foothill riparian) along the Sacramento River, because changes in stream flow attributable to the Proposed Action would fall within historical ranges.

Impacts on Special-Status Wildlife: Long-term water transfer actions under the Proposed Action would have a less than significant impact on special-status wildlife species that are associated with the Sacramento River because flow changes to the Sacramento River would fall within historical ranges.

Cache, Stony, Coon, and Little Chico creeks, and the Bear River would potentially experience a greater than ten percent change in mean monthly flows in at least one water year type and month of the year under the Proposed Action. The potential impacts in these waterways are discussed individually below.

Cache Creek

The Proposed Action could cause Cache Creek flows to be lower than under the No Action/No Project Alternative. Mean monthly flows in Cache Creek under the Proposed Action would not be greater than ten percent lower than the No Action/No Project Alternative when all water year types are combined in the mean calculation (Table 3.8-4), but would be greater than ten percent lower in individual water year types within months between May and November (Table 3.8-5). In most cases when flow reductions would exceed ten percent, reductions would be less than 20 percent (13 of 16 cases), but would be up to 31 percent (0.6 cfs) lower in critical water years during November (Table 3.8-5). Flow reductions of this magnitude would have a substantial effect on the riparian natural communities associated with the stream.

Impacts on Natural Communities: The effect of groundwater substitution on natural communities under the Proposed Action could be significant, because groundwater substitution pumping would cause stream flows in Cache Creek to be substantially reduced. The reduction in stream flow would result in a substantial adverse effect on riparian natural communities associated with Cache Creek because root zones would be dewatered to such an extent to cause die back of riparian tree and shrub foliage, branches or entire plants. Implementation of Mitigation Measure GW-1 (See Section 3.3, Groundwater Resources), would reduce this effect to less than significant, because it requires monitoring of wells and implementing a mitigation plan if the seller's monitoring efforts indicate that the operation of the wells for groundwater substitution pumping are causing substantial adverse impacts. The mitigation plan would include curtailment of pumping until natural recharge corrects the environmental impact, and natural communities would recover from any adverse effects of reduced flows, and would not be substantially reduced in area or geographic range.

Impacts on Special-Status Wildlife: The Proposed Action would could a significant impact on special-status wildlife species associated with riparian natural communities along Cache Creek, because groundwater substitution pumping would cause stream flows in Cache Creek to be substantially reduced which would cause a substantial reduction in the area or habitat quality of riparian natural communities associated with the creek that provide habitat to special-status wildlife species. Implementation of Mitigation Measure GW-1, would mitigate this effect, because it requires monitoring of wells and implementing a mitigation plan if the seller's monitoring efforts indicate that the operation of the wells for groundwater substitution pumping are causing substantial adverse impacts. ~~The mitigation plan would include curtailment of pumping until natural recharge corrects the environmental impact. Implementation of these measures would reduce significant effects on special-status wildlife because riparian vegetation that provides habitat to these species would recover as the result of natural groundwater recharge.~~

Table 3.8-4. Average Monthly Flow in Cache Creek Under the No Action/No Project Using Historical Data and the Proposed Action using the Groundwater Model and Reduction in Flow due to the Proposed Action[1]

Month	Flow (cfs)			Percent Reduction
	No Action/ No Project[1]	Proposed Action	Reduction	
Jan	1,255.2	1,251.2	4.1	0.3
Feb	1,625.1	1,621.8	3.4	0.2
Mar	1,706.0	1,702.6	3.4	0.2
Apr	801.8	800.0	1.8	0.2
May	157.2	155.6	1.6	1.0
Jun	34.4	33.1	1.3	3.9
Jul	18.4	17.4	1.0	5.6
Aug	16.8	15.8	1.1	6.3
Sep	16.0	14.9	1.0	6.5
Oct	16.8	15.8	1.0	5.7
Nov	72.5	71.3	1.2	1.7
Dec	444.8	442.7	2.1	0.5

USGS data, streamflow gage for Cache Creek near Yolo, gage #11452500 (1975-2013). Groundwater model data (1976-2003).

Table 3.8-5. Average Monthly Flow by Water Year Type in Cache Creek Under the No Action/No Project Using Historical Data and the Proposed Action using the Groundwater Model and Reduction in Flow due to the Proposed Action[1]

Month	WYT	Flow (cfs)			Percent Reduction
		No Action/ No Project[1]	Proposed Action	Reduction	
Jan	W	2,677.3	2,673.7	3.8	0.1
	AN	1,604.0	1,595.3	8.7	0.5
	BN	634.7	630.4	4.3	0.7
	D	312.5	310.1	2.4	0.8
	C	231.5	228.7	2.8	1.2
Feb	W	3,713.8	3,711.6	2.3	0.1
	AN	1,945.8	1,941.6	4.1	0.2
	BN	1,014.2	1,009.7	4.5	0.4
	D	193.1	191.1	2.0	1.0
	C	168.2	162.9	5.3	3.2
Mar	W	4,159.3	4,157.3	2.1	0.0
	AN	1,758.1	1,754.7	3.5	0.2
	BN	805.1	802.7	2.4	0.3
	D	225.5	223.5	2.0	0.9
	C	103.1	96.6	6.5	6.3
Apr	W	2,170.1	2,168.2	1.9	0.1
	AN	589.7	586.5	3.2	0.5
	BN	337.0	334.9	2.1	0.6
	D	28.2	26.4	1.7	6.2
	C	11.0	10.4	0.7	6.1
May	W	367.2	365.3	1.9	0.5
	AN	219.3	216.5	2.8	1.3
	BN	60.9	60.1	0.8	1.3
	D	15.1	13.8	1.6	10.3
	C	3.8	3.2	0.4	11.5
Jun	W	86.6	84.8	1.8	2.1
	AN	33.4	30.9	2.5	7.4
	BN	6.5	5.3	1.2	18.9
	D	7.9	6.8	1.1	13.5
	C	0.6	0.5	0.2	27.9
Jul	W	43.0	41.2	1.8	4.1
	AN	18.1	16.9	1.2	6.4
	BN	7.6	6.4	1.2	15.8
	D	6.4	5.5	0.9	13.5
	C	0.6	0.4	0.1	21.5
Aug	W	41.1	39.4	1.7	4.1
	AN	13.8	12.6	1.2	8.4
	BN	3.2	2.8	0.4	13.0
	D	7.1	5.8	1.3	18.2
	C	0.5	0.4	0.1	18.0

Month	WYT	Flow (cfs)			Percent Reduction
		No Action/ No Project[1]	Proposed Action	Reduction	
Sep	W	37.6	35.9	1.7	4.6
	AN	16.2	14.6	1.7	10.2
	BN	1.3	1.3	0.0	0.0
	D	6.9	6.2	0.7	10.6
	C	0.9	0.8	0.1	13.4
Oct	W	29.9	28.4	1.5	5.0
	AN	16.5	15.9	0.5	3.3
	BN	2.0	2.0	0.0	0.0
	D	17.5	16.8	0.7	4.1
	C	4.0	3.1	0.9	22.8
Nov	W	197.1	195.1	2.0	1.0
	AN	11.0	10.6	0.4	3.8
	BN	7.3	7.3	0.0	0.0
	D	39.2	37.5	1.7	4.5
	C	2.0	1.4	0.6	30.5
Dec	W	963.4	961.6	1.8	0.2
	AN	399.6	396.8	2.8	0.7
	BN	170.7	170.7	0.0	0.0
	D	276.9	274.1	2.7	1.0
	C	26.8	25.1	1.8	6.7

[1] USGS data, stream gage Cache Creek near Yolo, gage #11452500 (1975-2013). Groundwater model data (1976-2003).

Stony Creek

Groundwater substitution under the Proposed Action could cause Stony Creek flows to be lower than under the No Action/No Project Alternative. According to the groundwater modeling, mean monthly flow rates in Stony Creek under the Proposed Action with all water year types combined would be less than three percent relative to the No Action/No Project Alternative (Table 3.8-6).

Table 3.8-7 describes flow changes for different water year types. In general, flows under the Proposed Action would be similar or less than ten percent lower than those under the No Action/No Project Alternative, except in one water year type in one month (critical water years during October) in which flows would be reduced by 10.0 percent (3.3 cfs). Flow reductions of this magnitude could have a substantial effect on the riparian natural communities associated with the stream.

Table 3.8-6. Average Monthly Flow in Stony Creek Under the No Action/No Project Using Historical Data and the Proposed Action using the Groundwater Model and Reduction in Flow due to the Proposed Action

Month	Flow (cfs)			Percent Reduction
	No Action/ No Project[1]	Proposed Action	Reduction	
Jan	1403.0	1401.9	1.1	0.1
Feb	1556.6	1555.6	1.0	0.1
Mar	891.2	890.2	0.9	0.1
Apr	168.5	167.6	0.9	0.5
May	207.1	206.5	0.7	0.3
Jun	74.5	73.8	0.7	0.9
Jul	31.0	30.3	0.6	2.0
Aug	40.9	40.3	0.6	1.5
Sep	40.5	40.0	0.5	1.2
Oct	58.8	57.2	1.6	2.7
Nov	112.8	111.7	1.1	1.0
Dec	562.4	561.4	1.0	0.2

[1] USGS data, streamflow gage for Stony Creek below Black Butte Dam, gage #11388000 (1976-2003). Groundwater model data (1976-2003).

Table 3.8-7. Average Monthly Flow by Water Year Type in Stony Creek Under the No Action/No Project Using Historical Data and the Proposed Action using the Groundwater Model and Reduction in Flow due to the Proposed Action[1]

Month	WYT	Flow (cfs)			Percent Reduction
		No Action/ No Project[1]	Proposed Action	Reduction	
Jan	W	2662.6	2661.9	0.7	0.0
	AN	1841.4	1839.9	1.6	-0.1
	BN	53.8	53.1	0.6	-1.2
	D	439.9	438.9	1.0	-0.2
	C	488.7	487.1	1.6	-0.3
Feb	W	3660.6	3659.9	0.7	0.0
	AN	1905.4	1904.5	0.9	0.0
	BN	105.0	104.3	0.6	0.6
	D	104.6	103.7	0.9	0.9
	C	54.2	52.8	1.5	2.7

Month	WYT	Flow (cfs)			Percent Reduction
		No Action/ No Project[1]	Proposed Action	Reduction	
Mar	W	2176.3	2175.6	0.7	0.0
	AN	698.9	698.1	0.8	0.1
	BN	158.0	157.4	0.6	0.4
	D	228.6	227.8	0.9	0.4
	C	48.9	47.4	1.4	2.9
Apr	W	335.7	335.1	0.6	0.2
	AN	173.0	172.3	0.8	0.5
	BN	84.7	84.1	0.6	0.7
	D	66.7	65.8	0.9	1.4
	C	49.6	48.3	1.4	2.8
May	W	449.9	449.3	0.6	0.1
	AN	201.7	201.2	0.5	0.3
	BN	55.1	54.5	0.5	1.0
	D	101.7	100.8	1.0	0.9
	C	10.8	10.2	0.6	5.6
Jun	W	177.7	177.1	0.6	0.3
	AN	47.2	46.7	0.5	1.1
	BN	30.0	29.5	0.5	1.7
	D	24.4	23.3	1.1	4.3
	C	10.5	9.9	0.5	5.0
Jul	W	47.9	47.4	0.6	1.2
	AN	46.1	45.6	0.5	1.1
	BN	26.5	26.0	0.5	1.9
	D	17.0	16.2	0.8	5.0
	C	10.9	10.3	0.5	4.9
Aug	W	80.0	79.5	0.6	0.7
	AN	47.6	47.1	0.5	1.1
	BN	23.4	22.9	0.5	2.0
	D	15.3	14.3	1.0	6.2
	C	10.2	9.6	0.5	5.4
Sep	W	64.7	64.2	0.5	0.8
	AN	66.5	66.0	0.6	0.8
	BN	13.0	12.5	0.5	3.5
	D	16.8	16.0	0.8	5.0
	C	14.9	14.8	0.1	0.9
Oct	W	108.2	107.4	0.7	0.7
	AN	44.2	43.1	1.1	2.6
	BN	27.1	26.4	0.7	2.7
	D	32.2	30.8	1.4	4.5
	C	33.0	29.7	3.3	10.0

Month	WYT	Flow (cfs)			Percent Reduction
		No Action/ No Project[1]	Proposed Action	Reduction	
Nov	W	255.8	255.1	0.7	0.3
	AN	35.3	34.5	0.8	2.2
	BN	36.7	36.0	0.7	1.9
	D	54.1	53.0	1.1	2.1
	C	45.6	43.5	2.0	4.5
Dec	W	1234.8	1234.1	0.7	0.1
	AN	367.6	366.9	0.6	0.2
	BN	53.8	52.9	0.7	1.2
	D	363.0	362.0	1.0	0.3
	C	80.7	78.9	1.8	2.2

1. USGS data, streamflow gage for Stony Creek below Black Butte Dam, gage #11388000 (1976-2003). Groundwater model data (1976-2003).

Impacts on Natural Communities: The effect of groundwater substitution on natural communities under the Proposed Action could be significant, because groundwater substitution pumping would cause stream flows in Stony Creek to be substantially reduced. The reduction in stream flow would result in a substantial adverse effect on riparian natural communities associated with Stony Creek because root zones would be dewatered to such an extent to cause die back of riparian tree and shrub foliage, branches or entire plants. Implementation of Mitigation Measure GW-1 (See Section 3.3, Groundwater Resources) would reduce this effect to less than significant, because it requires monitoring of wells and implementing a mitigation plan if the seller's monitoring efforts indicate that the operation of the wells for groundwater substitution pumping are causing substantial adverse impacts. ~~The mitigation plan would include curtailment of pumping until natural recharge corrects the environmental impact, and natural communities would recover from any adverse effects of reduced flows, and would not be substantially reduced in area or geographic range.~~

Impacts on Special-Status Wildlife: The Proposed Action would have a significant impact on special-status wildlife species associated with riparian natural communities along Stony Creek, because groundwater substitution pumping would cause stream flows in Stony Creek to be substantially reduced which would cause a substantial reduction in the area or habitat quality of riparian natural communities associated with the creek that provide habitat to special-status wildlife species. Implementation of Mitigation Measure GW-1 would mitigate this effect, because it requires monitoring of wells and implementing a mitigation plan if the seller's monitoring efforts indicate that the operation of the wells for groundwater substitution pumping are causing substantial adverse impacts. ~~The mitigation plan would include curtailment of pumping until natural recharge corrects the environmental impact. Implementation of these measures would reduce significant effects on special-~~

~~status wildlife because riparian vegetation that provides habitat to these species would recover as the result of natural groundwater recharge.~~

Coon Creek

Groundwater substitution under the Proposed Action could cause Coon Creek flows to be lower than under the No Action/No Project Alternative.

Although existing baseline data is incomplete, the comparison of modeling results to Coon Creek stream flow data from 2003 to 2005 (Bergfeld personal communication 2014) indicates that, in a worst case scenario, there would be one water year in one month (above normal water years during April) in which flows could potentially be reduced by 13.9 percent (2.8 cfs) under Alternative 2.. This calculation represents a worst case scenario because baseline flows used in this calculation are at the low end (20 cfs) of existing flow data range (20 cfs to 40 cfs) during April in 2003-2005. If the calculation included the high end of the range (40 cfs) for baseline flows, the reduction due to the Proposed Action would be 7.0 percent. Therefore, this flow reduction would likely occur less frequently than assumed. Flows in all other months and water year types would be reduced by less than ten percent of baseline flows.

Because flow reductions would likely be less than ten percent and only occur in one month during above normal water years the flow reduction would not substantially reduce natural communities or wildlife species habitat.

Impacts on Natural Communities: Long-term water transfers under the Proposed Action would have a less than significant impact on natural communities because flow reductions would likely be less than ten percent and would occur only during above average water years.

Impacts on Special-Status Wildlife: Long-term water transfers under the Proposed Action would have a less than significant impact on special status wildlife habitat because flow reductions would likely be less than ten percent and would occur only during above average water years.

Little Chico Creek

Groundwater substitution under the Proposed Action could cause Little Chico Creek flows to be lower than under the No Action/No Project Alternative. As modeled, flows in Little Chico Creek would be reduced by more than ten percent in multiple water year types during July through October (up to 100 percent of instream flows). It is not uncommon for Little Chico Creek flows to be very low during these months. A review of existing stream gage data from 1976 to ~~1995~~ <u>1996</u> reveals that flows would be less than 0.5 cfs during at least one month in 20 of 21 years and would be 0 cfs in 14 of 21 years. The modeled changes, while greater than 10 percent, represent a very small overall change in flow (a maximum of 0.04 cfs during these months). <u>With the Proposed Project, there would be the same number of years with no flow or flows less than 0.5 cfs</u>

in at least month. In fact, flows would be less than 0.5 cfs under both the No Action/No Project Alternative and Proposed Project in the exact same months of the evaluated period except one (less than 0.5 cfs under the Proposed Project in August 1993) and there would be no flow in the exact same 27 months between the No Action/No Project Alternative and Proposed Project. Therefore, the Proposed Project would not increase the frequency of these low flow events relative to the No Action/No Project Alternative.

Because flow reductions would be small and only during months when the creek is essentially dry, changes in stream flow would not substantially reduce natural communities or wildlife species habitat.

Impacts on Natural Communities: Long-term water transfers under the Proposed Action would have a less than significant impact on natural communities because flow reductions would be small and only occur during months when the creek is essentially dry.

Impacts on Special-Status Wildlife: Long-term water transfers under the Proposed Action would have a less than significant impact on special status wildlife habitat because flow reductions would be small and only occur during months when the creek is essentially dry.

Bear River

The Proposed Action could cause Bear River flows to be lower than under the No Action/No Project Alternative. Under the Proposed Action, the only flow reduction greater than ten percent in Bear River would occur in critical water years during February (approximately 18 percent, or 45 cfs lower). This flow change would occur during wet conditions when Camp Far West Reservoir is refilling after a reservoir release transfer. The amount of surface flow in the stream would remain within the historical range of variability observed under the No Action/No Project Alternative and would meet minimum flow requirements.

Average monthly flows would be higher, compared to the No Action/No Project Alternative, in critical water years during July (approximately 240 percent, 58 cfs), and dry years during August and September (219 percent, 27 cfs and 127 percent, 12 cfs, respectively) when water is released from Camp Far West Reservoir for transfer.

These flow changes would not alter stream morphology, but may result in minor changes to habitat suitability. The flow changes that would occur on the Bear River under the Proposed Action would have a less than significant impact on natural communities.

Impacts on Natural Communities: Flow decreases, resulting from long-term water transfer actions under the Proposed Action would have a less than significant impact on natural communities. Flow reductions would occur late in the year, when plants and animals are less dependent on streamflow. While flows would be reduced, they would remain within the normal range of variability experienced under the No Action/No Project condition and would occur only during critical years (approximately one year in every five), and riparian natural communities would not be substantially reduced in area or geographic range.

Impacts on Special-Status Wildlife: Based on the changes in flows and natural communities previously described, long-term water transfer actions under the Proposed Action would have a less than significant impact on special-status wildlife species associated with Bear River, as natural communities that support these species would not be affected, as described above.

San Joaquin River Watershed

San Joaquin River

The Proposed Action could cause San Joaquin River flows to be lower than under the No Action/No Project Alternative. Under the Proposed Action, flows on the San Joaquin River would be reduced by less than two percent on the San Joaquin River relative to the No Action/No Project Alternative in all months and water year types. This small change in flows would be within the range of flow fluctuations typical of the San Joaquin River and therefore would not be considered substantial.

Impacts on Natural Communities: Long-term water transfer actions under the Proposed Action would have a less than significant impact on natural communities along the San Joaquin River, including seasonal wetland, valley/foothill riparian, and grasslands, because flow reductions would be too small to substantially affect natural communities.

Impacts on Special-Status Wildlife: Long-term water transfer actions under the Proposed Action would have a less than significant impact on special-status wildlife species along the San Joaquin River, because flow changes would be too small to substantially affect these species habitats and be within the natural range of variability and, thus, would not affect special-status species.

Merced River

The Proposed Action could cause Merced River flows to be lower than under the No Action/No Project Alternative. Under the Proposed Action, flows would generally be similar to or greater than flows under the No Action/No Project Alternative in most months. Flows would be higher compared to the No Action/No Project Alternative during April and May. The greatest relative increase in flow would occur in dry water years during April (approximately 38 percent, 85 cfs higher than existing conditions). River flows would decrease during wetter periods as the reservoir refills, but this refill would occur over longer periods of time and would have only small effects on flows.

Impacts on Natural Communities: Long-term water transfer actions under the Proposed Action would have a less than significant impact on natural communities along the Merced River, as flow reductions would be too small to substantially affect natural communities.

Impacts on Special-Status Wildlife: Long-term water transfer actions under the Proposed Action would have a less than significant impact on special-status wildlife species along the Merced River, because flow reductions would be too small to affect natural communities or associated special-status species.

Delta

The Proposed Action could cause changes to Delta hydrology relative to the No Action/No Project Alternative. Under the Proposed Action, Delta outflows would be less than two percent lower than flows under the No Action/No Project Alternative in any month or water year type. Outflow would be up to 11 percent higher in during July through September in dry and critically dry water years. The maximum mean monthly upstream shift in X2 location would be unlikely to be detected upstream during periods of decreased flow, and may be up to two km (1.0 percent) downstream during periods of increased flow. These changes to Delta outflow, and resultant changes in X2 position, would not have a substantial adverse impact on biological resources because the change is minimal and consistent with changes in annual fluctuations of X2.

These changes would not have a significant impact on biological resources.

Impacts on Natural Communities: Long-term water transfer actions under the Proposed Action would have a less than significant impact on natural communities associated with the Delta. No impacts are expected to occur to tidal perennial aquatic habitat, saline emergent wetland, and tidal fresh emergent wetland, because the project would have negligible effects on Delta hydrology, that would not substantially affect natural communities. As changes in flow are expected to be within daily and seasonal tidal fluctuations, natural communities in the Delta would be unaffected.

Impacts on Special-Status Plants and Wildlife: Long-term water transfer actions under the Proposed Action would have a less than significant impact on special-status plant and wildlife species associated with the Delta, because the project would have very small effects on Delta hydrology that would be too small to substantially affect natural communities or associated special-status species.

Cropland Idling/Crop Shifting

Upland Crop Habitat

Cropland idling/shifting under the Proposed Action could alter habitat for upland species relative to the No Action/No Project Alternative. The maximum potential acreage of upland crop that could be idled under the Proposed Action would be 800 acres of tomatoes, 2,700 acres of corn, and 5,000 acres of alfalfa/sudan grass, for a total of 8,500 acres, as indicated in Table 3.8-8. The maximum allowed acreage of corn would be idled/shifted in Solano County, just less than the 1,500 acres indicated. This would leave approximately 5,900 acres in corn in Solano County, which is well within, the historical range of 2,800 to 13,700 acres.

Table 3.8-8. Upland Cropland Idling/Shifting under the Proposed Action

Region	Alfalfa/ Sudan Grass	Corn	Tomatoes	Total
Glenn, Colusa, Yolo Counties	1,400	400	400	2,200
Butte and Sutter Counties	600	800	400	1,800
Solano County	3,000	1,500	-	4,500
Total	**5,000**	**2,700**	**800**	**8,500**

Most forage and other habitat would still be available to wildlife species within the Sacramento Valley, as indicated in Table 3.8-8. Crop idling in Glen, Colusa, and Yolo Counties could result in a two percent loss of residual feed, whereas in Sutter and Solano Counties crop idling could result in a nine percent loss in residual feed. Corn idling represents the crop with the biggest reduction of 16–20 percent depending on the County. Idling would reduce forage areas, but species would respond by looking for forage in other habitats. The bird species that would be potentially affected by idling of upland crops would be capable of dispersing to other areas or other non-idled parcels. Most species are well adapted to changes in environmental conditions such as drought and flooding, and therefore, use of specific areas can vary greatly from year to year depending on habitat conditions. Cropland idling decisions would be made early in the year before the general breeding season of most birds that have the potential to occur in the area of analysis, therefore impacts to nesting birds would not be expected.

Because of the limited amount of upland crop acreage that would be idled under this alternative, and in conjunction with the environmental commitments described in Section 2.3.2.4, and because this is within the historic range of variation for the individual crops, cropland idling/shifting in the Seller Service Area is not expected to significantly impact wildlife species dependent on upland cropland habitat.

Impacts on Natural Communities: Long-term water transfer actions under the Proposed Action would have a less than significant impact on upland cropland habitat in the Seller Service Area, as the amount of cropland idled would generally be small and within the historical range of variation.

Impacts on Special-Status Plants and Wildlife: Long-term water transfer actions under the Proposed Action would have a less than significant impact on plant and wildlife species associated with upland cropland habitat because the lack of impacts on the natural communities.

Seasonal Flooded Agriculture

Cropland idling/shifting under the Proposed Action could alter the amount of suitable habitat for natural communities and special-status wildlife species associated with seasonally flooded agriculture and associated irrigation waterways relative to the No Action/No Project Alternative. Based on proposed transfer quantities and sellers, the maximum amount of rice acreage that could be idled under the Proposed Action would be 51,473 acres throughout the Sacramento River valley (Table 3.8-9).

Table 3.8-9. Cropland Idling/Shifting for Rice under the Proposed Action

Cropland Idling under Proposed Action	Acres (Percent of Acres Idled) in Glenn, Colusa, and Yolo Co.	Acres (Percent of Acres Idled) in Sutter and Butte Co.	Acres (Percent of Acres Idled) in Solano Co.	Total Acres (Percent of Acres Idled)
Rice	40,704 (16%)	10,769 (11%)	0 (0%)	51,473 (11%)

The reduction in available habitat in rice fields and the associated reduction in the availability of waste grains and prey items as forage to wildlife species that use seasonally flooded agriculture for some portion of their lifecycle, could result in potentially significant effects to those species.

Associated with idling seasonally flooded agricultural fields is the potential for habitat fragmentation, as idling large parcels of land could impede the movement of wildlife from one area to another, inhibiting normal wildlife migration and dispersal of individuals, and potentially dissociating habitats for roosting from those for foraging. These effects would have a negative effect on individual fitness and be potentially significant effects to wildlife. The decision to idle or shift a field would be made early in the year. So for species that migrate into the area seasonally (mainly birds), those arriving in the spring would not be impacted as they would select suitable habitat upon their arrival. For year round residents (i.e., pond turtle, giant garter snake) the potential impacts would be greater.

Potential impacts on special-status wildlife resulting from cropland idling/shifting ~~These~~ would be minimized by the Environmental Commitments described in Section 2.3.2.4 that would preserve habitat and natural communities in canals and ditches which may serve as movement corridors and minimize cropland idling/shifting in areas with known occupancy or high probability of occurrence of special-status wildlife.

Impacts on Natural Communities: Long-term water transfer actions under the Proposed Action would have a less than significant impact on seasonally flooded agricultural habitat communities in the Seller Service Area, because Environmental Commitments limit effects on seasonally flooded agricultural fields and associated natural communities.

Impacts on Special-Status Plants and Wildlife: Long-term water transfer actions under the Proposed Action would have a less than significant impact on special-status plant and wildlife species associated with seasonally flooded agriculture habitat because of the lack of impact to natural communities and maintenance of movement corridors within the landscape. Additional special-status species analysis is provided in 3.8.2.4.3 Special-Status Species.

Impacts on Migratory Birds: For the millions of birds that use rice fields during winter migration, this small reduction in crops planted is not expected to affect the amount of post-harvest flooded agriculture that provides important winter forage for migratory birds, particularly waterfowl and shorebirds. Farmers in the Sacramento Valley only flood-up a fraction of the cropland planted; typically around 60 percent in normal water years (Miller et al 2010, Central Valley Joint Venture 2006) and as little as 15 percent in critically dry years (Buttner 2014). The decision on whether to flood is not based on what was produced for the year but instead is determined by the availability of fall and winter water. Because the project does not include transfers of rice decomposition water, it will not reduce the availability of water for post-harvest flooding and therefore is not expected to result in a reduction of winter forage for migrating birds. The location of cropland idling does have the potential to affect the use of historic roost sites, particularly for Sand hill cranes, if those areas are not available to flood up because they were not planted.

Long-term water transfer actions under the Proposed Action would have a less than significant impact on migratory birds associated with seasonally flooded agriculture habitat because the maximum reduction in rice production would be within the historic range of variation, cropland idling/shifting would be minimized in known wintering areas that support high concentrations of wintering waterfowl and shorebirds, -and water transfers will not include rice decomposition water and so will not reduce the availability of post-harvest forage. Additional migratory bird analysis is provided in 3.8.2.4.3 Migratory Birds.

3.8.2.4.2 Buyer Service Area

Reservoirs

San Luis Reservoir

The Proposed Action could alter surface water elevation and reservoir storage at San Luis Reservoir relative to existing conditions and the No Action/No Project Alternative. Under the Proposed Action, CVP storage at San Luis Reservoir would be reduced by up to 25,600 acre feet relative to the No Action/No Project Alternative in most water year types throughout the year, although these reductions would generally be less than ten percent. Exceptions include below normal water years during August (20,800 acre feet, or 10.6 percent, lower), dry years during August and September (11,000 to 13,700 acre feet, or 13.1 to 13.3 percent, lower) and critical years during September and October (13,300 to 18,400 acre feet, or 10.8 to 12.0 percent, lower).

There would be small reductions (less than five percent) in SWP storage at San Luis Reservoir due to the Proposed Action relative to the No Action/No Project Alternative in all months and water year types. The largest SWP storage reduction of 15,900 acre feet (corresponding to a 2.5 to 2.6 percent reduction) would occur in critical water years during March and April.

Changes in storage for either the CVP or SWP are generally small (less than five percent) with few exceptions. Because decreases in storage would remain within the normal range of operation for the reservoir, they would not have a substantial effect on biological resources. The most substantial changes would occur during dry and critically dry years, when the reservoir would already be at low water surface elevations, with the same types of effects as described for Camp Far West Reservoir.

At San Luis Reservoir, riparian habitat is limited to scattered patches of mule fat and occasional willows (Reclamation and DWR 2004). The water sources for riparian vegetation are dependent upon stream flows in the tributaries and would not be affected by water transfers; therefore, there would be no impacts to this habitat type. Similarly, other natural communities associated with San Luis Reservoir including freshwater emergent vegetation, upland scrub, and non-native grasslands surround San Luis Reservoir are not dependent of the reservoir for water and would not be affected by water transfers, thus wildlife associated with these habitats would not be impacted.

Impacts on Natural Communities: Long-term water transfer actions under the Proposed Action would have a less than significant impact on lacustrine and other natural communities around San Luis Reservoir because the changes in storage would fall within the normal range of operations of the reservoir and would comply with all existing operational requirements, and there would not be substantially reduced in area or geographic range of lacustrine natural communities.

Impacts on Special-Status Wildlife: Long-term water transfer actions under the Proposed Action would have a less than significant impact on special-status wildlife species associated with lacustrine and other natural communities around San Luis Reservoir because the changes in storage would fall within the normal range of operations of the reservoir and would comply with all existing operational requirements.

Effects of Water Use

Upland Crop Habitat

The Proposed Action could alter planting patterns and urban water use relative to the No Action/No Project Alternative. Under the Proposed Action, buyers would receive water made available through long-term water transfer actions. The amount of water available for purchase and the way in which water could be used, the effects of using this water on natural resources would be within the range of existing activities each CVP contract and associated BOs. Based on this, there would be no new effects on natural habitats or wildlife species in the Buyer Service Area.

Impacts on Natural Communities: Long-term water transfer actions under the Proposed Action would have a less than significant impact on natural communities in the Buyer Service Area because the effects of using the water would be within the range of existing activities under the buyers' CVP contract and associated BOs.

Impacts on Special-Status Wildlife: Long-term water transfer actions under the Proposed Action would have a less than significant impact on special-status wildlife species associated with upland crops because the water would be used on previously farmed lands and would not impact the natural communities upon which these wildlife species depend.

3.8.2.4.3 Special-Status Species

Special-Status Plant Species

The Proposed Action could impact wetlands that provide suitable habitat for Ahart's dwarf rush, Sanford's arrowhead, Red Bluff dwarf rush, and saline clover. The effects of cropland idling/shifting and groundwater substitution on the wetland habitat that special-status plant species depend on would be small and temporary as was described in the previous sections.

Seller Service Area

Cropland Idling/Shifting

An increase in cropland idling/shifting under the Full Range of Transfers Alternative (Proposed Action) would result in decreased flows in irrigation canals and return ditches adjacent to seasonally flooded agriculture (e.g., rice fields). These canals and ditches provide moderately suitable habitat for several special-status plant species including Sanford's arrowhead.

Environmental Commitments would reduce potential impacts due to cropland idling/shifting to less than significant by ensuring canals bordering rice parcels continue to carry water even when adjacent parcels are idled.

Impacts on Special-Status Plants: With incorporation of Environmental Commitments, cropland idling/shifting actions under the Proposed Action would have a less than significant impact on special-status plant species that could occur in wetlands and waterways associated with seasonally flooded agriculture in the Seller Service Area.

Groundwater Substitution

As discussed in Section 3.8.2.4.1, potential impacts to special-status plant species could result if changes in the composition and function of wetland and/or riparian plant communities occur as a result of transfer actions. As part of Proposed Action, there would be increased utilization of groundwater to irrigate crops. This would entail more groundwater pumping compared to the No Action/No Project Alternative to substitute for the seller's CVP contract water. Due to the complex interaction between groundwater and surface water, negative impacts would result from a reduction in creek flows to downstream wetland and riparian habitats. Decreased surface flows could potentially impact downstream natural communities, such as seasonal wetland and managed wetland habitats, which are reliant on creek and river flows for all or part of their water supply.

Perennial species, such as Sanford's arrowhead, could be extirpated from any areas where non-tidal freshwater emergent wetland extent is temporarily or permanently reduced during the long-term water transfer actions.

As described in the preceding sections, the effect of groundwater substitution under the Proposed Action, as predicted by the groundwater model, would generally be less than ten percent, except in Cache, Stony, Coon, and Little Chico creeks, and the Bear River. In addition, the Proposed Action has the potential to cause flow reductions of greater than ten percent on other small creeks where no data are available on existing streamflows to be able to determine this. The impacts of groundwater substitution on flows in small streams and associated water ways would be mitigated by implementation of Mitigation Measure GW-1 (see Section 3.3, Groundwater Resources) because it requires monitoring of wells and implementing a mitigation plan if the seller's monitoring efforts indicate that the operation of the wells for groundwater substitution pumping are causing substantial adverse impacts. ~~The mitigation plan would include curtailment of pumping until natural recharge corrects the environmental impact. Implementation of these measures would reduce significant effects on vegetation and wildlife resources associated with streams to less than significant.~~

Impacts to Special-Status Plants: With incorporation of Mitigation Measure GW-1, groundwater substitution actions under the Proposed Action would have a less than significant impact on special-status plant species that could occur in wetlands and waterways associated with small streams in the Seller Service Area.

Giant Garter Snake

The Proposed Action could result in impacts to giant garter snake by reducing available aquatic habitat through cropland idling/shifting and groundwater substitution. Giant garter snakes require aquatic habitat during their active phase, extending from spring until fall. During the winter months, giant garter snakes are dormant and occupy burrows in upland areas. Giant garter snakes have the potential to be affected by the Proposed Action through cropland idling/shifting and the effects of groundwater substitution on small streams and associated wetlands. Idling/shifting of upland crops, water conservation actions, and reservoir releases are not anticipated to affect giant garter snakes, as they do not provide suitable habitat for this species. While the preferred habitat of giant garter snakes is natural wetland areas with slow moving water, giant garter snakes use rice fields and their associated water supply and tailwater canals for foraging and escape from predators, particularly where natural wetland habitats are not available. Because of the historic loss of natural wetlands, rice fields and their associated canals and drainage ditches have become important habitat for giant garter snakes.

The acreage to be idled/shifted under the action alternatives would be subject to the Environmental Commitments described in Section 2.3.2.4, which include measures to protect giant garter snakes. Environmental Commitments would provide additional protection to giant garter snakes with regard to cropland idling/shifting actions. These include provisions for sellers to demonstrate that any impacts to water resources needed for special-status species protection have been addressed, avoiding cropland idling actions in areas that could result in the substantial loss or degradation of habitats supporting priority giant garter snake populations, maintaining water levels in drainage canals to provide adequate movement corridors and foraging opportunities for giant garter snake, and implementing best management practices for canal maintenance activities.

Cropland Idling/Shifting

Long-term water transfers are expected to contribute a relatively small amount of rice idling/shifting acreage annually in relation to the variation in planted rice acreage resulting from drought conditions and typical farming practices. Under the Proposed Action, cropland idling/shifting transfers could idle up to a maximum of approximately 51,473 acres of rice fields (Table 3.8-9. This represents approximately 10.5 percent of the average land in rice production from 1992 to 2012 (U.S. Department of Agriculture [USDA], National Agricultural Statistics Service 2012). Any level of cropland idling/shifting would reduce the availability of stable wetland areas during a particular transfer year and may reduce suitable giant garter snake foraging habitat and increase the risk of predation on individual giant garter snakes.

Some individual giant garter snakes may have to relocate from an area that may have been their foraging area in prior years. Environmental Commitments that target priority areas that include suitable habitat with a high likelihood of giant garter snake occurrence requires that participating districts keep water in smaller drains and conveyance infrastructure such that emergent aquatic vegetation remains intact for giant garter snake escape cover and foraging. Also maintaining water in areas where occupied quality habitat occurs may limit the need for giant garter snake to relocate. If water resources do become limiting for giant garter snake, the water in these smaller drains and canals, as well as the required water in major drainage and irrigation canals, would aid movement of individuals to other foraging areas.

Although individual snakes that must relocate would be subject to greater risk of predation as they move to find new suitable foraging areas, it is likely that some individuals would be able to successfully relocate in suitable habitat elsewhere within the area. Young snakes (two years old and less) that need to relocate may be particularly vulnerable to increased predation risk. A reduction in available habitat and foraging opportunities compared to recent years where rice idling transfers were minimal may adversely affect foraging success and breeding condition if some individuals are unable to relocate. Young snakes would be anticipated to be at greater risk.

Information with which to estimate the size or age-class structure of the resident snake population in the area of analysis is not available. It is a product of annual fluctuation in acreage planted with rice in previous years, in combination with other physical and environmental factors. Regardless, some individual snakes would be likely to be displaced and would need to relocate elsewhere. Of these, it is expected that some will successfully relocate and some may be lost to predation or other forms of mortality caused by loss of foraging opportunities, either through competition with other individuals or loss of body condition and failure to thrive, particularly young snakes. The Proposed Action includes an environmental commitment to maintain water in major drains and canals in priority habitat areas to minimize the potential for such effects, with the assumption that proximity to water results in decreased stress on snake populations.

Impacts on Giant Garter Snake: Cropland idling/shifting actions under the Proposed Action would have a less than significant impact on giant garter snakes because a relatively small proportion (no more than 10.5 percent) of the rice acreage would be affected in any given year and the Environmental Commitments would avoid or reduce many of the potential impacts associated with this activity and the displacement of giant garter snake that could result. Individual giant garter snakes would be exposed to displacement and the associated increased risk of predation, reduced food availability, increased competition, and potentially reduced fecundity.

Groundwater Substitution

Natural and managed seasonal wetlands and riparian communities often depend on interactions between surface water and groundwater for part or all of their water supply. However, specific examples of streams and marshes with heavy clay soils and perched water tables, that typically provide giant garter snake habitat, do not typically depend on this interaction to a large degree to provide aquatic habitat. Also given the nature of soils in these environments it is unlikely that a direct linkage between the deeper groundwater basin and surface water in marshes exists.

Impacts on Giant Garter Snake: Groundwater substitutions under the Proposed Action are not expected to have a substantial effect on natural communities, including freshwater emergent vegetation. Thus, impacts to giant garter snake from groundwater substitution would be less than significant.

Pacific Pond Turtle

The Proposed Action could result in impacts to Pacific pond turtle by reducing available aquatic habitat through cropland idling/shifting, groundwater substitution, and reservoir drawdowns. Pacific pond turtle can utilize irrigation ditches and rice fields as aquatic habitat and adjacent uplands and levees as upland habitat. They may also use small streams and reservoirs for habitat. Actions that result in the desiccation of aquatic habitat could result in the turtle migrating to new areas, which in turn puts them at an increased risk of predation. Further reduction of turtle population as a result of long-term water transfer actions would be considered a significant impact.

The environmental commitments described above for the giant garter snake will also be beneficial to the protection of Pacific pond turtle. This includes a specific measure for Pacific pond turtle that ensures drainage canals will not be allowed to completely dry out.

Seller Service Area

Cropland Idling/Shifting

Cropland idling/shifting would reduce habitat for Pacific pond turtle. As described in the giant garter snake discussion, above, cropland idling/shifting is expected to primarily affect rice acreage, with up to 51,473 acres idled under the Proposed Action, based on the crop idling/shifting simulations. There is potential for decreased water flows in irrigation and return ditches associated with seasonally flooded agriculture such as rice fields because these distribution systems would no longer be delivering water to the fields being idled. Pacific pond turtles potentially utilize these waterways and associated upland areas for forage, shelter, nesting, estivation, overwintering, and dispersal, The decrease in available water could negatively impact habitat for Pacific pond turtle. The application of the Environmental Commitments would minimize these potential impacts.

Impacts to Pacific Pond Turtle: Cropland idling/shifting actions under the Proposed Action would have a less than significant impact on Pacific pond turtle, because a relatively small proportion (no more than 10.5 percent) of the seasonally flooded agriculture acreage would be affected in any year and environmental commitments in place as part of the project would limit the size and distribution of parcels that could be idled and ensure water remains in adjacent irrigation canals and return ditches.

Groundwater Substitution

Groundwater substitution could affect Pacific pond turtle through reduction in the flows of smaller streams in the Seller Service Area. Reduced flows could negatively impact suitable habitat for this species both in the streams themselves, and the wetlands and riparian habitats associated with them.

As described in the preceding sections, the effect of groundwater substitution under the Proposed Action, as predicted by the groundwater model, would generally be less than ten percent, except in Cache, Stony, Coon, and Little Chico creeks. In addition, the Proposed Action has the potential to cause flow reductions of greater than ten percent. Water levels naturally fluctuate depending on year type and timing of discharge in these creeks, and sections of the creeks dry up in dry or critical years. Pacific pond turtles require permanent water and would visit these water ways temporarily when they have flow. The reduction of flow caused by the Proposed Action would not substantially reduce habitat for the Pacific pond turtle and would not substantially affect habitat connectivity, because under the No Action/No Project condition these creeks are subject to substantial variability in flow, including periodic drying of reaches, and changes in groundwater levels would have a relatively small effect on this variation and the temporary Pacific pond turtle habitat in these streams.

Impacts on Pacific Pond Turtle: Groundwater substitution actions under the Proposed Action would have a less than significant impact on Pacific pond turtle because changes in flows in small streams would have a small effect on Pacific pond turtle habitat availability and would not substantially interfere with habitat connectivity.

Reservoir Drawdown

Fluctuations in water level elevation in reservoirs as a result of long-term water transfer actions could negatively impact habitat for Pacific pond turtle through dewatering of suitable aquatic habitat and alteration of upland nesting and refugia habitat. Lowering the water elevation could leave adult and juvenile Pacific pond turtle utilizing the reservoirs more vulnerable to predation. The decrease in storage may isolate Pacific pond turtles and impact juvenile turtles by limiting available cover and forage, as well as reproduction. Adult turtles could disperse safely, however hatchling maybe be preyed upon by a variety of predators including fish, bullfrogs, garter snakes, wading birds, and mammals. Hatchlings are also subject to rapid death by desiccation (Zeiner 1988). These impacts would be most noticeable at Camp Far West and New Bullards Bar reservoirs, both of which would experience the greatest increase in water elevation fluctuation as a result of the Proposed Action.

Normal operations at the reservoirs include annual average fluctuations in water levels ranging from 60 to 124 feet per year. Under the Proposed Action the average change in water level elevation would increase this average fluctuation by an extra one to three feet in any single year, with a maximum of four feet. Because the water level fluctuation is already so dramatic throughout the year, this increase of a maximum of four feet of water elevation drop would not significantly increase stress on individual Pacific pond turtle or affect populations of Pacific pond turtle that may be present within the reservoirs.

Impacts on Pacific Pond Turtle: The Proposed Action would have a less than significant impact on Pacific pond turtle on reservoirs in the Seller Service Area, as reservoirs would be operated within the same range as under the No Action/No Project Alternative. The additional change in reservoir elevation would be a small fraction of the total fluctuation experienced, and would not affect the movement or survival of Pacific pond turtle in these reservoirs.

Buyer Service Area

Though habitat for this species occurs over much of the Buyer Service Area, no changes in that habitat are anticipated as a result of the Proposed Action. The amount of water buyers could purchase would be limited by existing contracts and agreements, and they would not be able to utilize more water than is currently allotted them. There would be no appreciable change when compared to the No Action/No Project alternative in stream flows, reservoir levels, and/or cropland idling/shifting in the Buyer Service Area.

Impacts on Pacific Pond Turtle: The Proposed Action would have no impact on Pacific pond turtle in the Buyer Service Area as buyers could not purchase more water than allowed under their CVP contract. Therefore, the effects of using the water would be within the range described under the buyers' CVP contract and associated BOs.

San Joaquin Kit Fox

The Proposed Action could result in impacts to San Joaquin kit fox by reducing available habitat ~~through cropland idling/shifting~~.

Buyer Service Area

Kit foxes prefer open annual grassland habitats with abundant small prey item food sources. The effects of using transfer water on natural resources would be within the range of existing activities within each CVP contract and existing BOs. Based on this, there would be no new effects on natural habitats or wildlife species in the Buyer Service Area.

Impacts on San Joaquin Kit Fox: Actions under the Proposed Action would have no impact on San Joaquin kit fox, as buyers could not purchase more water than allowed under their CVP contract. Therefore, the effects of using the water would be within the range of existing activities under the buyers' CVP contract and existing BOs.

Special-Status Bird Species and other Migratory Birds

The Proposed Action could result in impacts to greater sandhill crane, black tern, purple martin, long-billed curlew, tricolored blackbird, white-faced ibis, ~~and~~ yellow-headed blackbird, and other migratory birds by reducing available nesting, ~~and~~ foraging, and roosting habitat through cropland idling, groundwater pumping, and reservoir drawdown.

Seller Service Area

Cropland Idling/Shifting

Birds within the area of analysis can be associated with both upland croplands and/or seasonally flooded agriculture (e.g., rice). Greater sandhill crane and long-billed curlew are the species that would be affected by idling/shifting upland crops, although both use seasonally flooded agricultural fields, as well. Black tern, purple martin, tricolored blackbird, white-faced ibis, and yellow-headed blackbird would be affected by idling seasonally flooded agriculture. As described previously, the Proposed Action would result in the idling/shifting of up to 8,500 acres of upland crops (corn, alfalfa, tomatoes) and up to 51,473 acres of seasonally flooded agriculture (primarily rice). This corresponds to a reduction of approximately five and 11 percent, respectively, of the historically planted upland and seasonally flooded crops. Associated with this reduction in planted acreage are the potential loss of water within adjacent agricultural supply and return canals, which could affect habitats associated with these canals, as well as water supply to downstream users, including the wildlife management areas, as well as streams and wetland habitats.

Seasonally flooded agriculture and associated canals that provide habitat for giant garter snake also provide foraging and nesting habitat for special-status birds. Potential impacts on special-status birds within these habitats would be avoided or reduced through the implementation of Environmental Commitments for giant garter snake that include: restricting water transfers within and adjacent to established wildlife refuges and conservation areas and maintaining water in drains and canals in priority habitat areas. Decisions about the location and amount of cropland idling/shifting that would occur in any year would be made early in the year, before those birds that nest in affected habitats would have established their nests. In the process of selecting their nest territory, the adult birds would select areas that support their needs for cover and forage and thus there would be minimal impact of idling shifting on nesting habitat.

Groundwater Substitution

Purple martin, tricolored blackbird, and yellow-headed blackbird may inhabit riparian areas and associated wetland habitats that could be impacted by the groundwater substitution. As previously described, this activity has the potential to reduce flows in small streams within the Seller Service Area, which could reduce the amount or suitability of streams and associated wetland and riparian areas for special-status bird species. This potential impact would be reduced through Mitigation Measure GW-1 (see Section 3.3, Groundwater

Resources), which would be implemented if groundwater monitoring would indicate adverse environmental effects.

Releases from Reservoir Storage

Some of the species above occur in wetlands associated with reservoirs that may be affected by long-term water transfer. As described in Section 3.8.2.4.1, the effect of water transfers on natural communities associated with these reservoirs and wetlands, would be less than significant, because the elevation of the affected reservoirs fluctuate by scores of feet each year, and the additional increment of fluctuation caused by water transfers would be small.

The potential impacts of water transfers on each of the seven special-status bird species are discussed in the following sections.

Greater Sandhill Crane

Reducing seasonally flooded acreage in the Seller Service Area could reduce winter foraging habitat for this special-status bird species. One of five known greater sandhill crane populations in North America resides in the Central Valley (Littlefield et al. 1994). Though the Central Valley population does not breed within the area of analysis, the entire population winters in the Central Valley from Sacramento Valley south to the Bay-Delta (Pogson and Lindstedt 1991), roosting in areas of shallow water and foraging in adjacent areas of abundant waste rice, corn and other grains.

This species would be affected by water transfer activities through its cropland idling/shifting. As small streams, rivers and reservoirs are not primary habitats for this species, the effects of groundwater substitution and releases from reservoir storage would not affect this species.

Rice production cycle coincides with the bird's seasonal behavior: it uses rice grain waste (and upland corn fields) for wintering and foraging habitat from October to early spring and it over winters when rice and corn are harvested (fall). Greater sandhill cranes exhibit site fidelity (Zeiner et al. 1990), typically returning to the same location each year to winter. Idling fields or crop shifting within areas that greater sandhill cranes historically return to, may affect their wintering distribution patterns due to reduced forage availability on idled or crop shifted fields. Although the birds would disperse as their main food source diminishes, crop idling and/or crop shifting could affect the timing of dispersal and could negatively affect those individuals that have not had sufficient time to prepare for winter migration (i.e., hyperphagia - dramatic increase in appetite and food consumption) (Smithsonian Institution 2012). Environmental Commitments includes avoiding crop idling near ~~Butte Sink~~wildlife refuges and established wildlife areas that provide ~~, a~~ core wintering areas for greater sandhill crane, to reduce impacts to the crane population. This species would also benefit from Environmental Commitments to protect giant garter snake and

Pacific pond turtle. With these actions, this alternative would have a less than significant impact on greater sandhill crane.

Long-Billed Curlew

Reducing seasonally flooded acreage in the Seller Service Area would reduce winter forage for this special-status bird species. The curlew is a winter migrant in the Central Valley (Zeiner et al. 1990) where it generally forages on rice fields, upland croplands, and herbaceous plants. The Long-billed curlew breeds in elevated grasslands from April to September and returns to seasonally flooded agriculture (i.e. rice fields) during harvest (October through the end of fall). The curlew will use rice fields or other shallow open waters to forage for invertebrates from November through March. The winter migrants can arrive as early as June (Zeiner et al. 1990) to feed on small vertebrates and invertebrates. Winter curlews take advantage of seasonally flooded agricultural fields to probe for small prey items, but have been known to feed on dry fields. The idling of seasonally flooded agricultural fields would reduce foraging habitat for this species. Birds would generally disperse to other fields; however, idling of habitat known to support colonies of long-billed curlew would be avoided. Environmental Commitments aimed at the protection of giant garter snake would also reduce impacts on long-billed curlew. Impacts to long-billed curlew would be less than significant.

Tricolored Blackbird

Reducing seasonally flooded acreage in the Sacramento Valley would reduce summer forage and potential breeding habitat for this species. Groundwater substitution may reduce flows in small streams or reduce the availability of surface waters in wetland habitats which would affect forage and potential breeding habitat for this species. In the winter, tricolored blackbirds inhabit the Sacramento-San Joaquin Delta and central California coast. In the spring, they migrate to breeding locations in Sacramento County and throughout the San Joaquin Valley (Zeiner et al. 1990). Tricolored blackbirds generally breed from March to July, but have been observed breeding in the Sacramento Valley as early as October through December. The birds use breeding habitat adjacent to rice lands and will use shallow open water and rice land resources for foraging on small aquatic insects, emergent plants, and seeds. They also forage on cultivated grains (such as rice), on croplands and flooded fields, and forage for rice waste grain following harvest. Studies have shown that rice can constitute up to 38 percent of the annual diet of tricolored blackbirds (Zeiner et al. 1990). Although the rice plants are not tall or sturdy enough to support nests, the seasonally flooded fields provide resources required for breeding colony locations, which consist of open access to water and suitable foraging space with insect prey. Tricolored blackbirds will use emergent vegetation in return ditches and irrigation canals associated with the seasonally flooded fields. The rice agriculture cycle provides insect forage in the flooded fields during the summer and waste grain forage over winter. Because the species has specific breeding requirements and there are limited suitable breeding habitats, the same areas will often be used from year to year. Where changes in habitat prevent this, colonies are generally found in the vicinity of the previous year's colony (Zeiner et al. 1990).

The primary concern for the tricolored blackbird's association with rice fields is the use of the habitat as a source of insects and waste grain forage. Cropland idling/ crop shifting would affect the populations foraging distribution behavior and patterns and would reduce foraging and breeding habitat. Implementing the environmental commitments would help avoid or minimize these potential impacts. The Proposed Action, with the environmental commitments, would have a less than significant impact on tricolored blackbird.

White-Faced Ibis

Reducing seasonally flooded agriculture in the Sacramento Valley could reduce winter forage for this special-status species. The species is a winter migrant to the Central Valley. Important wintering locations include the Delevan-Colusa Butte Sink, northwestern Yuba County, the Yolo Bypass, Grasslands Wetlands Complex, and Mendota Wildlife Area (Zeiner et al. 1990). Central Valley breeding colonies can include the Mendota Wildlife Area and Colusa National Wildlife Area. White-faced ibis inhabit wetland habitat and seasonally flood agricultural fields, including rice fields that provide abundant prey sources. Population declines are due to drainage of wetlands and loss of nesting habitat (Zeiner et al. 1990); seasonally flooded agricultural habitat have in part, replaced the lost wetland foraging habitat for this species. This species forages in seasonally flooded agricultural field during the summer, and forages in dry or flooded rice fields during the fall and winter. Cropland idling/ crop shifting would reduce winter forage for this specie, however, the species does not rely solely on flooded fields for foraging. This species would also benefit from Environmental Commitments aimed at protecting giant garter snake and Pacific pond turtle. The Proposed Action, with the environmental commitments, would have a less than significant impact on white-faced ibis.

Black Tern

Reducing seasonally flooded acreage in the Seller Service Area would reduce breeding habitat and summer habitat for this special-status bird species. Black terns were formerly a common spring and summer migrant, and despite the presence of suitable habitat in rice farming areas and croplands, black tern numbers have declined throughout its range, especially in the Central Valley (Zeiner et al. 1990). Flooded agricultural fields have, in part, replaced the lost emergent wetland breeding and foraging habitat for this species. The rice production cycle coincides with the bird's seasonal behavior: field flooding would occur during the tern's Central Valley breeding season (May through August) and fields are drained when the birds migrate to other habitat (September and October). During breeding season the terns use flooded rice land and emergent vegetation for foraging (for insects and small vertebrates) and for nesting. This species constructs ground nests on dead vegetation; in rice fields, it will also nest on dikes that separate the patties. Reduction of seasonally flooded agricultural habitat could adversely affect local populations. However, the decisions regarding crop shifting/idling will have already been made prior to the onset of the species breeding season, and they would be able to select appropriate nesting sites for that year. Reclamation would review maps of areas proposed for crop idling/ crop shifting to ensure avoidance of core areas for black tern. This species would also benefit from environmental commitments aimed at the protection of giant garter snake and other special-status birds. Based on the forgoing, the Proposed Action, with the environmental commitments, would have a less than significant impact on black tern.

Purple Martin

Reducing seasonally flooded agriculture in the Sacramento Valley could reduce summer forage for this special-status species. Groundwater substitution transfers could reduce the quality or extent of habitat for purple martin in the Seller Service Area. Purple martins are generally associated with valley foothill and riparian habitats and are primarily a resident of wooded areas. They may be found in a variety of open habitats during migration, including grassland, wet meadow, and fresh emergent wetlands, usually near water (Zeiner et al. 1990), and have been observed in the Seller Service Area (CDFW 2014). This species feeds on insects. Purple martin may occur in the area of analysis from March through August. This species could be impacted by a reduction in the amount of rice and wetland habitat acreage. As previously described, crop idling/shifting would reduce the amount of rice habitat by approximately 10.5 percent under the Proposed Action. Groundwater substitution could reduce flows in small streams and wetlands associated with areas of groundwater withdrawal and in downstream areas. Reduced stream flows could result in stress on the riparian community and reduce riparian habitat suitability for the species and reduce the amount of available habitat. Implementation of the environmental commitments limit effects on irrigation system waterways, and small streams. With implementation of these environmental commitments, the impacts to purple martin would be less than significant.

Yellow-Headed Blackbird

Reducing seasonally flooded agriculture in the Sacramento Valley would reduce summer forage for this special-status species. Groundwater substitution in the Seller Service Area would reduce summer foraging and breeding habitat for this bird species. The species is associated with fresh emergent wetlands, along lakes and ponds. The yellow-headed blackbird uses these habitats for breeding, nesting, and roosting. These species has been observed in the Buyer Service Area and suitable habitat exists in both the Buyer and Seller Service Areas. Adults feed primarily on grains, but eat insects during breeding season (Zeiner et al. 1990). Nesting colonies require dense emergent wetland vegetation and a large insect prey base; nesting is timed to coincide with maximum aquatic insect emergence.

Transfer actions coincide the blackbird's breeding season (mid-April to late July) This species could be impacted by a reduction in the amount of rice and wetland habitat. As previously described, crop idling/shifting would reduce the amount of rice habitat by approximately seven percent under the Proposed Action. Groundwater substitution could reduce flows in small streams and wetlands associated with areas of groundwater withdrawal and in downstream areas. Reduced stream flows could result in stress on the riparian community and reduce suitability for the species and reduce the amount of available habitat for the species. ~~Purple martin~~The yellow-headed blackbird would benefit from the environmental commitments limiting effects on irrigation system waterways and in small streams. With implementation of these environmental commitments, the impacts to ~~purple martin~~the yellow-headed blackbird would be less than significant.

Other Migratory Birds

Reducing seasonally flooded acreage in the Seller Service Area could reduce foraging and roosting habitat for resident and migratory waterfowl and shorebirds. Millions of waterfowl and hundreds of thousands of shorebirds, wading birds, and passerines use seasonal flooded agriculture in the Sacramento Valley during a portion of their winter stopover on the Pacific Flyway. Habitat use varies with rainfall, site-specific flooding cycles, post-harvest management practices, and the particular habitat requirements of each species. -Waste grains provide a significant source of forage for waterfowl.

Idling fields or crop shifting may affect the wintering distribution patterns of migratory birds in agricultural areas depending on which fields are idled; however, cropland idling is not expected the affect the amount of winter forage that is available through post-harvest flooding since water transfers will not be made using rice decomposition water. As discussed above in Section 3.8.2.4.1, only a portion of fields planted are flooded post-harvest and decisions on whether to flood are made based on the availability of fall and winter water and not on the amount of acres planted.

Because cropland idling/shifting as a result of water transfers would remain within historical variation of rice production and would not affect the amount of post-harvest flooding, –and because Environmental Commitments include minimizing crop idling near wildlife refuges and established wildlife areas that provide core wintering areas for these species, this alternative would have a less than significant impact on migratory birds.

Impacts on Special-Status Bird Species: Long-term water transfer actions, including implementation of the environmental commitments, under the Proposed Action would have a less than significant impact on greater sandhill crane, black tern, purple martin, long-billed curlew, tricolored blackbird, white-faced ibis, and yellow-headed blackbird, because there would be a less than significant impact on the habitats that support these species. These species are highly mobile and could easily relocate to other suitable habitats that would continue to exist in the surrounding areas.

Buyer Service Area

Under the Proposed Action, buyers would receive water made available through long-term water transfer actions. The effects of using the purchased water on natural resources would be within the range of existing activities in each CVP contract and existing BOs. Based on this, there would be no new effects on natural habitats or wildlife species in the Buyer Service Area.

Impacts on Special-Status Bird Species: Actions under the Proposed Action would have no impact on special-status bird species, as the impacts associated with transferred water would be within the range of existing activities under the buyers' CVP contracts and their associated BOs.

3.8.2.5 Alternative 3: No Cropland Modifications

3.8.2.5.1 Seller Service Area

Under this alternative, water would not be made available through cropland idling or crop shifting. Water would be made available for transfer through groundwater substitution, stored reservoir releases, and conservation. The amount of water made available from each of these sources would be at the same levels as described for the Proposed Action.

Groundwater Levels

Groundwater Substitution Transfers

Groundwater substitution under the No Cropland Modifications Alternative could decrease available groundwater for natural communities relative to the No Action/No Project Alternative. The No Cropland Modifications Alternative would result in the same level of groundwater substitution as the Proposed Action. Effects on natural communities and special-status plant and wildlife species are described in Section 3.8.2.4.1.

Reservoirs

The No Cropland Modifications Alternative could impact reservoir storage and reservoir surface area. Under the No Cropland Modifications Alternative, model output predict that there would be no substantial (more than ten percent) decrease in end-of-month storage volume, reservoir elevation, or surface area relative to existing conditions in Shasta, Oroville, and Folsom reservoirs.

Changes in non-Project reservoirs participating in reservoir release transfers (Lake McClure and Camp Far West, Hell Hole, and French Meadows reservoirs) would be the same as described in the Proposed Action. Water elevations and storage levels during transfers would occur within the normal range of operations of these reservoirs under existing conditions.

Overall, all reservoirs would continue to be operated according to their existing requirements and within their current range of operations under the No Cropland Modifications Alternative.

Impacts on Natural Communities: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on natural communities associated with reservoirs, because the changes caused by the project would occur within the normal range of operations for the reservoirs.

Impacts on Special-Status Wildlife: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on special-status wildlife species associated with reservoirs, because the changes caused by the project would be within the normal range of operations for the reservoirs.

Rivers and Creeks

Sacramento River Watershed

The No Cropland Modifications Alternative could cause flows in rivers and creeks in the Sacramento River watershed to be lower than under the No Action/No Project Alternative. Under the No Cropland Modifications Alternative, mean monthly modeled flows would be reduced by less than ten percent on the Sacramento, Feather, Yuba, and American rivers. Based on the screening level criteria, these flow reductions are not considered substantial. Existing stream flow requirements (flow magnitude and timing, temperature, and other water quality parameters) would continue to be met. Among larger rivers, only the Bear River would have flows reduced by more than ten percent by the No Cropland Modifications Alternative. The effects of Alternative 3 on Bear River flows would be the same as described for the Proposed Action in Section 3.8.2.4.1.

Because smaller streams are affected only by groundwater, the effects of Alternative 3 on smaller streams would be the same as described for the Proposed Action in Section 3.8.2.4.1.

San Joaquin River Watershed

The effects to river flows in the San Joaquin and Merced rivers would be the same as those described for the Proposed Action in Section 3.8.2.4.1.

Delta

The No Cropland Modifications Alternative could cause Delta Outflows to be lower than under the No Action/No Project Alternative. Under the No Cropland Modifications Alternative, Delta outflows would not be more than 1.3 percent lower than flows under the No Action/No Project Alternative in any month or water year type. The maximum upstream shift in X2 location would be 0.1 km (0.2 percent) upstream during periods of decreased flow, and 0.6 km (0.7

percent) downstream during periods of increased flow. These flow changes would not have a significant impact on biological resources.

Impacts on Natural Communities: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on natural communities associated with Delta Outflow. No impacts would be expected to occur to tidal perennial aquatic habitat, saline emergent wetland, and tidal fresh emergent wetland, because the project would have very small effects on Delta hydrology.

Impacts on Special-Status Plants and Wildlife: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on special-status plant and wildlife species associated with Delta outflow, because the project would have very small effects on Delta hydrology.

3.8.2.5.2 Buyer Service Area

Reservoirs

San Luis Reservoir
The No Cropland Modifications Alternative could alter storage at San Luis Reservoir relative to the No Action/No Project Alternative. The effects to San Luis Reservoir storage would be the same as those described for the Proposed Action in Section 3.8.2.4.1.

3.8.2.6 Alternative 4: No Groundwater Substitution

3.8.2.6.1 Seller Service Area

Under this alternative, water would not be made available through groundwater substitution. Water would be made available for transfer through cropland idling or crop shifting, stored reservoir releases, and conservation. The amount of water made available from each of these sources would be at the same levels as described for the Proposed Action.

Groundwater Levels

Groundwater Substitution Transfers
Groundwater substitution under the No Groundwater Substitution Alternative would not decrease available groundwater and therefore have no impacts on natural communities that rely on groundwater.

Because the No Groundwater Substitution Alternative would not result in increased groundwater drawdown in relation to the No Action/No Project Alternative, no impacts to natural communities and associated wildlife would occur.

Reservoirs

The No Groundwater Substitution Alternative could impact reservoir storage and reservoir surface area. Under the No Groundwater Substitution Alternative, modeled storage volumes, reservoir elevations and surface areas would change. Model outputs predict that there would be no substantial (more than ten percent) decrease in end-of-month storage volume, reservoir elevation, or surface area relative to existing conditions in Shasta, Oroville, and Folsom reservoirs. Changes in non-Project reservoirs participating in reservoir release transfers (Lake McClure and Camp Far West, Hell Hole, and French Meadows reservoirs) would be the same as described in the Proposed Action in Section 3.8.2.4.1.Overall, all reservoirs would continue to be operated according to their existing requirements and within their current range of operations under the No Groundwater Substitution Alternative.

Impacts on Natural Communities: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on natural communities associated with reservoirs, because the changes caused by the project would occur within the normal range of operations for the reservoirs.

Impacts on Special-Status Wildlife: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on special-status wildlife species associated with reservoirs as the changes caused by the project would be within the normal range of operations for the reservoirs.

Rivers and Creeks

Sacramento River Watershed

The No Groundwater Substitution Alternative could cause rivers and creeks in the Sacramento River watershed to be lower than under the No Action/No Project Alternative. Under the No Groundwater Substitution Alternative, mean monthly modeled flows would be reduced by less than ten percent on the Sacramento, Feather, Yuba, and American rivers. Therefore, these flow reductions would not be considered substantial. Existing stream flow requirements (flow magnitude and timing, temperature, and other water quality parameters) would continue to be met. Therefore, the effects of the No Groundwater Substitution Alternative on terrestrial resources along these rivers would be less than significant. Among larger rivers, only the Bear River would have flows reduced by more than ten percent by the No Groundwater Substitution Alternative and, therefore, is further discussed in detail below.

Smaller streams in the Sacramento River watershed (see Table 3.8-3 for list of streams) would not be impacted by transfers under the No Groundwater Substitution Alternative because groundwater substitution would not occur.

Impacts on Natural Communities: Long-term water transfer actions under the No Groundwater Substitution Alternative would have no impact on surrounding natural communities in the Sacramento, Feather, Yuba, and American rivers and in smaller streams within the Sacramento River watershed, as no changes in streamflow would occur.

Impacts on Special-Status Wildlife: Long-term water transfer actions under the No Groundwater Substitution Alternative would have no impact on special-status wildlife species in the Sacramento, Feather, Yuba, and American rivers and in smaller streams within the Sacramento River watershed, as no changes in streamflow would occur and there would be no effect on natural communities.

Bear River

The No Groundwater Substitution Alternative could cause Bear River flows to be lower than under the No Action/No Project Alternative. Under the No Groundwater Substitution Alternative, the only flow reduction greater than ten percent would occur in critical water years during February (approximately 18 percent, or 45 cfs lower). These flow reductions would occur only in one month during critical water years.

Average monthly flows would be higher, compared to the No Action/No Project Alternative, in critical water years during July (approximately 240 percent, 58 cfs), and dry years during July and August (52 percent, 38 cfs and 22 percent, three cfs, respectively) when water is released from Camp Far West Reservoir for transfer.

Impacts on Natural Communities: Flow decreases, resulting from long-term water transfer actions under the No Groundwater Substitution Alternative, would occur in winter months, when terrestrial plants and animals are less dependent on stream flow. While flows would be reduced in some years in winter, they would remain within the normal range of variability experienced under the No Action/No Project condition and would occur only during winter critical years (approximately one year in every five). Flows would be higher in summer during dry and critically dry years, which would benefit riparian vegetation along the Bear River. Therefore, overall the flow changes that would occur on the Bear River under the No Groundwater Substitution Alternative would be beneficial to natural communities.

Impacts on Special-Status Wildlife: Long-term water transfer actions under the No Groundwater Substitution Alternative would be beneficial to terrestrial special-status wildlife species, because during summer flows would be higher than under the No Action/No Project condition, while flow reduction during winter in some years would not affect special-status species habitat.

San Joaquin River Watershed

San Joaquin River

The No Groundwater Substitution Alternative could cause San Joaquin River flows to be lower than under the No Action/No Project Alternative. Under the No Groundwater Substitution Alternative, flows would be reduced by less than ten percent on the San Joaquin River relative to the No Action/No Project Alternative. Based on the screening level criteria, these flow reductions would not be considered substantial. Further, there would be a 162.6 cfs (15 percent) increase in flows in dry water years during July.

These flow changes would not have a significant impact on biological resources.

Impacts on Natural Communities: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on natural communities along the San Joaquin River, because changes in flow would be small.

Impacts on Special-Status Wildlife: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on special-status wildlife species along the San Joaquin River, because flow reductions would be small and thus would have little effect on natural communities or associated special-status species.

Merced River

The No Groundwater Substitution Alternative could cause Merced River flows to be lower than under the No Action/No Project Alternative. Under the No Groundwater Substitution Alternative, flows in the Merced River would be reduced by less than ten percent relative to the No Action/No Project Alternative in all months and water year types. Flows would be 124 percent (163 cfs) and 59 percent (70 cfs) higher under the No Groundwater Substitution Alternative compared to the No Action/No Project Alternative in dry and critical water years, respectively, during July. While these flow changes exceed the ten percent screening criterion, the flow changes on the Merced River would not have a significant impact on biological resources, as flows would remain within the range that would occur under the No Action/No Project Alternative during this time of year.

Impacts on Natural Communities: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on natural communities along the Merced River, as flows would not be substantially decreased and would remain within the range of variability projected for the No Action/No Project alternative.

Impacts on Special-Status Wildlife: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on special-status wildlife species along the Merced River because flow changes would be small and thus would have little effect on natural communities or associated special-status species.

Delta

Delta Outflow

The No Groundwater Substitution Alternative could cause Delta Outflows to be higher than under the No Action/No Project Alternative. Under the No Groundwater Substitution Alternative, Delta outflows would not be more than one percent lower than outflows under the No Action/No Project Alternative in any month or water year type.

The maximum upstream shift in X2 location would be 0.1 km (0.1 percent) upstream during periods of decreased flow, and 0.8 km (0.5 percent) downstream during periods of increased flow. These changes to Delta outflow, and resultant changes in X2 position, would not have a substantial impact on biological resources because the change is minimal (less than ten percent).

These flow changes would not have a significant impact on biological resources.

Impacts on Natural Communities: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on natural communities associated within the Delta, because changes in Delta hydrology would be small. No impacts are expected to occur to tidal perennial aquatic habitat, saline emergent wetland, and tidal fresh emergent wetland, because the project would have very small effects on Delta hydrology.

Impacts on Special-Status Plants and Wildlife: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on special-status plant and wildlife species within the Delta, because changes in Delta hydrology would be small and thus would not affect natural communities or associated special-status species.

3.8.2.5.2 Buyer Service Area

Reservoirs

San Luis Reservoir

The No Groundwater Substitution Alternative would alter surface water elevation and reservoir storage at San Luis Reservoir relative to the No Action/No Project Alternative. Under the No Groundwater Substitution Alternative, neither CVP nor SWP storage at San Luis Reservoir would change relative to the No Action/No Project Alternative, and thus would have no effect on natural communities or special-status species associated with this reservoir.

3.8.3 Comparative Analysis of Alternatives

Table 3.8-10 summarizes the effects of each of the action alternatives. The following text supplements the table by describing the magnitude of the effects under the action alternatives ~~and~~ relative to the No Action/No Project Alternative.

Table 3.8-10. Comparative Analysis of Alternatives

Potential Impact	Alternative	Significance[1]			Significance after Mitigation	
		Natural Communities	Special-Status Species	Proposed Mitigation	Natural Communities	Special-Status Species
Groundwater substitution could reduce groundwater levels and available groundwater for ~~supporting~~ natural communities.	2, 3	LTS	LTS	None	LTS	LTS
Transfers could impact reservoir storage and reservoir surface area and alter habitat availability and suitability associated with those reservoirs.	2, 3, 4	LTS	LTS	None	LTS	LTS
Transfers could reduce flows in large rivers in the Sacramento and San Joaquin River watersheds, altering habitat availability and suitability associated with these rivers.	2, 3, 4	LTS	LTS	None	LTS	LTS
Groundwater substitution could reduce stream flows supporting natural communities in some small streams.	2, 3	S	S	GW-1	LTS	LTS
Transfer actions could alter hydrologic conditions in the Delta, altering associated habitat availability and suitability.	2, 3, 4	LTS	LTS	None	LTS	LTS
Cropland Idling/Shifting could alter habitat availability and suitability for upland species.	2, 4	LTS	LTS	None	LTS	LTS

Potential Impact	Alternative	Significance[1]			Significance after Mitigation	
		Natural Commu-nities	Special-Status Species	Proposed Mitigation	Natural Communities	Special-Status Species
Cropland idling/shifting under could alter the amount of suitable habitat for natural communities ~~and~~ , special-status wildlife species, and migratory birds associated with seasonally flooded agriculture and associated irrigation waterways.	2, 4	LTS	LTS	None	LTS	LTS
Transfers could impact San Luis Reservoir storage and surface area.	2, 3, 4	LTS	LTS	None	LTS	LTS
Transfers could alter planting patterns and urban water use in the Buyer Service Area.	2, 3, 4	LTS	LTS	None	LTS	LTS
Transfers could affect wetlands that provide habitat for special status plant species.	2, 3, 4	--	LTS	None	LTS	LTS
Transfers could affect giant garter snake and Pacific pond turtle by reducing aquatic habitat.	2, 3, 4	--	LTS	None	LTS	LTS
Transfers could affect the San Joaquin kit fox by reducing available habitat.	2, 3, 4	--	LTS	None	LTS	LTS
Transfers could impact special status bird species and migratory birds.	2, 3, 4	--	LTS	None	LTS	LTS

[1] LTS = Less than significant, S = Significant

3.8.3.1 Alternative 1: No Action/No Project Alternative

There would be no changes in agricultural use or water availability in the Seller Service Area relative to existing conditions. In the Buyer Service Area, land idling could occur in response to CVP shortages which could affect habitat availability, but this would be similar to existing conditions. Conditions for natural communities and special-status species would remain the same as under existing conditions.

3.8.3.2 Alternative 2: Full Range of Transfers (Proposed Action)

Cropland idling, groundwater substitution, and reservoir storage transfers could affect the availability of water in the Seller Service Area and the availability and suitability of habitat. This could affect conditions for special-status species relative to the No Action/No Project Alternative, but the effects with the implementation of the Environmental Commitments would be less than significant to both natural communities and special-status species. The

Proposed Action would increase water supplies to agricultural users in the Buyer Service Area, and the effects of using the water would be within the range of existing activities under the users' water service contracts.

3.8.3.3 Alternative 3: No Cropland Modifications

The No Cropland Modifications Alternative would not include cropland idling/shifting as a mechanism for transferring water. Effects would continue to occur from groundwater substitution and reservoir storage transfers at the same levels described for the Proposed Action. The effects of this alternative with the implementation of the Environmental Commitments would be less than significant to both natural communities and special-status species. The Proposed Action would increase water supplies to agricultural users in the Buyer Service Area, and the effects of using the water would be within the existing activities under the users' water service contracts.

3.8.3.4 Alternative 4: No Groundwater Substitution

The No Groundwater Substitution Alternative would not include groundwater substitution as a mechanism for transferring water. Effects would continue to occur from cropland idling/shifting and reservoir storage transfers. The amount of cropland idled/shifted would be greatest under this alternative, while reservoir storage transfers would be similar to the Proposed Action. The effects of this alternative with the implementation of the Environmental Commitments would be less than significant to both natural communities and special-status species. The Proposed Action would increase water supplies to agricultural users in the Buyer Service Area, and the effects of using the water would be within existing activities under the users' water service contracts.

3.8.4 Environmental Commitments/Mitigation Measures

Environmental Commitments described in Section 2.3.2.4 and Mitigation Measure GW-1 described in Section 3.3 would eliminate or reduce the potentially substantial effects of water transfer actions.

3.8.5 Potentially Significant Unavoidable Impacts

None of the alternatives would result in potentially significant unavoidable impacts on natural communities, wildlife, or special-status species.

3.8.6 Cumulative Impacts

The timeframe for the cumulative effects analysis extends from 2015 through 2024, a ten-year period. The cumulative effects area of analysis for vegetation and wildlife is the same as the area of analysis shown in Figure 3.8-1. This section analyzes cumulative effects using the project method, which is further described in Chapter 4.

The projects considered for the vegetation and wildlife cumulative condition are the SWP water transfers, CVP Municipal and Industrial Water Shortage Policy (WSP), Lower Yuba River Accord, refuge transfers, San Joaquin River Restoration Program (SJRRP), and Exchange Contractors 25-Year Water Transfers, described in more detail Section 4.3 in Chapter 4. SWP transfers could involve groundwater substitution transfers in the Seller Service Area and, therefore, could affect vegetation and wildlife resources. The WSP could reduce agricultural water deliveries and increase land idling in the Buyer Service Area. Effects of the WSP in the Seller Service Area would be minor as agricultural water supplies would not substantially change relative to existing conditions.

The following section describes potential vegetation and wildlife resources cumulative effects for each of the proposed alternatives.

3.8.6.1 Alternative 2: Full Range of Transfers (Proposed Action)

3.8.6.1.1 Seller Service Area

Groundwater substitution and cropland idling/shifting under the Proposed Action in combination with other cumulative projects could decrease available groundwater for natural communities relative to the No Action/No Project Alternative. The SWP water transfers would make up to 6,800 acre feet of water available through groundwater substitution for transfer and up to 89,930 acre feet through cropland idling. The sellers for the SWP transfers are located in the Feather River Basin and receive water from Lake Oroville. There would be minimal geographic overlap between SWP transfers and long-term water transfers.

The WSP is primarily a policy development program and planning tool to clearly define water shortage conditions and what reductions in allocation CVP users should expect in the event of shortages. The WSP could reduce agricultural water deliveries and increase land idling in the Buyer Service Area. Effects of the WSP in the Seller Service Area would be minor as agricultural water supplies would not substantially change relative to existing conditions.

The effects of the long term water transfers on groundwater dependent natural communities would be small and local and the cumulative effect in combination with SWP water transfers and WSP would have a less than significant cumulative effect on groundwater dependent natural communities and special-status wildlife.

The Proposed Action in combination with other cumulative projects could cause flows in rivers and creeks in the Sacramento River watershed to be lower than under the No Action/No Project Alternative. The sellers for the SWP transfers are in the Feather River Basin and receive water from Lake Oroville. There would be minimal geographic overlap between this program and long-term water transfers, and therefore there effects on the flows in rivers and creeks in the Sacramento River watershed and the vegetation and wildlife resources that depend on them.

The WSP could reduce agricultural water deliveries and increase land idling in the Buyer Service Area. Effects of the WSP in the Seller Service Area would be minor as agricultural water supplies would not substantially change relative to existing conditions. Therefore, changes on flows in rivers and creeks in the Sacramento River watershed and the vegetation and wildlife resources that depend on them would not be substantial.

The Lower Yuba River Accord is a set of agreements designed to provide additional water to meet fisheries needs in the lower Yuba River. In addition, up to 60,000 acre feet of water per year would be made available for purchase by Reclamation and DWR for fish and environmental purposes. The Accord would provide a benefit to environmental resources within its action area and there would be no cumulative effect on vegetation and wildlife resources.

Long-term water transfers would not be cumulatively considerable with the other projects because each of the projects would have little or no impact flows in rivers and creeks in the Sacramento River watershed or the vegetation and wildlife resources that depend on them.

The Proposed Action in combination with other cumulative projects could affect reservoir storage and reservoir surface area. Changes to reservoir storage from SWP transfers, WSP, Yuba Accord, refuge transfers, SJRRP, and Exchange Contractors 25-Year Water Transfers would be within the normal range of operations of the reservoirs. Overall, all reservoirs would continue to be operated according to their existing regulatory requirements under each of the projects. Therefore, the Proposed Action in combination with other cumulative projects would not have significant cumulative effects on vegetation and wildlife in reservoirs.

The Proposed Action in combination with other cumulative projects could cause flows in rivers and creeks in the San Joaquin River watershed to be lower than under the No Action/No Project Alternative. The SJRRP would increase flows and improve habitat conditions in and along the San Joaquin River to support spring-run and fall-run Chinook salmon, steelhead and other native fish. Portions of the Buyers service area border the area affected by the SJRRP, but do not directly overlap this area. The SJRRP would create additional habitat for sensitive vegetation and wildlife species by increasing flows and expanding floodplains. Refuge transfers could result in small increases in San Joaquin River flows if transfers from Merced ID are conveyed to refuges by flowing down the San Joaquin River to the Delta. Therefore, ~~this~~ these actions would not be cumulatively adverse in combination with long-term water transfers and there would be no adverse cumulative effect on vegetation and wildlife resources.

The Proposed Action in combination with other projects could cause changes to Delta hydrology relative to the No Action/No Project Alternative. SWP transfers, WSP, Yuba Accord, refuge transfers, and the SJRRP would have small effects on Delta hydrology and operations of these projects, and the long term transfers would be in compliance with applicable BOs for CVP and SWP operations. Generally, the SWP transfers, Yuba Accord, refuge transfers, and Long-Term Water Transfers would increase flows in the Delta during the dry season and decrease flows slightly during other times of year. The SJRRP would increase inflows into the Delta, and the WSP would have minimal effects on Delta flows. The Proposed Action, in combination with other cumulative projects, would have only small effects on flows in the Delta, which would not result in a cumulative significant impact related to vegetation and wildlife resources.

3.8.6.1.2 Buyer Service Area

The Proposed Action in combination with other cumulative projects could alter planting patterns and urban water use relative to the No Action/No Project Alternative. Exchange contractors would sell up to 150 TAF to willing buyers under the Exchange Contractors 25- Year Water Transfers, including many of the buyers for the long-term water transfers. The Exchange Contractors service area does not overlap geographically with Long-Term Water Transfers Seller Service Area. However, both projects could sell their water to the same buyers. No buyer would be allowed to purchase more than their maximum CVP contract amount under the combined programs, so effects are existing activities under their CVP contracts and associated BOs. Therefore, the Proposed Action in combination with other cumulative projects would not have a significant cumulative effect on vegetation and wildlife resources.

3.8.6.2 Alternative 3: No Cropland Modification

The cumulative effects of Alternative 3 and other cumulative projects would be the same as those described for the Proposed Action.

3.8.6.3 Alternative 4: No Groundwater Substitution

Cropland idling/shifting under Alternative 4 would have the same effects as described in the Proposed Action; therefore, cumulative effects would be the same as effects of cropland idling/shifting described for the Proposed Action.

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Section 3.9
Agricultural Land Use

This section presents existing conditions for agricultural land use and resources within the area of analysis and discusses potential effects from the proposed alternatives.

Cropland idling would be the only water transfer method that would directly affect land use in the area of analysis. Implementation of crop shifting, groundwater substitution, conservation, or stored reservoir purchase transfers would not affect agricultural land uses and are not further discussed in this section. None of the alternatives or transfer types would affect other types of land uses (such as municipal or industrial); therefore, only agricultural land use is analyzed.

3.9.1 Affected Environment/Environmental Setting

3.9.1.1 Area of Analysis

The area of analysis for agricultural land use includes counties where cropland idling transfers could occur in the Seller Service Area and counties where transferred water would be used for agricultural purposes in the Buyer Service Area. Counties in the Seller Service Area include Glenn, Colusa, Butte, Sutter, Yolo, and Solano and counties in the Buyer Service Area include San Joaquin, Stanislaus, Merced, San Benito, Fresno, and Kings. Figure 3.9-1 shows the area of analysis for agricultural land use.

3.9.1.2 Regulatory Setting

3.9.1.2.1 Federal

Conservation Reserve Program (CRP)
The CRP is a Federal program administered by the U.S. Department of Agriculture (USDA) Farm Service Agency. The CRP is a voluntary program that offers annual rental payments, incentive payments, and annual maintenance payments for certain activities, and cost-share assistance to establish approved cover on eligible cropland. To be eligible for placement in the CRP, land must be (1) cropland that is planted or considered planted to an agricultural commodity two of the five most recent crop years (including field margins) and that is physically and legally capable of being planted in a normal manner to an agricultural commodity or (2) marginal pastureland that is either enrolled in the Water Bank Program or suitable for use as a riparian buffer to be planted to trees. As of April 1, 2012, there was a total of 103,471 acres of CRP cropland

in California (USDA, Farm Service Agency 2012). Counties in the area of analysis with cropland acres in the CRP include: Glenn, Colusa, Sutter, Yolo, Solano, and Merced (USDA, Farm Service Agency 2012).

Figure 3.9-1. Agricultural Land Use Area of Analysis

3.9.1.2.2 State

Williamson Act

The California Land Conservation Act, also known as the Williamson Act, preserves agricultural and open space lands by discouraging premature and unnecessary conversion to urban uses. The Act creates an arrangement whereby private landowners contract with counties and cities to voluntarily restrict their land to agricultural and compatible open space uses. The vehicle for these agreements is a rolling term, 10-year contract (unless either party files a “notice of nonrenewal,” the contract is automatically renewed for an additional year). In return, restricted parcels are assessed for property tax purposes at a rate consistent with their actual use, rather than potential market value.

The Williamson Act established a definition of Prime agricultural lands based on the actual or potential agricultural productivity of the land being restricted (California Department of Conservation [DOC] 2010a; California DOC 2007a). Contracted land that meets the Williamson Act definition of prime agricultural land is designated as "Prime." Under the law, Prime Agricultural Land is defined as (California DOC 2007b):

- Land which qualifies for rating as class I or class II in the Natural Resources Conservation Service (NRCS) land use capability classifications;
- Land which qualifies for rating 80 to 100 in the Storie Index Rating;
- Land which supports livestock used for the production of food and fiber and which has an annual carrying capacity equivalent to at least one animal unit per acre as defined by the USDA;
- Land planted with fruit or nut-bearing trees, vines, bushes or crops which have a nonbearing period of less than five years and which will normally return during the commercial bearing period on an annual basis from the production of unprocessed agricultural plant production not less than two hundred dollars per acre;
- Land which has returned from the production of unprocessed agricultural plant production and has an annual gross value of not less than two hundred dollars per acre for three of the previous five years.

Non-Prime agricultural land is defined as land that does not meet any of the criteria for classification as Prime Agricultural Land. Most Non-Prime Land is in agricultural uses such as grazing or non-irrigated crops. However, Non-Prime Land may also include other open space uses that are compatible with agriculture and consistent with local general plans.

The Williamson Act also establishes a Farmland Security Zone (FSZ), which introduces a 20-year contract between a private landowner and a county that restricts land to agricultural or open space uses.[1] FSZ lands are designated as Urban and Non-Urban for subvention payment purposes. FSZ contracted land within a city's sphere of influence (SOI), or within three miles or the exterior boundaries of a city's SOI, is "Urban", while all other FSZ contracted land is "Non-Urban." Table 3.9-1 summarizes farm acreage by county enrolled in the Williamson Act and FSZ program in 2010 and 2011, which is data compiled by the California DOC, Division of Land Resource Protection [DLRP].

[1] An FSZ is essentially an area created within an AP by a board of supervisors upon request by a landowner or group of landowners. An AP defines the boundary of an area within which a city or county will enter into Williamson Act contracts with landowners. The boundary is designated by resolution of the board of supervisors or city council having jurisdiction. APs must generally be at least 100 acres in size.

California Farmland Conservancy Program (CFCP)

The CFCP is a voluntary program that seeks to encourage the long-term, private stewardship of agricultural lands through the use of agricultural conservation easements. The CFCP provides grant funding for projects that use and support agricultural conservation easements for protection of agricultural lands. An agricultural conservation easement is a voluntary, legally recorded deed restriction that is placed on a specific property used for agricultural production. The goal of an agricultural conservation easement is to maintain agricultural land in active production by removing the development pressures from the land. Such an easement prohibits practices that would damage or interfere with the agricultural use of the land. Because the easement is a restriction on the deed of the property, the easement remains in effect even when the land changes ownership. Table 3.9-1 summarizes the agricultural conservation easements in the area of analysis.

Farmland Mapping and Monitoring Program (FMMP)

The FMMP was established in 1982 and produces maps and statistical data used for analyzing effects on California's agricultural resources. The maps are updated every two years with the use of aerial photographs, a computer mapping system, public review, and field reconnaissance. The FMMP rates agricultural land according to soil quality and irrigation status and denotes the best quality land Prime Farmland. FMMP characterizes land use into the following categories:

- **Prime Farmland[2] –** Land with the best combination of physical and chemical features able to sustain long-term production of agricultural crops. This land has the soil quality, growing season, and moisture supply needed to produce sustained high yields. Land must have been used for production of irrigated crops at some time during the two update cycles prior to the mapping date.

[2] The term "Prime" as used here refers to the FMMPs designation of the location and extent of "Prime Farmland" as described above. The state's Williamson Act designates prime farmland based on different economic or production criteria, as described under the Williamson Act section above.

Table 3.9-1. Williamson Act and Agricultural Conservation Easement Acreage in Area of Analysis (2010-2011)

County	2010 Williamson Act Prime (acres)	2010 Williamson Act Non-Prime (acres)	2010 Total (Williamson Act lands; acres)	2011 Williamson Act Prime (acres)	2011 Williamson Act Non-Prime (acres)	2011 Total (Williamson Act lands; acres)	Percent Change (Total Williamson Act lands; 2010-2011)	FSZ (2011 acres) Urban Prime	FSZ (2011 acres) Urban Non-Prime	FSZ (2011 acres) Non-Urban Prime	FSZ (2011 acres) Non-Urban Non-Prime	Agricultural Conservation Easement (through the CFCP[1]; 2011 acres) Prime	Agricultural Conservation Easement (through the CFCP[1]; 2011 acres) Non-Prime	2011 Total Conservation lands (acres)[2]
Seller Service Area														
Glenn	63,618	267,432	**331,050**	63,781	270,024	**333,805**	**+0.83**	14,112	500	73,600	2,226	--	--	**424,243**
Colusa	66,952	193,720	**260,672**	66,952	193,720	**260,672**	**0**	15,989	737	40,628	2,035	--	--	**320,060**
Butte	113,686	106,293	**219,979**	113,808	103,367	**217,175**	**-1.3**	--	--	--	--	--	--	**220,175**
Sutter	51,408	13,165	**64,573**	51,408	13,165	**64,573**	**0**	--	--	--	--	--	--	**64,573**
Yolo	240,988	176,114	**417,102**	198,642	156,651	**355,593**	**-14.7**	158	1	--	--	200	7	**355,658**
Solano	120,053	145,582	**265,635**	119,936	145,371	**265,307**	**-0.12**	--	--	--	--	1,456	2,882	**269,916**
Buyer Service Area														
Stanislaus	293,495	396,459	**689,954**	--	--	**--**	**-100**	--	--	--	--	--	--	**--**
San Joaquin	323,478	149,489	**472,967**	322,528	148,460	**470,988**	**-0.42**	15,213	79	34,608	10,098	--	--	**530,986**
Merced	258,883	209,080	**467,963**	259,199	208,768	**467,967**	**+2.64**	--	--			--	--	**467,967**
San Benito	51,759	530,783	**582,542**	52,721	528,411	**580,132**	**-0.05**	--	--	--	--	--	--	**580,132**
Fresno	982,032	483,245	**1,465,277**	982,032	483,245	**1,465,277**	**-0.06**	--	--	25,799	3,482	--	--	**1,494,558**
Kings	279,062	110,671	**389,733**	278,839	110,671	**389,510**	**-0.07**	28,851	227	248,090	10,642	--	--	**677,320**

Source: California DOC 2013

[1] CFCP = California Farmland Conservation Program

[2] 2010 total conservation lands includes all Williamson Act lands, FSZ lands, and Agricultural Conservation Easements in 2010.

- **Farmland of Statewide Importance –** Land similar to Prime Farmland that has a good combination of physical and chemical characteristics for the production of crops. This land has minor shortcomings, such as greater slopes or less ability to store soil moisture than Prime Farmland. Land must have been used for production of irrigated crops at some time during the two update cycles prior to the mapping date.

- **Unique Farmland –** Lesser quality soils used for the production of the state's leading agricultural crops. This land is usually irrigated, but may include non-irrigated orchards or vineyards as found in some climatic zones in California. Land must have been cropped at some time during the two update cycles prior to the mapping date.

- **Farmland of Local Importance –** Land of importance to the local agricultural economy as determined by each county's board of supervisors and a local advisory committee. Often includes lands used for dryland farming and formerly irrigated land that has been left idle for three or more update cycles.

- **Grazing Land –** Land on which the existing vegetation is suited to the grazing of livestock.

- **Urban and Built-Up Land –** Land occupied by structures with a building density of at least one unit to 1.5 acres, or approximately six structures to one 10-acre parcel.

- **Other Land –** Land that does not meet the criteria of any other category.

- **Water –** Water areas with an extent of at least 40 acres.

3.9.1.2.3 Regional/Local

Cropland idling in the Seller Service Area could affect Important Farmland as well as lands enrolled in the Williamson Act and other land conservation programs by resulting in land conversion and/or incompatible land uses. The following local policies apply to agricultural lands in the Seller Service Area.

Glenn County

The Glenn County General Plan, Volume I – Policies, includes the following policies in relation to the preservation of agricultural lands (Glenn County 1993a):

- Natural Resources Policy (NRP)-1: Maintain agriculture as a primary, extensive land use, not only in recognition of the economic importance of agriculture, but also in terms of agriculture's contribution to the preservation of open space and wildlife habitat.

- NRP-2: Support the concept that agriculture is a total, functioning system which will suffer when any part of it is subjected to regulation resulting in the decline of agriculture: economics productivity, unmitigated land use conflicts and/or excessive land fragmentation.

- NRP-5: Continue participation in the Williamson Act policy, and allow new lands devoted to commercial agriculture and located outside urban limit lines to enter the program, subject to the specific standards for inclusion in this General Plan.

- NRP-8: Assure future land use decisions protect and enhance the agricultural economics industry while also protecting existing uses from potential incompatibilities.

Glenn County Code Title 15 establishes the Unified Development Code. Section 15.460 describes the Agricultural Preserve (AP) Zone. The AP Zone applies to lands covered by the Williamson Act within the county and has the purpose of:

- Preserving the maximum amount of the limited supply of agricultural land which is necessary in the conservation of the county's economic resources and vital for a healthy agricultural economy; and,

- Protecting the general welfare of the agricultural community for encroachments of unrelated agricultural uses which, by their nature, would be injurious to the physical and economic well-being of the agricultural community.

The county code defines permitted uses in AP zones. Similarly, Section 15.470 defines FSZs within the county and permitted uses on these lands (Ordinance Number 1183 § 2) (Glenn County 2006).

Colusa County

The Conservation Element of Colusa County's 1989 General Plan includes Conservation (CO) Policy CO-2, which states that agricultural land should be preserved and protected (Colusa County 1989).

Colusa County's Code, Chapter 34, Farming Practices, is intended to, in part, "preserve and protect for agricultural use those lands zoned for agricultural use" (Ordinance Number 510) (Colusa County 2012).

Appendix 1.4, Article 4 of the county's code establishes zoning district regulations for the AP Zone and the exclusive agriculture zone.

Butte County

Chapter 7 of the Butte County General Plan (Butte County 2012a) is the agricultural element of the plan and addresses agricultural resource goals and policies. Relevant goals include:

- Goal (Agriculture) AG-2: Protect Butte County's agricultural lands from conversion to non-agricultural uses.

This goal is supported by multiple policies regarding protection of agricultural lands and requirements before redesignation or rezoning of agricultural land.

Sutter County

Chapter 4 of the Sutter County General Plan (Sutter County 2010a) addresses agricultural resources and agricultural resource policies within the county. Relevant policies include the following:

- AG 1.1 – Preserve and maintain agriculturally designated lands for agricultural use and direct urban/suburban and other nonagricultural related development to the cities, unincorporated rural communities, and other clearly defined and comprehensively planned development areas.

- AG 1.5 – Discourage the conversion of agricultural land to other uses unless all of the following findings can be made:

  - The net community benefit derived from conversion of the land outweighs the need to protect the land for long-term agricultural use;

  - There are no feasible alternative locations for the proposed use that would appreciably reduce impacts upon agricultural lands; and,

  - The use will not have significant adverse effects, or can mitigate such effects, upon existing and future adjacent agricultural lands and operations.

Chapter 1500, Division 13 of Sutter County's Code establishes the zoning code for unincorporated areas in the county (Sutter County 2011). As with other counties in the area of analysis, the Sutter County zoning code establishes permitted uses for agricultural lands within the unincorporated county.

Yolo County

The Yolo County 2030 Countywide General Plan, Agriculture and Economic Development Element (Yolo County 2009) addresses the preservation of agricultural resources through the following policies:

- Policy AG-1.2: Maintain parcel sizes outside of the community growth boundaries large enough to sustain viable agriculture and discourage conversion to non-agricultural home sites.

- Policy AG-1.3: Prohibit the division of agricultural land for non-agricultural uses.

- Policy AG-1.4: Prohibit land use activities that are not compatible within agriculturally designated areas.

- Policy AG-1.5: Strongly discourage the conversion of agricultural land for other uses. No lands shall be considered for redesignation from Agricultural or Open Space to another land use designation unless all of the following findings can be made:

  - There is a public need or net community benefit derived from the conversion of land that outweighs the need to protect the land for long-term agricultural use;

  - There are no feasible alternative locations for the proposed project that are either designated for non-agricultural land uses or are less productive agricultural lands; and,

  - The use would not have a significant adverse effect on existing or potential agricultural activities on surrounding lands designated Agriculture.

- Policy AG-1.6: Continue to mitigate at a ratio of no less than 1:1 the conversion of farmland and/or the conversion of land designated or zoned for agriculture, to other uses.

- Policy AG-1.8: Regulate and encourage removal of incompatible land uses and facilities from agriculturally designated lands.

- Policy AG-1.21: Within conservation easements, preclude the practice of fallowing fields for the purpose of water export. Fallowing as a part of normal crop rotation is not subject to this policy.

Yolo County's Code, Title 8, Chapter 2, addresses zoning in the unincorporated county including AP zones, Agricultural Exclusive zones, and Agricultural General zones (Articles 4, 5, and 6) (Yolo County 2000). The zoning codes establish the principle uses for each agricultural zone.

Solano County
Chapter 3, Agriculture, of the Solano County General Plan (2008a) includes the following policies related to agricultural lands in the county:

- Agriculture Policy (Policy AG.P)-1: Ensure that agricultural parcels are maintained at a sufficient minimum parcel size so as to remain a farmable unit. Farmable units are defined as the size of parcels a farmer would consider viable for leasing or purchasing for different agricultural purposes. A farmable unit is not considered the sole economic function that will internally support a farm household.

- Policy AG.P-18: Support long-term viability of commercial agriculture and discourage inappropriate development of agricultural lands within the Delta.

- Policy AG.P-19: Require agricultural practices to be conducted in a manner that minimizes harmful effects on soils, air and water quality, and marsh and wildlife habitat.

Chapter 2.2 of Solano County's Code describes requirements for agricultural lands and operations within the unincorporated county (Solano County no date). Section 2.2-20 describes that it is the county's policy to conserve and protect both intensive and extensive agricultural land, and to protect those lands for exclusive agricultural uses that do not interfere with agricultural operations (Solano County no date). Chapter 28 of the county's code establishes zoning regulations within the unincorporated county including for agricultural districts.

3.9.1.3 Existing Conditions

The California DOC maps farmland throughout California every two years. The most recent data on farmland acreages and farmland conversions throughout the state is reported in the DOC's *Farmland Conversion Report 2006-2008* (California DOC 2011a). Additionally, the DOC has analyzed data on agricultural land conversions for the 2008 to 2010 period for some counties in the area of analysis.

The following sections describe agricultural and other land use within the counties in the area of analysis as well as recent land use conversions in each county.

3.9.1.3.1 Seller Service Area

Glenn County
In 2010, of the 849,129 acres mapped in Glenn County, 574,894 were in agricultural use, 6,420 acres were urbanized, 5,950 acres were water, and 261,775 acres were "other" (California DOC, DLRP 2012a). Table 3.9-2 summarizes further land use classifications and net changes from 2008 to 2010.

Table 3.9-2. Glenn County Summary and Change by Land Use Category

Land Use Category	Total Acreage Inventoried 2008	Total Acreage Inventoried 2010	2008-10 Acreage Changes: Acres Lost (-)	Acres Gained (+)	Total Acreage Changed	Net Acreage Changed
Prime Farmland	159,811	157,940	3,576	1,705	5,281	-1,871
Farmland of Statewide Importance	87,497	87,071	1,244	818	2,062	-426
Unique Farmland	17,306	17,300	1,007	1,001	2,008	-6
Important Farmland Subtotal	264,614	262,311	5,827	3,524	9,351	-2,303
Farmland of Local Importance	83,544	85,836	3,446	5,738	9,184	2,292
Grazing Land	227,391	226,837	1,587	1,033	2,620	-554
Agricultural Land Subtotal	575,549	574,984	10,860	10,295	21,155	-565
Urban and Built-up Land	6,372	6,420	123	171	294	48
Other Land	261,258	261,775	1,087	1,604	2,691	517
Water Area	5,950	5,950	0	0	0	0
Total Area Inventoried	**849,129**	**849,129**	**12,070**	**12,070**	**24,140**	**0**

Source: California DOC, DLRP 2012a.

In Glenn County, Farmland of Local Importance includes all lands not qualifying for Prime, Statewide, or Unique farmland that are cropped on a continuing or cyclic basis (irrigation is not a consideration). The classification also includes all farmable land within the Glenn County water district boundaries not qualifying for the Prime, Statewide, or Unique designations (California DOC 2011a).

Colusa County

In 2010, of the 740,393 acres mapped in Colusa County, 554,695 were in agricultural use, 5,142 acres were urbanized, 1,911 acres were water and 169,484 acres were “other” (California DOC, DLRP 2012b). Table 3.9-3 summarizes further land use classifications and net changes in land use categories.

Table 3.9-3. Colusa County Summary and Change by Land Use Category

Land Use Category	Total Acreage Inventoried 2008	2010	2008-10 Acreage Changes Acres Lost (-)	Acres Gained (+)	Total Acreage Changed	Net Acreage Changed
Prime Farmland	197,497	196,320	1,537	360	1,897	-1,177
Farmland of Statewide Importance	2,012	2,046	14	48	62	34
Unique Farmland	121,186	120,316	1,435	565	2,000	-870
Important Farmland Subtotal	320,695	318,682	2,986	973	3,959	-2,013
Farmland of Local Importance	235,023	236,013	729	1,719	2,448	990
Grazing Land	9,111	9,161	49	99	148	50
Agricultural Land Subtotal	564,829	563,856	3,764	2,791	6,555	-973
Urban and Built-up Land	5,111	5,142	26	57	83	31
Other Land	168,542	169,484	406	1,348	1,754	942
Water Area	1,911	1,911	0	0	0	0
Total Area Inventoried	740,393	740,393	4,196	4,196	8,392	0

Source: California DOC, DLRP 2012b.

In Colusa County, Farmland of Local Importance includes all farmable lands within the county that do not meet the definitions of Prime, Statewide, or Unique, but are currently irrigated pasture or non-irrigated crops. The classification also includes non-irrigated land with soils qualifying for Prime Farmland or Farmland of Statewide Importance and lands that would have Prime or Statewide designation and have been improved for irrigation but are now idle. Additionally, lands in this category include lands with a General Plan Land Use designation for agricultural purposes, and lands that are legislated to be used only for agricultural (farmland) purposes (California DOC 2011a).

Butte County

In 2010, of the 1,073,252 acres mapped in Butte County, 640,350 were in agricultural use, 45,924 acres were urbanized, 22,858 acres were water and 364,130 acres were “other” (California DOC, DLRP 2012c). Table 3.9-4 summarizes further land use classifications and net changes in land use categories. In Butte County, the Board of Supervisors determined there would be no Farmland of Local Importance designation (California DOC 2011a).

Table 3.9-4. Butte County Summary and Change by Land Use Category

Land Use Category	Total Acreage Inventoried		2008-10 Acreage Changes			
	2008	2010	Acres Lost (-)	Acres Gained (+)	Total Acreage Changed	Net Acreage Changed
Prime Farmland	194,689	193,290	1,926	527	2,453	-1,399
Farmland of Statewide Importance	22,794	21,792	1,215	213	1,428	-1,002
Unique Farmland	23,078	22,190	1,143	255	1,398	-888
Important Farmland Subtotal	240,561	237,272	4,284	995	5,279	-3,289
Farmland of Local Importance	0	0	0	0	0	0
Grazing Land	401,859	403,078	873	2,092	2,965	1,219
Agricultural Land Subtotal	642,420	640,350	5,157	3,087	8,244	-2,070
Urban and Built-up Land	45,350	45,914	204	768	972	564
Other Land	362,624	364,130	977	2,483	3,460	1,506
Water Area	22,858	22,858	0	0	0	0
Total Area Inventoried	1,073,252	1,073,252	6,338	6,338	12,676	0

Source: California DOC, DLRP 2012c.

Sutter County

In 2010, of the 389,314 acres mapped in Sutter County, 339,358 were in agricultural use, 13,560 acres were urbanized, 1,883 acres were water, and 34,513 acres were "other." (California DOC, DLRP 2012d) Table 3.9-5 summarizes further land use classifications and net changes from 2008 to 2010. In Sutter County, the Board of Supervisors determined there would be no Farmland of Local Importance designation (California DOC 2011a).

Table 3.9-5. Sutter County Summary and Change by Land Use Category

Land Use Category	Total Acreage Inventoried		2008-10 Acreage Changes			
	2008	2010	Acres Lost (-)	Acres Gained (+)	Total Acreage Changed	Net Acreage Changed
Prime Farmland	165,315	162,673	3,266	624	3,890	-2,642
Farmland of Statewide Importance	106,597	105,395	1,709	507	2,216	-1,202
Unique Farmland	19,156	17,752	1,720	316	2,036	-1,404
Important Farmland Subtotal	291,068	285,820	6,695	1,447	8,142	-5,248
Farmland of Local Importance	0	0	0	0	0	0
Grazing Land	52,571	53,538	1,426	2,393	3,819	967
Agricultural Land Subtotal	343,639	339,358	8,121	3,840	11,961	-4,281
Urban and Built-up Land	13,230	13,560	25	355	380	330
Other Land	30,562	34,513	670	4,621	5,291	3,951
Water Area	1,883	1,883	0	0	0	0
Total Area Inventoried	389,314	389,314	8,816	8,816	17,632	0

Source: California DOC, DLRP 2012d.

Yolo County

In 2010, of the 653,453 acres mapped in Yolo County, 534,984 were in agricultural use, 30,537 acres were urbanized, 7,804 acres were water, and 80,128 acres were "other" (California DOC, DLRP 2012e).

Table 3.9-6 summarizes further land use classifications and net increases and reductions in categories from 2008 to 2010. In Yolo County, Farmland of Local Importance includes cultivated farmland having soils which meet the criteria for Prime or Statewide, except that the land is not presently irrigated, and other nonirrigated land (California DOC 2011a).

Table 3.9-6. Yolo County Summary and Change by Land Use Category

	Total Acreage Inventoried		2008-10 Acreage Changes			
Land Use Category	**2008**	**2010**	**Acres Lost (-)**	**Acres Gained (+)**	**Total Acreage Changed**	**Net Acreage Changed**
Prime Farmland	255,193	252,083	3,661	551	4,212	-3,110
Farmland of Statewide Importance	16,793	16,412	568	187	755	-381
Unique Farmland	45,750	43,629	3,071	950	4,021	-2,121
Important Farmland Subtotal	317,736	312,124	7,300	1,688	8,988	-5,612
Farmland of Local Importance	60,345	62,410	3,096	5,161	8,257	2,065
Grazing Land	157,963	160,450	2,337	4,824	7,161	2,487
Agricultural Land Subtotal	536,044	534,984	12,733	11,673	24,406	-1,060
Urban and Built-up Land	30,225	30,537	20	332	352	312
Other Land	79,370	80,128	693	1,451	2,144	758
Water Area	7,814	7,804	10	0	10	-10
Total Area Inventoried	653,453	653,453	13,456	13,456	26,912	0

Source: California DOC, DLRP 2012e.

Solano County

In 2010, of the 582,373 acres mapped in Solano County, 356,659 were in agricultural use, 59,591 acres were urbanized, 53,462 acres were water and 112,661 acres were "other" (California DOC, DLRP 2012f). Table 3.9-7 summarizes further land use classifications and net changes in land use categories from 2008 to 2010.

Table 3.9-7. Solano County Summary and Change by Land Use Category

Land Use Category	Total Acreage Inventoried 2008	Total Acreage Inventoried 2010	2008-10 Acreage Changes: Acres Lost (-)	Acres Gained (+)	Total Acreage Changed	Net Acreage Changed
Prime Farmland	135,735	131,820	4,498	583	5,081	-3,915
Farmland of Statewide Importance	7,038	6,369	873	204	1,077	-669
Unique Farmland	10,526	9,275	1,540	289	1,829	-1,51
Important Farmland Subtotal	153,299	147,464	6,911	1,076	7,987	-5,835
Farmland of Local Importance	0	0	0	0	0	0
Grazing Land	204,519	209,195	1,511	6,187	7,698	4,676
Agricultural Land Subtotal	357,818	356,659	8,422	7,263	15,685	-1,159
Urban and Built-up Land	59,157	59,591	194	628	822	434
Other Land	112,087	112,661	420	994	1,414	574
Water Area	53,311	53,462	0	151	151	151
Total Area Inventoried	582,373	582,373	9,036	9,036	18,072	0

Source: California DOC, DLRP 2012f.

In Solano County, the Board of Supervisors determined that there will be no Farmland of Local Importance (California DOC 2011a).

3.9.1.3.2 Buyer Service Area

The following sections summarize land use in the counties in the Buyer Service Area that could be affected by the proposed alternatives. Land use numbers were derived from the most recent FMMP mapping.

Stanislaus

In 2012, of the 970,168 acres mapped in Stanislaus County, 832,453 acres were in agricultural use, 64,822 acres were urbanized, 7,465 acres were water and 65,428 acres were “other” (California DOC, DLRP 2012k). Table 3.9-8 summarizes further land use classifications and net changes in land use categories from 2010 to 2012.

Table 3.9-8. Stanislaus County Summary and Change by Land Use Category

Land Use Category	Total Acreage Inventoried 2010	2012	2010-12 Acreage Changes Acres Lost (-)	Acres Gained (+)	Total Acreage Changed	Net Acreage Changed
Prime Farmland	253,434	251,723	3,037	1,326	4,363	-1,711
Farmland of Statewide Importance	31,475	31,765	297	587	884	290
Unique Farmland	87,524	95,187	715	8,378	9,093	7,663
Important Farmland Subtotal	**31,366**	**31,331**	**2,312**	**2,277**	**4,589**	**-35**
Farmland of Local Importance	403,799	410,006	6,361	12,568	18,929	6,207
Grazing Land	429,545	422,447	8,968	1,870	10,838	-7,098
Agricultural Land Subtotal	**833,344**	**832,453**	**15,329**	**14,438**	**29,767**	**-891**
Urban and Built-up Land	64,529	64,822	76	369	445	293
Other Land	64,830	65,428	521	1,119	1,640	598
Water Area	7,465	7,465	0	0	0	0
Total Area Inventoried	**970,168**	**970,168**	**15,926**	**15,926**	**31,852**	**0**

Source: California DOC, DLRP 2012k.

Stanislaus County defines Farmland of Local Importance as farmlands growing dryland pasture, dryland small grains, and irrigated pasture (California DOC 2011a).

San Joaquin

In 2008, of the 912,593 acres mapped in San Joaquin County, 754,229 acres were in agricultural use, 91,929 acres were urbanized, 54,662 acres were water and 11,773 acres were "other" (California DOC, DLRP 2012l). Table 3.9-9 summarizes further land use classifications and net changes in land use categories from 2008 to 2010.

Table 3.9-9. San Joaquin County Summary and Change by Land Use Category

Land Use Category	Total Acreage Inventoried 2008	2010	2008-10 Acreage Changes Acres Lost (-)	Acres Gained (+)	Total Acreage Changed	Net Acreage Changed
Prime Farmland	396,984	385,337	12,570	923	13,493	-11,647
Farmland of Statewide Importance	86,297	83,307	3,202	212	3,414	-2,990
Unique Farmland	66,621	69,481	1,590	4,450	6,040	2,860
Important Farmland Subtotal	**65,788**	**76,869**	**3,644**	**14,725**	**18,369**	**11,081**
Farmland of Local Importance	615,690	614,994	21,006	20,310	41,316	-696
Grazing Land	142,460	139,235	3,341	116	3,457	-3,225
Agricultural Land Subtotal	**758,150**	**754,229**	**24,347**	**20,426**	**44,773**	**-3,921**

Land Use Category	Total Acreage Inventoried		2008-10 Acreage Changes			
	2008	2010	Acres Lost (-)	Acres Gained (+)	Total Acreage Changed	Net Acreage Changed
Urban and Built-up Land	90,529	91,929	127	1,527	1,654	1,400
Other Land	52,141	54,662	838	3,359	4,197	2,521
Water Area	11,773	11,773	0	0	0	0
Total Area Inventoried	**912,593**	**912,593**	**25,312**	**25,312**	**50,624**	**0**

Source: California DOC, DLRP 2012l.

San Joaquin County defines Farmland of Local Importance as lands that are farmable and do not meet the definition of Prime Farmland, Farmland of Statewide Importance, or Unique Farmland. This also includes idle lands previously designated as Prime Farmland, Farmland of Statewide Importance, or Unique Farmland (California DOC 2011a).

Merced

In 2010, of the 1,265,619 acres mapped in Merced County, 1,160,885 acres were in agricultural use, 37,417 acres were urbanized, 16,859 acres were water and 50,458 acres were “other” (California DOC, DLRP 2012f). Table 3.9-10 summarizes further land use classifications and net changes in land use categories from 2006 to 2008.

Table 3.9-10. Merced County Summary and Change by Land Use Category

Land Use Category	Total Acreage Inventoried		2006-10 Acreage Changes			
	2006	2010	Acres Lost (-)	Acres Gained (+)	Total Acreage Changed	Net Acreage Changed
Prime Farmland	272,095	270,644	5,739	722	6,461	-5,017
Farmland of Statewide Importance	153,249	150,874	3,207	485	3,692	-2,722
Unique Farmland	104,418	103,992	2,141	1,715	3,856	-426
Important Farmland Subtotal	529,762	525,510	11,087	2,922	14,009	-8,165
Farmland of Local Importance	59,851	67,984	1,188	9,321	10,509	8,133
Grazing Land	569,829	567,391	2,593	155	2,748	-2,438
Agricultural Land Subtotal	1,159,442	1,160,885	14,868	12,398	27,266	-2,470
Urban and Built-up Land	36,769	37,417	116	668	784	552
Other Land	48,351	50,458	340	2,258	2,598	1,918
Water Area	16,859	16,859	0	0	0	0
Total Area Inventoried	1,261,421	1,265,619	15,324	15,324	30,648	0

Source: California DOC, DLRP 2012f.

Merced County defines Farmland of Local Importance as farmlands that have physical characteristics that would qualify for Prime or Statewide except for the lack of irrigation water. Merced County also includes farmlands that produce crops not listed under Unique but are important to the economy of the county or city (California DOC 2011a).

San Benito

In 2010, of the 899,386 acres mapped in San Benito County, 672,281 were in agricultural use, 8,023 acres were urbanized, 1,145 acres were water, and 207,937 acres were "other" (California DOC, DLRP 2012g). Table 3.9-11 summarizes further land use classifications and net changes from 2008 to 2010.

Table 3.9-11. San Benito County Summary and Change by Land Use Category

Land Use Category	Total Acreage Inventoried 2008	Total Acreage Inventoried 2010	2008-10 Acreage Changes: Acres Lost (-)	Acres Gained (+)	Total Acreage Changed	Net Acreage Changed
Prime Farmland	28,701	27,425	2,106	830	2,936	-1,276
Farmland of Statewide Importance	6,587	6,475	700	588	1,288	-112
Unique Farmland	2,399	2,250	355	206	561	-149
Important Farmland Subtotal	37,687	36,150	3,161	1,624	4,785	-1,537
Farmland of Local Importance	23,234	21,310	5,056	3,132	8,188	-1,924
Grazing Land	612,455	614,821	3,116	5,482	8,598	2,366
Agricultural Land Subtotal	**673,376**	**672,281**	11,333	10,238	21,571	-1,095
Urban and Built-up Land	7,902	8,023	55	176	231	121
Other Land	206,968	207,937	326	1,295	1,621	969
Water Area	1,140	1,145	10	15	25	5
Total Area Inventoried	**889,386**	**889,386**	**11,724**	**11,724**	**23,448**	**0**

Source: California DOC, DLRP 2012g.

San Benito County defines Farmland of Local Importance as land cultivated as dry cropland. The usual crops grown on Farmland of Local Importance include wheat, barley, safflower, and grain hay. Orchards affected by boron in the area specified by County Resolution Number 84-3 are also included (California DOC 2011a).

Fresno

The most recent land use mapping for Fresno County was completed by the California DOC in 2008. Out of the 2,437,418 acres mapped in Fresno County, 2,203,231 were in agricultural use, 177,568 acres were urbanized, 4,915 acres were water, and 111,704 acres were "other" (California DOC, DLRP 2012h). Table 3.9-12 summarizes further land use classifications and net changes from 2006-2008.

Table 3.9-12. Fresno County Summary and Change by Land Use Category

Land Use Category	Total Acreage Inventoried		2006-08 Acreage Changes			
	2006	2008	Acres Lost (-)	Acres Gained (+)	Total Acreage Changed	Net Acreage Changed
Prime Farmland	713,084	693,173	17,455	1,112	18,567	-16,343
Farmland of Statewide Importance	478,730	439,020	39,939	576	40,515	-39,363
Unique Farmland	98,091	94,177	4,315	401	4,716	-3,914
Important Farmland Subtotal	1,289,905	1,226,370	61,709	2,089	63,798	-59,620
Farmland of Local Importance	95,534	149,906	2,344	56,716	59,060	54,372
Grazing Land	827,116	826,955	365	204	569	-161
Agricultural Land Subtotal	**2,212,555**	**2,203,231**	64,418	59,009	123,427	-5,409
Urban and Built-up Land	115,366	117,568	601	2,897	3,498	2,296
Other Land	108,783	111,704	1,680	4,790	6,470	3,110
Water Area	4,912	4,915	1	4	5	3
Total Area Inventoried	**2,441,616**	**2,437,418**	**66,700**	**66,700**	**133,400**	**0**

Source: California DOC, DLRP 2012h

In Fresno County, all farmable lands within the county that do not meet the definitions of Prime, Statewide, or Unique are defined as Farmland of Local Importance. This definition includes land that is or has been used for irrigated pasture, dryland farming, confined livestock and dairy, poultry facilities, aquaculture and grazing land (California DOC 2011a).

Kings

In 2010, of the 890,786 acres mapped in Kings County, 823,918 were in agricultural use, 35,847 acres were urbanized, 62 acres were water, and 30,959 acres were “other” (California DOC, DLRP 2012i). Table 3.9-13 summarizes further land use classifications and net changes from 2008 to 2010.

Lands that support dairies, confined livestock, and poultry operations are defined as Farmland of Local Importance in Kings County (California DOC 2011a).

Table 3.9-13. Kings County Summary and Change by Land Use Category

Land Use Category	Total Acreage Inventoried 2008	Total Acreage Inventoried 2010	2008-10 Acreage Changes: Acres Lost (-)	Acres Gained (+)	Total Acreage Changed	Net Acreage Changed
Prime Farmland	138,089	130,257	8,327	495	8,822	-7,832
Farmland of Statewide Importance	397,065	388,891	11,183	3,009	14,192	-8,174
Unique Farmland	22,928	21,801	1,792	665	2,457	-1,127
Important Farmland Subtotal	558,082	540,949	21,302	4,169	25,471	-17,133
Farmland of Local Importance	10,022	11,138	156	1,272	1,428	1,116
Grazing Land	257,746	271,831	4,610	18,695	23,305	14,085
Agricultural Land Subtotal	**825,850**	**823,918**	26,068	24,136	50,204	-1,932
Urban and Built-up Land	32,220	35,847	56	3,683	3,739	3,627
Other Land	32,654	30,959	2,445	750	3,195	-1,695
Water Area	62	62	0	0	0	0
Total Area Inventoried	**890,786**	**890,786**	28,569	28,569	57,138	0

Source: California DOC, DLRP 2012i.

3.9.2 Environmental Consequences/Environmental Impacts

These sections describe the environmental consequences/environmental impacts associated with each alternative.

3.9.2.1 Assessment Methods

Cropland idling transfers would take agricultural land out of production during the transfer year. If consecutive idling actions occur for the same fields over the ten year period, there could be a change in land use classifications.

To analyze these impacts, potential changes in land use are evaluated qualitatively within the counties that could participate in cropland idling water transfers. This analysis assesses any permanent conversions of agricultural land to other uses under transfer conditions relative to the baseline condition. Such conversions could result in a change in land classification or an incompatible use.

3.9.2.2 Significance Criteria

Impacts on agricultural land use would be considered potentially significant if transfers result in:

- Substantial conversion of any lands categorized as Prime Farmland, Farmland of Statewide Importance, or Unique Farmland (referred together as Important Farmland) under the FMMP.

- Substantial permanent conversion of agricultural lands, including lands enrolled in the Williamson Act and other land conservation programs, to an incompatible use.

- Conflict with local land use policies.

3.9.2.3 Alternative 1: No Action/No Project

There would be no impacts to Prime Farmland, Farmland of Statewide Importance, or Unique Farmland under the No Action/No Project Alternative. Under the No Action/No Project Alternative, Central Valley Project (CVP) water supply shortages to agricultural users could result in increased land idling in the Buyer Service Area in Merced, Fresno, Kings, and San Benito counties. As shown in Tables 3.9-8 through 3.9-11, these counties have lost acres of prime farmland, farmland of statewide importance, and unique farmland in recent years. Much of this acreage was converted to non-irrigated land uses because it was fallow for three or more update cycles. This trend would likely continue under the No Action/No Project Alternative with continued CVP water shortages. Land reclassified to a non-irrigated uses would not be a permanent change in land use; farmers can place previously idled lands back into production and land could be reclassified to its previous status.

Conversions of irrigated agricultural lands under existing conditions also occur in response to urban development pressures. Important Farmland is converted to houses, commercial businesses, industrial buildings, schools, and other urban infrastructure. Continued CVP water shortages under the No Action/No Project Alternative may make more farmers willing to sell lands for urban development, which would result in permanent conversions of agricultural lands. Conversions to urban lands would likely continue as in previous years. This would further reduce agricultural lands in the future.

There would be no change in cropland conversion compared to existing conditions under the No Action/No Project Alternative.

There would be no impacts to agricultural lands under the Williamson Act and other land resource programs under the No Action/No Project Alternative. Water shortages under the No Action/No Project Alternative could increase land idling in the Buyer Service Area, similar to existing conditions. Some farmers may choose to take land out of production for one or two years and others may remove land from agricultural production for the long-term if shortages are expected to prolong and increase. Under the No Action/No Project Alternative, lands taken out of agricultural production temporarily would not affect Williamson Act or FSZ contracts. Some land may be reclassified as Non-Prime, but the land would still be in the program and be compatible with agricultural uses. From 2009 to 2010, there was very little change (0.05 – 0.07 percent decreases) in acreage of Williamson Act lands in the Buyer Service Area (Table 3.9-1). This trend is expected to continue under the No Action/No Project Alternative.

Agricultural lands enrolled in the Williamson Act and other land resources programs under the No Action/No Project Alternative would not likely change relative to existing conditions.

3.9.2.4 Alternative 2: Full Range of Transfers (Proposed Action)

Cropland idling transfers could decrease the amount of lands categorized as Prime Farmland, Farmland of Statewide Importance, or Unique Farmland under the FMMP. Under the Proposed Action, cropland idling transfers could occur in Glenn, Colusa, Butte, Yolo, Solano, and Sutter Counties in the Seller Service Area. Table 3.9-12 shows the maximum acreages that could be idled in a year. Cropland idling transfers during a single year would likely affect less than the maximum acreages listed in Table 3.9-14.

Table 3.9-14. Maximum Annual Cropland Idling Acreages under the Proposed Action

Region	Rice	Alfalfa/ Sudan Grass	Corn	Tomatoes	Total
Sacramento Region	40,704	1,400	400	400	42,904
Feather Region	10,769	600	800	400	12,569
Delta Region	-	3,000	1,500	-	4,500
Total	**51,473**	**5,000**	**2,700**	**800**	**59,973**

Cropland idling would be temporary in nature and would not result in a permanent conversion of agricultural lands. Landowners would annually choose whether to idle their fields to transfer water and could place fields back into production the following season. Therefore, there would be no permanent effects to land categorized as Important Farmland as a result of transfers.

In order for agricultural lands to be categorized as Important Farmland on the FMMP maps, they must have been used for irrigated agricultural production at some point during the four years prior to the Important Farmland Map date (mapping is completed every two years) and the soils must meet the physical and chemical criteria as determined by the USDA NRCS (California DOC 2011a and California DOC, DLRP 2012j). Therefore, for lands to be reclassified out of Important Farmland categories, the same parcel would need to be idled for four consecutive years. Transfers would not change the soil characteristics of land.

As shown in Tables 3.9-2, 3.9-3, and 3.9-6, there was a total of 893,117 acres of Important Farmland in Colusa, Glenn, and Yolo counties (the Sacramento Region) in 2010. Of this, the maximum proposed for idling in any one year is 42,904 acres. This is about 4.8 percent of the Important Farmland in these counties. In Sutter and Butte counties (the Feather Region), there was a total of 523,092 acres of Important Farmland (Tables 3.9-4 and 3.9-5) as of the most recent FMMP mapping. Maximum idling would affect approximately 12,569 acres, or 2.4 percent of the total Important Farmland in these counties. As shown in Table 3.9-7, Solano County has 147,464 acres of Important Farmland. Cropland idling in Solano County under the Proposed Action would idle a maximum of 4,500 acres, or 3.1 percent, of Important Farmland in the county. As mentioned, these are maximum idling acreages and would not likely occur each year over the 10-year transfer period.

The proposed maximum acreages for idling do not represent a substantial amount of total Important Farmland in the counties. Further, buyers have indicated cropland idling transfers are the lowest priority transfer method under the Proposed Action (see Chapter 2); therefore, it is unlikely that the maximum cropland idling transfer would occur consecutively over four years and the same parcels would be included in the transfers for substantial amounts of land to be reclassified out of Important Farmland.

Because cropland idling would be temporary in nature and transfers would affect a small percentage of the overall Important Farmland acres within counties in the Seller Service Area, the Proposed Action's impacts on agricultural land use would be less than significant.

Cropland idling water transfers could convert lands under the Williamson Act and other land resource programs in the Seller Service Area to an incompatible use. As discussed above, cropland idling would be temporary and would not result in permanent changes to the land and land would not be converted to an incompatible use. Idling actions would not interfere with objectives of the Williamson Act, FSZ lands, or other agricultural easements to preserve open space land. Yolo and Solano counties have lands under CFCP conservation easements (Table 3.9-1) that could be idled under the Proposed Action. However, agricultural lands temporarily taken out of production as a result of cropland idling water transfers would not be converted to an incompatible use. The Proposed Action's potential effects to agricultural land use would be less than significant.

Cropland idling transfers could conflict with local land use policies. Section 3.9.1.2.3 summarizes agricultural land-related policies in local planning documents of counties in the Seller Service Area. All counties have policies to protect and maintain agricultural land uses for the long-term. Cropland idling would be temporary and not permanently change land uses or conflict with land use policies in Glenn, Colusa, Butte, Sutter, and Solano counties. Yolo County has a policy that precludes the practice of fallowing fields within conservation easements for the purpose of water export. Lands under farmland conservation easements are restricted to agricultural activities. The easement would preclude landowners from participating in cropland idling water transfers. Therefore, land would continue to be farmed and there would be no change relative to the No Action/No Project Alternative.

Water transfers could provide water to irrigators in the Buyer Service Area to irrigate existing crop fields. Water deliveries could bring lands back into agricultural production that were previously idle because of reductions in available water supply. Based on the amount of water available relative to the agricultural water needs in the San Joaquin Valley, lands returned to production would not be substantial as a result of the Proposed Action. Therefore, the Proposed Action's impacts on agricultural land use would be beneficial, but minor.

3.9.2.5 Alternative 3: No Cropland Modifications

There would be no cropland idling under Alternative 3. There would be no impacts to agricultural land use in the Seller Service Area as a result of the No Cropland Modification Alternative.

Water transfers could provide water to irrigators in the Buyer Service Area to irrigate existing crop fields. Similar to the Proposed Action, the No Cropland Modification Alternative could convert land back to agricultural use that was idled because of limited water supplies. The land conversion would not be extensive because of the amount of water available relative to the agricultural water needs in the San Joaquin Valley. Therefore, the No Cropland Modification Alternative's impacts on agricultural land use would be beneficial, but minor.

3.9.2.6 Alternative 4: No Groundwater Substitution

Cropland idling transfers could permanently or substantially decrease the amount of lands categorized as Prime Farmland, Farmland of Statewide Importance, or Unique Farmland under the FMMP. Table 3.9-15 shows the maximum acreage that could be idled in the Seller Service Area under the No Groundwater Substitution Alternative. Cropland idling transfers could idle a maximum of 59,973 acres of farmland in counties in the Seller Service Area. These upper limits for cropland idling transfers are the same as in the Proposed Action. The maximum acreage would not likely be idled each year of the 10-year period.

Table 3.9-15. Maximum Annual Cropland Idling Acreages under Alternative 4

Region	Rice	Alfalfa/ Sudan Grass	Corn	Tomatoes	Total
Sacramento Region	40,704	1,400	400	400	42,904
Feather Region	10,769	600	800	400	12,569
Delta Region	-	3,000	1,500	-	4,500
Total	**51,473**	**5,000**	**2,700**	**800**	**59,973**

As discussed in the analysis of the Proposed Action, cropland idling would be temporary in nature and would not result in a permanent conversion of agricultural lands. The maximum number of acres idled would be small relative to the overall acreage of Important Farmland within the counties.

While the upper limit for cropland idling transfers would be the same as in the Proposed Action, cropland idling transfers could occur more often under the No Groundwater Substitution Alternative because groundwater substitution transfers would not be available.

There is a potential for cropland idling water transfers to change the classification of Important Farmland. Changes to the classification of farmland could result in a significant impact. In order to avoid a significant impact if cropland would change the classification to levels less than Prime Farmland, Farmland of Statewide Importance, or Unique Farmland under the FMMP, agencies participating in water transfers would implement Mitigation Measure Land Use (LU)-1, described in Section 3.9.4 to avoid changing land classifications. Consequently, land use effects would be less than significant with mitigation.

Cropland idling water transfers could convert lands under the Williamson Act and other land resource programs in the Seller Service Area to an incompatible use. As discussed above, crop idling would be temporary and would not result in permanent changes to the land and land would not be converted to an incompatible use under the Williamson Act, CFCP, or FSZ. Idling actions would not interfere with objectives of the Williamson Act and other agricultural easements to preserve open space land. In addition, increased net returns allowed by water transfers could help landowners avoid selling land for development and preserve farmland. Potential effects to agricultural land use would be less than significant.

Cropland idling transfers could conflict with local land use policies. Yolo County has a policy that precludes the practice of fallowing fields within conservation easements for the purpose of water export. The easement would preclude landowners from participating in cropland idling water transfers. Therefore, land would continue to be farmed and there would be no change relative to the No Action/No Project Alternative.

Water transfers could provide water to irrigators in the Buyer Service Area to irrigate existing crop fields. Water deliveries could bring lands back into agricultural production that were previously fallow due to reductions in available water supply. Potential effects would be the same as those described for the Proposed Action. Impacts would be beneficial, but minor.

3.9.3 Comparative Analysis of Alternatives

Table 3.9-16 lists the effects of each of the action alternatives. The following text supplements the table by describing the magnitude of the effects under the action alternatives and No Action/No Project Alternative.

3.9.3.1 No Action/No Project Alternative

Under the No Action/No Project Alternative, farmers in the Buyer Service Area would idle fields as a result of CVP water shortages. Depending on the extent of shortages and the number of years a particular field is idled consecutively, there could be reductions in the amount of land classified as Important Farmland. Prolonged water shortages could also result in permanent conversions of agricultural land if farmers choose to sell land to developers because of lack of irrigation water.

Table 3.9-16. Comparative Analysis of Alternatives

Potential Impact	Alternatives	Significance	Proposed Mitigation	Significance after Mitigation
Reductions in CVP water supplies for agricultural users could permanently or substantially decrease lands categorized as Prime Farmland, Farmland of Statewide Importance, or Unique Farmland under the FMMP.	1	NCFEC	None	NCFEC
Reductions in CVP water supplies for agricultural users could convert agricultural lands under the Williamson Act and other land resource programs to an incompatible use.	1	NCFEC	None	NCFEC
Cropland idling water transfers could ~~permanently or substantially~~ decrease the amount of lands categorized as Prime Farmland, Farmland of Statewide Importance, or Unique Farmland under the FMMP.	2	LTS	None	LTS
	4	S	Mitigation Measure LU-1: Avoiding changes in FMMP land use classifications	LTS
Cropland idling water transfers could convert agricultural lands under the Williamson Act and other land resource programs to an incompatible use.	2, 4	LTS	None	LTS
Cropland idling water transfers could conflict with local land use policies.	2, 4	NI	None	NI
Water transfers could provide water to irrigators in the Buyer Service Area to irrigate existing crop fields and maintain agricultural land uses.	2, 3, 4	B	None	B

Note:
B = beneficial;
LTS = less than significant
NCFEC = no change from existing conditions
NI = no impact
S = significant

3.9.3.2 Alternative 2: Full Range of Transfers (Proposed Action)

The Proposed Action includes idling of up to 59,973 acres. This maximum acreage would not be idled each year over the 10-year transfer period or each year that transfers occur. The maximum acreage is also a small percentage of the total amount of Important Farmland in the Seller Service Area. Therefore, cropland idling transfers would not substantially decrease the amount of land classified as Important Farmland. Cropland idling transfers would also not result in permanent land reclassifications or conversions to incompatible uses. In the Buyer Service Area, increased water deliveries from transfers could result in beneficial impacts to agricultural land use because owners may start farming land again that had been idled because of limited water supplies.

3.9.3.3 Alternative 3: No Cropland Modifications

The No Cropland Modification Alternative does not include cropland idling. There would be no impacts in the Seller Service Area as a result of idling. Effects in the Buyer Service Area would be the same as the Proposed Action.

3.9.3.4 Alternative 4: No Groundwater Substitution

The No Groundwater Substitution Alternative includes the same upper limit for cropland idling as the Proposed Action. This maximum acreage would not likely be idled each year over the 10-year transfer period; however, it would occur more frequently during years that transfers occur relative to the Proposed Action because there are fewer other types of transfers. The frequency of idling in the No Groundwater Substitution Alternative could result in substantial decreases in the amount of Important Farmland. Implementation of Mitigation Measure LU-1 would make impacts to agricultural land use designations less than significant. Similar to the Proposed Action, cropland idling transfers would not result in permanent land reclassifications or conversions to incompatible uses. Effects in the Buyer Service Area would be the same as the Proposed Action.

3.9.4 Environmental Commitments/Mitigation Measures

The following mitigation measures would reduce adverse land use effects of the No Groundwater Substitution Alternative.

3.9.4.1 Mitigation Measure LU-1: Avoiding Changes in FMMP Land Classifications

Water would not be acquired from a particular parcel of land if idling the land would result in a lower classification of Important Farmland as defined under the FMMP. The selling agency will provide cropping history of specific parcels to be idled for the transfer to Reclamation to determine if idling will result in a change in classification from Important Farmland.

3.9.5 Potentially Significant Unavoidable Impacts

None of the action alternatives would result in potentially significant unavoidable impacts to agricultural land use.

3.9.6 Cumulative Effects

The timeframe for the Long-Term Water Transfers cumulative analysis extends from 2015 through 2024, a ten-year period. The cumulative effects analysis for agricultural land use considers State Water Project (SWP) water transfers and the CVP Municipal and Industrial (M&I) Water Shortage Policy (WSP). Chapter 4 further describes these projects and policies. Land protections and environmental restoration programs are also considered since these programs take actions to maintain agricultural and open space land uses.

The cumulative analysis also considers general population growth and associated urban development planned in the future in counties where cropland idling could occur. The following paragraphs describe planned land use changes in the area of analysis.

3.9.6.1 Seller Service Area

3.9.6.1.1 Glenn County

The most recent county general plan documents (1993b) describe the prominent land use in the county as agriculture, forests, and open space/grazing lands. While the general plan is from almost a decade ago, existing land uses in the county have not changed substantially during that period (Popper 2012). Approximately 500,000 acres of land in the unincorporated county is used for agricultural purposes with half in grazing land and half in farming (Glenn County 1993b). Urban and residential development is clustered around the unincorporated communities in the county including Bayliss, Glenn, Ord Bend, Capay, Codora Four Corners, Artois, Hamilton City, Butte City, North Willows, Northeast Willows, and West Orland (Glenn County 1993b).

There are currently no development applications in the unincorporated area of Glenn County which would potentially displace large acreages of irrigable ground (Popper 2012). Approximately seven miles northwest of the City of Willows, there is a pending solar power development. The proposed project is currently undergoing environmental review. It proposes to change the zoning of an approximately 170 acre parcel from AP to Recreation and Planned Motor Sports. This rezoning would also cancel a land conservation contract (Popper 2012). There is no current timeline for construction of this proposed project.

As shown in Table 3.9-1, from 2010 to 2012, there was a slight increase in Williamson Act lands in the county. However, the California DOC notes that from 2008 to 2010 there were land use changes in the county from irrigated farmland to urban land (California DOC 2011b). These changes were primarily due to the construction of new homes, buildings and parking lots.

City of Orland

Land use in the City of Orland is primarily low density residential and residential estate (City of Orland no date). Other uses that make up a smaller portion of land area within the city and the SOI include commercial, heavy and light industrial, medium and high density residential, public facility, mixed-used, and open space/resource conservation. The Land Use Element of the 2008 Draft General Plan guides the city's growth over 15-20 years (City of Orland 2010). One of the basic principles in the General Plan, Land Use Element is to preserve open space and farmland from intensive development. The land use SOI is defined as lands surrounding the city where expansion is likely to occur in the near future. While the city can work with Glenn County to affect changes to land use and proposed development within the SOI, it has no direct land use authority outside of the city limits.

From 1990 to 2000, the population of the city increased by 24.3 percent with an average annual increase of 2.2 percent. By comparison, the population of Glenn County increased by 6.7 percent over that same time period (City of Orland 2010). The General Plan also presents projected population growth from 2008-2028 using three growth rate scenarios. Table 3.9-17 summarizes these projections.

Table 3.9-17. Population Projections, City of Orland (2008-2028)

Growth Rate	Orland Population				
(%)	**2008**	**2013**	**2018**	**2023**	**2028**
High (2.6)	7,376	8,386	9,534	10,840	12,324
Medium (2.2)	7,347	8,192	9,133	10,183	11,354
Low (1.8)	7,318	8,001	8,748	9,564	10,456

Source: City of Orland 2010

The city also projects future land use demands based on projected population growth. Table 3.9-18 summarizes the land use development forecast for all residential, commercial, and industrial land use needs from 2007 through 2027 at each potential growth rate.

Table 3.9-18. Total Land Use Development Forecast

Growth Rate (%)	Land Required (acres)				
	2007-2011	2012-2016	2017-2021	2022-2027	Total
High (2.6)	165	189	214	244	812
Medium (2.2)	139	157	171	193	606
Low (1.8)	113	121	133	143	510

Source: City of Orland 2010

The city used the established General Plan land uses and densities of land within the city as well as the undeveloped land acreages to estimate the number of new homes and population that could result from current policies. Table 3.9-19 summarizes the maximum residential growth (on land designated for residential land use in the General Plan) and population at buildout of the General Plan. If the city's residential land were built out to its potential (assuming a density of three persons per single-family unit, 2.5 persons per medium-density multi-family unit, and two persons per high density multi-family unit) the total population could reach over 25,000 (City of Orland 2010).

Table 3.9-19. Maximum Residential Growth at Buildout

General Plan Designation	Additional Developable Acres	Additional Population	Total Possible Population[1]
Residential, low density	149	2,682	29,705
Residential, medium density	-5	-120	1,284
Residential, high density	41	2,050	4,027
Residential, estate	896	5,376	10,090
Mixed Use	29	870	870
TOTAL	**1,110**	**10,858**	**45,940**

Source: City of Orland 2010
Note:
[1] Number is based on addition to Possible Population under 2003 General Plan

Table 3.9-17 illustrates that total possible population at maximum buildout of residential lands in the city would accommodate the population projections shown in Table 3.9-15, above. Further, Policy 2.2.A in the General Plan states that the city will "maintain defined boundaries and adequate buffers between agricultural land and urbanized areas" (City of Orland 2010). Policy 2.2B states that the "City shall direct development towards existing neighborhoods by encouraging infill and redevelopment activity" (City of Orland 2010).

City of Williams

Main land uses in the city consist of business park, agriculture, and suburban residential on the edges of the city with urban residential, commercial, downtown, industrial, institutional, neighborhood conservation, and parks and recreation in the central part of the city (City of Williams 2010a).

The City of Williams' General Plan describes that the city population is expected to grow to around 9,822 persons by the year 2030 (City of Williams 2010b). This represents an increase of approximately 4,535 persons. Similar to the City of Orland, Williams developed three future growth scenarios to plan for future land use and population growth, a low growth, moderate growth, and high growth scenario (City of Williams 2010b). Table 3.9-20 summarizes the population estimates and projections from 2009 to 2030.

Table 3.9-20. Population Projections, City of Williams (2009-2030)

	Population	Actual Change
2009 Estimate	5,287	--
Year 2030 Low	7,667	2,380
Year 2030 Mid	9,822	4,535
Year 2030 High	12,048	6,761

Source: City of Williams 2010b

The city identified the mid-range growth scenario as their preferred future growth rate and the future land use plan establishes residential land acreages that will accommodate this level of growth; these are summarized in Table 3.9-21.

Table 3.9-21. District Acreages and Corresponding Populations

	Residential District			
	Estate	Suburban	Urban	Total
Acres	204	101	260	565
Density (units/acre)	0.43	2.13	3.48	
Persons per Household	3.7	3.7	3.7	
Total Persons	325	796	3,348	9,755[1]

Source: City of Williams 2010b

Note:

[1] Total includes total persons projected in each residential district (4,468) added to the 2009 population estimate of 5,287.

The city's General Plan and Future Land Use Plan illustrate that housing for projected population increases is anticipated to be accommodated for within the existing SOI. Land use policies related to future growth patterns including growing contiguously to maintain the efficiency of public services and a compact community form (Policy 3.30 of the City of Williams 2010b).

3.9.6.1.2 Colusa County

Existing land uses in Colusa County are primarily agricultural (Colusa County 2010). Steady population growth over the last several decades has led to corresponding increases in housing development throughout the unincorporated county and incorporated cities over the past 20 years. Table 3.9-22 summarizes the percentage of existing land uses in Colusa County.

Table 3.9-22. Existing Land Uses (2008)

Land Use Category	Percent
Cropland	75
Grazing Lands	1
National Forest	10
National Wildlife Refuge	2
Incorporated Cities	0.3
Communities	0.4
Rural Subdivisions and Settlements	0.2
Other Lands	11
Water Areas	0.3

Source: Colusa County 2010.

The county's General Plan Background Report (Colusa County 2010) lists several approved and pending development projects in the unincorporated county as well as in the Cities of Colusa and Williams. Some of the planned development within the county, both incorporated and unincorporated areas, has slowed as a result of the economic downturn in recent years; however, residential development is still occurring and more is planned for the future. The background report notes that while growth in the unincorporated county is directed primarily to Special Growth Areas designated by the county's general plan, areas in the county are slowly transitioning from orchard and field crop land uses to residential land uses.

As shown in Table 3.9-1, the county lost 0.19 percent of its Williamson Act lands from 2009 to 2010; although, this is not directly tied to increases in residential development. In light of this decrease, the California DOC notes that from 2008 to 2010, there were no conversions from irrigated farmland to urban land within the county (California DOC 2011c). While there were no direct conversions from irrigated farmland to urban land, there were land use conversions from irrigated farmland to nonirrigated uses. The majority of these changes occurred because plots of irrigated farmland had been fallow for three or more FMMP update cycles (California DOC 2011c).

City of Colusa

The City of Colusa's SOI is approximately 2,842 acres including all land within the city limits and an additional 1,668 acres outside of the city limits. Unincorporated land represents approximately 59 percent of the city's total SOI area (City of Colusa 2007). The population growth rate since 1990 has averaged 0.95 percent per year with a high of 2.56 percent between 1996 and 1997 (City of Colusa 2007). Existing land uses in the city consist of residential, commercial (along the State Route (SR) 20/45 corridor and in the core downtown area), industrial, airport, recreation, open space, and public facilities. The city's General Plan Land Use Map identifies lands adjacent to and outside of the SOI as agricultural lands.

The city anticipates a growth rate of three to four percent over the next 20 years. The General Plan Land Use Element describes that various areas proposed for future annexation and/or development are designated as agricultural land. While this fact may lead to some continuing conversion of agricultural lands to residential or other uses, the city acknowledges the need for agricultural buffers to mitigate impacts from the agriculture-urban interface. General Plan policies support the use of various techniques such as the use of Urban Reserve land use designations, density transfers, agricultural easements, land transfers to non-profit farmland trusts, and private agreements between developers and agricultural land owners to allow necessary residential development while preserving important agricultural resources.

3.9.6.1.3 Butte County

The majority of existing land use in unincorporated Butte County is agricultural, with small areas of residential, commercial, and industrial land use types (Butte County 2012b). Table 3.9-23 summarizes existing land uses within the unincorporated county.

Table 3.9-23. Existing Land Uses (2008)

Land Use Category	Percent
Agriculture	58
Public/Quasi-Public	17
Residential – Single-Family	11
Vacant	9
Undefined	2.6
Residential – Multi-Family	0.9
Commercial and Office	0.4
Industrial	0.1
Tribal Lands	0.04

Source: Butte County 2012b.

While most residential units are located within the five incorporated municipalities, which are Cities of Chico, Oroville, Gridley, and Biggs, and the Town of Paradise, some residential units are dispersed throughout the unincorporated county. Commercial and industrial uses are primarily located near the municipalities (Butte County 2012b).

The county directs growth to existing urbanized areas and near existing infrastructure to prevent scattered development (Butte County 2012b). Existing and future planned unit developments and area, neighborhood, or specific plans have been or are being developed for areas surrounding Chico, Oroville, and Paradise. Transfers in Butte County occur in the southwestern portion of the county, near the Cities of Gridley and Biggs, and therefore these development plans do not affect agricultural resources in the transfers area.

The California DOC reports that from 2008 to 2010 there were small changes from irrigated farmland or non-irrigated land uses to urban land within the county. These changes are due to construction of homes and commercial buildings on parcels less than 15 acres adjacent to municipalities, including Gridley and Biggs. Conversions of irrigated farmland to non-irrigated uses were primarily a result of farmland going fallow for three or more FMMP update cycles. There were a large number of changes from irrigated farmland to other land, with large areas near the Gray Lodge Wildlife Area and south of Chico being tracked for seasonal flooding and return to wetlands. In Gridley, almost 20 acres planned for an industrial park was changed from urban land due to inactivity on the project. The California DOC reports that Gridley and Biggs area appear to have more land use changes on a smaller scale (California DOC 2011d).

City of Biggs

The Biggs SOI encompasses 540.6 acres and the Planning Area is 4,627 acres. The City of Biggs, which is approximately 414 acres, is predominantly single-family residential. Less than 16 percent of the total area of the city is employment-generating, commercial, or vacant and available for development. Commercial and industrial land use have been declining due to development of large retail stores in the surrounding larger cities and limited employment options. Biggs has limited infill and redevelopment opportunities and has expressed interest in extending the SOI to expand growth opportunities (City of Biggs 2014).

The Butte County Association of Governments has projected that the city could potentially double its population by the year 2035. Up to 1,090 new housing demand is projected for a high growth scenario. Development areas surrounding the city, within the current Planning Area, have been identified to accommodate new residences, schools, parks, wastewater treatment plant, and commercial and industrial uses (City of Biggs 2014).

City of Gridley

Similar to Biggs, growth within the current City of Gridley is limited. To accommodate for future growth of Gridley and Biggs, a 2,846-acre area of concern was established by the Butte Local Agency Formation Commission. Approximately 1,200 acres of this area is designated as the planned growth area for Gridley. The buildout of the General Plan could result in up to 4,700 residential units, 1.3 million square feet of commercial building space, four million square feet of industrial building space, and additional schools, parks, and infrastructure for the growth within the existing city, the SOI, and planned growth area. (City of Gridley 2010)

3.9.6.1.4 Sutter County

Unincorporated Sutter County land use is dominated by agriculture. Other uses including residential and commercial are located in unincorporated rural communities in the county as well as the cities of Yuba and Live Oak (Sutter County 2010b). Table 3.9-24 summarizes existing land uses within the county.

Table 3.9-24. Existing Land Uses (2010)

Land Use Category	Percent
Agricultural	86.6
Residential	1
Public and Airport	0.1
Commercial	0.1
Industrial	0.2
Open Space, Parks and Golf Course	11.9
Transportation and Utilities	0.5
Vacant	0.1

Source: Sutter County 2010b.

The majority of agricultural land is located in the unincorporated areas of the county outside of the boundaries of the unincorporated communities (Meridian, Sutter, Robbins, Nicolaus, East Nicolaus, Trowbridge, and Rio Oso). While most residential uses are located in these communities and Yuba City and Live Oak, there are also residential uses in the unincorporated county. Most of these residential uses are located near the cities and communities or along major transportation corridors (Sutter County 2010b).

In order to accommodate future growth, the county directs growth to five identified Growth Areas that are in close proximity to existing public infrastructure and services. In addition to these growth areas, future growth in the county is planned to be directed towards the Yuba City and Live Oak spheres of influence. In total, new growth is expected to change the land use of approximately eight percent of unincorporated county lands (Sutter County 2010b). Some of these growth areas overlap lands currently used for agriculture (Sutter County 2010b).

The California DOC reports that from 2008 to 2010 there were small additions to existing urban land within the county. These changes are noted as primarily small changes from irrigated farmland to urban land. The largest land use conversion was a residential development located near orchards south of Yuba City (California DOC 2011e). Other conversions of irrigated farmland to non-irrigated uses were primarily a result of farmland going fallow for three or more FMMP update cycles (California DOC 2011e).

City of Live Oak

The majority of land in the City of Live Oak is in residential use (City of Live Oak Nd.). Commercial uses occur along the SR-99 corridor, with both a historic commercial and new commercial district. There are also parks and civic land uses throughout the city. Through their General Plan, the city describes that they have provided sufficient land to accommodate housing and job growth through the year 2030. Table 3.9-25 summarizes the acreage and housing units of land uses in the county under full buildout.

Table 3.9-25. General Plan Land Use Designations and Housing Units, City of Live Oak (1999-2030)

Designation	Acres	Housing Units
Low-Density Residential	1,610-1,970	5,290-6,460
Smaller-Lot Residential	1,310-1,610	6,190-7,570
Medium-Density Residential	160-200	1,200-1,460
Higher Density Residential	100-130	1,410-1,720
Commercial Mixed Use	190-230	--
Downtown Mixed Use	70-90	--
Community Commercial	60-70	--
Employment	190-230	--
Civic	140-180	--
Park	160-200	--
Open Space Buffer	60-70	--

Source: City of Live Oak Nd.

As with other cities, Live Oak recognizes development pressures in the urban reserve area outside of the city boundaries. Land use policies, such as policy LU-1.5, provide for development within this urban reserve area only after a comprehensive planning and environmental review (City of Live Oak Nd.).

City of Yuba City

Lands within the urban growth boundary (UGB) for Yuba City include 12,954 acres (City of Yuba City 2004). Most of the developed land is within the existing city limits and approximately 7,079 acres are located in unincorporated Sutter County. Table 3.9-26 summarizes existing land uses with the UGB.

Table 3.9-26. Land Use in the Yuba City UGB, 2002

Designation	Incorporated (acres)	Unincorporated (acres)	Total (acres)
Single-Family Residential	2,266	1,271	3,538
Multi-Family Residential	371	51	421
Mobile Home Park	66	72	138
Commercial Retail	311	34	345
Shopping Center	95	--	95
Office	104	8	111

Designation	Incorporated (acres)	Unincorporated (acres)	Total (acres)
Other Commercial	18	2	20
Auto Services	5	1	6
Visitor Services – Hotel/Motel	11	--	11
General Industrial	380	159	539
Public and Semi-Public	601	499	1,100
School	122	17	140
Park and Recreation	84	1	85
Agricultural Land	630	4,821	5,451
Transportation, Communications, and Utilities	25	12	38
Vacant	787	130	918
Total	**5,875**	**7,079**	**12,954**

Source: City of Yuba City 2004

The General Plan describes that adequate land was provided in the planning process to accommodate anticipated housing and job development through 2025 (City of Yuba City 2004). Full buildout includes a total of 7,200 gross acres that would be developed within the UGB, including infill sites. Most areas planned for new development are residential in use and total an area of approximately 4,655 acres.

The city estimates a 2.5 percent annual growth rate and a total population within the SOI (including the City of Yuba City and surrounding unincorporated areas) in 2025 of 105,730. The Land Use Plan of the General Plan accommodates a higher population than the projection. The Plan accommodates for 19,220 new housing units and 51,310 new residents, for a projected possible population of 108,340.

While realizing the need to accommodate this growth, the Land Use Plan policies encourage maintaining the compact form of the city and continuing to protect rural areas by the establishment of the UGB. The Land Use Plan policies, such as policy 3.4-G-1, which states “maintain a well-defined compact urban form, with a defined growth boundary and urban development intensities on land designated for urban uses,” are focused on maintaining the city’s small town feel and preserving the surrounding agricultural land (City of Yuba City 2004).

3.9.6.1.5 Yolo County

The majority of land use in Yolo County is cultivated agriculture with livestock grazing and public open space as the next largest uses (Yolo County 2005). Approximately four percent of total county lands are within the jurisdictional boundaries of a city (Yolo County 2005). Existing land uses in Yolo County (both incorporated and unincorporated areas) are summarized in Table 3.9-27.

Table 3.9-27. Existing Land Uses – Yolo County Incorporated and Unincorporated Areas[1]

Land Use Category	Percent
Agricultural commodities	0
Commercial	0
Cultivated Agricultural Lands	54
Industrial	1
Livestock	22
Office	0
Orchards/Vineyards	7
Private Recreational (developed and open space)	0
Public Open Space	8
Public/Quasi-Public	2
Residential (mobile home, multi-family, single-family)	1
Roads	0
Rural Residential	2
Unknown	0
Vacant	1
Water	1

Source: Yolo County 2005

[1] Does not account for most lands in railroad and public rights of way.

The county's *Agricultural Preservation Techniques Report* (Yolo County 2006) describes the urban development pressures Yolo County faces due to statewide population growth as well as the county's proximity to Sacramento and the San Francisco Bay Area.

The county actively protects its farmlands through Williamson Act contracts, agreements with cities to limit new development within the cities' spheres of influence, and requirements for mitigation of farmland conversion (Yolo County 2006). There are several approved and pending development projects in the county that would alter agricultural land use. One such project is the Clark Pacific Expansion Project. The Clark Pacific Company manufactures concrete products and is requesting rezoning on approximately 140 acres of their property to change the use from agriculture to industrial (Yolo County Planning and Public Works Department 2012). In addition to this development in the unincorporated county, there are several approved and completed residential and commercial developments in the community areas of Clarksburg, Dunnigan, Esparto, and Knights Landing (Yolo County 2012). These developments range from a 180-unit subdivision and proposed town center area in Esparto to a truck and travel center in Dunnigan (Yolo County 2012). Many of these would take place on existing open space and agriculturally zoned land.

City of Woodland

The Planning Area for the Woodland General Plan Land Use and Community Design Chapter includes all land designated for or to be considered for future development as part of the city (City of Woodland 2002). The area outside of the Planning Area is designated as agriculture. The General Plan describes that "many forces are encouraging new residential and employment development in Woodland" (City of Woodland 2002). The city projects population growth to increase from approximately 42,500 in 1995 to approximately 66,000 by 2020. The urban limit line, which is within the Planning Area and is defined as a line encompassing all land to be considered for urban development within the timeframe of the General Plan, is established to accommodate projected growth through 2020.

The city recognizes that continued development and growth would convert some agricultural land to urban development. However, policies in the General Plan are aimed at maintaining agricultural uses and protecting adjacent agricultural lands from the negative effects to urban development (City of Woodland 2002). For example, Policy 1.I.1 states that "the city shall discourage leapfrog development and development in peninsulas extending into agricultural lands to avoid adverse effects on agricultural operations" (City of Woodland 2002).

3.9.6.1.6 Solano County

Approximately 85 percent of the land in Solano County is unincorporated. Of this, approximately 70 percent is currently used for agriculture (Solano County 2008b). Agricultural land is concentrated in the eastern part of the county, where cropland idling transfers would occur. Solano County's cities include Benicia, Dixon, Fairfield, Rio Vista, Suisun City, Vacaville, and Vallejo. Given the majority of residential development occurs within the incorporated areas of the county, the county's cities account for approximately 95 percent of the population (Solano County 2008b). While residential development does exist in the unincorporated county, it is at rural residential densities of one unit per 2.5 or more acres. Denser residential development is located in the cities and a small amount in the unincorporated areas in Vallejo.

The county's 2030 general plan defines future land use designations and land uses within the unincorporated county. The majority of open space and agricultural designations within the county are not proposed to change (Solano County 2008b). Table 3.9-28 summarizes existing land uses within the county as of 2006.

There are a couple of current planning projects in the unincorporated county that propose major subdivisions (Solano County 2012). One is an eight lot subdivision of an Exclusive Agriculture District, which is a zoning designation where regulations and special permitting apply, and the other is a seven lot subdivision of an Exclusive Agriculture District (Solano County 2012). The county continues to guide most residential and commercial development toward the incorporated cities using municipal service areas (generally defined as the city boundaries) (Solano County 2008b).

Table 3.9-28. Existing Land Uses – Solano County (2006)

Land Use Category	Percent
Water	8.8
Park and Recreation	0.1
Marsh	11.1
Watershed	6.3
Agriculture	56.5
Public/Quasi-Public	0.3
Residential	1.2
Commercial	0.1
Industrial	0.4
Vacant Land	0.2
Roadways/Railroad Right of Ways	1.1
Incorporated Areas	14

Source: Solano County 2008b.

3.9.6.2 Buyer Service Area

3.9.6.2.1 Stanislaus County

The vast majority of land within Stanislaus County is designated as agricultural land and lies outside of designated growth areas. The county actively directs additional growth and urban development to underused land within the incorporated cities and unincorporated communities in the county. There are nine incorporated cities in the county: Ceres, Hughson, Modesto, Newman, Oakdale, Patterson, Riverbank, Turlock, and Waterford (Stanislaus County 2012~~3~~).

The most recent land use change report, published by the California DOC, for Stanislaus County is from 2012. The report notes that there was a slight land use change from irrigated farmland to urban land. The majority of these changes occurred in or adjacent to the City of Riverbank. Additional urban development took place on non-irrigated land uses (defined as grazing areas, dryland crop farming, and formerly irrigated land that has been left idle for three or more FMMP update cycles) (California DOC 2012~~11k~~).

3.9.6.2.2 San Joaquin County

Like most of the counties in the area of analysis, agriculture (including grazing) accounts for the majority of existing land use in the unincorporated county, approximately 89.1 percent of the total land in the county. Residential uses make up approximately ~~4.8~~3 percent of the existing land use in the county (San Joaquin County ~~2005~~2014a). There are ~~eleven~~ seven incorporated cities in the county: ~~Delta,~~ Escalon, Lathrop, ~~Linden, Lockeford,~~ Lodi, Manteca, Ripon, Stockton, ~~Thornton,~~ and Tracy (San Joaquin County 2014b~~1~~). Table 3.9-29 summarizes the acreage and percent of lands in major land use categories in the unincorporated county.

Table 3.9-29. Existing Land Uses – San Joaquin County (2009)

Land Use Category	Percent
Agriculture	89.1
Commercial	1.2
Industrial	0.6
Residential[1]	4.8
Vacant	1.21
Miscellaneous	3.0

Source: San Joaquin County 2005.

[1] Rural parcels which are five acres are les and which contain a house are considered residential.

The most recent land use change report, published by the California DOC, for San Joaquin County is from 2010. The report notes land use changes from irrigated farmland to urban land. The majority of these changes occurred in or adjacent to the cities of Manteca, Stockton, and Tracy. Additional urban development took place on non-irrigated land uses (defined as grazing areas, dryland crop farming, and formerly irrigated land that has been left idle for three or more FMMP update cycles). While urban development is responsible for some of the conversions of irrigated farmland, land fallowing (for three or more update cycles), contributed to a large portion of land conversions from irrigated agricultural uses (California DOC 201~~1j~~0b).

3.9.6.2.3 Merced County

Land in Merced County is separated into specific land use designations which aid in guiding the type of development that takes place within the county. The vast majority of land within the county is designated as Agriculture and Foothill Pasture and lies outside of designated growth areas. Growth is directed towards the county's urban land use area, which include city planning areas, urban communities, rural centers, rural residential centers, highway interchange centers, and isolated urban designations (Merced County 2011). These urban area boundaries are defined either by the city jurisdictional boundaries in the county or by areas of existing concentrations of residential and commercial uses supported by existing infrastructure. The county actively directs additional growth and urban development to vacant and underused land within the incorporated cities and unincorporated communities in the county. There are six incorporated cities in the county: Atwater, Dos Palos, Gustine, Livingston, Los Banos, and Merced (Merced County 2011).

The most recent land use change report, published by the California DOC, for Merced County is from 2008. The report notes land use changes from irrigated farmland to urban land. The majority of these changes occurred in or adjacent to the cities of Atwater, Merced, and Los Banos. Additional urban development took place on non-irrigated land uses (defined as grazing areas, dryland crop farming, and formerly irrigated land that has been left idle for three or more FMMP update cycles). While urban development is responsible for some of the conversions of irrigated farmland, land fallowing (for three or more update cycles), contributed to a larger portion of land conversions from irrigated agricultural uses (California DOC 2009a).

3.9.6.2.4 San Benito County

Approximately 99.5 percent of land within the county is unincorporated, while the remaining 0.5 percent is incorporated (San Benito County 2010). Like most of the counties in the area of analysis, agriculture (including grazing) accounts for the majority of existing land use in the unincorporated county. The county also contains a significant amount of land (8.9 percent of the unincorporated county) owned by city, state, and federal governments. Residential uses make up approximately 1.1 percent of the existing land use in the county (San Benito County 2010). Table 3.9-30 summarizes the acreage and percent of lands in major land use categories in the unincorporated county.

Table 3.9-30. Existing Land Uses – San Benito County (2009)

Land Use Category	Percent
Agriculture[1]	83.2
Commercial[2]	0.1
Industrial[3]	0.3
Residential[4]	1.1
Vacant[5]	0.6
Other[6]	14.5

Source: San Benito County 2010.

[1] Agriculture includes crops, dry farming, facility, general, grazing, nursery, recreation, resource, livestock, orchard, and vineyard.

[2] Commercial includes commercial, medical, motel, and recreation.

[3] Industrial includes heavy industrial, industrial, industrial farming, industrial food, and mines or quarries.

[4] Residential includes residential, rural, single-family, multi-family, mobile homes, and mobile home park.

[5] Vacant includes vacant agriculture, vacant commercial, vacant industrial, and vacant residential.

[6] Other includes infrastructure, miscellaneous, public/quasi-public, parks/resource management land, and unknown.

The two cities within San Benito County are Hollister and San Juan Batista. The county operates with a Local Agency Formation Commission, which acts to, among other things, preserve agricultural land resources and discourage urban sprawl (San Benito County 2010).

Based on the existing general plan land use designations and zoning, there is future residential buildout potential in the county of approximately 32,300 units to 34,300 units (San Benito County 2010). Information on previous developments from the county illustrates that both residential and industrial developments resulted in some conversions of agricultural land over the past year (San Benito County 2012).

The California DOC reports changes from irrigated farmland to both residential and non-irrigated land uses as well. Between 2008 and 2010, there were only a couple conversions from irrigated farmland to urban land. These occurred in the Cities of Hollister and San Juan Bautista (California DOC 2011hf). The majority of conversions from irrigated farmland to non-irrigated uses were related to land fallowing for three or more FMMP update cycles (California DOC 2011hf).

3.9.6.2.5 Fresno County

As shown in Table 3.9-31, the largest land use in Fresno County is agriculture.

Table 3.9-31. Existing Land Uses – Fresno County (1997)

Land Use Category	Percent
Residential	2.5
Commercial	0.12
Industrial	0.18
Agriculture	48.0
Resource Conservation	44.8
Unclassified (includes streets, highways, and rivers)	0.18
Incorporated Cities	2.6

Source: Fresno County 2000.

The most recent land use change report, published by the California DOC, for Fresno County is from 2008. The report notes land use changes from irrigated farmland to urban land. The majority of these changes was less than 20 acres and was attributable to residential and educational facility development. Two of these changes were developments over 100 acres in size (California DOC 2009b). While urban development is responsible for some of the conversions of irrigated farmland, land fallowing (for three or more FMMP update cycles), contributed to a larger portion of land conversions from irrigated agricultural uses (California DOC 2009b).

Other recent pending and approved developments that propose rezoning agricultural land to residential and other uses in the county include a couple proposals for natural gas drilling, a solar power generation facility, and residential development (Fresno County 2012). While Fresno County faces development pressures and conversions of agricultural land uses, the county's policies of directing urban growth away from agricultural lands and to cities, unincorporated communities, and other areas planned for such development, helps maintain agriculturally designated areas for agricultural use (Fresno County 2010).

3.9.6.2.6 Kings County

Kings County has four incorporated cities, Avenal, Corcoran, Hanford, and Lemoore (Kings County 2010). Table 3.9-32 summarizes land uses in the county and illustrates the fact that agriculture is by far the dominant land use in the county (Kings County 2010).

Table 3.9-32. Existing Land Uses – Kings County

Land Use Category	Percent
Agriculture	90.17
Residential	0.38
Mixed Use	0.02
Commercial	0.10
Industrial	0.31
Other Uses (Natural Resource Conservation, Open Space, and Public)	9.03

Source: Kings County 2010.

Between 1993 and the county's most recent General Plan update, agriculture accounted for the greatest amount of land use conversions (Kings County 2010). Of the over 97,000 acres of agricultural land converted to another use, approximately 73 percent was converted to Natural Resource Conservation and Open Space (Kings County 2010).

Kings County's land use policies identify priority agricultural areas for conservation and guide development away from these areas; however, the California DOC reports land use changes from irrigated farmland to urban land in the county between 2008 and 2010 (California DOC 2011ig). The majority of these changes took place within the incorporated cities in the county. Additionally, as with other counties in the area of analysis, changes from irrigated farmland to non-irrigated land uses were largely the result of land being fallow for three or more FMMP update cycles (California DOC 2011ig).

3.9.6.3 Alternative 2: Full Range of Transfers (Proposed Action)

3.9.6.3.1 Seller Service Area

Water acquisition via cropland idling under the Proposed Action in combination with other water management activities, population growth, and development projects converting agricultural land to different uses could decrease the amount of land in the Seller Service Area categorized as Prime Farmland, Farmland of Statewide Importance, or Unique Farmland under the FMMP and convert Williamson Act or other land conservation program lands to an incompatible use. Water management activities that could result in cumulative effects with long-term water transfers include the CVP M&I WSP and SWP water transfers. The CVP M&I WSP could limit water supplies to agricultural users and result in increased agricultural land idling in the Seller Service Area. These changes, however, would likely be minor because the changes in water deliveries would likely represent a small amount of the overall water supply within the area of analysis.

Cropland idling implemented under the SWP transfers could result in a maximum of 26,342 acres of idled rice land. Similar to cropland idling for CVP transfers, SWP cropland idling transfers would be a temporary effect and would not result in land being converted to incompatible uses. Under the cumulative condition, land classifications could change if parcels are repeatedly idled under other water transfer programs. The majority of SWP cropland idling transfers would occur in Butte County, where only small amounts of idling could occur under the Proposed Action. Both CVP and SWP transfers could occur in Sutter County, although SWP transfers projected from Sutter County are relatively small. The Proposed Action includes a maximum of up to 12,569 acres that could be idled in Butte and Sutter counties, which is not a substantial amount of Important Farmland acreage in the counties.

As described in Section 3.9.2.4, cropland idling under the Proposed Action would be temporary in nature and transfers would affect a small percentage of the overall Important Farmland acres within counties in the Seller Service Area. The cumulative water management activities similarly have temporary and small impacts to agricultural land classification.

Counties and cities in the Seller Service Areas continue to undergo development pressures that result in the conversion of agricultural lands to urban uses. Additionally, throughout the area of analysis, cropland idling is a large driver in the conversion of agricultural lands and the reclassification of FMMP designations. Conversions of agricultural lands to urban uses and land fallowing would likely continue into the future. While counties in the area of analysis set policies to guide development in ways that conserve agricultural lands, permanent conversions of agricultural lands would continue in the future.

As described in Section 3.9.6.1, cities in the Seller Service Area would continue to undergo population and employment growth into the future and throughout the city general plan planning horizons. In the current general plans for cities in the Seller Service Area, many cities anticipate higher annual growth rates than have been experienced over previous planning horizons. All of the cities have accounted for this future growth in their general plans, and many attempt to guide growth through the establishment of UGBs or urban limit lines. All city general plans acknowledge the possibility of future pressures for annexation of lands designated as agriculture. While cities in the Seller Service Area acknowledge the importance of preserving agricultural resources as well as the agricultural industry, future development could continue to convert agricultural land to non-agricultural uses. These cumulative land use changes as well as other agricultural land conversions in the county would be potentially significant.

Cropland idling under the Proposed Action would not result in permanent conversions of Important Farmland under the FMMP or Williamson Act and other land conservation program lands to an incompatible use. When considered in combination with other past, current, and future changes to agricultural land use in the area of analysis, agricultural land use impacts associated with acquisition of water via cropland idling in the Proposed Action would not be cumulatively considerable.

3.9.6.3.2 Buyer Service Area

Water transfers in combination with other water management activities, population growth, and development projects in the Buyer Service Area could change the amount of land in the area of analysis categorized as Prime Farmland, Farmland of Statewide Importance, or Unique Farmland under the FMMP. Water management activities that could result in cumulative effects with long-term water transfers include the CVP M&I WSP, refuge transfers, and SWP water transfers. The CVP M&I WSP could limit water supplies to agricultural users and result in increased agricultural land idling in the Buyer Service Area. These changes, however, would likely be minor because the changes in water deliveries would likely represent a small amount of the overall water supply within the Buyer Service Area. Refuge transfers could purchase water from sellers in the San Joaquin Valley that make water available through cropland idling, but this would also represent a very small change in land use within the area. The Proposed Action and SWP transfers would offset this minor, adverse impact by increasing the water supplies within the Buyer Service Area.

Similar to the Seller Service Area, the counties in the Buyer Service Area project agricultural conversion to urban or environmental uses in the future. The cumulative agricultural land conversions would be potentially significant. The Proposed Action's incremental contribution to this significant cumulative effect would be beneficial because it would increase water supplies and potentially allow growers to place previously idled land into production.

3.9.6.4 Alternative 3: No Cropland Modifications

Because Alternative 3 would not include cropland idling, it would not contribute to cumulative impacts as a result of conversion of Important Farmland under the FMMP in the Seller Service Area. Additionally, there would be no cumulative impacts related to conversion of Williamson Act or other land conservation program lands to an incompatible use in the Seller Service Area.

Water transfers in combination with other water management activities, population growth, and development projects in the Buyer Service Area could change the amount of land in the area of analysis categorized as Prime Farmland, Farmland of Statewide Importance, or Unique Farmland under the FMMP. Water management activities that could result in cumulative effects with Alternative 3 include the CVP M&I WSP, refuge transfers, and SWP water transfers. The CVP M&I WSP could limit water supplies to agricultural users and result in increased agricultural land idling in the Buyer Service Area. These changes, however, would likely be minor because the changes in water deliveries would likely represent a small amount of the overall water supply within the Buyer Service Area. Refuge transfers could purchase water from sellers in the San Joaquin Valley that make water available through cropland idling, but this would also represent a very small amount of the water supply within the area. Alternative 3 and SWP transfers would offset this minor, adverse impact by increasing the water supplies within the Buyer Service Area.

The counties in the Buyer Service Area project agricultural conversion to urban or environmental uses in the future. The cumulative agricultural land conversions would be potentially significant. The incremental contribution from Alternative 3 to this significant cumulative effect would be beneficial because it would increase water supplies and potentially allow growers to place previously idled land into production.

3.9.6.5 Alternative 4: No Groundwater Substitution

Cumulative impacts under Alternative 4 would be similar to those described under the Proposed Action.

3.9.6.5.1 Seller Service Area

Cropland idling under Alternative 4 in combination with other water management activities could decrease the amount of land in the Seller Service Area categorized as Prime Farmland, Farmland of Statewide Importance, or Unique Farmland under the FMMP and convert Williamson Act or other land conservation program lands to an incompatible use.

Water acquisition via cropland idling under Alternative 4 in combination with other water management activities, population growth, and other development projects converting agricultural land to different uses could decrease the amount of lands in the Seller Service Area categorized as Prime Farmland, Farmland of Statewide Importance, or Unique Farmland under the FMMP and convert Williamson Act or other land conservation program lands to an incompatible use. As described under Section 3.9.2.6, Cropland idling transfers would occur more often under the No Groundwater Substitution Alternative relative to the Proposed Action. Thus, there is a potential for cropland idling water transfers to change the classification of Important Farmland. However, Mitigation Measure LU-1 (Section 3.9.4), would reduce this potential impact to less than significant.

Cumulatively, the M&I WSP would continue to have very small effects relative to agricultural land use (see Section 3.9.6.1). However, both Alternative 4 and the SWP transfers could idle cropland in Butte and Sutter counties.

As described for the Proposed Action (Section 3.9.6.1), permanent conversion of agricultural land would likely continue into the future despite counties' policies to guide development in ways that conserve agricultural lands. In the Seller Service Area, cumulative agricultural land conversions would be potentially significant. Cropland idling under Alternative 4, after incorporating Mitigation Measure LU-1, would not result in permanent conversions of Important Farmland under the FMMP or Williamson Act and other land conservation program lands to an incompatible use. When considered in combination with other past, current, and future changes to agricultural land use in the area of analysis, agricultural land use impacts associated with acquisition of water via cropland idling in Alternative 4 would not be cumulatively considerable.

3.9.6.5.2 Buyer Service Area

Water transfers in combination with other water management activities, population growth, and development projects in the Buyer Service Area could change the amount of land in the area of analysis categorized as Prime Farmland, Farmland of Statewide Importance, or Unique Farmland under the FMMP. Water management activities that could result in cumulative effects with Alternative 4 include the CVP M&I WSP, refuge transfers, and SWP water transfers. The CVP M&I WSP could limit water supplies to agricultural users and result in increased agricultural land idling in the Buyer Service Area. These changes, however, would likely be minor because the changes in water deliveries would likely represent a small amount of the overall water supply within the Buyer Service Area. Refuge transfers could purchase water from sellers in the San Joaquin Valley that make water available through cropland idling, but this would also represent a very small amount of the water supply within the area. Alternative 4 and SWP transfers would offset this minor, adverse impact by increasing the water supplies within the Buyer Service Area.

The counties in the Buyer Service Area project agricultural conversion to urban or environmental uses in the future. The cumulative agricultural land conversions could be potentially significant. The incremental contribution from Alternative 4 to this significant cumulative effect would be beneficial because it would increase water supplies and potentially allow growers to place previously idled land into production.

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Section 3.10 Regional Economics

This section describes the regional economies within the area of analysis and discusses potential economic effects from the proposed alternatives.

Economic effects could occur from all types of transfer methods: cropland idling, crop shifting, groundwater substitution, stored reservoir water, and conservation.

3.10.1 Affected Environment/Environmental Setting

This section identifies the area of analysis, describes applicable laws and policies relevant to water transfers and potential economic effects, and describes the regional economies that could be affected by water transfers.

3.10.1.1 Area of Analysis

The area of analysis for regional economics includes counties where cropland idling transfer water would originate, areas overlying groundwater basins where groundwater substitution for water transfers could occur, counties where stored and conserved water would originate, and counties where transfer water would be used. Counties of origin are also affected because sellers within these counties receive payment for water, and sellers within the destination counties provide payment. Figure 3.10-1 shows the regional economics area of analysis.

3.10.1.2 Regulatory Setting

Federal and state laws provide some protection for local economies from potential adverse effects of water transfers. These laws and applicable sections that are further described in Chapter 1 are:

- Central Valley Project (CVP) Improvement Act Section 3405(a)
- California Water Code Sections 1745 and 1810

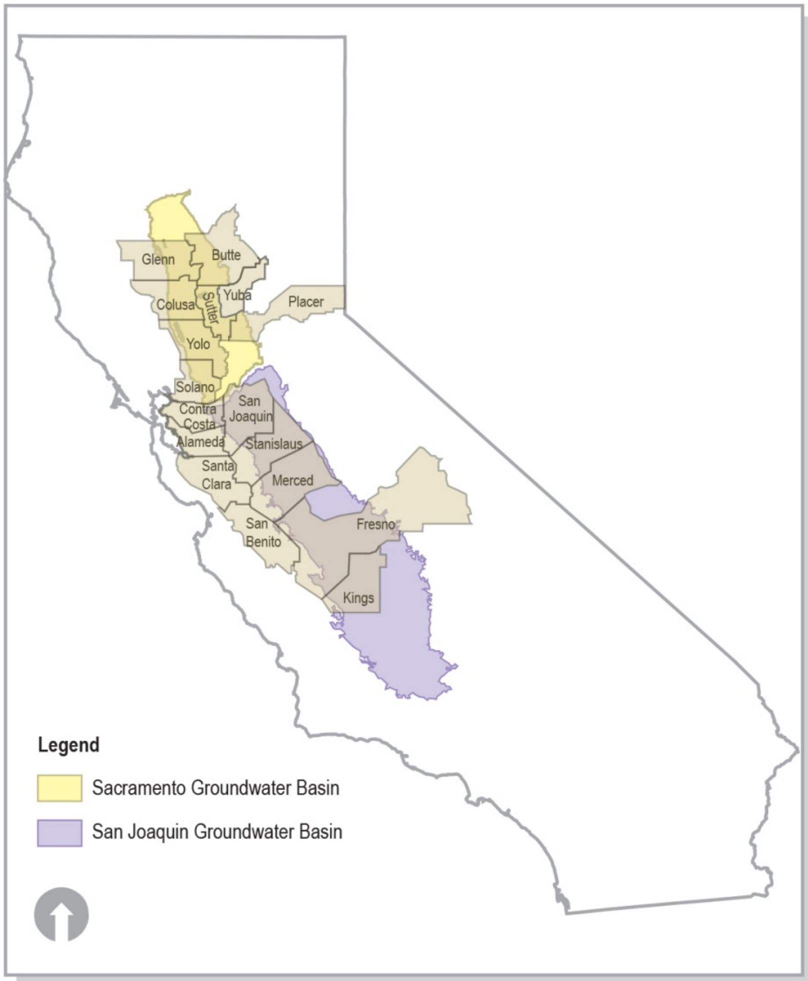

Figure 3.10-1. Regional Economics Area of Analysis

Local governments have also adopted policies and ordinances to protect their respective economies. County and city general plans in the area of analysis have policies for economic development and maintaining agricultural activities. For example, one of Colusa County's General Plan objectives in the Economic Development Element is to Promote and Expand the County's Agricultural Sector, which includes policies to encourage development of agricultural businesses and increase processing and manufacturing of agricultural commodities. Yolo County's Agriculture and Economic Development Element of the General Plan has goals for the Preservation of Agriculture and a Healthy Farm Economy.

Section 3.9, Agricultural Land Use, provides additional detail on county General Plans, codes, and other planning documents.

Section 3.3, Groundwater Resources, also discusses local ordinances that protect non-transferring parties from the effects of water transfers.

3.10.1.3 Existing Conditions

The following section describes relevant portions of regional economies within the area of analysis.

3.10.1.3.1 Seller Service Area

Glenn County

In 2011, the top two industries in Glenn County in terms of employment and value of output were agriculture and services. Table 3.10-1 presents employment, labor income, and output by industry for Glenn County in 2011. The county had over $560 million of agricultural production in 2010 (California Department of Food and Agriculture [CDFA] 2011). Important economic centers include Willows, Orland, and Artois, all on the I-5 corridor.

Table 3.10-1. Summary of 2011 Regional Economy in Glenn County

	Employment[1]	Labor Income (million $)[2]	Output (million $)[3]
Agriculture	3,924	$148.0	$703.7
Mining	43	$3.8	$13.2
Construction	695	$27.8	$70.3
Manufacturing	616	$34.7	$278.1
Transportation, Information, Public Utilities	837	$38.4	$170.6
Trade	1,054	$45.3	$109.3
Service	3,730	$93.2	$445.2
Government	2,015	$146.2	$185.1
Total	12,912	$537.3	$1,975.5

Source: Minnesota Implan Group (MIG) Inc. 2011

[1] Employment is measured in number of jobs.

[2] Income is the dollar value of total payroll for each industry plus income received by self-employed individuals.

[3] Output represents the dollar value of industry production.

In 2007, Glenn County had 1,242 farms encompassing a total of 489,186 acres with a median farm size of 50 acres (U.S. Department of Agriculture [USDA] 2009). These farms had production expenses of about $300 million. Total cropland[1] acreage was 250,279 acres. Harvested cropland[2] was 228,533 acres on 924 farms. Irrigated land[3] acreage was 236,134 acres on 1,020 farms.

[1] Total cropland includes cropland harvested, cropland used only for pasture or grazing, cropland on which all crops failed or were abandoned, cropland in cultivated summer fallow, and cropland idle or used for cover crops or soil improvement but not harvested and not pastured or grazed.

[2] Harvested cropland includes land from which crops were harvested and hay was cut, land used to grow short-rotation woody crops and land in orchards, citrus groves, Christmas trees, vineyards, nurseries, and greenhouses. Land from which two or more crops were harvested was counted only once.

[3] Irrigated land includes all land watered by any artificial or controlled method and includes supplemental, partial, and preplant irrigation. Each acre was counted only once regardless of the number of times it was irrigated or harvested.

Of the total farms, full owners operated 810 farms, part owners operated 271 farms, and tenant farmers operated 161 farms in 2007 (USDA 2009).

In 2010, the top five commodities in terms of production value in Glenn County were rice ($165.8 million), almonds ($104.4 million), walnuts ($0.70 million), milk ($0.55 million), and olives ($0.25 million) (CDFA 2011). Table 3.10-2 shows crop acreages for the types of crops that may be included in cropland idling transfer in Glenn County.

Table 3.10-2. 2001-2012 Crop Acreage Summary for Potential Cropland Idling Transfers in Glenn County

Year	Alfalfa	Beans, Dry	Corn, Grain	Rice	Safflower	Sunflowers	Vine Seed	Wheat
2001	15,964	864	22,992	87,239	930	3,612	1,033	15,726
2002	19,184	2,618	21,813	92,382	2,839	4,772	1,058	14,006
2003	19,280	608	15,653	87,793	287	4,427	1,948	16,000
2004	15,247	374	12,529	86,017	146	4,555	2,916	8,184
2005	10,506	2,267	12,620	88,876	205	6,915	n/a[1]	5,019
2006	16,345	2,153	8,413	82,436	306	4,120	1,448	6,389
2007	16,008	3,033	15,101	82,668	221	3,456	1,251	10,019
2008	16,068	1,713	10,807	77,770	1,030	2,790	641	14,902
2009	17,736	2,394	13,617	89,483	n/a	4,275	3,742	13,125
2010	15,100	1,550	15,750	88,209	n/a	4,380	3,610	10,500
2011	11,000	1,104	16,200	84,900	n/a	6,240	2,580	13,500
2012	12,800	1,790	n/a	84,800	n/a	5,320	4,510	10,800
Average (2001-12)	15,437	1,706	15,045	86,048	746	4,572	2,249	11,514
Average (2008-12)	14,541	1,710	14,094	85,032	1,030	4,601	3,017	12,565

Source: National Agricultural Statistics Service (NASS) 2001-2013
n/a – no acreage present or data is not reported individually for Glenn County. Averages do not include these years

Colusa County
In 2011, the top two industries in Colusa County in terms of employment were agriculture and services. The top two industries in value of output were agriculture and manufacturing. Table 3.10-3 presents employment, labor income, and output by industry for Colusa County in 2011. The county had over $640 million of agricultural production in 2010 (CDFA 2011). Important economic centers include Colusa, Williams, Maxwell, and Arbuckle, all on or near the I-5 corridor.

Table 3.10-3. Summary of 2011 Regional Economy in Colusa County

	Employment[1]	Labor Income (million $)[2]	Output (million $)[3]
Agriculture	3,810	$179.1	$642.3
Mining	5	$0.2	$1.4
Construction	251	$16.6	$31.9
Manufacturing	1,485	$90.0	$854.9
Transportation, Information, Public Utilities	273	$17.5	$76.5
Trade	1,495	$73.4	$186.3
Service	2,722	$86.5	$321.6
Government	2,083	$120.4	$160.3
Total	12,124	$583.7	$2,275.2

Source: MIG Inc. 2011

[1] Employment is measured in number of jobs.

[2] Income is the dollar value of total payroll for each industry plus income received by self-employed individuals.

[3] Output represents the dollar value of industry production.

In 2007, Colusa County had 814 farms encompassing a total of 474,092 acres with a median farm size of 190 acres (USDA 2009). These farms had production expenses of about $310 million. Total cropland acreage was 298,996 acres. Harvested cropland was 276,588 acres on 661 farms. Irrigated land acreage was 277,332 acres on 682 farms.

Of the total farms, full owners operated 429 farms, part owners operated 175 farms, and tenant farmers operated 210 farms in 2007 (USDA 2009).

In 2010, the top five commodities in terms of production value in Colusa County were rice ($270.3 million), almonds ($144.2 million), vegetable and vine seed ($0.44 million), processing tomatoes ($0.35 million), and rice seed ($0.25 million) (CDFA 2011). Table 3.10-4 shows crop acreages for the types of crops that may be included in cropland idling transfer in Colusa County.

Table 3.10-4. 2001-2012 Crop Acreage Summary for Potential Cropland Idling Transfers in Colusa County

Year	Alfalfa	Beans, Dry	Corn, Grain	Rice	Safflower	Sunflowers	Tomatoes, Processing	Vine Seed	Wheat
2001	6,650	8,250	1,690	111,250	10,750	475	20,250	8,010	22,600
2002	6,700	7,520	1,700	134,300	12,400	390	18,900	6,977	21,400
2003	6,750	7,050	1,240	127,350	9,350	790	16,900	10,525	21,500
2004	6,550	4,370	1,410	150,130	4,950	810	20,500	14,255	24,200
2005	7,150	6,050	720	136,400	4,200	1,760	23,650	11,715	13,500
2006	8,000	6,400	410	142,600	3,840	2,180	18,400	9,837	14,700
2007	10,050	6,100	6,420	148,550	7,650	1,790	16,500	7,570	22,900
2008	11,800	4,390	2,750	150,200	7,750	1,780	13,940	9,090	27,400
2009	12,300	4,620	650	152,400	3,630	3,850	18,440	8,000	20,450
2010	12,700	4,040	4,310	154,000	2,050	2,220	11,800	14,200	18,600
2011	10,900	4,260	4,560	149,000	1,060	5,570	12,700	16,600	16,600
2012	11,800	5,290	5,660	150,000	1,610	6,560	13,500	11,700	16,100
Average (2001-12)	9,279	5,695	2,627	142,182	5,770	2,348	17,123	10,707	19,996
Average (2008-12)	11,900	4,520	3,586	151,120	3,220	3,996	14,076	11,918	19,830

Source: NASS 2001-2013

Butte County

In 2011, the top industry in terms of employment and output was services. Table 3.10.5 presents employment, labor income, and output by industry for Butte County for 2011.

Table 3.10-5. Summary of 2011 Regional Economy in Butte County

	Employment[1]	Labor Income (million $)[2]	Output (million $)[3]
Agriculture	5,760	$199.6	$655.5
Mining	131	$1.5	$24.6
Construction	6,078	$271.6	$643.7
Manufacturing	4,012	$205.1	$1,903.6
Transportation, Information, Public Utilities	3,354	$146.4	$700.4
Trade	14,087	$495.6	$1,232.6
Service	55,459	$1,866.7	$6,185.2
Government	13,693	$813.7	$1,010.0
Total	102,574	$4,000.2	$12,355.6

Source: MIG Inc. 2011

1 Employment is measured in number of jobs.

2 Income is the dollar value of total payroll for each industry plus income received by self-employed individuals.

3 Output represents the dollar value of industry production.

In 2007, Butte County had 2,048 farms encompassing a total of 373,786 acres with a median farm size of 21 acres (USDA 2009). These farms had production expenses of about $276 million. Total cropland acreage was 222,713 acres.

Harvested cropland was 200,943 acres on 1,460 farms. Irrigated land acreage was 202,234 acres on 1,429 farms.

Of the total farms, full owners operated 1,582 farms, part owners operated 275 farms, and tenant farmers operated 191 farms in 2007 (USDA 2009).

In 2010, the top five commodities in terms of production value in Butte County were rice ($182.2 million), walnuts ($173.4 million), almonds ($113.8 million), dried plums ($0.42 million), and nursery products ($0.24 million) (CDFA 2011). Table 3.10-6 shows crop acreages for the types of crops that may be included in cropland idling transfer in Butte County. Crops eligible for idling that are not listed in the table are not grown in notable acreages in Butte County (corn, sunflowers, tomatoes for processing, and vine seed).

Table 3.10-6. 2001-2012 Crop Acreage Summary for Potential Cropland Idling Transfers in Butte County

Year	Alfalfa	Beans, Dry	Rice	Safflower	Wheat
2001	3,000	500	86,000	900	3,500
2002	3,171	500	94,700	891	4,000
2003	2,900	500	92,500	700	4,440
2004	2,400	600	105,000	267	2,147
2005	1,885	756	96,400	210	1,600
2006	1,944	600	105,673	150	2,700
2007	1,602	610	101,634	380	3,200
2008	1,716	930	105,301	222	4,271
2009	1,508	1,672	103,416	120	3,704
2010	1,080	950	93,800	375	3,960
2011	987	619	95,000	348	5,750
2012	1,080	794	94,500	288	8,970
Average (2001-12)	1,939	753	97,827	404	4,020
Average (2008-12)	1,274	993	98,403	271	5,331

Source: NASS 2001-2013

Sutter County

In 2011, the top two industries in Sutter County in terms of employment were services and trade. The top two industries in value of output were services and manufacturing. Table 3.10-7 presents employment, labor income, and output by industry for Sutter County in 2011. The county had over $520 million of agricultural production in 2010 (CDFA 2011). Yuba City is the main economic center.

Table 3.10-7. Summary of 2011 Regional Economy in Sutter County

	Employment[1]	Labor Income (million $)[2]	Output (million $)[3]
Agriculture	5,688	$189.4	$523.4
Mining	228	$17.3	$85.2
Construction	2,563	$101.4	$258.4
Manufacturing	1,627	$94.2	$727.2
Transportation, Information, Public Utilities	2,543	$91.8	$352.6
Trade	6,599	$276.1	$626.9
Service	20,351	$623.6	$2,218.4
Government	4,524	$287.1	$375.0
Total	44,124	$1,680.9	$5,167.2

Source: MIG Inc. 2011

[1] Employment is measured in number of jobs.

[2] Income is the dollar value of total payroll for each industry plus income received by self-employed individuals.

[3] Output represents the dollar value of industry production.

In 2007, Sutter County had 1,263 farms encompassing a total of 359,802 acres with a median farm size of 45 acres (USDA 2009). These farms had production expenses of about $268 million. Total cropland acreage was 274,439 acres. Harvested cropland was 241,597 acres on 1,055 farms. Irrigated land acreage was 231,713 acres on 1,039 farms.

Of the total farms, full owners operated 856 farms, part owners operated 237 farms, and tenant farmers operated 170 farms in 2007 (USDA 2009).

In 2010, the top five commodities in terms of production value in Sutter County were rice ($203.0 million), walnuts ($0.72 million), dried plums ($0.49 million), peaches ($0.32 million), and processing tomatoes ($0.22 million) (CDFA 2011). Table 3.10-8 shows crop acreages for the types of crops that may be included in cropland idling transfer in Sutter County.

Table 3.10-8. 2001-2012 Crop Acreage Summary for Potential Cropland Idling Transfers in Sutter County

Year	Alfalfa	Beans, Dry	Corn, Grain	Rice	Safflower	Sunflowers	Tomatoes, Processing	Vine Seed	Wheat	Wild Rice
2001	6,740	4,482	5,931	81,857	15,596	2,008	9,500	1,684	11,594	4,185
2002	7,054	6,605	4,780	96,224	13,556	2,103	9,100	1,725	10,331	3,245
2003	7,247	5,429	2,928	93,654	14,991	3,685	8,000	2,910	14,246	2,261
2004	6,935	4,268	6,491	121,131	4,960	3,310	6,300	2,905	12,950	1,720
2005	7,004	4,084	3,210	97,801	10,641	4,069	5,200	1,704	11,580	1,707
2006	8,960	4,869	1,644	92,984	6,984	4,383	6,900	2,000	2,415	2,670
2007	7,772	2,320	7,800	108,241	5,213	4,435	7,900	745	20,721	2,871
2008	8,444	3,067	7,720	92,344	6,517	7,103	8,000	2,124	15,669	4,455
2009	7,250	2,183	3,477	109,766	1,965	9,041	9,000	2,266	14,045	1,371
2010	5,760	1,960	4,320	115,000	1,940	7,740	7,330	3,630	12,500	550
2011	5,960	4,770	7,700	112,000	1,940	6,520	7,740	3,760	12,900	871
2012	6,570	-	9,810	116,000	1,940	9,680	7,830	2,580	11,500	1,100
Average (2001-12)	7,141	4,003	5,484	103,084	7,187	5,340	7,733	2,336	12,538	2,251
Average (2008-12)	6,797	2,995	6,605	109,022	2,860	8,017	7,980	2,872	13,323	2,383

Source: NASS 2001-2013

Yolo County

In 2011, the top two industries in Yolo County in terms of employment and output were services and government. Table 3.10-9 presents employment, labor income, and output by industry for Yolo County in 2011. The county had over $440 million of agricultural production in 2010 (CDFA 2011). Yolo County is an important suburb of the Sacramento metropolitan area and important economic centers in the county include West Sacramento, Davis, and Woodland.

Table 3.10-9. Summary of 2011 Regional Economy in Yolo County

	Employment[1]	Labor Income (million $)[2]	Output (million $)[3]
Agriculture	6,385	$312.6	$818.2
Mining	340	$14.0	$100.2
Construction	4,952	$307.0	$610.1
Manufacturing	5,865	$353.5	$2,728.3
Transportation, Information, Public Utilities	8,138	$384.9	$1,061.4
Trade	14,613	$680.8	$1,620.9
Service	43,135	$1,693.9	$5,475.0
Government	34,297	$2,648.5	$3,087.0
Total	117,725	$6,395.3	$15,501.1

Source: MIG Inc. 2011

[1] Employment is measured in number of jobs.

[2] Income is the dollar value of total payroll for each industry plus income received by self-employed individuals.

[3] Output represents the dollar value of industry production.

In 2007, Yolo County had 983 farms encompassing a total of 479,858 acres with a median farm size of 60 acres (USDA 2009). These farms had production expenses of about $313 million. Total cropland acreage was 311,307 acres. Harvested cropland was 258,261 acres on 682 farms. Irrigated land acreage was 246,341 acres on 694 farms.

Of the total farms, full owners operated 692 farms, part owners operated 142 farms, and tenant farmers operated 149 farms in 2007 (USDA 2009).

In 2010, the top five commodities in terms of production value in Yolo County were processing tomatoes ($0.88 million), rice ($0.56 million), wine grapes ($0.46 million), vegetable ($0.45 million), and alfalfa ($0.28 million) (CDFA 2011). Table 3.10-10 shows crop acreages for types of crops that may be included in cropland idling transfer in Yolo County.

Table 3.10-10. 2001-2012 Crop Acreage Summary for Potential Cropland Idling Transfers in Yolo County

Year	Alfalfa[1]	Corn, Grain	Rice	Safflower	Sunflowers	Tomatoes, Processing	Vine Seed	Wheat
2001	45,885	18,308	28,717	27,650	4,540	40,374	1,100	43,774
2002	53,231	9,195	32,446	20,765	3,372	42,812	1,179	33,076
2003	55,914	6,495	37,303	20,674	9,294	38,274	1,703	56,227
2004	52,904	9,523	45,655	9,991	13,403	45,129	3,591	44,098
2005	45,776	4,238	34,670	12,955	13,615	42,232	2,942	34,647
2006	59,269	2,452	29,997	10,176	35,500	37,026	2,756	20,976
2007	53,959	11,596	32,660	9,030	28,136	42,149	684	35,613
2008	56,710	8,118	30,057	13,514	13,808	37,571	1,663	42,398
2009	49,450	6,502	36,593	8,563	15,574	37,881	2,698	28,062
2010	42,900	16,300	41,400	9,530	12,700	33,000	1,030	33,900
2011	41,000	20,200	42,500	8,780	19,000	40,100	2,630	42,900
2012	42,600	23,500	40,500	9,790	21,900	36,800	3,170	35,800
Average (2001-12)	49,967	11,369	36,042	13,452	15,904	39,446	2,096	37,623
Average (2008-12)	46,532	14,924	38,210	10,035	16,596	37,070	2,238	36,612

Source: NASS 2001-2013
[1] Alfalfa cannot be idled within the legal boundaries of the Delta

Solano County

In 2011, the top two industries in Solano County in terms of employment were services and government. The top two industries in value of output were services and manufacturing. Table 3.10-11 presents employment, labor income, and output by industry for Solano County in 2011. The county had over $259 million of agricultural production in 2010 (CDFA 2011). Important economic centers include Dixon, Vacaville and Fairfield, all on the I-80 corridor.

Table 3.10-11. Summary of 2011 Regional Economy in Solano County

	Employment[1]	Labor Income (million $)[2]	Output (million $)[3]
Agriculture	2,126	$118.9	$454.3
Mining	302	$21.5	$155.8
Construction	11,052	$801.0	$1,477.8
Manufacturing	8,937	$982.8	$11,397.7
Transportation, Information, Public Utilities	10,176	$259.6	$990.8
Trade	25,026	$986.4	$2,355.9
Service	73,403	$3,314.2	$9,922.1
Government	30,325	$3,094.8	$3,834.4
Total	161,347	$9,579.2	$30,588.9

Source: MIG Inc. 2011

1 Employment is measured in number of jobs.

2 Income is the dollar value of total payroll for each industry plus income received by self-employed individuals.

3 Output represents the dollar value of industry production.

In 2007, Solano County had 890 farms encompassing a total of 358,225 acres with a median farm size of 30 acres (USDA 2009). These farms had production expenses of about $195 million. Total cropland acreage was 154,937 acres. Harvested cropland was 120,410 acres on 506 farms. Irrigated land acreage was 145,988 acres on 517 farms.

Of the total farms, full owners operated 646 farms, part owners operated 137 farms, and tenant farmers operated 107 farms in 2007 (USDA 2009).

In 2010, the top five commodities in terms of production value in Solano County were processing tomatoes ($0.37 million), walnuts ($0.31 million), vegetables ($0.27 million), nursery products ($0.23 million), and cattle and calves ($0.23 million) (CDFA 2011). Table 3.10-12 shows crop acreages for types of crops that may be included in cropland idling transfer in Solano County.

Table 3.10-12. 2001-2012 Crop Acreage Summary for Potential Cropland Idling Transfers in Solano County

Year	Alfalfa[1]	Beans, Dry	Corn, Grain	Safflower	Sudan Grass	Sunflowers	Tomatoes, Processing	Vine Seed	Wheat
2001	31,969	2,911	13,677	6,018	3,233	1,191	13,801	519	39,350
2002	36,492	3,927	10,900	6,017	3,853	1,246	14,626	634	34,516
2003	34,602	1,859	7,406	8,246	6,242	2,474	11,952	1,221	32,956
2004	33,782	1,713	10,457	5,771	6,504	4,263	10,344	1,476	27,997
2005	34,605	2,789	6,445	6,276	7,938	6,526	10,300	1,307	25,227
2006	36,304	2,894	2,836	5,764	8,360	6,615	10,000	887	21,494
2007	29,483	n/a	8,282	4,200	6,863	6,070	9,700	832	26,575
2008	30,599	2,968	7,504	3,235	8,370	7,535	10,000	222	25,669
2009	31,438	1,642	7,104	1,680	5,024	9,439	12,000	221	25,141
2010	27,100	1,060	11,200	3,220	10,100	6,010	11,000	496	25,700
2011	26,100	545	11,200	3,710	8,820	7,670	9,000	1,250	30,400
2012	28,200	1,590	10,700	2,920	9,020	8,640	10,000	1,020	20,000
Average (2001-12)	31,723	2,173	8,976	4,755	7,027	5,640	11,060	840	27,919
Average (2008-12)	28,687	1,561	9,542	2,953	8,267	7,859	10,400	642	25,382

Source: NASS 2001-2013

n/a – no acreage present or data is not reported individually for Solano County

[1] Alfalfa cannot be idled within the legal boundaries of the Delta

Yuba County

In 2011, the top two industries in Yuba County in terms of employment and output were government and services. Table 3.10-13 presents employment, labor income, and output by industry for Yuba County in 2011. Important economic centers include Marysville and Olivehurst. No cropland idling transfers are proposed in Yuba County; therefore, data on agricultural economies are not presented.

Table 3.10-13. Summary of 2011 Regional Economy in Yuba County

	Employment[1]	Labor Income (million $)[2]	Output (million $)[3]
Agriculture	1,858	$91.5	$279.3
Mining	102	$6.3	$29.9
Construction	1,631	$60.1	$160.0
Manufacturing	511	$36.1	$195.4
Transportation, Information, Public Utilities	1,216	$211.0	$308.3
Trade	1,927	$87.4	$195.2
Service	8,335	$309.6	$1,064.7
Government	9,833	$986.5	$1,249.4
Total	25,412	$1,788.5	$3,482.1

Source: MIG Inc. 2011

[1] Employment is measured in number of jobs.

[2] Income is the dollar value of total payroll for each industry plus income received by self-employed individuals.

[3] Output represents the dollar value of industry production.

Shasta County

In 2011, services provided the most jobs in Shasta County, followed by trade, and government. Services had the highest output in the county, followed by trade, and government. Incorporated cities are Anderson, Redding, and Shasta Lake. Table 3.10-14 summarizes the regional economy in Shasta County, in terms of employment, output, labor income, and total value added. No cropland idling transfers are proposed in Shasta County; therefore, data on agricultural economies are not presented. Shasta County is include because it overlies the Redding Groundwater Basin where economic effects from groundwater substation could occur.

Table 3.10-14. Summary of 2011 Regional Economy in Shasta County

Industry	Employment (Jobs)	Output (Million $)	Labor Income (Million $)	Total Value Added (Million $)
Agriculture	2,465	$218.3	$76.1	$86.1
Mining	753	$133.9	$16.0	$58.0
Construction	5,306	$597.2	$272.3	$321.4
Manufacturing	2,524	$733.0	$143.8	$202.8
TIPU	3,786	$925.0	$236.4	$405.7
Trade	12,810	$1,129.9	$458.9	$824.8
Service	44,448	$5,074.1	$1,598.3	$3,170.5
Government	12,225	$1,033.3	$827.4	$966.4
Total	84,317	$9,844.7	$3,629.2	$6,035.7

Source: MIG Inc. 2011

[1] Employment is measured in number of jobs.

[2] Income is the dollar value of total payroll for each industry plus income received by self-employed individuals.

[3] Output represents the dollar value of industry production.

Tehama County

In 2011, services provided the most jobs in Tehama County, followed by government, and agriculture. Services had the highest output in the county, followed by manufacturing, and agriculture. Corning, Red Bluff, and Tehama are the only incorporated cities in the county Table 3.10-15 summarizes the regional economy in Tehama County, in terms of employment, output, labor income, and total value added. No cropland idling transfers are proposed in Tehama County; therefore, data on agricultural economies are not presented. Tehama County is include because it overlies the Redding Groundwater Basin where economic effects from groundwater substation could occur.

Table 3.10-15. Summary of 2011 Regional Economy in Tehama County

Industry	Employment (Jobs)	Output (Million $)	Labor Income (Million $)	Total Value Added (Million $)
Agriculture	3,290	$367.1	$106.0	$164.7
Mining	169	$55.3	$3.2	$14.5
Construction	1,284	$128.2	$49.6	$61.5
Manufacturing	1,430	$495.0	$86.7	$117.7
TIPU	1,569	$280.3	$80.1	$126.0
Trade	2,573	$239.7	$92.0	$173.4
Service	8,946	$1,056.5	$272.6	$637.0
Government	3,853	$303.2	$228.1	$273.2
Total	23,114	$2,925.3	$918.3	$1,568.0

Source: MIG Inc. 2011

1 Employment is measured in number of jobs.

2 Income is the dollar value of total payroll for each industry plus income received by self-employed individuals.

3 Output represents the dollar value of industry production.

Sacramento County

In 2011, services provided the most jobs in Sacramento County, followed by government, and trade. Services had the highest output in the county, followed by government, and manufacturing. Table 3.10-16 summarizes the regional economy in Sacramento County in 2011, in terms of employment, output, and labor income. No cropland idling transfers are proposed in Sacramento County; therefore, data on agricultural economies are not presented. Sacramento County is include because it overlies the Sacramento Valley Groundwater Basin where economic effects from groundwater substation could occur.

Table 3.10-16. Summary of 2011 Regional Economy in Sacramento County

Industry	Employment[1]	Labor Income (million $)[2]	Output (million $)[3]
Agriculture	3,468	$831.7	$248.3
Mining	325	$138.7	$12.9
Construction	35,107	$4,410.2	$2,260.8
Manufacturing	20,291	$11,641.3	$1,768.8
TIPU	14,149	$3,164.5	$1,077.0
Trade	86,564	$8,204.4	$3,615.0
Service	391,826	$55,621.6	$19,928.2
Government	188,723	$18,740.2	$15,949.1
Total	740,453	$102,752.6	$44,860.1

Source: MIG Inc. 2011

1 Employment is measured in number of jobs.

2 Income is the dollar value of total payroll for each industry plus income received by self-employed individuals.

3 Output represents the dollar value of industry production.

Placer County

In 2011, the top two industries in Placer County in terms of employment were services and trade. The top two industries in output were services and manufacturing. Table 3.10-~~14~~ 17 presents employment, labor income, and output by industry for Placer County in 2011. Placer County is closely linked to the Sacramento metropolitan area and also includes communities in the Sierra Nevada foothills and near Lake Tahoe. No cropland idling transfers are proposed in Placer County; therefore, data on agricultural economies are not presented.

Table 3.10-~~14~~17. Summary of 2011 Regional Economy in Placer County

	Employment[1]	Labor Income (million $)[2]	Output (million $)[3]
Agriculture	1,661	$30.7	$166.8
Mining	297	$2.1	$62.7
Construction	12,972	$1,063.3	$1,856.4
Manufacturing	7,533	$683.7	$3,741.1
Transportation, Information, Public Utilities	3,117	$343.9	$1,287.9
Trade	32,379	$1,342.5	$3,047.9
Service	104,943	$4,740.8	$14,303.9
Government	17,230	$1,207.4	$1,496.6
Total	180,131	$9,414.4	$25,963.3

Source: MIG Inc. 2011

[1] Employment is measured in number of jobs.

[2] Income is the dollar value of total payroll for each industry plus income received by self-employed individuals.

[3] Output represents the dollar value of industry production.

Merced County

In 2011, the top two industries in Merced County in terms of employment were agriculture and services. The top two industries in value of output were services and manufacturing. Table 3.10-~~15~~ 18 presents employment, labor income, and output by industry for Merced County in 2010. No cropland idling transfers are proposed in Merced County; therefore, data on agricultural economies are not presented.

Table 3.10-~~15~~18. Summary of 2010 Regional Economy in Merced County

	Employment	Labor Income (million $)	Output (million $)
Agriculture	16,175	$680.3	$3,121.9
Mining	119	$7.4	$27.5
Construction	3,469	$194.7	$407.1
Manufacturing	7,764	$383.7	$3,348.4
Transportation, Information, Public Utilities	4,254	$220.1	$731.0
Trade	12,206	$425.7	$1,107.5
Service	34,518	$1,101.8	$4,320.3
Government	15,817	$1,050.8	$1,306.5
Total	94,323	$4,064.4	$14,370.2

Source: MIG Inc. 2011

[1] Employment is measured in number of jobs.

[2] Income is the dollar value of total payroll for each industry plus income received by self-employed individuals.

[3] Output represents the dollar value of industry production.

3.10.1.3.2 Buyers Service Area

The buyer service area includes CVP municipal and industrial (M&I) and agricultural contractors. Transfers would be used to serve existing demands in the contractors' service areas.

M&I Contractors

M&I contractors include East Bay Municipal Utility District (MUD), Contra Costa Water District (WD), and Santa Clara Valley WD. The M&I contractors serve mostly urban water customers in Contra Costa, Alameda, and Santa Clara counties. This section presents both regional economic data on the counties served by the M&I contractors and information about water use by sector within their service areas.

Table 3.10-~~16~~ 19 presents employment, labor income, and output in these three counties in 2011. In 2011, the top two industries in the three-county region in terms of employment were services and trade. The top two industries in terms of output were manufacturing and services.

Table 3.10-~~16~~19. Summary of 2011 Regional Economy in Alameda, Contra Costa and Santa Clara Counties

	Employment[1]	Labor Income (million $)[2]	Output (million $)[3]
Agriculture	6,078	$329.0	$690.6
Mining	3,071	$337.8	$1,542.6
Construction	114,261	$8,959.4	$15,952.7
Manufacturing	244,305	$37,615.4	$314,807.7
Transportation, Information, Public Utilities	56,873	$4,125.7	$13,539.1
Trade	325,985	$19,139.1	$38,641.8
Service	1,459,455	$103,203.8	$234,574.7
Government	227,128	$20,929.8	$24,705.4
Total	2,437,156	$194,640.0	$644,454.6

Source: MIG Inc. 2011

[1] Employment is measured in number of jobs.

[2] Income is the dollar value of total payroll for each industry plus income received by self-employed individuals.

[3] Output represents the dollar value of industry production.

Contra Costa WD is a wholesale and retail water provider in Contra Costa County. Figure 3.10-2 shows actual 2010 retail water use within the service area. In 2010, total service area demands were 114,679 acre-feet (AF), including 39,570 AF of wholesale demands and 66,460 AF of retail demands. The remainder of total demands account for system losses (Contra Costa WD 2011). Contra Costa WD projects service area demands to increase to 203,400 AF in 2025 (74,770 for wholesale demands and 116,420 for retail demands), which does not include planned conservation and water recycling. This is a 77 percent increase over actual 2010 water use. The largest projected increase in water use is for untreated industrial water, an increase of 28,441 over 2010 use (Contra Costa WD 2011).

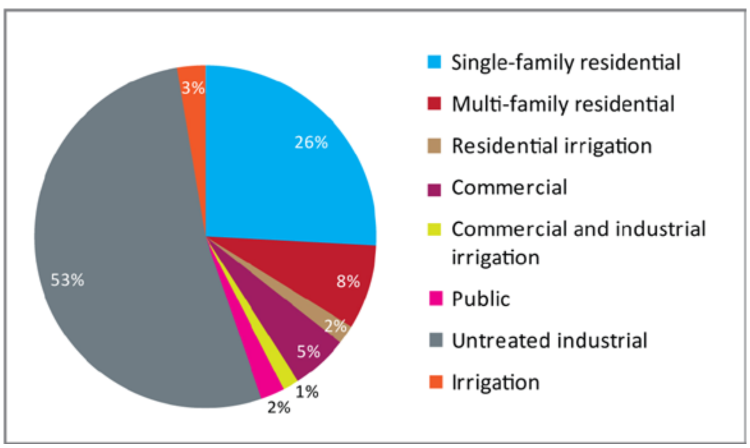

Figure 3.10-2. Sector Water Use in Contra Costa WD Service Area

East Bay MUD provides water to customers in Alameda and Contra Costa counties. Figure 3.10-3 summarizes historic water consumption by customer category in East Bay MUD. Residential water use accounted for about 63 percent of total water use (East Bay MUD 2011a). East Bay MUD projects demands to remain relatively stable from 2010 through 2025, except for an increase in multi-family residential demands of about 17,930 AF (East Bay MUD 2011a). Single-family, industrial, institutional and irrigation uses are projected to slightly decrease during the same period (East Bay MUD 2011a).

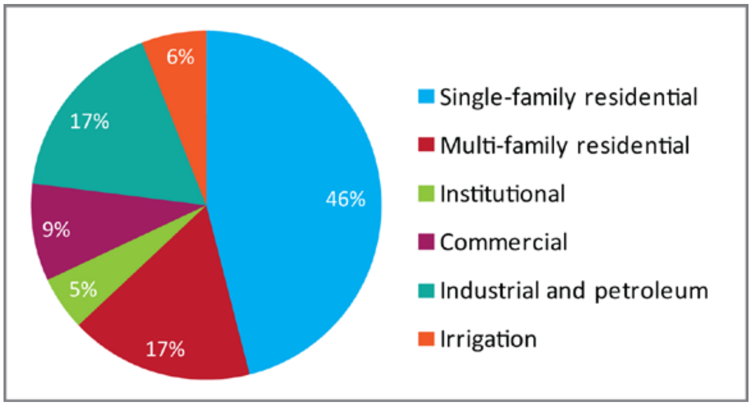

Figure 3.10-3. Sector Water Use in East Bay MUD Service Area

Santa Clara Valley WD is a wholesale district that provides water to 13 local retail agencies throughout Santa Clara County. About 90 percent of the water use in the county is for M&I uses and the remaining ten percent is for agricultural uses. As a wholesaler, Santa Clara Valley WD does not collect water use data by classification, but has estimated sector use based on available data provided by retailers. Figure 3.10-4 shows county water use by sector. Total demands in the Santa Clara Valley WD service area are projected to increase from 375,720 AF in 2015 to 396,420 AF in 2025, a six percent increase. San Jose Water Company estimated the largest increase, in terms of AF, of 7,140 AF. Agricultural demands were projected to decrease about 1,950 AF from 2015 to 2025 (Santa Clara Valley WD 2011).

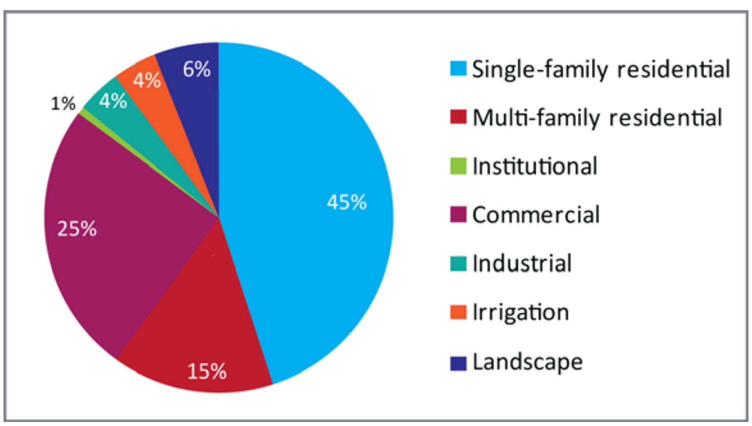

Figure 3.10-4. Sector Water Use in Santa Clara Valley WD Service Area

As part of the Urban Water Management Plans, M&I contractors are required to develop a Water Shortage Contingency Plan that defines actions during various stages of supply shortages. Each stage involves district actions in response to shortage (such as outreach, adopting ordinances, enforcing regulations, offering financial incentives, and monitoring), water use reductions, and penalties. As the shortage increases, customer water use reductions typically increase and become mandatory and penalties for disallowed uses become more severe.

Contra Costa WD and East Bay MUD set customer water rates and charges sufficient to cover operating expenses, including interest on debts, and to provide funds for replacement or construction of facilities. Contra Costa WD's residential water rates are made up of a service and demand charge, a quantity charge based on the volume of water used, an energy surcharge and a fire protection surcharge (Contra Costa WD ~~2012~~2015). East Bay MUD's water rates to residential customers are made up of a service charge; a Seismic Improvement Program surcharge for each residential account; a charge for water delivered; and an elevation surcharge (East Bay MUD 2014). Santa Clara Valley WD charges water retailers for water supplies, which affect retail agencies customer water rates. Santa Clara Valley WD major costs include operations, debt service, capital improvements to the treatment and delivery system, and water purchases from outside the county (Santa Clara Valley WD 2014).

Agricultural Contractors

Potential buyers also include CVP contractors that serve water primarily for agricultural uses in San Benito County and western areas of San Joaquin, Stanislaus, Merced, Fresno, and Kings counties. Transfers to these counties would also serve some M&I uses, but for purposes of the analysis, it is assumed agriculture would be the primary use of transfer water.

Table 3.10-~~17~~ 20 presents employment, labor income, and output in the six counties combined in 2011. In 2011, the top two industries in the six-county region in terms of employment were services and government. In 2011, the top two industries in the six-county region in output were services and manufacturing. The region had over $10.6 billion of agricultural production in 2010 (CDFA 2011). Important economic centers include Fresno, Merced, Hanford and Hollister.

Table 3.10-~~18~~ 21 summarizes some farm, owner, and operator characteristics in the six counties in 2007.

Table 3.10-~~17~~20. Summary of 2011 Regional Economy in Merced, Fresno, Kings, San Joaquin, Stanislaus and San Benito Counties

	Employment[1]	Labor Income (million $)[2]	Output (million $)[3]
Agriculture	111,743	$5,677	$18,073
Mining	678	$42	$231
Construction	47,387	$2,702	$5,602
Manufacturing	83,427	$4,769	$37,457
Transportation, Information, Public Utilities	51,266	$2,732	$9,076
Trade	155,649	$6,000	$14,906
Service	479,179	$17,510	$58,525
Government	158,653	$12,339	$15,215
Total	1,087,982	$51,771	$159,085

Source: MIG Inc. 2011

[1] Employment is measured in number of jobs.

[2] Income is the dollar value of total payroll for each industry plus income received by self-employed individuals.

[3] Output represents the dollar value of industry production.

Table 3.10-~~18~~21. 2007 Farm and Farm Tenure Characteristics in Merced, San Benito, San Joaquin, Stanislaus, Fresno, and Kings Counties

	Merced	San Benito	San Joaquin	Stanislaus	Fresno	Kings
Number of farms	2,607	625	3,624	4,114	6,081	1,129
Median farm size (acres)	40	25	25	20	36	40
Land in farms (acres)	1,041,115	579,851	737,503	788,954	1,636,224	680,662
Total cropland (acres)	537,716	55,213	492,032	351,195	1,102,163	512,870
Irrigated land (acres)	514,162	30,372	453,980	374,997	984,445	421,571
Full owners	1,826	435	2,746	3,110	4,643	798
Part owners	492	116	584	631	907	212
Tenants	289	74	294	373	531	119

Source: USDA 2009

In 2010, Fresno, Stanislaus, San Joaquin, Kings, and Merced counties all were in the top ten counties in California in agricultural production value. Fresno County led the state in 2010 with an agricultural production value of $5.94 billion, an increase of 11.2 percent from the 2009 production value. In 2010, Stanislaus County had a production value of $2.31 billion, an 11.2 percent increase over 2009; San Joaquin County had a production value of $2 billion, a 2 percent decrease since 2009; Merced County had a production value of $2.73 billion, an 11.2 percent increase over 2009; Kings County had a production value of $1.72 billion, a 30.1 percent increase over 2009; and San Benito County had a production value of $255.45 million, a 5.2 percent increase over 2009. Table 3.10-~~19~~ 22 shows the top five commodities in terms of value of production in the six counties.

Table 3.10-~~19~~22. 2010 Top Five Commodities in Gross Value of Agricultural Production in Merced, San Benito, Fresno , Kings, Stanislaus and San Joaquin Counties

Rank	Merced Commodity	Merced Value ($1,000)	San Benito Commodity	San Benito Value ($1,000)	Fresno Commodity	Fresno Value ($1,000)
1.	Milk	$736,192	Vegetables	$40,989	Almonds	$581,230
2.	Almonds	$286,600	Lettuce	$23,594	Poultry	$423,768
3.	Chickens	$275,536	Bell Peppers	$21,563	Grapes	$399,734
4.	Cattle and Calves	$225,408	Fruits and Nuts	$19,916	Milk	$391,453
5.	Sweet Potatoes	$152,863	Nursery Products	$18,392	Tomatoes, Processing	$347,208
Rank	**Kings Commodity**	**Kings Value ($1,000)**	**Stanislaus Commodity**	**Stanislaus Value ($1,000)**	**San Joaquin Commodity**	**San Joaquin Value ($1,000)**
1.	Milk	$584,956	Milk	$506,056	Milk	$308,389
2.	Cotton, Pima	$185,566	Almonds	$390,498	Grapes	$247,641
3.	Tomatoes, Processing	$134,872	Chickens	180,852	Walnuts	$207,230
4.	Cattle and Calves	$129,451	Chickens (Chicks)	$127,189	Cherries	$184,544
5.	Pistachios	$73,766	Walnuts	$116,246	Almonds	$156,822

Source: NASS 2011

3.10.1.3.3 Crop Prices

Growers voluntarily participate in water transfers. There are likely many factors that affect a grower's decision to idle fields and sell water via cropland idling transfers, including crop prices. Table 3.10-23 presents past crop prices for most crops eligible for idling. Growers would presumably participate in idling transfers if water transfer revenues are greater than the net revenues received from growing the crop. Rice prices peaked in 2008 and have been steadily decreasing, but are still higher than prices from 2003 through 2007. Reclamation has set maximum annual acreages for cropland idling transfers; therefore, even if crop prices are beneficial for a grower to participate, the level of idling would be limited by the maximum acreages.

Table 3.10-23 Past Crop Prices for Crops Eligible for Idling

	Alfalfa	Beans, Dry	Corn, Grain	Rice	Safflower	Sunflower	Tomatoes, Processing	Wheat
	$/Ton	$/Cwt.	$/Ton	$/Cwt.	$/Cwt.	$/Cwt.	$/Ton	$/Ton
2003	$93.00	$35.30	$103.57	$10.40	---	---	$57.20	$118.00
2004	$118.00	$36.90	$94.64	$7.34	---	---	$57.40	$126.67
2005	$136.00	$41.00	$96.43	$10.10	$11.30	---	$59.60	$124.67
2006	$116.00	$46.60	$119.64	$13.00	$13.70	---	$65.40	$138.00
2007	$165.00	$48.90	$152.86	$16.20	$19.10	---	$70.30	$180.33
2008	$204.00	$61.40	$170.36	$27.50	$23.90	---	$78.60	$236.00
2009	$107.00	$50.80	$152.86	$19.60	$16.40	$18.60	$86.10	$187.67

	Alfalfa	Beans, Dry	Corn, Grain	Rice	Safflower	Sunflower	Tomatoes, Processing	Wheat
	$/Ton	$/Cwt.	$/Ton	$/Cwt.	$/Cwt.	$/Cwt.	$/Ton	$/Ton
2010	$133.00	$47.00	$181.43	$21.00	$17.00	$20.90	$71.40	$173.65
2011	$239.00	$55.10	$228.93	$18.60	$23.50	$26.40	$74.30	$225.98
2012	$211.00	$54.60	$251.79	$17.10	$25.30	$26.30	$75.00	$271.64

Source: CDFA 2013

3.10.1.3.4 Groundwater ~~Pumping~~ Costs

Section 3.3, Groundwater Resources, describes existing groundwater conditions in the area of analysis. The area of analysis for the groundwater costs analysis includes the counties overlying the Sacramento Valley Groundwater Basin and the Redding Groundwater Basin. Groundwater pumping costs are related to depth to groundwater, pump efficiencies, and power costs. Pumping costs tend to increase during drought as more water is pumped and average depth to water increases. Groundwater costs also include costs to deepen wells or drill new wells. The costs for deepening or drilling a well can vary widely depending on many factors, such as depth, diameter, well use (potable vs. irrigation), and construction materials. There are also permitting costs.

3.10.1.3.~~4~~ 5 Local Government Revenues

County services typically include public safety (police, fire and emergency services), land use planning, parks and recreation, social services, and the justice system. Local governments also provide facilities including roads, flood protection, sewers, water, solid waste disposal and other utilities. Counties also deliver many state services, such as foster care, public health care, jails and elections.

Revenues to pay for these services come from many sources. Statewide, most county revenues are transfers from other governments. Service charges, property income, fines and forfeitures, and a variety of other sources are typically about a quarter of revenues.

Tax revenues average less than a quarter of all county revenues. General taxes can be used for any legitimate purpose, but special tax revenues are dedicated to specified purposes. Most local tax revenue is from the sales and use tax. Most sales tax revenue goes directly to State government, but about 20 percent of that is returned to cities and counties. Sales tax revenues fund county and city operations, social services, mental health, transportation, and public safety, and additional special taxes fund a variety of voter-approved programs. Other local taxes include business license, hotel, utility and parcel taxes.

Local governments in rural counties are facing financial stress stemming from the ongoing economic recession. Statewide, county revenues decreased from $56.4 billion in 2007-2008 to $55.8 billion in 2009-2010 (California State Controller 2009 and 2011). In 2009-2010, tax revenues had fallen 4.21 percent from the previous year. Most of the loss was made up by federal funds. The

State has proposed to reduce some revenue transfers from the State, and some program responsibilities may be shifted to the counties.

3.10.2 Environmental Consequences/Environmental Impacts

These sections describe economic assessment methods and the environmental consequences associated with each alternative.

3.10.2.1 Assessment Methods

This section describes the assessment methods used to analyze potential economic effects of implementing water transfers to CVP contractors.

3.10.2.1.1 Cropland Idling

In cropland idling transfers, participating growers would voluntarily cease irrigation for a crop season and transfer the unused irrigation water to the buyer. The potential economic effects of cropland idling could occur because of trade linkages between irrigated production and regional economies. Many businesses trade with growers. Growers buy inputs from workers, farm stores, equipment supply stores, custom operators, and other growers. Other regional businesses earn their income by transporting, storing, marketing, and processing agricultural products. Idling of cropland reduces the volume of sales for these businesses in the counties where cropland idling occurs. These types of effects are often referred to as third-party economic effects.

For purposes of the economic analysis of cropland idling transfers, the Seller Service Area is separated into three regions:

- Colusa, Glenn, and Yolo counties
- Sutter and Butte counties
- Solano County

Glenn, Colusa and Yolo counties and Sutter and Butte counties were combined because some participating sellers span the county boundaries. For Solano County, Reclamation District (RD) 2068 is primarily in Solano County with a small portion of the service area in Yolo County. A single region for Solano County was used for this district because it is in the Delta region and cropland idling requirements are unique for the Delta region, as described in Chapter 2. Table 3.10-~~20~~ 24 shows the potential sellers and the counties they are in.

Table 3.10-~~20~~24. Sellers Potentially Participating in Cropland Idling Transfers and County Locations

Sellers	County
Conaway Preservation Group	Yolo
Cranmore Farms	Sutter
Glenn-Colusa Irrigation District	Glenn and Colusa
Pelger Mutual Water Company	Sutter
Pleasant Grove-Verona MWC	Sutter
RD 108	Colusa and Yolo
RD 1004	Colusa
Sycamore MWC	Colusa
Te Velde Revocable Family Trust	Yolo
Butte Water District	Butte and Sutter
Goose Club Farms and Teichert Aggregates	Sutter
RD 2068	Solano and Yolo

The economic analysis of cropland idling transfers uses a model based on IMPLAN, an input-output (IO) database and modeling software, with information from recent University of California Cooperative Extension (UCCE) crop budgets (UCCE 2008a, 2008b, 2008c and 2012). IMPLAN is a county-level database and modeling package that calculates the economic impacts of a change in value of production.

The analysis estimates the direct agricultural effects of cropland idling using the crop budget information and potential amount of idled acreage, and estimates indirect and induced effects in individual counties or aggregations of counties with IMPLAN. Indirect effects are caused by expenditures in the region by affected regional industries, and include purchases of inputs to grow crops and make products. Induced effects are caused by expenditure of household income.

IMPLAN is designed to look at backward linkages of the supply chain in the economy. Forward linkages are typically examined outside the model. Forward linkages describe the process of how a company in a given sector sells its goods, products, or supplies to a company in a different sector. For example, after rice is harvested, it must be transported and milled. IMPLAN does not account for these changes, depending on the sector where the change in final demand was measured. For this analysis, forward linkages for transportation, rice milling, and tomato processing were added to the direct effect, which was then run through IMPLAN to calculate indirect and induced effects.

IMPLAN estimates effects on various economic measures, including employment, labor income, and total value of output. Employment is the number of jobs, including full-time, part-time and seasonal. Labor income consists of employee compensation and proprietor's income. Value of output is the dollar value of production.

IMPLAN calculates annual effects based on the long-run average cost structure of each industry. In the case of single year transfers, land idling may not reduce all long run costs. For example, the grower might retain most of their equipment and other fixed assets, and this would reduce the direct effect of the transfer relative to that estimated by IMPLAN. For this reason, IMPLAN tends to provide a larger direct impact per acre for temporary transfers than might be warranted. If the grower expected to transfer water every year, then the economic impacts provided by IMPLAN are more representative. However, as discussed previously and in Chapter 2, cropland idling would not likely be implemented each year and the grower would not have the option to idle fields. If the grower has the option to transfer in consecutive years, the economic effects presented in this analysis could occur each year.

IMPLAN calculates annual effects based on a single year economy. The 2011 county data packages were used for this analysis, which were the most recent available data packages at the time the analysis was completed.

IMPLAN can apply IO models for any county or group of counties. There is no readily available method for developing IO information for local economies within counties, so this analysis includes a qualitative discussion of economic effects on local economies.

Use of Representative Crops

Table 2-3 in Chapter 2, Proposed Action and Alternatives, shows the crops eligible for cropland idling transfers, as defined by Reclamation and California Department of Water Resources (DWR). Section 2.3.2.1.3 explains why the crops are eligible for idling transfers. Because of the complexity of analyzing all eligible crops, this analysis uses a representative crop approach to assess potential economic effects. The analysis combines crops based on similar water use, agricultural production practices, gross returns, and farm labor requirements. Each group is represented by one crop that is predominant in the region. Table 3.10-~~21~~ 25 identifies the representative crops and crop groups and provides the technical basis for developing crop groups and assigning representative crops. Crops with little or no acreage in the Seller Service Area are listed as part of a crop group, but economic information is not provided.

Table 3.10-2125. Representative Crops, Eligible Crops, and Crop Characteristics

Representative Crop	Eligible Crops	Regional Acreage[1]	ETAW (AF/ Acre)	Direct Labor Hours/Acre [2]	Gross Revenue per acre[2]	Operating Costs per acre[2]	Production Practices[2]
Rice	Rice	383,384	3.3	4.99	$1,547	$1,111	May be rotated depending on soils
	Wild Rice	1,669	2	Data not available in recent cost and return studies	Data not available in recent cost and return studies	Data not available in recent cost and return studies	May be rotated depending on soils
Tomatoes, Processing[3]	Tomatoes, Processing	69,526	1.9	27.42	$2,450	$2,017	Rotation crop, contracts with processors
	Vine Crops	20,687	1.1	Data not available in recent cost and return studies	Data not available in recent cost and return studies	Data not available in recent cost and return studies	Rotation crop
Corn[4]	Corn Grain	48,751	1.9	11.03	$1,020	$673	Rotation crop
	Beans	10,786	1.5	11.88	$975	$731	Rotation crop
	Sunflower	41,069	1.4	4.86	$1,360	$447	Rotation crop
	Safflower	20,099	1	4.99	$363	$261	Rotation crop, some acreage is not irrigated
	Wheat	107,712	1	3.17	$450	$351	Rotation crop, some acreage is not irrigated
Alfalfa[5]	Alfalfa	108,457	1.7	1.91	$1,450	$582	Rotation crop, contracts with dairies
	Sudan Grass	8,267	3	1.52	$550	$756	Rotation crop

Source:
[1] NASS 2009-2013, Region includes Glenn, Colusa, Butte, Sutter, Yolo, and Solano counties. 2008-2012 averages
[2] UCCE Crop Budgets. Does not include labor provided by custom operators
[3] Other crops included in this group that could be idled: Sugar Beets, Melons, Onions
[4] Other crops included in this group that could be idled: Sorghum Grain, Cotton
[5] In Sacramento Valley north of the American River. Alfalfa cannot be idled in the Delta Region.
Key:
ETAW = evapotranspiration of applied water

Cropland Idling Acreages

The extent of economic effects depends on the crop type, amount of acreage, and frequency that crops are idled. This analysis estimates economic effects based on maximum idling acreages for each alternative that includes cropland idling transfers. Sellers provided crop types and quantities of water that could be made available through cropland idling.

Rice provides the largest amount of water per acre idled, currently 3.3 AF of evapotranspiration of applied water (ETAW) per acre. Rice is the most likely crop to be idled because it has historically been the largest source of water for crop idling transfers and it has the highest ETAW per acre of all the crops eligible for idling. Therefore, to estimate rice acreage idled, this analysis assumes that all water available for cropland idling transfers under each alternative could be made up completely by idling rice fields only.

Because other non-rice crops can also be idled, this analysis also estimates economic effects of idling other crops. The assumed acreages of these crops are much lower than rice acreage because, as previously stated, rice would be the main crop idled. The acreages idled for other crops were based on information provided by sellers.

Table 3.10-26 shows the maximum acreages for idling annually for each of the crop groups by economic region. Table 3.10-25 lists the crops within each representative crop category.

Table 3.10-26. Maximum Acreages for Cropland Idling

Region	Rice	Tomatoes, Processing	Corn	Alfalfa	Total
Colusa, Glenn, Yolo	40,704	400	400	1,400	42,904
Sutter, Butte	10,769	400	800	600	12,569
Solano	-	-	1,500	3,000[1]	4,500
Total	51,473	800	2,700	5,000	59,973

[1] Alfalfa cannot be idled within the legal boundaries of the Delta

Cropland idling transfers are the lowest priority for buyers because buyers would need to pay for the ETAW for an entire irrigation season, but they may only receive the ETAW amount from July through September if the water could not be stored April through June. Therefore, in the Proposed Action, idling transfers would be limited in quantity and do not occur every year that transfers are implemented. For the No Groundwater Substitution Alternative, cropland idling transfers continue to be the lowest priority for buyers; however, because less water is available from other transfer methods, crops may be idled more frequently to meet transfer needs. Though, the acreages shown in Table 3.10-26 are the maximum acreages for all alternatives that include cropland idling transfers.

Water Code Section 1745.05 (b) provides that, if the amount of water made available by land fallowing (idling) exceeds 20 percent of the water that would have been applied absent the proposed water transfer, a public hearing by the water supply agency is required. In the past, cropland idling programs have stayed well below the 20 percent water delivery threshold for a hearing.

Crop Shifting

In crop shifting, participating growers would shift from a higher water use crop mix to a lower water use crop mix and sell the remaining unused water to the buyer. The crop shifting analysis is conducted qualitatively using relevant information from the cropland idling analysis described.

Local Government Finances and Economic Policies
Regional economic effects of cropland idling transfers could affect sales tax and other revenues to local governments or increase costs of providing social programs. Effects to local government finances, including tax revenues and costs, are described qualitatively. Water transfers could conflict with some economic policies that local governments have identified in planning and policy documents, such as General Plans. These effects are described qualitatively.

Groundwater Substitution Transfers
Groundwater substitution transfers could reduce groundwater levels, which would result in increased pumping costs for growers selling water and growers using nearby wells. This analysis uses results of changes in groundwater levels from the groundwater simulation described in Section 3.3, Groundwater Resources, to evaluate potential changes in pumping costs. Section 3.3 also describes the existing groundwater levels in the Sacramento Valley Basin. In the Sacramento Valley Groundwater Basin, production wells are typically located no closer than 0.25 mile from each other (Niblack 2012). For nearby wells, this analysis estimates changes in groundwater pumping costs in areas 0.25 miles away from regions of maximum drawdown as a result of transfers.

The energy costs required to pump one acre-foot of groundwater per one foot of lift can be estimated using the following formula[4]:

Energy Cost ($) = (1.02 x Electricity Rate)/Pump Efficiency

The Pacific Gas and Electric Company (PG&E) rate schedules for large agricultural users shows an average power rate of approximately $0.22/kilowatt-hour (PG&E 2012). Pump efficiencies average about 56 percent in the Sacramento and San Joaquin Valleys (Irrigation Training and Research Center 2011). Based on the above equation, a farmer pays approximately $0.32 for electricity to pump one acre-foot of water one foot.

Stored Reservoir Purchase and Conservation Transfers
Revenues received from stored reservoir and conservation transfers could increase operating incomes for sellers. These effects are described qualitatively.

Use of Transfer Water in Buyer Service Area
Use of transfer water in the Buyer Service Area would reduce potential effects of CVP shortages for agricultural and M&I uses. In agricultural areas of the Buyer Service Area, districts would be able to use water to support the farming industries, including related businesses. This analysis describes economic effects in the Buyer Service Area qualitatively.

[4] UCCE 1996, Reclamation 2012

3.10.2.2 Alternative 1: No Action/No Project

3.10.2.2.1 Seller Service Area

Under the No Action/No Project Alternative, there would be no cropland idling or crop shifting transfers to CVP contractors that would affect the regional economies in the Seller Service Area. Under the No Action/No Project Alternative, sellers would not sell water to CVP contractors in the Buyer Service Area through cropland idling or crop shifting. Therefore, crop production would not decrease in the Seller Service Area and the volume of business for agricultural support businesses would not change as a result of water transfers. In general, irrigated acreages and agricultural economies in the Seller Service Area would not change substantially under the No Action/No Project Alternative relative to existing conditions. Growers would continue to idle some land temporarily and would continue to rotate other previously-idled land back into production as common land management practices. These farming practices cause normal variations in employment, labor income, and output.

Under the No Action/No Project Alternative, water transfers to CVP contractors would not affect local government finances. Under the No Action/No Project Alternative, water transfers to CVP contractors would not occur and would not affect tax receipts or operating costs of local governments. There would be no effects related to CVP transfers to local government finances.

Under the No Action/No Project Alternative, groundwater pumping costs would not be affected by water transfers to CVP contractors in the Seller Service Area. Under the No Action/No Project Alternative, water users in the Seller Service Area would continue to use surface water supplies, rather than pump groundwater. Groundwater levels would not be affected by water transfers to CVP contractors; therefore, groundwater pumping costs for sellers and nearby well owners would not change relative to existing conditions.

3.10.2.2.2 Buyer Service Area

Under the No Action/No Project Alternative, growers in the Buyer Service Area would idle crops in responses to CVP water shortages. In the Buyer Service Area, growers would need to idle crops in response to CVP water shortages. Idling could last for one year or multiple years depending on the length of the shortage. Under existing conditions, growers are idling crops because of reduced water supplies. Cropland idling reduces farm incomes, purchases of agricultural inputs, and farm labor. Under the No Action/No Project Alternative, there could be adverse effects to regional economics because cropland idling would continue similar to existing conditions.

Under the No Action/No Project Alternative, growers would pump groundwater for irrigation in the Buyer Service Area, which could increase pumping costs if groundwater levels decline. Under existing conditions, growers are pumping groundwater for irrigation because of reduced surface water supplies. Under the No Action/No Project Alternative, growers in the Buyer Service Area would continue to pump groundwater for irrigation when CVP water deliveries are reduced, which would reduce groundwater levels. As a result, groundwater pumping and management costs would be similar to or more than that which would occur under existing conditions. Increased groundwater costs would reduce farmer net revenues and spending in the regional economy.

3.10.2.3 Alternative 2: Full Range of Transfers

3.10.2.3.1 Seller Service Area

Cropland Idling and Crop Shifting Transfers

Cropland idling transfers would occur from sellers in Glenn, Colusa, Yolo, Sutter, Butte, and Solano counties. Table 3.10-22 27 summarizes the maximum acreages of each crop that would be idled under the Proposed Action. Idling rice fields would likely provide most, if not all, of the transfer water in Glenn, Colusa, Yolo, Sutter, and Butte counties.

Table 3.10-2227. Maximum Acreages for Cropland Idling under the Proposed Action

	Rice	Tomatoes, Processing	Corn	Alfalfa	Total
Colusa, Glenn, Yolo	40,704	400	400	1,400	42,904
Sutter, Butte	10,769	400	800	600	12,569
Solano	-	-	1,500	3,000[1]	4,500
Total	51,473	800	2,700	5,000	59,973

[1] Alfalfa cannot be idled within the legal boundaries of the Delta

Revenues from cropland idling water transfers could increase incomes for growers or landowners selling water. Selling water for transfers is voluntary for growers and landowners. For cropland idling transfers, growers would be willing to participate if the expected net return from the water transfer exceeds their expected net return from growing the crop. This would increase returns to farmers and be an economic benefit.

The economics of participation for a typical farmer can be shown using 20062008-2010 2012 agricultural prices and crop yields and farm production costs from UCCE crop budgets. Table 3.10-23 compares the net revenues gained by the water transfer to the net revenue lost from discontinued crop production based on 20062008-2010 2012 conditions. The analysis assumes a transfer price of $225 350 for each acre-foot for water made available by idling crop land. This water transfer price is a representative price. It was calculated based on the weighted average of SLDMWA transfers in 2013 and 2014. Prices were $190 per acre-foot in 2013 and $500 per acre-foot in 2014. The actual price would be negotiated among buyers and sellers and would likely vary according to hydrologic conditions, prices in agricultural markets, and other factors.

Table 3.10-~~24~~ 28 suggests whether or not it would be economical for a typical farmer to participate in a crop idling transfer based on the assumed water transfer prices and representative crop production costs and returns. The table compares net revenues from farming and water transfers for rice, corn, tomatoes, and alfalfa. In general, if the net revenue received per acre from a water transfer (column 1) would be larger than the net revenue over variable costs received from crop production (column 4), a farmer would choose to participate.

Table 3.10-~~23~~28. Net Revenue From Water Transfer, Lost Revenue, Variable Costs Avoided and Lost Return Over Variable Costs ($ per Acre)

	(1)	(2)	(3)	(4)	(5)
Crop	Net Revenue from Water Transfer	Revenue from Crop Production (lost)	Variable Costs Avoided by the Transfer	Net Revenue from Crop Production (lost) (2) – (3)	Net Revenue Gained from Water Transfer (1) – (4)
Rice	1,155	1,719	1,111	608	547
Tomatoes, Processing	665	3,513	2,017	1,496	-831
Corn	665	1,041	673	368	297
Alfalfa	595	1,237	582	655	-60

Source: UCCE 2012, 2008a, 2008b, 2008c, CDFA 2013

Table 3.10-~~23~~ 28 shows that tomato and alfalfa crops may not be economical to idle based on the assumed water transfer price and net revenues. It is important to note that each farmer's situation is unique and growers might choose to participate for reasons other than net revenues. Also, some growers with less productive fields or higher costs would likely expect more net revenue improvement from participating in the water transfer than the representative farm. It is expected that growers would first idle marginal fields. For these fields, the economic benefits of water transfers would be better than average. If water transfer prices remain at 2014 levels, which was $500 per acre-foot, alfalfa would become economical to idle. The farmer would receive $850 per acre for the transfer water and the price differential between the water transfer revenue and the net revenue lost from crop production would be $195 per acre. At this water transfer price, tomato crops would still not be economical to transfer at the assumed price and yield. The farmer would receive $950 per acre for the transfer water and the price differential between the water transfer revenue and the net revenue lost from crop production would be -$545 per acre.

Growers would likely spend a portion of their income received from the transfer in the regional economy, which would result in positive induced effects in the regional economy. These effects would offset some of the adverse regional economic effects of cropland idling described below. In general, the higher the water transfer price, the more money would likely be spent in the regional economy and it would offset a larger portion of the adverse regional economic effects. It is difficult to quantify how much of the farmer income would result in induced effects because it is unknown how much of the water transfer revenue would go to debt retirement, savings, vacations, or outside investments, which would not have any regional economic effects. However, a higher transfer price would be a benefit to the Seller Service Area.

Cropland idling transfers in Glenn, Colusa, and Yolo counties could reduce employment, labor income, and economic output for businesses and households linked to agricultural activities. Growers or landowners selling water for transfers would be compensated for their expected losses in income; however, adverse regional economic effects would still occur to businesses and individuals who support farming activities, such as farm workers, fertilizer and chemical dealers, wholesale and agricultural service providers, truck transport, and others involved in crop production and processing. These businesses and individuals would not receive any compensation from the water transfer.

Table 3.10-~~24~~ 29 shows maximum annual cropland idling acreages, crop ETAW values, and water made available for transfer in Glenn, Colusa, and Yolo counties. It is not likely that all the acreage would be idled in a single year. Since the maximum crop acreage would not be idled in most years, the average annual effect would be even less. Cropland idling transfers would also not occur each year over the 10-year long-term water transfers period. As discussed in Chapter 2, cropland idling transfers are the lowest priority transfer for buyers.

Table 3.10-~~24~~29. Maximum Annual Cropland Idling Acreages in Glenn, Colusa, and Yolo Counties under the Proposed Action

	Rice	Tomatoes, Processing	Corn	Alfalfa	Total
Acres Idled	40,704	400	400	1,400	42,904
ETAW (AF per acre)	3.3	1.8	1.8	1.7	-
Total AF	134,323	720	720	2,380	138,143

As described in Section 3.10.2.1, Assessment Methods, Glenn, Colusa, and Yolo counties have been combined into one region for this economic analysis. Table 3.10-~~25~~ 30 shows economic data for the combined three-county region. Tables 3.10-1, 3.10-3 and 3.10-9 show the regional economies individually for each county. Regional economic effects are compared relative to the three-county region. It is important to note that Yolo County represents a significant portion of the employment, labor income, and output in this region because of its proximity to the urban Sacramento area and economic activities associated with the University of California at Davis. If acres idled are concentrated in Glenn or Colusa counties, local economic effects may be more severe. The discussion below on local economic effects discusses economic effects of idling in small rural areas.

Table 3.10-~~25~~30. Summary of 2011 Regional Economy in Glenn, Colusa, and Yolo Counties

	Employment[1]	Labor Income (million $)[2]	Output (million $)[3]
Agriculture	14,118	639.7	2,164.3
Mining	388	17.9	114.7
Construction	5,897	351.3	712.3
Manufacturing	7,965	478.3	3,861.2
Transportation, Information, Public Utilities	9,248	440.7	1,308.5
Trade	17,161	799.5	1,916.4
Service	49,587	1,873.6	6,241.8
Government	38,395	2,915.1	3,432.4
Total	142,761	7,516.2	19,751.7

Source: MIG Inc. 2011

[1] Employment is measured in number of jobs.

[2] Income is the dollar value of total payroll for each industry plus income received by self-employed individuals.

[3] Output represents the dollar value of industry production.

Table 3.10-~~26~~ 31 shows the potential annual economic effects of idling the proposed maximum acreages of rice in Glenn, Colusa, and Yolo counties in a single year. Effects to employment, labor income, and output would result in a reduction of less than one percent relative to 2011 baseline economy.

In some transfer years, growers may choose to idle crops other than rice, which would have varying economic effects. It is likely that limited acreages of these crops would be idled because of lower ETAWs, higher net returns to growers, existing contracts with processors, and other factors. Table 3.10-~~26~~ 31 also shows annual economic effects of idling the maximum acreage of other crop types, which are represented by tomatoes, corn, and alfalfa in this analysis. Idling the proposed acreages of non-rice crops would result in minimal effects (0.0 to 0.01 percent of the baseline economy) to the employment, labor income and output in the three-county region.

Cropland idling transfers could occur in consecutive years, meaning that these effects would occur each year. If the maximum cropland idling transfers occurred in consecutive year, 495 jobs would be lost in the regional economy each year the transfer occurs. Output and labor income would also reduce each year the same amounts as shown in Table 3.10-31. During consecutive year cropland idling transfers, the economic effects would become less temporary and the adverse economic effects may be felt more in the local agricultural economy than a single year cropland idling transfer. Local economic effects are described below. On a regional level, the adverse economic effects are relatively small each year and would not substantially affect regional economic activities in the three county region. Cropland idling transfers are the lowest priority for buyers and would not likely occur each year during the 10-year period, or even in all years that transfers occur. Chapter 2 describes the frequency of transfers.

Table 3.10-~~26~~31. Regional Economic Effects in Glenn, Colusa, Yolo Counties from Maximum Cropland Idling Transfer under the Proposed Action (2012 dollars)

Crop	Maximum Acreage Idled	Employment (Jobs)	% change from Total Employment	Labor Income (Million $)	% change from Total Labor Income	Output (Million $)	% change from Total Output
Rice	40,704	-464	-0.33%	-$18.31	-0.24%	-$86.52	-0.44%
Tomatoes, Processing	400	-14	-0.01%	-$0.50	-0.01%	-$1.90	-0.01%
Corn	400	-3	-0.00%	-$0.11	-0.00%	-$0.37	-0.00%
Alfalfa	1,400	-13	-0.01%	-$0.47	-0.01%	-$1.64	-0.01%
Total	42,904	-495	-0.35%	-$19.38	-0.26%	-$90.43	-0.46%

Cropland idling transfers in Sutter and Butte counties could reduce economic output, value added, and employment for businesses and households linked to agricultural activities. Table 3.10-~~27~~ 32 shows maximum cropland idling acreages, ETAW values, and water made available for transfers in Sutter and Butte counties. It is not likely that all the acreage would be idled in a single year under the Proposed Action. Since the maximum would not be idled in most years, the average annual effect would be even less.

Table 3.10-~~27~~32. Maximum Cropland Idling Acreages in Sutter and Butte Counties under the Proposed Action

	Rice	Tomatoes, Processing	Corn	Alfalfa	Total
Acres Idled	10,769	400	800	600	12,569
ETAW (AF/acre)	3.3	1.8	1.8	1.7	-
Total AF	35,538	720	1,440	1,020	38,718

As described in Section 3.10.2.1, Assessment Methods, Sutter and Butte counties have been combined into one region for this economic analysis. Table 3.10-~~28~~ 33 shows economic data for the combined two-county region. It is important to note that Butte County represents a significant portion of the employment, labor income, and output in this region because it includes the larger economy of the City of Chico and economic activities associated with California State University at Chico. Tables 3.10-5 and 3.10-7 show the individual county economies.

Table 3.10-~~28~~33. Summary of 2011 Regional Economy in Sutter and Butte Counties

	Employment[1]	Labor Income (million $)[2]	Output (million $)[3]
Agriculture	11,448	$389.0	$1,178.8
Mining	359	$18.7	$109.7
Construction	8,642	$373.0	$902.1
Manufacturing	5,640	$299.3	$2,630.9
Transportation, Information, Public Utilities	5,897	$238.2	$1,053.0
Trade	20,686	$771.7	$1,859.5
Service	75,809	$2,490.3	$8,403.6
Government	18,217	$1,100.8	$1,385.0
Total	146,698	$5,681.1	$17,522.7

Source: MIG Inc. 2011

[1] Employment is measured in number of jobs.

[2] Income is the dollar value of total payroll for each industry plus income received by self-employed individuals.

[3] Output represents the dollar value of industry production.

Table 3.10-~~29~~ 34 shows the potential economic effects of idling the proposed maximum acreages of rice in a single year. Effects are compared to the regional economy of Sutter and Butte counties. Effects to employment, labor income, and output of idling the maximum rice acreages would result in a less than one percent change relative to the 2011 regional economy.

Table 3.10-~~29~~ 34 also shows economic effects of idling the maximum assumed acreage of other crop types in Sutter and Butte counties, which are represented by tomatoes, corn, and alfalfa in this analysis. Idling the proposed acreages of non-rice crops would result in minimal effects to the employment, labor income and output in the county.

Table 3.10-~~29~~34. Regional Economic Effects in Sutter and Butte Counties from Maximum Cropland Idling Transfer under the Proposed Action (2012 dollars)

Crop	Maximum Acreage Idled	Employment (Jobs)	% change from Total Employment	Labor Income (Million $)	% change from Total Labor Income	Output (Million $)	% change from Total Output
Rice	10,769	-132	-0.09%	-$4.56	-0.08%	-$23.21	-0.13%
Tomatoes, Processing	400	-16	-0.01%	-$0.50	-0.01%	-$2.00	-0.01%
Corn	800	-8	-0.01%	-$0.22	-0.00%	-$0.81	-0.00%
Alfalfa	600	-7	-0.00%	-$0.21	-0.00%	-$0.75	-0.00%
Total	12,569	-163	-0.11%	-$5.50	-0.10%	-$26.76	-0.15%

Cropland idling transfers could occur in consecutive years, meaning that these effects would occur each year. If the maximum cropland idling transfers occurred in consecutive year, 163 jobs would be lost in the regional economy each year the transfer occurs. Output and labor income would also reduce each year the same amounts as shown in Table 3.10-34. During consecutive year cropland idling transfers, the economic effects would become less temporary and the adverse economic effects may be felt more in the local agricultural economy than a single year cropland idling transfer. Local economic effects are described below. On a regional level, the adverse economic effects are relatively small each year and would not substantially affect regional economic activities in the region. Cropland idling transfers are the lowest priority for buyers and would not likely occur each year during the 10-year period, or even in all years that transfers occur. Chapter 2 describes the frequency of transfers.

Cropland idling transfers in Solano County could reduce economic output, labor income, and employment for businesses and households linked to agricultural activities. RD 2068 is the only potential seller in Solano County that could make water available through cropland idling. Table 3.10-~~30~~ 35 summarizes a potential maximum transfer in the county under the Proposed Action. RD 2068 would not idle rice or tomato crops; therefore, these crops are not included in the cropland idling analysis for Solano County.

Table 3.10-~~30~~35. Maximum Cropland Idling Acreages in Solano County under the Proposed Action

	Corn	Alfalfa	Total
Acres Idled	1,500	3,000	4,500
ETAW (AF/acre)	1.8	1.7	-
Total AF	2,700	5,100	7,800

Table 3.10-~~31~~ 36 shows economic effects of idling the maximum assumed acreage of other crop types in Solano County, which are represented by corn and alfalfa in this analysis. Idling effects are compared to the regional economy of Solano County, shown in Table 3.10-11. Idling the proposed acreages would result in minimal effects to the employment, labor income and output in the county. Since the maximum acreage would not be idled in most years, the average annual effect would be even less.

Table 3.10-~~31~~36. Regional Economic Effects in Solano County from Maximum Non-Rice Idling Transfer (2012 dollars)

Crop	Maximum Acreage Idled	Employment (Jobs)	% change from Total Employment	Labor Income (Million $)	% change from Total Labor Income	Output (Million $)	% change from Total Output
Corn	1,500	-14	-0.01%	-$0.43	-0.00%	-$1.45	-0.00%
Alfalfa	3,000	-18	-0.01%	-$0.70	-0.01%	-$3.12	-0.01%
Total	4,500	-32	-0.02%	-$1.13	-0.01%	-$4.58	-0.01%

Cropland idling transfers could occur in consecutive years, meaning that these effects would occur each year. If the maximum cropland idling transfers occurred in consecutive year, 32 jobs would be lost in the regional economy each year the transfer occurs. Output and labor income would also reduce each year the same amounts as shown in Table 3.10-36. During consecutive year cropland idling transfers, the economic effects would become less temporary and the adverse economic effects may be felt more in the local agricultural economy than a single year cropland idling transfer. Local economic effects are described below. On a regional level, the adverse economic effects are relatively small each year and would not substantially affect regional economic activities in the region. Cropland idling transfers are the lowest priority for buyers and would not likely occur each year during the 10-year period, or even in all years that transfers occur. Chapter 2 describes the frequency of transfers.

Cropland idling transfers could have adverse local economic effects. The following is a qualitative discussion of local economic effects that applies to local agricultural communities in the Seller Service Area. For this analysis, "local effects" means economic effects on towns, small cities, and local industries. Local economic data do not exist for all local communities, and the locations of cropland idling within counties cannot be predicted with certainty. Therefore, this analysis does not attempt to predict economic effects in specific communities, and the analysis of local effects is handled descriptively and qualitatively.

Most of the communities in areas where cropland idling could occur are small and are dependent on agriculture. The small towns often house companies associated with crop production, such as seed and fertilizer suppliers, aerial application services, rice mills and driers, tomato processing plants, and storage warehouses that rely on crop production for revenue. These companies also provide employment to many local residents.

The effects of the idling actions described in the above sections are changes in employment, labor income, and output at the regional or county levels. Large urban centers in some counties create large baseline economic measures. In the area of analysis, Solano, Butte, and Yolo counties have larger baseline economies than Glenn, Colusa and Sutter counties because of their economic base and proximity to the Sacramento area and the San Francisco Bay area. Rural communities that have much smaller economic bases are more dependent on local agriculture, so any change to economic measures would be relatively more adverse at the local level than for the larger regional and county economies. That is, the percent change in an economic measure based on local measures alone may be much larger than the "% change" estimates in the previous tables.

Local economic effects would be more adverse if cropland idling transfers occurred in consecutive years. Business owners would likely be able to recover from reduced sales in a single year, but it would be more difficult if sales remained low for multiple years. Workers may also have more trouble finding long-term jobs if cropland idling occurred in consecutive years.

The size of local effects depends on the location of the local community relative to an urban center, the buying patterns of the participating farmer, and the types of other services provided.

The magnitude of effects to local businesses could vary based on the proximity of a local community to a large urban center. The adverse effects would be larger if the idled land was near a local community that was far from any large urban center because growers would likely pay a larger share of expenses to local businesses. Residents of rural communities far from urban centers typically spend larger portions of their incomes within the community than residents of rural communities that are close to large urban centers. A reduction in local spending would be adverse to the regional economy.

Despite the location of the community, some growers have unique buying patterns that could influence the overall effect of a transfer on a regional economy. For example, some growers may buy inputs locally, as described above. Cropland idling would have a more adverse effect on the regional economy if that farmer participates in water transfers. Other growers may drive to a larger urban area outside the region or use the internet to purchase inputs. If those growers participated in water transfers, there would not be much effect to local businesses. Depending on the buying patterns of the participating growers, a water transfer may affect local businesses very much, or not at all.

Farmland owners would realize a net gain in net revenue by selling water. Presumably, growers or landowners would spend some of their increased net revenues in the local economy. This effect could offset some of the decrease in local spending by the third parties described above.

Agriculture is in the top two industries in employment, labor income, and output in Glenn and Colusa counties. The counties do not offer many other services, such as recreation tourism, that attracts outside spending to boost the regional economy. Some out-of-region visitors go to the wildlife refuges and spend money within the counties, but the county economy cannot depend on outside tourism. Therefore, changes in agricultural production would have more adverse effects on Glenn and Colusa counties relative to counties that can provide alternate services to support the regional economy.

Water transfers from idling alfalfa could increase costs for dairy and other livestock feed. Alfalfa is an important feed for California dairy and other livestock producers. California is the nation’s largest dairy producer, providing about 20 percent of the nation’s milk supply and $5 billion of dairy products annually. California is also the nation’s largest producer of alfalfa (Putnam et al 2007). California recently grew alfalfa on about one million acres and produced about seven million tons per year.

On average, grazing is a small share of California dairy feed, and most feed is purchased. A loss of alfalfa production from land idling could increase the cost of purchased feed for California dairies and the cost of dairy products. However, the amount of acreage and production potentially affected is very small relative to California's market for alfalfa. Also, reductions in production of alfalfa in the Seller Service Area could be partly offset by increases of alfalfa plantings in the Buyer Service Area. Therefore, any effects of water transfers on alfalfa and dairy prices would be minimal.

Cropland idling transfers could decrease net revenues to tenant farmers whose landowners choose to participate in transfers. Tenant farmers, those who rent land from property owners, could be adversely affected by cropland idling. The landowner would receive revenues from the sale of the water instead of rent from the tenant, but the tenant farmer would not receive the net revenue from crop production. If there was no other land available for rent, or if land rents were increased, the tenant farmer would be worse off.

In 2007, full owners operated about 66 percent of harvested cropland in the Seller Service Area and part owners operated about 19 percent. Tenant farmers operated about 15 percent of harvested cropland in the region (USDA 2009). Tenant farmers might be able to rent other parcels of land or engage in alternative economic activity. Some tenant farmers could also own land. In other cases, tenants could have formal or informal agreements with landowners that would result in sharing of the water transfer revenue. Still, the temporary loss of farming opportunities would have an adverse effect on some tenant farmers in the region.

Crop shifting transfers could change economic output, value added, and employment for businesses and households linked to agricultural activities. For crop shifting transfers, growers would switch from a higher water use crop mix to a lower water use crop mix and sell the excess water for transfer. For a crop shifting transfer, growers would continue to spend money to grow a crop, employ farm labor, and generate revenue. Some crops such as wheat require less labor and inputs, which may have some adverse indirect and induced effects. Normal farming practices in the Seller Service Area include crop rotations; therefore, agricultural support businesses and farm workers are subject to these variations in sales and employment. Some crops may also be shifted to those that require more inputs and employment, which would have positive indirect and induced effect. Crop shifting to a lower water use crop would have minimal adverse effects on the regional economy.

Local Government Finances and Economic Policies

Reductions in local sales associated with cropland idling transfer effects could reduce tax revenues and increase costs to county governments. Idling of cropland could reduce revenues to county governments, primarily through the sales and use tax. Idling reduces the farmer's expenditures for production inputs, but much of this expenditure is not bought through retail channels that are subject to the tax. However, the reduced expenditure, especially reduced labor expenditure, reduces the incomes of many other persons who buy goods and services in the local economy. These people have less income to spend, and the share they spend on retail goods results in a loss of sales and use tax. On the other hand, the farmer who transfers water would presumably have a higher net income relative to revenues received from farming and could spend more in the regional economy.

Regional economic effects as a result of water transfers could increase costs for local governments in the form of unemployment costs and other social services. Given the size of economic effects relative to base economies, such effects would be minimal.

Table 3.10-37 shows tax impacts of cropland idling transfers, as estimated by IMPLAN. IMPLAN calculates tax impacts based on tax receipts, not actual tax rates. IMPLAN does not have the underlying data to separate state and local taxes; therefore, they are lumped together. It is not possible to identify the tax impact on local county and city jurisdictions. These impacts to tax revenues would be an adverse effect on the federal, state, and local economies.

Table 3.10-37. Federal, State, and Local Tax Impacts of Cropland Idling Transfers

-	Colusa, Glenn, Yolo	Sutter, Butte	Solano
State/Local	-$2,307,000	-$707,000	-$108,000
Federal	-$2,851,000	-$930,000	-$167,000

Source: MIG Inc. 2011

Economic effects associated with cropland idling could conflict with economic policies and objectives set forth in local plans. As identified in the Regulatory Setting, some counties in the Seller Service Area have established policies in documents such as General Plans to promote growth in the agricultural economy. As described above, cropland idling could affect sales for agricultural support businesses, which would conflict with economic policies or objectives. This would occur during the year of the transfer and effects would be an adverse effect. Cropland idling would benefit growers that sell water for transfer by increasing income. This increased income to growers could support growth in the agricultural economy.

Groundwater Substitution Transfers

Groundwater substitution transfers could increase costs to water users for groundwater pumping, ~~g costs~~ deepening existing wells, or drilling new wells ~~for water users~~ in areas where groundwater levels decline as a result of the transfer. Groundwater substitution transfers would cause groundwater levels to decline in local areas within the Sacramento and Redding Groundwater Basins.

Section 3.3, Groundwater Resources, discusses potential impacts to groundwater levels as a result of water transfers. Decreased groundwater levels would increase pumping costs for nearby well owners who are not participating in groundwater substitution transfers. Increased costs would reduce net farm revenues and, subsequently, household spending in the regional economy. In general, most agricultural wells in the Sacramento Valley Groundwater Basin are at least about 0.25 miles apart, so neighboring wells would not be pumping at the point of maximum drawdown in the basin. Figures 3.10-5 and 3.10.6 show potential changes in groundwater pumping costs after a one-year transfer and after multi-year transfers, respectively. As described in Section 3.3.2.4.2, the groundwater level figures show the simulated drawdown of groundwater elevations under September 1976 hydrologic conditions (WY 1976 was historically a critical dry year) and simulated drawdown of groundwater elevations under September 1990 hydrologic conditions, which shows the cumulative effects of multi-year transfers as groundwater substitution pumping was simulated in 1987, 1988, 1989, and 1990. Table 3.10-~~32~~ 38 shows potential changes in pumping costs corresponding to decline in groundwater levels. Figure 3.10-5 shows that after a single year transfer, pumping costs in most areas would increase about $0.64 to $1.60 per AF. In some areas in Sacramento, Glenn and Sutter counties, pumping costs could increase up to $3.20 to $4.80 per AF for nearby wells close to 0.25 miles from the transfer well. In some areas of Colusa and Yuba counties, groundwater levels could decline up to about 25 feet, which would be an increase in pumping costs between $6.40 and $8.00 per AF. After consecutive years of water transfers, changes in pumping costs would be similar (Figure 3.10-6); however, they would be more widespread across the basin. For many growers, pumping costs would increase in the range of $0.32 to $1.60 per AF. Increased pumping costs for nearby growers would be an adverse economic effect.

Table 3.10-~~32~~38. Potential Increases in Energy Costs Associated With Groundwater Level Declines

Groundwater Decline	Energy Costs ($/AF)
1-2 feet	$0.32-$0.64
2-5 feet	$0.64-$1.60
5-10 feet	$1.60-$3.20
10-15 feet	$3.20-$4.80
15-20 feet	$4.80-$6.40
20-25 feet	$6.40-$8.00
25-30 feet	$8.00-$9.60
30-50 feet	$9.60- $16.00
>50 feet	>$16.00

Reduction in groundwater levels could also result in existing wells that may not be participating in the water transfers to dry out. This would require either deepening existing wells or drilling new wells to continue to pump groundwater. Deepening or drilling new wells would result in excessive costs to third parties and would be a substantial adverse economic effect.

Mitigation measure GW-1 (see Section 3.3, Groundwater Resources) establishes monitoring programs for groundwater substitution transfers. The programs would monitor groundwater level fluctuations within the local pumping area and if effects were reported or occurred, the participating selling agencies would implement appropriate mitigation, also described in mitigation measure GW-1. Mitigation measure GW-1 would reduce the effects of increased groundwater pumping costs for well owners in areas where groundwater levels decline as a result of transfers. This would reduce adverse economic effects of increased pumping costs. Mitigation measure GW-1 also includes monitoring and mitigation actions to prevent wells from going dry or to mitigate the third party in the event that a well does go dry. Section 3.3.4.1.2 describes the monitoring plan that sellers must complete for groundwater substitution transfers and to address third party concerns. Section 3.3.4.1.3 details the mitigation plan for third party effects.

Revenues from groundwater substitution water transfers could increase incomes for growers or landowners selling water. Similar to cropland idling transfers, growers or landowners would likely participate in groundwater substitution water transfers if the income received from the water transfer is larger than the cost of pumping groundwater in lieu of surface water for irrigation. This would increase total net revenues for the farmer.

Stored Reservoir Release and Conservation Transfers

Revenues received from stored reservoir release and conservation transfers could increase operating incomes for sellers. Water transfer revenues from stored reservoir release and conservation transfers would go to the seller. The seller could use the revenues for operating expenses or to fund planned future projects, such as infrastructure replacement. Any of these effects could be beneficial, but would be minor as water transfer revenues would not be a large or consistent income source.

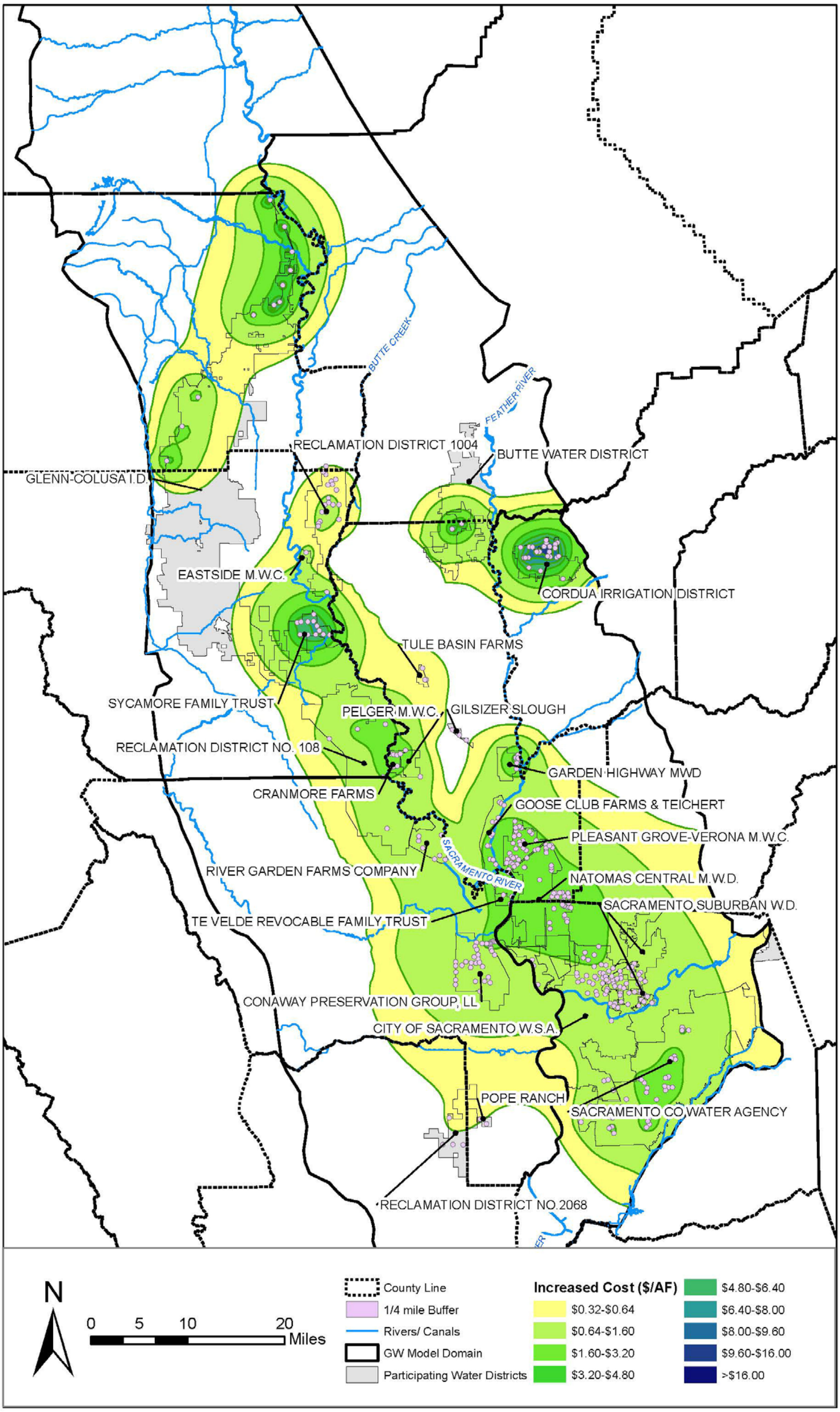

Figure 3.10-5. Potential Change in Groundwater Pumping Cost Related to Groundwater Level Declines (Aquifer Depth of Approximately 700 to 900 feet), September 1990

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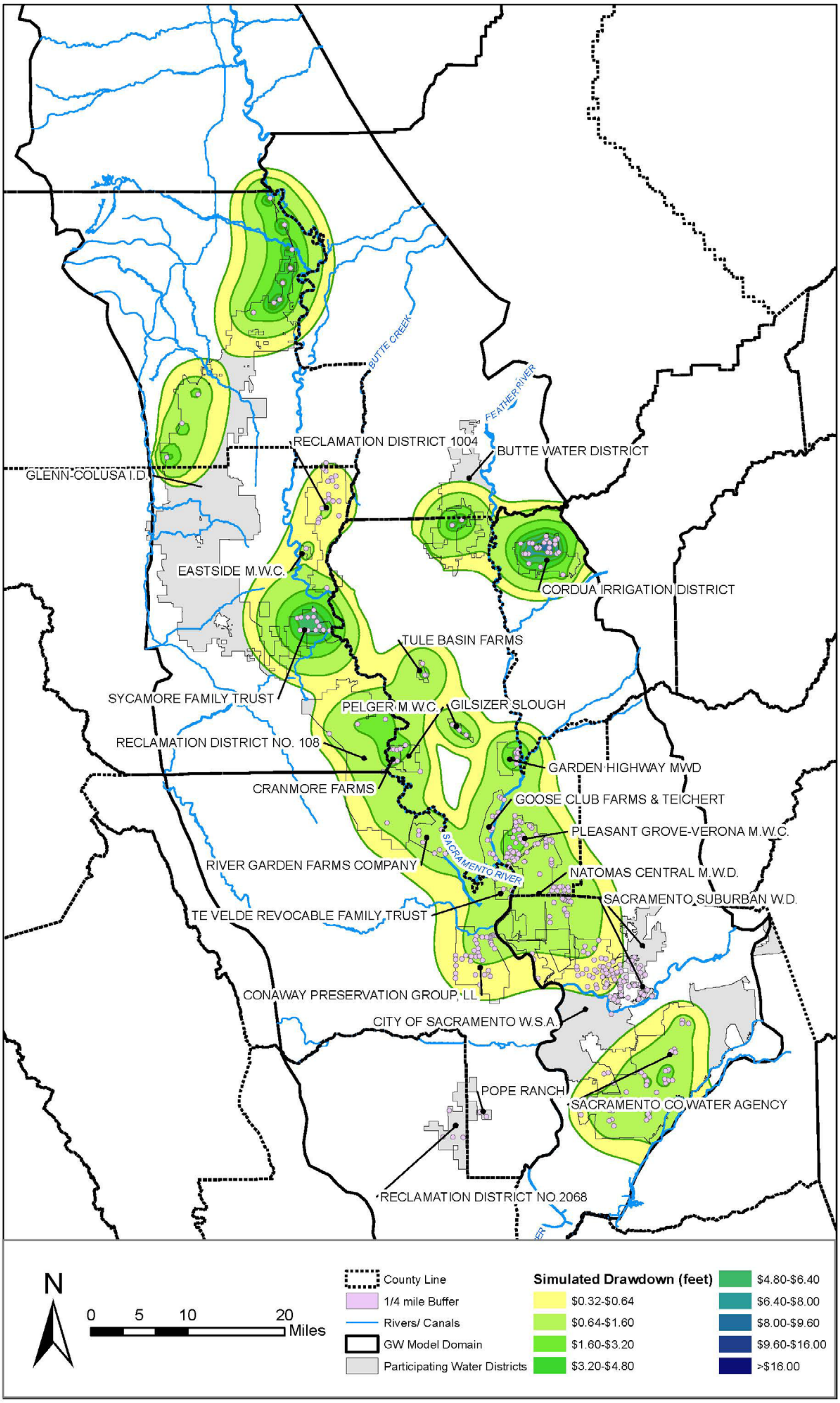

Figure 3.10-6. Potential Change in Groundwater Pumping Cost Related to Groundwater Level Declines (Aquifer Depth of Approximately 700 to 900 feet), September 1976

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3.10.2.3.2 Buyer Service Area

Use of Transfer Water
Water transfers would provide water for agricultural uses that could support revenues, economic output, and employment. Water transfers would provide water for irrigation in the Buyer Service Area that would help maintain crop production. Growers would likely continue to face water shortages and need to pump groundwater or idle fields, but water transfers would reduce water shortages and associated effects. Continuing crop production would support employment and incomes for farm workers and others employed by a farm. Growers would also continue to purchase inputs from suppliers, which would provide revenues to these businesses. Household spending in the region would also increase as farm workers, business owners, and other employees spend a portion of their incomes in the regional economy relative to the No Action/No Project Alternative. These would be positive regional economic effects in the agricultural areas of the Buyer Service Area.

Water transfers would provide water for M&I uses that could support revenues, economic output, and employment. Water transfers would also support M&I uses in the Buyer Service Area during dry and critical years. Supplementing a water supply during drought conditions could increase economic activity. Water supply provided by transfers would also help maintain the customers' quality of living relative to both indoor and outdoor water uses.

3.10.2.4 Alternative 3: No Cropland Modifications

3.10.2.4.1 Seller Service Area

Cropland Idling or Crop Shifting Transfers
Cropland idling and crop shifting transfers would not occur under Alternative 3; therefore, there would be no economic effects as a result of changes in agricultural production.

Local Government Finances and Economic Policies
Cropland idling transfers would not occur under Alternative 3; therefore, there would be no effects to tax revenues or operating costs of local governments. Other transfer methods would not likely affect local government activities or tax revenues.

Groundwater Substitution Transfers
Economic effects of groundwater substitution transfers would be the same as the Proposed Action.

Stored Reservoir Release and Conservation Transfers
Economic effects of stored reservoir release and conservation transfers would be the same as the Proposed Action.

3.10.2.4.2 Buyer Service Area

Use of Transfer Water
Economic effects in the Buyers Service Area would be the same as the Proposed Action.

3.10.2.5 Alternative 4: No Groundwater Substitution

3.10.2.5.1 Seller Service Area

Cropland Idling or Crop Shifting Transfers
Cropland idling transfers for Alternative 4 are the same acreages as the Proposed Action. Therefore, effects of cropland idling transfers would be the same as described for the Proposed Action.

Local Government Finances and Economic Policies
Economic effects would be the same to those described for the Proposed Action.

Groundwater Substitution Transfers
Groundwater substitution transfers would not occur under Alternative 4; therefore, there would be no economic effects as a result of increases in groundwater pumping costs.

Stored Reservoir Release and Conservation Transfers
Economic effects of stored reservoir release and conservation transfers would be the same as the Proposed Action.

3.10.2.5.2 Buyer Service Area

Use of Transfer Water
Economic effects in the Buyers Service Area would be the same as the Proposed Action.

3.10.3 Comparative Analysis of Alternatives

Table 3.10-~~33~~ 39 summarizes the potential economic effects of each of the action alternatives and the No Action/No Project Alternative.

Table 3.10-~~33~~39. Comparative Analysis of the Alternatives

Potential Effect	No Action/No Project	Proposed Action	Alternative 3: No Cropland Modifications	Alternative 4: No Groundwater Substitution
Seller Service Area				
Revenues from cropland idling water transfers could increase incomes for growers or landowners selling water.	Same as existing conditions	Beneficial	No Effect	Same as the Proposed Action
Cropland idling transfers in Glenn, Colusa, and Yolo counties could reduce employment, labor income, and economic output for businesses and households linked to agricultural activities.	Same as existing conditions	Employment: - 495 Labor Income: - $19.38 Million Output: - $90.43 Million	No Effect	Same as the Proposed Action
Cropland idling transfers in Sutter and Butte counties could reduce economic output, value added, and employment for businesses and households linked to agricultural activities.	Same as existing conditions	Employment: - 163 Labor Income: - $5.50 Million Output: - $26.76 Million	No Effect	Same as the Proposed Action
Cropland idling transfers in Solano County could reduce economic output, labor income, and employment for businesses and households linked to agricultural activities.	Same as existing conditions	Employment: - 32 Labor Income: - $1.13 Million Output: - $4.58 Million	No Effect	Same as the Proposed Action
Cropland idling transfers could have adverse local economic effects.	Same as existing conditions	Adverse	No Effect	Adverse
Water transfers from idling alfalfa could increase costs for dairy and other livestock feed.	Same as existing conditions	Adverse, but minimal	No Effect	Adverse, but minimal
Cropland idling transfers could decrease net revenues to tenant farmers whose landowners choose to participate in transfers.	Same as existing conditions	Adverse	No Effect	Adverse
Crop shifting transfers could change economic output, value added, and employment for businesses and households linked to agricultural activities.	Same as existing conditions	Adverse, but minimal	No Effect	Adverse, but minimal
Reductions in local sales associated with cropland idling transfer effects could reduce tax revenues and increase costs to county governments.	Same as existing conditions	Adverse, but minimal	No Effect	Adverse, but minimal
Economic effects associated with cropland idling could conflict with economic policies and objectives set forth in local plans.	Same as existing conditions	Adverse	No Effect	Adverse
Groundwater substitution transfers could increase groundwater pumping costs for water users in areas where groundwater levels decline as a result of the transfer.	Same as existing conditions	Adverse	Same as the Proposed Action	No Effect

Potential Effect	No Action/No Project	Proposed Action	Alternative 3: No Cropland Modifications	Alternative 4: No Groundwater Substitution
Revenues from groundwater substitution water transfers could increase incomes for growers or landowners selling water.	Same as existing conditions	Beneficial	Same as the Proposed Action	No Effect
Revenues received from stored reservoir and conservation transfers could increase operating incomes for sellers.	Same as existing conditions	Beneficial, but minimal	Same as the Proposed Action	Same as the Proposed Action
Buyer Service Area				
Water transfers would provide water for agricultural uses that could support revenues, economic output, and employment.	Same as existing conditions	Beneficial	Same as the Proposed Action	Same as the Proposed Action
Water transfers would provide water for M&I uses that could support revenues, economic output, and employment.	Same as existing conditions	Beneficial	Same as the Proposed Action	Same as the Proposed Action

3.10.3.1 No Action/No Project Alternative

Under the no Action/No Project Alternative, there would be no cropland idling or crop shifting transfers to CVP contractors, and therefore there would be no effects on the existing regional economy in the Seller Service Area, as well as no effect on local government finances. Additionally, groundwater pumping costs would not be affected by water transfers in the Seller Service Area to CVP contractors.

In the Buyer Service Area, growers would continue to take actions, such as cropland idling or groundwater pumping, in response to CVP water shortages. There would be no change from existing conditions.

3.10.3.2 Alternative 2: Full Range of Transfers (Proposed Action)

Under the Proposed Action, the full range of transfers including cropland idling and crop shifting transfers as well as groundwater substitution, stored reservoir release, and conservation transfers would be utilized. The revenues from cropland idling water transfers could potentially increase incomes for the farmer or landowners selling water. In Glenn, Colusa, Butte, Yolo, Sutter, and Solano counties, there would be reductions in employment, labor income, and economic output for business and households linked to agricultural activities. In Glenn, Colusa, Yolo, Sutter, Butte, and Solano counties, effects to employment, labor income, and output would result in a reduction of less than one percent relative to 2010 baseline economy.

Local government finances would be affected by the Proposed Action by reductions in local sales associated with cropland idling transfer effects. These effects could reduce tax revenues and increase costs to county governments primarily through the sales and use tax. Regional economic effects could increase costs for local governments in the form of unemployment costs and other social services, however, such effects are expected to be minimal.

Groundwater substitution transfers would be utilized in the Proposed Action. These transfers could increase groundwater pumping costs for water users in areas where groundwater levels decline as a result of the transfer. Decreased groundwater levels would increase pumping costs to nearby well owners, which would be an adverse economic effect.

Revenues received from stored reservoir and conservation transfers could increase operating incomes from sellers, however, these effects are expected to be minor as water transfer revenues would not be a large or consistent income source.

In the Buyer Service Area, water transfers would provide water for agricultural uses that could support revenues, economic output, and employment. Transfers in this area would provide irrigation that would help maintain crop production. While growers would likely continue to face water shortages and need to pump groundwater or idle fields, water transfers would reduce these effects. Water transfers would also provide water for M&I uses that could support revenue, economic output, and employment.

3.10.3.3 Alternative 3: No Cropland Modification

Under Alternative 3, there would be no cropland modifications, however, groundwater substitution transfers and stored reservoir purchase and conservation transfers would be utilized. In the Seller Service Area, there would be no economic effects as a result of changes in agricultural production.

Groundwater substitution transfers and stored reservoir purchase and conservation transfers would be identical to the Proposed Action, and therefore economic effects would be the same as the Proposed Action.

In the Buyers Service Area economic effects would be the same as the Proposed Action.

3.10.3.4 Alternative 4: No Groundwater Substitution

Under Alternative 4, there would be no groundwater substitution.

Similar to the Proposed Action, cropland idling or crop shifting would occur from sellers in Glenn, Colusa, Yolo, Sutter, Butte, and Solano counties. While growers and landowners selling water for transfers could increase their incomes, regional economic effects would still be adverse to businesses and individuals who support farming activities. Since groundwater substitution transfers would not occur under Alternative 4 there would be no economic effects as a result of increases in groundwater pumping costs.

Economic effects of stored reservoir purchase and conservation transfers would be the same as the Proposed Action.

Additionally, economic effects in the Buyers Service Area would be the same for Alternative 4 as they are in the Proposed Action.

3.10.4 Cumulative Effects

The timeframe for the Long-Term Water Transfers cumulative analysis extends from 2015 through 2024, a ten year period. The cumulative effects analysis for regional economics considers State Water Project (SWP) water transfers and the CVP M&I Water Shortage Policy (WSP). Chapter 4 identifies potential SWP cropland idling transfers by seller and potential alternatives for the CVP M&I WSP. Reclamation is operating under an existing WSP and is evaluating the policy for revisions. Refer to Chapter 4 for further information. The cumulative analysis also considers land protection programs, general population growth and associated economic development in the Seller and Buyer Service Areas.

3.10.4.1 Alternative 2: Full Range of Transfers

3.10.4.1.1 Cropland Idling or Crop Shifting Transfers

Cropland idling and shifting transfers in combination with other cumulative projects could have regional economic effects in the Seller Service Area. Water management activities that could result in cumulative effects with long-term water transfers include the CVP M&I WSP and SWP water transfers. The CVP M&I WSP could limit water supplies to agricultural users and result in increased agricultural land idling in the Seller Service Area, which may result in fewer sellers participating in long-term water transfers. These changes, however, would likely be minor because the changes in water deliveries would likely represent a small amount of the overall water supply within the Seller Service Area. Therefore, the CVP M&I WSP would not contribute substantially to cumulative economic effects in the Seller Service Area.

Cropland idling implemented under the SWP transfers could result in a maximum of 26,342 acres of idled rice land in Butte and Sutter counties. Similar to cropland idling for CVP transfers, SWP cropland idling transfers would be a temporary effect and would not permanently affect employment, labor income, and output in the Seller Service Area.

Table 3.10-~~34~~ 40 summarizes cumulative economic effects to employment, labor income, and output in Butte and Sutter counties of idling of 10,769 acres of rice under the Proposed Action and up to 26,342 acres of rice for SWP transfers. The cumulative effects of transfers in Butte and Sutter counties would be less than one percent reduction in employment, labor income, and output in the regional economy.

Table 3.10-~~34~~40. Cumulative Regional Economic Effects in Butte and Sutter County from Rice Idling Transfer (2012 dollars)

Cumulative Acreage Idled	Employment (Jobs/1000 acres)	% change from Total Employment	Labor Income (Million $)	% change from Total Labor Income	Output (Million $)	% change from Total Output
37,111	456	0.31%	$15.71	0.28%	$79.98	0.46%

Figure 3.10-7 shows 2002 to 2013 unemployment rates in the cropland idling counties (Employment Development Department 2013). Glenn, Colusa, and Sutter counties have consistently had higher annual unemployment rates than the state average. During the 2009 to 2011 economic recession, cropland idling counties in the Seller Service Area experienced high levels of unemployment relative to previous years. Reductions in employment associated with cropland idling transfers would contribute to unemployment in the region. However, cropland idling effects are temporary and under the Proposed Action, cropland idling transfers would not occur each year over the 10-year period.

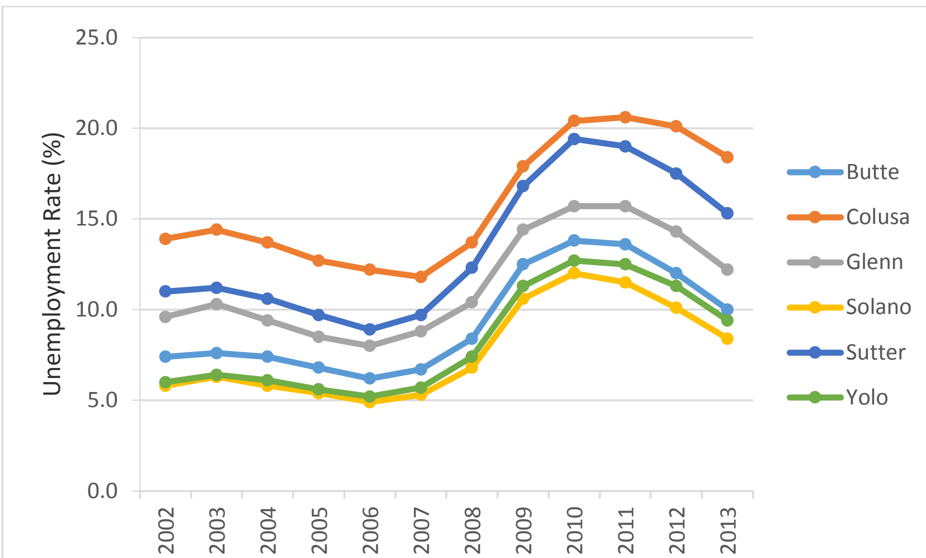

Figure 3.10-7. 2002 to 2013 Unemployment Rates in Seller Service Area

Populations are projected to increase in counties where cropland idling transfers could occur. Table 3.10-~~35~~ 41 shows projected population growth in Glenn, Colusa, Yolo, Sutter, Solano, and Butte counties. Population growth would increase the demand for housing and services, resulting in new construction and urban development. Urban development would include new businesses in the area, which would increase county revenues and provide employment opportunities. The counties might use new revenues to provide services, including programs to train unskilled workers. Overall, population growth and urban development would boost the regional economies under the cumulative condition.

Table 3.10-~~35~~41. Population Projections in the Seller Service Area Cropland Idling Counties

County	2015 Population	2030 Population	Total Growth Rate (%) 2015 to 2030
Glenn	28,871	33,552	16%
Colusa	22,417	29,023	29%
Yolo	209,198	250,414	20%
Sutter	98,833	133,010	35%
Solano	424,494	493,422	16%
Butte	224,955	284,082	26%

Source: California Department of Finance 2013

Section 3.9 discusses potential conversion of agricultural land to urban uses in the Seller Service Area. As described above, urban development would boost the regional economy; however, it would adversely affect the agricultural economy through loss of agricultural land. Agricultural to urban land conversions would affect incomes and employment for farm workers and agricultural businesses in the area as crop production decreased. However, crop yield increases might outpace agricultural land conversions, conversions to higher-value crops increase value of production, and some share of urban development will include agricultural service industries. Even with land conversion, agriculture is very likely to remain a dominant sector in the regional economy in the Sacramento Valley under the cumulative conditions.

There are also land protection programs in the Seller Service Area designed to preserve land in agriculture and open space. These programs, such as the California Land Conservation (Williamson) Act, provide financial assistance for growers who keep their land in private ownership and continue agricultural production. Under the cumulative condition, land protection programs would help maintain agricultural acreage, sales and employment for agricultural businesses.

Local Government Finances

Cropland idling and shifting transfers in combination with other cumulative projects could affect local government finances in the Seller Service Area. Many factors affect local government finances. Increasing urban development would increase construction activity. Construction can result in a temporary influx in spending in a county, which would increase sales tax revenues. Once constructed, development would likely increase property values and property tax revenues to local governments. Effects of construction and development would be a positive economic effect under the cumulative condition. CVP cropland idling transfers would reduce some spending in the region to support agriculture, which would reduce sales tax revenues to local governments. These reductions would be temporary and minor under the Proposed Action.

Groundwater Substitution Transfers
Section 3.3, Groundwater Resources, concludes that cumulative effects to groundwater levels would be significant. As a result, there would be adverse cumulative effects because of increased groundwater pumping costs.

Mitigation measure GW-1 (see Section 3.3, Groundwater Resources) establishes monitoring programs for groundwater substitution transfers. The programs would monitor groundwater level fluctuations within the local pumping area and if effects were reported or occurred, the participating selling agencies would implement appropriate mitigation, also described in mitigation measure GW-1. Mitigation measure GW-1 would reduce the effects of increased groundwater pumping costs for well owners in areas where groundwater levels decline as a result of transfers. This would reduce adverse cumulative economic effects of increased pumping costs of the Proposed Action.

Stored Reservoir Release and Conservation Transfers
Revenues received from stored reservoir release and conservation water transfers, in combination with other revenues and expenses, could increase operating incomes for sellers. Water districts often face increasing operation and maintenance costs and aging infrastructure and do not have new revenue sources to cover increasing costs. Increasing population growth in the Seller Service Area also requires water districts to develop urban water supplies under the cumulative condition. Water transfer revenues received by selling agencies could support financing of existing and planned activities to replace aging infrastructure and meet increasing demands. A portion of the revenues may go toward debt service, but another portion is likely to be spent in the regional economy on supplies and services, which would be a positive economic effect. Increased revenues would also support district employment and employee compensation.

Buyer Service Area Use of Transfer Water
Water transfers in combination with other cumulative projects would provide water for agricultural uses that could support revenues, economic output, and employment. Under the cumulative condition, agricultural water users in Merced, San Benito, San Joaquin, Stanislaus, Fresno, and Kings counties face increasing limitations on water supplies and pressures from urban development. Water transfers would provide some water to supplement CVP supplies, but would not eliminate future water supply shortages under the cumulative condition.

Figure 3.10-8 shows 2002 to 2013 unemployment rates in the six counties (Employment Development Department 2013). All counties have consistently had higher annual unemployment rates than the state average. During the 2009 to 2011 economic recession, the counties experienced high levels of unemployment relative to previous years. Water transfers to agricultural uses would provide farm worker jobs and have positive employment, labor income, and output effects in the regional economy. These effects would be temporary and only occur when transfers are implemented.

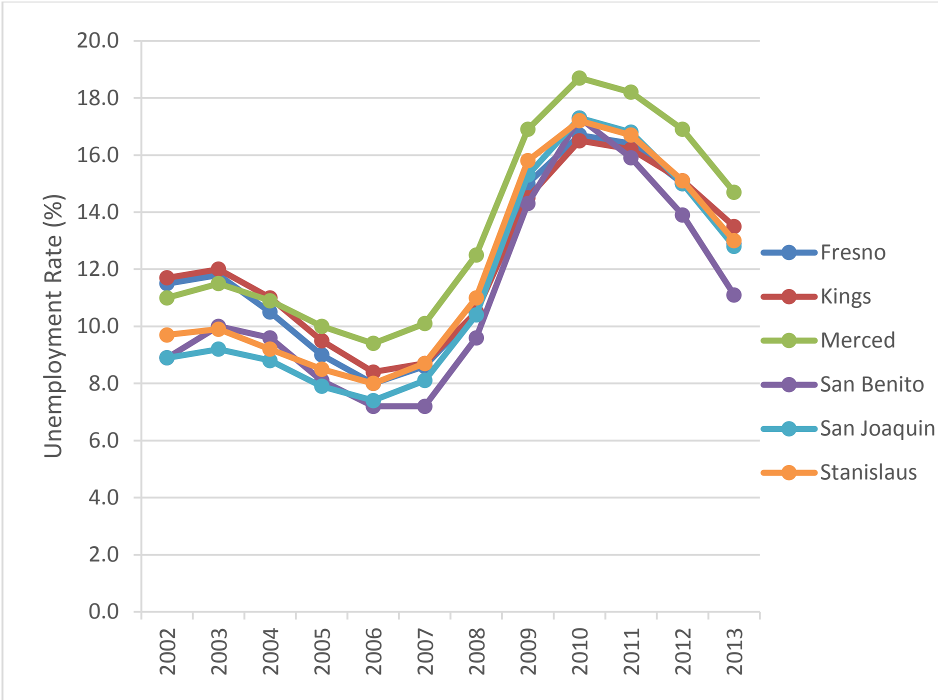

Figure 3.10-8. 2002-2013 Unemployment Rates in Buyer Service Area

Table 3.10-~~36~~ 42 shows projected population growth in Merced, San Benito, San Joaquin, Stanislaus, Fresno, and Kings counties. Population growth would increase the demand for housing and services, resulting in new construction and urban development. Urban development would include new businesses in the area, which would increase county revenues and provide employment opportunities. The counties could use new revenues to provide services, including programs to train unskilled workers. Overall, population growth and urban development would boost the regional economies under the cumulative condition.

Table 3.10-~~36~~42. Population Projections in the Merced, San Benito, San Joaquin, Stanislaus, Fresno and Kings Counties

County	2015 Population	2030 Population	Total Growth Rate (%) 2015 to 2030
Merced	273,156	366,352	34%
San Benito	57,512	69,215	20%
San Joaquin	725,884	1,004,147	38%
Stanislaus	540,853	674,859	25%
Fresno	988,970	1,241,773	26%
Kings	157,314	205,627	31%

Source: California Department of Finance 2013

Urban development would increase agricultural land conversions and permanently remove land from agricultural production. Section 3.9 discusses projected agricultural to urban land conversions in the counties. Water transfers under the Proposed Action would not be a permanent water source and would not likely change a landowners' decision to sell to developers in the long-term.

Refuge transfers could occur from sellers in the San Joaquin Valley near the Buyer Service Area. The single main seller of water supplies for refuge transfers is the San Joaquin River Exchange Contractors Water Authority. Water would be made available for refuges through cropland idling. Cropland idling in the sellers' areas would reduce agricultural employment and production. Refuge transfers would not affect agricultural employment or production in the Seller Service Area in the Sacramento Valley; therefore, refuge transfers in combination with the Proposed Action would not result in cumulative effects to regional economies in the Seller Service Area.

CVP water transfers in combination with other cumulative projects would provide water for M&I uses that could support economic activity and quality of living. The CVP M&I WSP and SWP transfers could increase M&I water supply to M&I contractors (East Bay MUD, Contra Costa WD, and Santa Clara Valley WD) during dry and critical years under the cumulative condition. The M&I contractors would also purchase water transfers during dry and critical years to supplement existing supplies. During the 10-year transfer period, a multi-year drought may require M&I contractors to implement water shortage contingency plans that require mandatory conservation measures and other drought relief actions. Supplementing a water supply during drought conditions could increase economic activity. Water supply provided by transfers would also help maintain the customers' quality of living relative to both indoor and outdoor water uses. Under the cumulative condition, the M&I WSP and water transfers would improve water supply reliability and support the regional economy.

Alameda, Contra Costa, and Santa Clara counties have projected population growth. Table 3.10-~~37~~ 43 shows population projections in the three counties.

Table 3.10-~~37~~43. Population Projections in the Alameda, Contra Costa, and Santa Clara Counties

County	2015 Population	2030 Population	Total Growth Rate (%) 2015 to 2030
Alameda	1,577,938	1,657,567	5%
Contra Costa	1,093,171	1,254,205	15%
Santa Clara	1,874,604	1,986,545	6%

Source: California Department of Finance 2013

Population growth would increase the demand for housing and services, resulting in new construction and urban development. Urban development would be associated with new businesses in the area, which would increase county revenues and provide employment opportunities. This would result in positive economic effects under the cumulative condition.

3.10.4.2 Alternative 3: No Cropland Modification

Cumulative effects would be the same as described for the Proposed Action in the Seller and Buyer Service Areas.

3.10.4.3 Alternative 4: No Groundwater Substitution

Cumulative effects would be the same as described for the Proposed Action in the Seller and Buyer Service Areas.

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Section 3.11 Environmental Justice

This section discusses environmental justice within the area of analysis and evaluates potential effects to minority and/or low-income populations from the proposed alternatives. The concept of environmental justice embraces two principles: 1) fair treatment of all people regardless of race, color, nation of origin, or income, and 2) meaningful involvement of people in communities potentially affected by proposed actions.

The concept of environmental justice as applied here is that minority and low-income people should not be adversely and disproportionately affected by economic and quality of life effects from implementation of the Proposed Action. Proposed cropland idling and crop shifting transfers could affect farm labor employment by temporarily reducing the amount of agricultural land in production and the number of farmworkers needed to work on agricultural fields. Groundwater, stored reservoir release and conservation transfers would not result in environmental justice effects; therefore, these measures are not further discussed in this analysis.

3.11.1 Affected Environment/ Environmental Setting

This section describes the area of analysis and presents county demographic, economic, and agricultural data in regard to environmental justice issues.

3.11.1.1 Area of Analysis

The area of analysis for environmental justice includes counties where cropland idling and/or crop shifting transfers could occur and counties where transferred water would be used for agricultural purposes. Figure 3.11-1 shows the environmental justice area of analysis.

Figure 3.11-1. Environmental Justice Area of Analysis

3.11.1.2 Regulatory Setting

The following section describes the applicable laws and regulations pertaining to environmental justice.

3.11.1.2.1 Federal

Executive Order 12898 *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, issued* February 11, 1994, requires all federal agencies to conduct "programs, policies, and activities that substantially affect human health or the environment, in a manner that ensures that such programs, policies, and activities do not have the effect of excluding persons (including populations) from participation in, denying persons (including populations) the benefits of, or subjecting persons (including populations) to discrimination under, such programs, policies, and activities, because of their race, color, or national origin." Section 1-101 of the Order requires federal agencies to identify and address "disproportionately high and adverse human health or environmental effects" of programs on minority and low-income populations (Executive Order 1994).

The Council on Environmental Quality (CEQ) (1997) states that environmental justice concerns may arise from effects on the natural or physical environment, such as human health or ecological effects on minority or low-income populations, or from related social or economic effects.

3.11.1.2.2 State

California law defines environmental justice as the "fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies," in Government Code Section 65040.12(e). Section 65040.12(a) designates the Governor's Office of Planning and Research (OPR) as the coordinating agency in State government for environmental justice programs and directs the agency to coordinate with Federal agencies regarding environmental justice information. OPR incorporated environmental justice into the *State of California 2003 General Plan Guidelines* (OPR 2003) and recommended that policies supportive of environmental justice be incorporated into all general plan elements.

3.11.1.3 Existing Conditions

This section presents the most current and available data relevant to identifying environmental justice conditions within the area of analysis.

3.11.1.3.1 Existing Regional Demographic and Economic Characteristics

This section presents the existing regional demographic and economic characteristic census data, from the 2012 American Community Survey Estimates by the U.S. Census Bureau for the area of analysis. Information for the State of California as a whole is presented for comparison purposes. See Section 3.11.2.1 below for definitions and assessment methodology on the identified thresholds to determine a minority or low-income affected area.

Seller Service Area

Table 3.11-1 presents the demographic characteristics of the Seller Service Area. This data shows that Colusa, Solano, Sutter, and Yolo counties all exhibit a total minority proportion exceeding 50 percent. All of these counties are considered minority affected areas within the Seller Service Area. Colusa County is the only county that has a Hispanic ethnic population that exceeds that of the State average, at 38.2 percent, suggesting that the high total minority percentage in this region is closely related to the proportion of Hispanic residents.

Table 3.11-3 presents the median household income, proportion of individuals living below the poverty threshold, and current unemployment rates for the Seller Service Area. The data shows that all counties within the Seller Service Area, for the exception of Solano County, have a median household income lower than the state; however, these counties do not fall below the U.S. Census Bureau's defined poverty thresholds for a family of four or an individual. Butte, Sutter and Yolo counties all have a higher proportion of low-income residents than compared to the State (12.9 percent); however, these counties do not surpass the identified 25.8 percent poverty level threshold. All counties within the Seller Service Area, for the exception of Yolo County, have an unemployment rate higher than the state. By definition, there are no low-income affected areas in the Seller Service Area.

Buyer Service Area

Table 3.11-2 presents the racial and ethnic composition of the Buyer Service Area. This data shows that all the counties within the Buyer Service Area, including Fresno, Kings, Merced, San Benito, San Joaquin and Stanislaus, exhibit a total minority proportion exceeding 50 percent. In addition all counties have Hispanic populations that exceed that of the state average, at 38.2 percent, suggesting that the high total minority percentage in the region is closely related to the proportion of Hispanic residents. All Buyer Service Area counties are considered minority affected areas.

Table 3.11-4 presents the median household income, proportion of individuals living below the poverty threshold and current unemployment rates for the Buyer Service Area. This data shows that all Buyer Service Area counties other than San Benito County has a median household income lower than the state average; however, none of the counties fall below the U.S. Census Bureau's defined poverty thresholds for a family of four or an individual. Also, these counties have a higher proportion of low-income residents compared to the state (12.9 percent); however, neither county surpasses the identified 25.8 percent poverty level threshold. All counties within the Buyer Service Area have an unemployment rate higher than the state. By definition, there are no low-income affected areas in the Buyer Service Area.

Table 3.11-1. Seller Service Area Demographic Characteristics, 2012

Geographic Area	Total Population	Race[1]							Hispanic Origin[2]		Total Minority[3]
		White	Black/ African American	American Indian and Alaska Native	Asian	Native Hawaiian/ Pacific Islander	Some Other Race	Two or More Races	White Alone, Non-Hispanic	All Race, Hispanic	
Butte	**221,539 (100%)**	**188,102 (84.9%)**	**3,425 (1.5%)**	**1,892 (0.9%)**	**10,111 (4.6%)**	**153 (0.1%)**	**4,273 (1.9%)**	**13,583 (6.1%)**	**164,755 (74.4%)**	**32,875 (14.8%)**	**56,784 (25.6%)**
Colusa	**21,421 (100%)**	**16,733 (78.1%)**	**111 (0.5%)**	**250 (1.2%)**	**238 (1.1%)**	**4 (0.0%)**	**3,054 (14.3%)**	**1,031 (4.8%)**	**8,376 (39.1%)**	**11,976 (55.9%)**	**13,045 (60.8%)**
Glenn	28,090 (100%)	23,707 (84.4%)	244 (0.9%)	589 (2.1%)	734 (2.6%)	0 (0.0%)	1,854 (6.6%)	962 (3.4%)	17,381 (61.9%)	10,709 (38.1%)	13,709 (48.8%)
Solano	**420,757 (100%)**	**227,816 (54.1%)**	**55,648 (13.2%)**	**2,055 (0.5%)**	**64,570 (15.3%)**	**3,944 (0.9%)**	**36,095 (8.6%)**	**30,629 (7.3%)**	**169,048 (40.2%)**	**104,203 (24.8%)**	**251,709 (59.8%)**
Sutter	**95,022 (100%)**	**66,209 (69.7%)**	**1,412 (1.5%)**	**1,600 (1.7%)**	**13,962 (14.7%)**	**51 (0.1%)**	**6,248 (6.6%)**	**5,540 (5.8%)**	**46,358 (48.8%)**	**27,878 (29.3%)**	**48,664 (51.2%)**
Yolo	**204,118 (100%)**	**136,360 (66.8%)**	**5,129 (2.5%)**	**1,806 (0.9%)**	**28,186 (13.8%)**	**640 (0.3%)**	**20,778 (10.2%)**	**11,219 (5.5%)**	**99,667 (48.8%)**	**63,340 (31.0%)**	**104,451 (51.1%)**
California	**38,041,430 (100%)**	**23,628,545 (62.1%)**	**2,263,723 (6.0%)**	**285,342 (0.8%)**	**5,120,354 (13.5%)**	**146,712 (0.4%)**	**4,912,894 (12.9%)**	**1,683,860 (4.4%)**	**14,904,055 (39.2%)**	**14,537,661 (38.2%)**	**23,137,375 (60.8%)**

Source: U.S. Census Bureau 2012a.

Notes:

[1] A minority is defined as a member of the following population groups: American Indian/Alaskan Native, Asian or Pacific Islander, Black (non-Hispanic), or Hispanic.

[2] The term "Hispanic" is an ethnic category and can apply to members of any race, including respondents who self-identified as "White." The total numbers of Hispanic residents for each geographic region are tabulated separately from the racial distribution by the U.S. Census Bureau.

[3] "Total Minority" is the aggregation of all non-white racial groups with the addition of all Hispanics, regardless of race with the total for "Not Hispanic or Latino: While Alone" subtracted from the total population.

Key:

Boldface denotes areas with meaningfully greater total minority proportion (more than 50 percent).

% = percent

Table 3.11-2. Buyer Service Area Demographic Characteristics, 2012

Geographic Area	Total Population	Race[1]							Hispanic Origin[2]		Total Minority[3]
		White	Black/ African American	American Indian and Alaska Native	Asian	Native Hawaiian/ Pacific Islander	Some Other Race	Two or More Races	White Alone, Non-Hispanic	All Race, Hispanic	
Fresno	**940,493 (100%)**	**533,459 (56.7%)**	**47,433 (5.0%)**	**9,534 (1.0%)**	**90,960 (9.7%)**	**1,373 (0.1%)**	**218,696 (23.3%)**	**39,038 (4.2%)**	**302,405 (32.2%)**	**477,827 (50.8%)**	**638,088 (67.8%)**
Kings	**151,869 (100%)**	**112,399 (74.0%)**	**10,049 (6.6%)**	**1,704 (1.1%)**	**6,109 (4.0%)**	**301 (0.2%)**	**15,103 (9.9%)**	**6,204 (4.1%)**	**53,055 (34.9%)**	**78,299 (51.6%)**	**98,824 (65.0%)**
Merced	**262,305 (100%)**	**157,661 (60.1%)**	**9,337 (3.5%)**	**2,839 (1.0%)**	**20,014 (7.6%)**	**1,016 (0.3%)**	**60,222 (22.9%)**	**11,216 (4.2%)**	**79,926 (30.5%)**	**147,210 (56.1%)**	**182,379 (69.5%)**
San Benito	**56,210 (100%)**	**47,911 (85.2%)**	**616 (1.1%)**	**472 (0.8%)**	**1,095 (1.9%)**	**0 (0.0%)**	**4,020 (7.2%)**	**2,096 (3.7%)**	**21,206 (37.7%)**	**32,002 (56.9%)**	**35,004 (62.2%)**
San Joaquin	**702,612 (100%)**	**395,346 (56.2%)**	**50,103 (7.1%)**	**5,158 (0.7%)**	**100,563 (14.3%)**	**4,031 (0.5%)**	**91,540 (13.0%)**	**55,871 (7.9%)**	**244,786 (34.8%)**	**279,104 (39.7%)**	**457,826 (65.1%)**
Stanislaus	**521,726 (100%)**	**395,749 (75.8%)**	**14,118 (2.7%)**	**3,515 (0.6%)**	**27,678 (5.3%)**	**3,884 (0.7%)**	**54,101 (10.3%)**	**22,681 (4.3%)**	**237,445 (45.5%)**	**224,498 (43.0%)**	**284,281 (54.4%)**
California	**38,041,430 (100%)**	**23,628,545 (62.1%)**	**2,263,723 (6.0%)**	**285,342 (0.8%)**	**5,120,354 (13.5%)**	**146,712 (0.4%)**	**4,912,894 (12.9%)**	**1,683,860 (4.4%)**	**14,904,055 (39.2%)**	**14,537,661 (38.2%)**	**23,137,375 (60.8%)**

Source: U.S. Census Bureau 2012a.

Notes:

[1] A minority is defined as a member of the following population groups: American Indian/Alaskan Native, Asian or Pacific Islander, Black (non-Hispanic), or Hispanic.

[2] The term "Hispanic" is an ethnic category and can apply to members of any race, including respondents who self-identified as "White." The total numbers of Hispanic residents for each geographic region are tabulated separately from the racial distribution by the U.S. Census Bureau.

[3] "Total Minority" is the aggregation of all non-white racial groups with the addition of all Hispanics, regardless of race with the total for "Not Hispanic or Latino: White Alone" subtracted from the total population.

Key:

Boldface denotes areas with meaningfully greater total minority proportion (more than 50 percent).

% = percent

Table 3.11-3. Seller Service Area Economic Characteristics, 2012

Geographic Area	Median Household Income[1, 2]	Percent Population Below Poverty Threshold[3]	Unemployment Rate
Butte	$40,960	13.6%	15.0%
Colusa	$51,016	12.1%	13.9%
Glenn	$38,920	12.0%	12.9%
Solano	$62,066	10.9%	13.6%
Sutter	$47,081	16.8%	12.9%
Yolo	$50,594	8.5%	10.9%
California	$58,328	12.9%	11.4%

Source: U.S. Census Bureau 2012a.

Notes:

[1] Household income is defined by the United States Census Bureau as “the sum of money income received in the calendar year by all household members 15 years old and over” (United States Census Bureau 2014).

[2] In 2012 inflation adjusted dollars.

[3] The census classifies families and persons as below poverty “if their total family income or unrelated individual income was less than the poverty threshold” as defined for all parts of the country by the federal government (United States Census Bureau 2012b). For 2012, the federal weighted average poverty level threshold for an individual was $11,720 and the 23,492 for a family of four (two adults and two children)

Key: % = percent

Table 3.11-4. Buyer Service Area Economic Characteristics, 2012

Geographic Area	Median Household Income[1, 2]	Percent Population Below Poverty Threshold[3]	Unemployment Rate
Fresno	$44,312	22%	15.7%
Kings	$47,112	17.8%	16.5%
Merced	$42,449	19.0%	16.9%
San Benito	$62,786	9.1%	15.2%
San Joaquin	$50,722	14.7%	16.0%
Stanislaus	$46,405	16.0%	17.2%
California	$58,328	12.9%	11.4%

Source: U.S. Census Bureau 2012a.

Notes:

[1] Household income is defined by the United States Census Bureau as “the sum of money income received in the calendar year by all household members 15 years old and over” (United States Census Bureau 2014).

[2] In 2012 inflation adjusted dollars.

[3] The census classifies families and persons as below poverty “if their total family income or unrelated individual income was less than the poverty threshold” as defined for all parts of the country by the federal government (United States Census Bureau 2012b). For 2012, the federal weighted average poverty level threshold for an individual was $11,720 and the 23,492 for a family of four (two adults and two children)

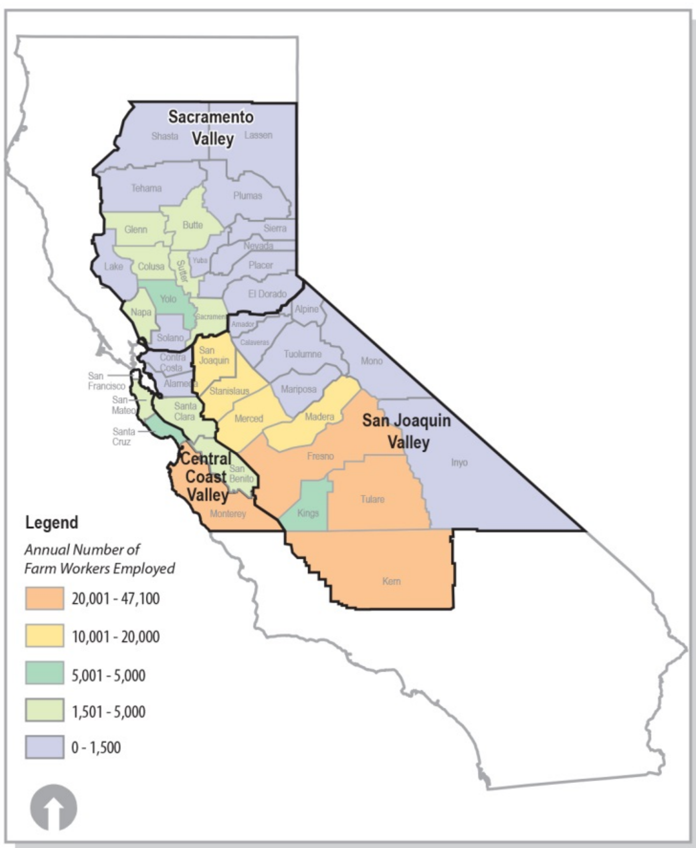
Key: % = percent

3.11.1.3.2 Agricultural Employment

Proposed cropland idling or shifting transfers could affect agricultural employment by changing the crops grown or decreasing the amount of agricultural production. This could potentially reduce the need for farm labor and the number of agricultural jobs available in the Seller Service Area. Water transferred to the Buyers Service Area for agricultural use could support agricultural employment. Figure 3.11-2 shows a detailed map of the distribution of agricultural employment in 2012 for the Sacramento, San Joaquin Valley and Central Coast Valley regions that encompass the seller and buyer serve areas.

Seller Service Area

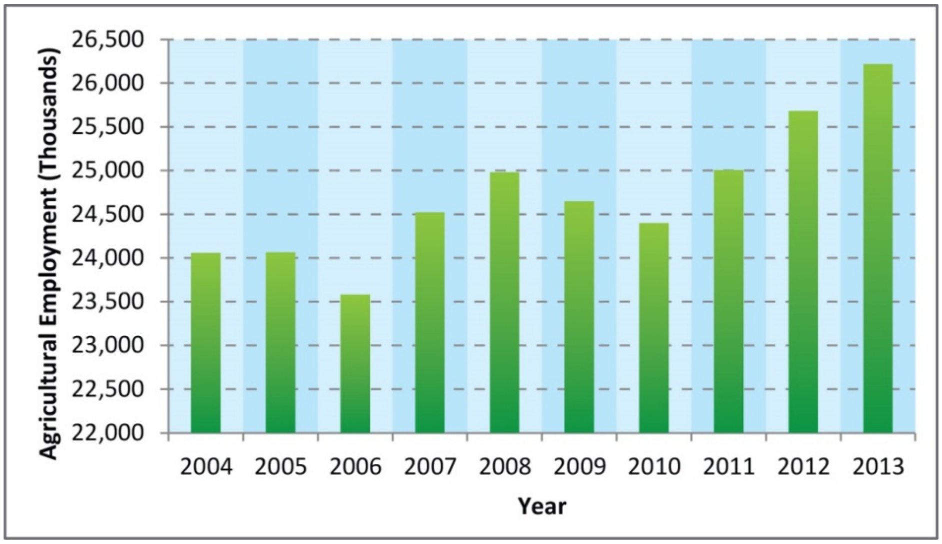
Counties within the Seller Service Area are located within the Sacramento Valley region. Figure 3.11-2 presents the State's agricultural employment for the year 2012. Based on this data, Yolo County employed the largest amount of agricultural employees in the region, employing between 5,001 and 10,000 people. The Sacramento Valley region comprised approximately 6.5 percent of the State's agricultural employment in 2012 (Employment Development Department [EDD] 2012a and EDD 2013).



Source: EDD 2012a

Figure 3.11-2. California Agricultural Employment by Region, 2012

Figure 3.11-3 shows historical agricultural employment between 2002 and 2012 for the Sacramento Valley region. In 2012, the Sacramento Valley region employed over 25,600 people in the agricultural labor market. In 2006, farm worker employment was the lowest for the region with approximately 23,500 jobs. The region has experienced a steady increase in agricultural jobs since 2010.



Source: EDD 2013.

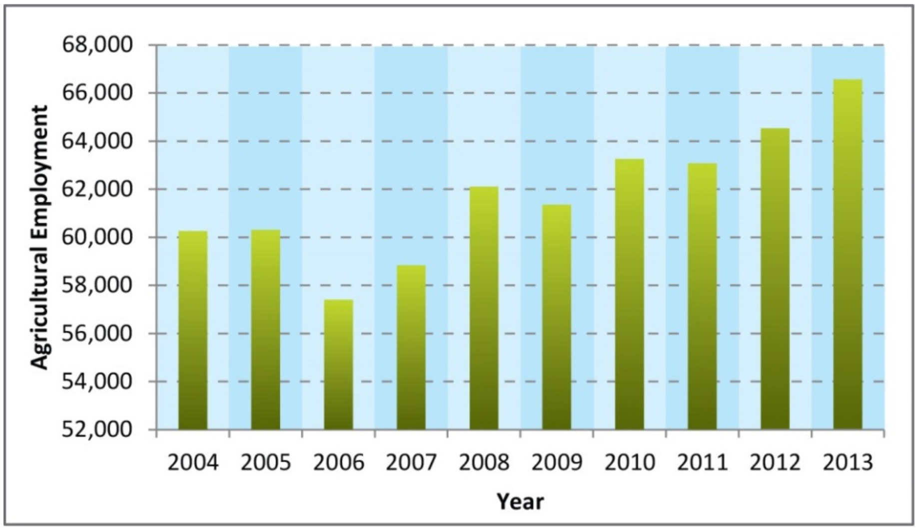
Notes: 2013 Data includes only the months of January to October.

Figure 3.11-3. Sacramento Valley Region Historical Agricultural Employment

Buyer Service Area

Counties within the Buyer Service Area are divided into two agricultural geographical regions. San Benito County is within the Central Coast Agricultural Employment Region, and the other counties are within the San Joaquin Valley Agricultural Employment Region.

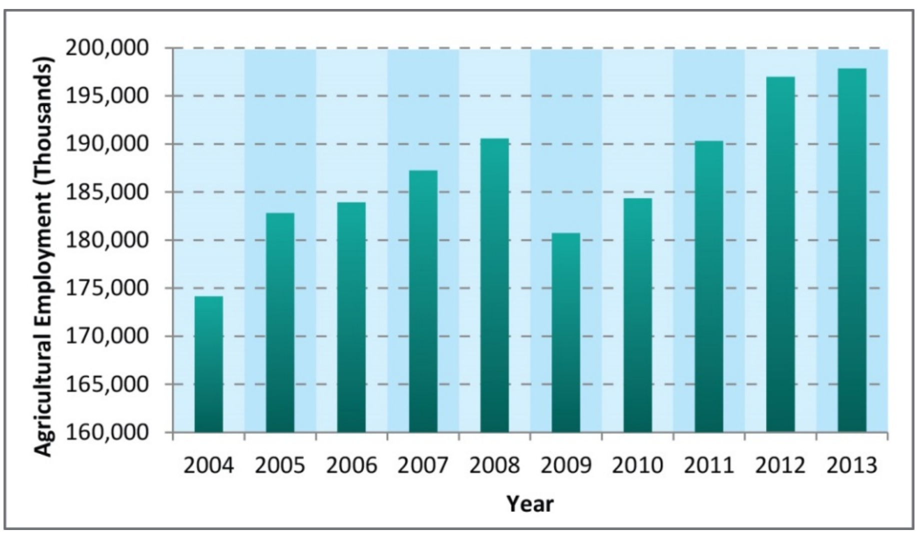
Figure 3.11-4 shows historical agricultural employment between 2002 and 2012 for the Central Coast Agricultural Region. The Central Coast region's agricultural employment has fluctuated over the past ten years with the least amount of agricultural employment occurring in the year 2006, with approximately 57,000 agricultural employed persons. San Benito County alone employed between 1,501 and 5,000 people in the agricultural industry in 2012. As a whole, the Central Coast region comprised approximately 16.2 percent of the State's agricultural employment in 2012 (EDD 2012a and EDD 2013).



Source: EDD 2013.
Notes: 2011 Data includes only the months of January to October.

Figure 3.11-4. Central Coast Region Historical Agricultural Employment

Figure 3.11-5 shows historical agricultural employment between 2002 and 2012 for the San Joaquin Valley region. For the past ten years, the San Joaquin Valley region has consistently employed over 174,000 people annually in the agricultural industry. The region experienced a decline in agricultural employment between the years 2008 and 2009, but has experience a steady increase in proceeding years. The San Joaquin Valley region comprised approximately 49.5 percent of the State's agricultural employment in 2012 (EDD 2012a and EDD 2013).



Source: EDD 2013.
Notes: 2011 Data includes only the months of January to October.

Figure 3.11-5. San Joaquin Valley Region Historical Agricultural Employment

According to EDD's 2008 Agricultural Report, Hispanics comprised 67.9 percent, or two-thirds of the State's agricultural employment in 2008. Fourteen percent of farmworkers reported unemployment and half reported an annual family income of less than $35,000. The majority of employed farmworkers earned $10 or less per hour. Based on these statistics, it is assumed that the majority of California farmworkers are minority and low-income, and could be affected by cropland idling or crop shifting transfers. Tables 3.11-5 through 3.11-10 below describe demographic and economic characteristic data from the U.S. Department of Agriculture (USDA) 2012 Census of Agriculture, U.S. Census Bureau’s 2010 Census, and EDD’s 2008 Agricultural Report. Information for the State of California as a whole is presented for comparison purposes.

Tables 3.11-5 and 3.11-6 present the racial and ethnic composition of farm operators in both the Seller and Buyer Service Areas. This data shows that the vast majority of farm operators in all counties are White, with the lowest percentage exhibited by Sutter County (71.4 percent), which has a large percentage of Asian operators (20.8 percent). For the exception of Butte and Sutter counties, Hispanic farm operators are higher than the state average (11.9 percent compared to 14 percent).

Tables 3.11-7 and 3.11-8 present the racial and ethnic composition of laborers and helpers in the Seller and Buyer Service Areas. Information for the State of California as a whole is presented for comparison purposes. The category "laborers and helpers" excludes construction personnel, as they are captured under a different category by the U.S. Census Bureau; however, the category is not necessarily exclusive to farm laborers and the data may include other manual labor sectors as part of the total. Regardless, the race and ethnic composition of this sector suggests that laborers and helpers, as an employment sector, are generally of minority status, with Hispanics comprising the largest proportion of laborers and helpers, in most cases exceeding that of the state (58.5 percent). This data suggest that impacts to the agricultural industry could be considered to disproportionately accrue to environmental justice populations. According to the CEQ guidance (1997), agencies may consider environmental justice communities either as a group of individuals living in geographic proximity to one other, or "a geographically dispersed/transient set of individuals (such as migrant workers or Native American[s]), where either type of group experiences common conditions of environmental exposure or effect."

Tables 3.11-9 and 3.11-10 present median annual wage information for farming occupations in Seller and Buyer Service Areas. While this data does not demonstrate as clearly as the U.S. Census data the proportion of residents living below the poverty threshold, the information presented in this table does suggest that median incomes in the farming industry are lower than the median income for all industries, with less skilled workers (graders and sorters, farmworkers) earning close to 50 percent of the median wage than that of the state. These data also suggest that impacts to the agricultural industry could be considered to disproportionately accrue to environmental justice populations.

Table 3.11-5. Farm Operators Demographic Characteristics in the Seller Service Area, 2012

Geographic Area	Total Farm Operators	White	Black/African American	American Indian and Alaska Native	Asian	Native Hawaiian/ Pacific Islander	Two or More Races	All Races, Hispanic
Butte	3,230 (100%)	2,908 (90.0%)	4 (0.1%)	70 (2.1%)	141 (4.3%)	4 (0.1%)	28 (0.8%)	295 (9.1%)
Colusa	1,372 (100%)	1,246 (90.8%)	2 (0.1%)	10 (0.7%)	44 (3.2%)	8 (0.5%)	7 (0.5%)	151 (11.0%)
Glenn	2,122 (100%)	1,935 (91.1%)	11 (0.5%)	19 (0.8%)	64 (3.0%)	1 (0.0%)	19 (0.8%)	272 (12.8%)
Solano	1,395 (100%)	1,280 (91.7%)	20 (1.4%)	18 (1.2%)	40 (2.8%)	NA	10 (0.7%)	161 (11.5%)
Sutter	2,297 (100%)	1,641 (71.4%)	3 (0.1%)	41 (1.7%)	479 (20.8%)	13 (0.5%)	29 (1.2%)	179 (7.7%)
Yolo	1,759 (100%)	1,486 (84.4%)	15 (0.8%)	20 (1.1%)	113 (6.4%)	7 (0.3%)	12 (0.6%)	222 (12.6%)
California	126,099 (100%)	111,141 (88.1%)	526 (0.4%)	1,761 (1.3%)	7,474 (5.9%)	455 (0.3%)	1,030 (0.8%)	15,123 (11.9%)

Source: USDA 2012.
Notes:
"Total Minority" cannot be computed from the data provided by the USDA Agriculture Census, as a tabulation of "White Alone, Non-Hispanic" farm operators is not provided.
Key: % = percent

Table 3.11-6. Farm Operators Demographic Characteristics in the Buyer Service Area, 2012

Geographic Area	Total Farm Operators	White	Black/African American	American Indian and Alaska Native	Asian	Native Hawaiian/ Pacific Islander	Two or More Races	All Races, Hispanic
Fresno	9,000 (100%)	6,964 (77.3%)	52 (0.5%)	140 (1.5%)	1,499 (16.6%)	36 (0.4%)	71 (0.7%)	1,616 (17.9%)
Kings	1,941 (100%)	1,621 (83.5%)	13 (0.6%)	29 (1.4%)	74 (3.8%)	7 (0.3%)	8 (0.4%)	235 (12.1%)
Merced	4,170 (100%)	3,585 (85.9%)	14 (0.3%)	41 (0.9%)	323 (7.7%)	35 (0.8%)	14 (0.3%)	572 (13.7%)
San Benito	1,015 (100%)	939 (92.5%)	3 (0.2%)	18 (1.7%)	24 (2.3%)	NA	3 (0.2%)	179 (17.6%)
San Joaquin	5,685 (100%)	5,051 (88.8%)	21 (0.3%)	61 (1.0%)	341 (5.9%)	15 (0.2%)	40 (0.7%)	580 (10.2%)
Stanislaus	6,567 (100%)	6,089 (92.7%)	18 (0.2%)	106 (1.6%)	153 (2.3%)	31 (0.4%)	56 (0.8%)	762 (11.6%)
California	126,099 (100%)	111,141 (88.1%)	526 (0.4%)	1,761 (1.3%)	7,474 (5.9%)	455 (0.3%)	1,030 (0.8%)	15,123 (11.9%)

Source: USDA 2012.

Notes:

"Total Minority" cannot be computed from the data provided by the USDA Agriculture Census, as a tabulation of "White Alone, Non-Hispanic" farm operators is not provided.

Key: % = percent

Table 3.11-7. Laborers and Helpers Demographic Characteristics in the Seller Service Area, 2010

Geographic Area	Total Laborers and Helpers	Race[1]					Hispanic Origin[2]		Total Minority[3]
		White	Black/ African American	American Indian and Alaska Native	Asian	Native Hawaiian/ Pacific Islander	White Alone, Non-Hispanic	All Race, Hispanic	
Butte	**5,595 (100%)**	**3,445 (61.6%)**	**105 (1.9%)**	**15 (0.3%)**	**120 (2.1%)**	**15 (0.3%)**	**880 (15.7%)**	**690 (12.3%)**	**4,715 (84.2%)**
Colusa	**1,715 (100%)**	**245 (14.3%)**	**0 (0.0%)**	**10 (0.6%)**	**4 (0.2%)**	**0 (0.0%)**	**575 (33.5%)**	**875 (51.0%)**	**1,140 (66.4%)**
Glenn	**1,755 (100%)**	**650 (37.0%)**	**0 (0.0%)**	**25 (1.4%)**	**0 (0.0%)**	**0 (0.0%)**	**605 (34.5%)**	**475 (27.1%)**	**1,150 (65.5%)**
Solano	**7,815 (100%)**	**2,225 (28.5%)**	**850 (10.9%)**	**20 (0.3%)**	**525 (6.7%)**	**95 (1.2%)**	**1,835 (23.5%)**	**1,960 (25.1%)**	**5,980 (76.5%)**
Sutter	**4,360 (100%)**	**870 (20.0%)**	**25 (0.6%)**	**45 (1.0%)**	**620 (14.2%)**	**0 (0.0%)**	**1,545 (35.4%)**	**1,135 (26.0%)**	**2,815 (64.5%)**
Yolo	**5,210 (100%)**	**1,515 (29.1%)**	**30 (0.6%)**	**20 (0.4%)**	**170 (3.3%)**	**0 (0.0%)**	**1,935 (37.1%)**	**1,325 (25.4%)**	**3,275 (62.8%)**
California	**870,025 (100%)**	**167,320 (19.2%)**	**29,900 (3.4%)**	**3,085 (0.4%)**	**34,505 (4.0%)**	**3,205 (0.4%)**	**360,550 (41.4%)**	**259,710 (29.9%)**	**509,475 (58.5%)**

Source: U.S. Census Bureau 2010.

Notes:

[1] A minority is defined as a member of the following population groups: American Indian/Alaskan Native, Asian or Pacific Islander, Black (non-Hispanic), or Hispanic.

[2] The term "Hispanic" is an ethnic category and can apply to members of any race, including respondents who self-identified as "White." The total numbers of Hispanic residents for each geographic region are tabulated separately from the racial distribution by the U.S. Census Bureau.

[3] "Total Minority" is the aggregation of all non-white racial groups with the addition of all Hispanics, regardless of race with the total for "Not Hispanic or Latino: While Alone" subtracted from the total population.

Key: Boldface denotes areas with meaningfully greater total minority proportion (more than 50 percent). % = percent

Table 3.11-8. Laborers and Helpers Demographic Characteristics in the Buyer Service Area, 2010

Geographic Area	Total Laborers and Helpers	Race[1]					Hispanic Origin[2]		Total Minority[3]
		White	Black/ African American	American Indian and Alaska Native	Asian	Native Hawaiian/ Pacific Islander	White Alone, Non-Hispanic	All Race, Hispanic	
Fresno	46,120 (100%)	4,085 (8.9%)	580 (1.3%)	130 (0.3%)	1,160 (2.5%)	0 (0.0%)	24,800 (53.8%)	14,910 (32.3%)	21,320 (46.2%)
Kings	9,520 (100%)	1,430 (15.0%)	55 (0.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	6,415 (67.4%)	1,615 (17.0%)	3,105 (32.6%)
Merced	**13,835 (100%)**	**6,175 (44.6%)**	**175 (1.3%)**	**0 (0.0%)**	**405 (2.9%)**	**35 (0.3%)**	**2,305 (16.7%)**	**4,625 (33.4%)**	**11,530 (83.3%)**
San Benito	**3,350 (100%)**	**345 (10.3%)**	**0 (0.0%)**	**0 (0.0%)**	**0 (0.0%)**	**0 (0.0%)**	**1,135 (33.9%)**	**1,840 (54.9%)**	**2,215 (66.1%)**
San Joaquin	**22,330 (100%)**	**4,110 (18.4%)**	**840 (3.8%)**	**85 (0.4%)**	**1,245 (5.6%)**	**105 (0.5%)**	**8,845 (39.6%)**	**6,855 (30.7%)**	**13,485 (60.3%)**
Stanislaus	16,835 (100%)	4,195 (24.9%)	160 (1.0%)	25 (0.1%)	410 (2.4%)	75 (0.4%)	8,530 (50.7%)	3,245 (19.3%)	8,305 (49.3%)
California	**870,025 (100%)**	**167,320 (19.2%)**	**29,900 (3.4%)**	**3,085 (0.4%)**	**34,505 (4.0%)**	**3,205 (0.4%)**	**360,550 (41.4%)**	**259,710 (29.9%)**	**509,475 (58.5%)**

Source: U.S. Census Bureau 2010.

Notes:

[1] A minority is defined as a member of the following population groups: American Indian/Alaskan Native, Asian or Pacific Islander, Black (non-Hispanic), or Hispanic.

[2] The term "Hispanic" is an ethnic category and can apply to members of any race, including respondents who self-identified as "White." The total numbers of Hispanic residents for each geographic region are tabulated separately from the racial distribution by the U.S. Census Bureau.

[3] "Total Minority" is the aggregation of all non-white racial groups with the addition of all Hispanics, regardless of race with the total for "Not Hispanic or Latino: While Alone" subtracted from the total population.

Key: Boldface denotes areas with meaningfully greater total minority proportion (more than 50 percent).% = percent

Table 3.11-9. Agricultural Workers Median Annual Wages in the Seller Service Area, 2012

Geographic Area	Farming, Fishing, and Forestry Occupations – Overall	First-Line Supervisors	Agricultural Inspectors	Graders and Sorters	Equipment Operators	Farmworkers (Crop, Nursery, and Greenhouse)	Farmworkers (Farm and Ranch Animals)	Agricultural Workers, All Other	Median Wage All Industries
Butte	$24,419	$69,875	NA	NA	$22,266	$19,963	$21,223	$38,175	$42,460
Colusa and Glenn[1]	$22,045	$42,837	NA	$26,405	NA	$19,648	$21,108	NA	$40,334
Solano	$22,017	$52,593	NA	NA	NA	$19,276	NA	NA	$49,281
Sutter	$20,622	$38,876	NA	$21,827	NA	$19,431	NA	NA	$42,633
Yolo	$24,718	$71,783	NA	$19,292	$26,950	$19,658	$25,809	$58,120	$52,261
California	$20,994	$43,958	$47,283	$19,594	$24,150	$19,551	$25,672	$28,725	$52,630

Source: EDD 2012b.
Notes:
[1] The EDD Occupational Employment & Wage data combines the counties of Colusa and Glenn, in addition to Tehama County, as part of the North Valley Region.
Key: No = applicable data not available for this jurisdiction

Table 3.11-10. Agricultural Workers Median Annual Wages in the Buyer Service Area, 2012

Geographic Area	Farming, Fishing, and Forestry Occupations – Overall	First-Line Supervisors	Agricultural Inspectors	Graders and Sorters	Equipment Operators	Farmworkers (Crop, Nursery, and Greenhouse)	Farmworkers (Farm and Ranch Animals)	Agricultural Workers, All Other	Median Wage All Industries
Fresno	$19,504	$31,512	$41,275	$19,847	$19,836	$18,821	$21,368	$38,584	$41,852
Kings	$19,786	$40,077	NA	$18,262	$23,403	NA	NA	$23,225	$45,004
Merced	$20,369	$37,484	NA	$19,643	$20,787	$18,467	NA	$28,184	NA
San Benito	$23,247	$52,471	$43,889	NA	$30,441	$19,813	$27,080	NA	$70,820
San Joaquin	$19,682	$44,505	$51,376	$18,751	$21,898	$18,356	$21,898	$39,273	$43,467
Stanislaus	$20,047	$43,186	$52,099	$19,972	$25,883	$18,986	$28,265	NA	$42,883
California	$20,994	$43,958	$47,283	$19,594	$24,150	$19,551	$25,672	$28,725	$52,630

Source: EDD 2012b.

3.11.2 Environmental Consequences/Environmental Impacts

The National Environmental Policy Act (NEPA) requires an analysis of social, economic, and environmental justice effects; however, there is no standard set of criteria for evaluating environmental justice impacts. According to the California Environmental Quality Act (CEQA), economic and social impacts are not considered significant effects on the environment. Therefore, no significance determinations are made or mitigation measures required in the impact analyses. For purposes of this Environmental Impact Statement/Environmental Impact Report, the No Action/No Project Alternative is the basis of comparison, as required by NEPA.

The section presents assessment methods performed to analyze the environmental justice effects and presents the potential environmental justice effects of the proposed alternatives.

3.11.2.1 Assessment Methods

This section describes the assessment methods used to analyze potential environmental justice effects of the project alternatives, including the No Action/No Project Alternative.

The CEQ (1997) recommends that the following three factors be considered by the environmental justice analysis to determine whether disproportionately high and adverse impacts may accrue to minority or low-income populations. Impacts on Indian tribes are discussed in detail in Section 3.12, Indian Trust Assets.

- Whether there is or would be an impact on the natural or physical environment that significantly and adversely affects a minority population, low-income population, or Indian tribe. Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural environment.

- Whether the environmental effects are significant and are, or may be, having an adverse impact on minority populations, low-income populations, or Indian tribes that appreciably exceeds or is likely to appreciably exceed those on the general population or other appropriate comparison group.

- Whether the environmental effects occur or would occur in a minority population, low-income population, or Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards.

The methodologies and thresholds used in this analysis are taken from the U.S. Environmental Protection Agency's (USEPA) final guidance on incorporating environmental justice concerns into NEPA analysis (USEPA 1998) and help define minority and low-income populations. The guidance states that a minority and/or low-income population may be present in an area if the proportion of the populations in the area of interest are "meaningfully greater" than that of the general population, or where the proportion exceeds 50 percent of the total population.

3.11.2.1.1 Minority

The CEQ (1997) defines the term "minority" as persons from any of the following U.S. Census categories for race: Black/African American, Asian, Native Hawaiian or Other Pacific Islander, and American Indian or Alaska Native. Additionally, for the purposes of this analysis, "minority" also includes all other nonwhite racial categories, such as "some other race" and "two or more races." The CEQ also mandates that persons identified through the U.S. Census as ethnically Hispanic, regardless of race, should be included in minority counts (CEQ 1997). Hispanic origin is considered to be an ethnic category separate from race, according to the U.S. Census. For this analysis, regional populations for the Seller and Buyer Service Areas were compared to the State of California as a whole. Regional populations exceeding 50 percent were considered environmental justice populations.

Based on demographic characteristic data presented above Colusa, Solano, Sutter, and Yolo counties in the Seller Service Area and counties in the Buyer Service Area are considered minority affected areas.

3.11.2.1.2 Low-Income

Persons living with income below the poverty level are identified as "low-income," according to the annual statistical poverty thresholds established by the U.S. Census Bureau. The U.S. Census Bureau poverty threshold indicates that the poverty level in 2012 for an individual was $11,720 and for a family of four (two adults and two children $23,492. The CEQ guidance states that a demographic area exhibiting a proportion of people living in poverty two times higher than the State average of 12.9 percent (A total of 25.8 percent was considered to be meaningfully greater for this analysis) are considered environmental justice populations (CEQ 2007). This analysis also considered whether an area's median household incomes were substantially lower than that of the state average.

Based on economic characteristic data presented above no low-income affected areas exist within the environmental justice area of analysis.

Although by definition no low-income affect areas exist, historical agricultural data presented above, depicts farmworkers within these counties as both minority and low-income populations that could be adversely and disproportionately affected by transfers. Because low-income – farmworker populations exist in all of the Seller and Buyer Service Area counties, these counties are evaluated further as low-income populations for the purpose of this analysis.

3.11.2.1.3 Cropland Idling and Crop Shifting Transfers

Cropland idling and crop shifting transfers could have adverse and disproportionate effects on minority and low-income populations identified above.

If transfers resulted in adverse and disproportionate effects on farmworker employment, there would be environmental justice effects to minority populations. This analysis uses full-time labor equivalents per 1,000 acres of idled cropland to estimate the changes in farmworker employment that could be caused by cropland idling transfers. Crops considered in this analysis include alfalfa, corn, rice and tomatoes, which are assumed to be representative of potential crops eligible for idling. Section 3.10, Regional Economics, discusses the use of representative crops for the cropland idling analysis and Chapter 2 Project Description, and identifies all the eligible crops for idling.

Table 3.11-11 presents the full-time labor equivalents for each representative crop. Labor requirements are based upon University of California Cooperative Extension (UCCE) cost and return studies for each representative crop. The average number of full-time workers per 1,000 acres includes both machine and non-machine labor (UCCE 2007, 2008a, 2008b, and 2008c). The UCCE studies do not distinguish between migrant and non-migrant workers and only include on-farm, hired labor. While some farmworkers work overtime, this analysis is based on a standard 40-hour work week.

Table 3.11-11. Full-Time Labor Equivalents

Representative Crop	Number of Full Time Workers/1,000 acres
Alfalfa	1.0
Corn	5.5
Rice	2.~~6~~5
Tomatoes	13.7

Source: UCCE ~~2007~~2012, 2008a, 2008b, and 2008c.

Note:

Full-time labor equivalents are based on a 2,000 hour per acre assumption

This analysis calculates the farmworker employment effects from cropland idling by estimating the total number of jobs per acre times the number of acres that could be idled under each alternative. The maximum idling actions would not likely occur in a single year; therefore, average annual effects would be less than those described in this section. To determine if an effect would be adverse and disproportionately high on minority populations, this analysis compares losses in farmworker employment as a result of transfers to total farmworker employment in the region. The change is compared to historical fluctuations in farm worker employment in the region.

Any job losses in either the Seller or Buyer Service Area counties could result in adverse and disproportionately high effects on low-income populations. Section 3.10, Regional Economics, uses the IMPLAN software to derive the total number of jobs affected by cropland idling transfers. Farmworkers are only one labor category of many that could be affected by transfers. Other types of employment influenced by transfers could include, but are not limited to, agricultural support services, wholesale trade, and trucking services. This analysis compares decreases in employment to total employment within the region to determine if an effect wou1d be adverse and disproportionately high on low-income populations. Environmental justice effects of crop shifting transfers are evaluated qualitatively.

3.11.2.2 Alternative 1: No Action/No Project

3.11.2.2.1 Seller Service Area

There would be no adverse and disproportionate effects to minority and low-income farm workers in the Seller Service Area. Under the No Action/No Project Alternative, sellers in the Seller Service Area would not transfer water; therefore, there would be no effect to low income and minority populations in the Seller Service Area and there would be no change from existing conditions.

3.11.2.2.2 Buyer Service Area

There would be no adverse and disproportionate effects to minority and low-income farm workers in the Buyer Service Area. Under existing conditions, farmers in the Buyer Service Area face potential shortages in Central Valley Project (CVP) water supplies. Farmers take various actions in response to potential shortages, including cropland idling, shifting to less water intensive crops. Cropland idling or some shifting actions cause reductions in agricultural employment and adversely and disproportionately affect minority and low-income populations in the Buyer Service Area. Under the No Action/No Project Alternative, these actions would continue in response to CVP shortages.

As mentioned above, all counties in the Buyer Service Area are all considered minority and low-income populations. Reductions in farm employment because of idling fields could result in adverse and disproportionately high effects to minority and low-income farm workers under existing conditions. These conditions would continue under the No Action/No Project Alternative.

3.11.2.3 Alternative 2: Full Range of Transfers (Proposed Action)

3.11.2.3.1 Seller Service Area

Cropland idling transfers could adversely and disproportionately affect minority and low-income farm workers in the Seller Service Area. Cropland idling transfers could reduce farm worker jobs, by temporarily taking farmland out of production and decreasing demand for farm labor. Table 3.11-12 presents the estimated maximum annual cropland idling acreage and crop type under the Proposed Action. A maximum of 59,973 acres could be idled under the Proposed Action; however, because cropland idling transfers are the lowest priority for buyers, the maximum acreage would not likely be idled in each transfer year. In some transfer years, buyers would not purchase any transfer water via cropland idling. Farm labor effects would occur only when cropland idling transfers took place.

Table 3.11-12. Maximum Proposed Acreage for Cropland Idling under the Proposed Action

Region	Rice	Alfalfa	Corn	Tomatoes	Total Acres Idled~~(Acre Feet)~~
Colusa, Glenn, and Yolo counties	40,704	1,400	400	400	42,904
Solano County	0	3,000	1,500	0	4,500
Sutter, Butte counties	10,769	600	800	400	12,569
				Total	**59,973**

Table 3.11-13 identifies the number of full-time farm workers whose jobs would be affected by maximum cropland idling in each region. This was calculated using the full-time labor equivalents in Table 3.11-11 and the proposed cropland idling acreages in Table 3.11-12. Table 3.11-13 compares the number of farm workers who would lose jobs through cropland idling transfers to the total farm worker employment.

Table 3.11-13. Farm Worker Effects from Proposed Cropland Idling in the Seller Service Area under the Proposed Action

Region/ County	Total County Farmworkers[1]	Farm Worker Jobs Affected by Proposed Action	Percent of Total Farm Worker Employment Affected	Maximum Annual Percent Change in Farm Worker Employment from 2003 to 2013[1]
Glenn/ Colusa/Yolo	9,940	-161	0.02%	15% (occurred 2001-2002)
Solano	1,600	-15	0.01%	15% (occurred 2006-2007)
Sutter/Butte	6,600	-54	0.01%	9% (occurred 2003-2004)
Total	**18,140**	**-230**	**0.01%**	**5% (occurred 2007-2008)**

Source: EDD 2013.
Notes:
[1] Based on 2010 Labor Market Statistics.

Farm worker job losses as a result of cropland idling transfers are within historic annual fluctuation in farm worker employment. In most transfer years, fewer acres would be idled than those described here and effects to farm worker employment would be less. All farm worker effects of the Proposed Action would be temporary. Cropland idling under the Proposed Action would not result in an adverse and disproportionately high effect to farm workers.

Crop shifting transfers could adversely and disproportionately affect minority and low-income populations in the Seller Service Area. For crop shifting transfers, farmers would switch from a higher water use crop to a lower water use crop, such as wheat, and sell the excess water for transfer. In general, crop shifting would have smaller labor effects relative to cropland idling, because the farmer continues to produce a crop and must hire farm labor. Farmers would also continue to purchase inputs and services for crop production, which would support additional jobs throughout the regional economy. Therefore, crop shifting in the Seller Service Area would have a beneficial effect on minority and low-income populations.

3.11.2.3.2 Buyer Service Area

Use of cropland modification transfers could adversely and disproportionately affect minority and low-income farm workers in the Buyer Service Area. Under the Proposed Action, potential buyers in the Buyer Service Area would receive transfer water to supplement water supplies during dry and critical years. Water would be used for existing agricultural uses, which would support farm worker and other employment in the counties. Minority and low-income populations within the Buyer Service Area would benefit from a supplemented water source; therefore, transfers would have a beneficial effect on minority and low-income populations in the Buyer Service Area.

3.11.2.4 Alternative 3: No Cropland Modifications

3.11.2.4.1 Seller Service Area

Use of cropland modification transfer could adversely and disproportionately affect minority or low-income populations in the Seller Service Area. Under the No Cropland Modifications Alternative, cropland modifications would not occur; therefore, there would be no effect to low income and minority populations in the Seller Service Area from implementation of cropland idling or shifting transfers.

3.11.2.4.2 Buyer Service Area

Use of cropland modification transfers could adversely and disproportionately affect minority and low-income farm workers in the Buyer Service Area. Under the No Cropland Modifications Alternative, cropland modifications would not occur; however, the Buyer Service Area would still receive transfers through other methods, i.e., groundwater substitution. Minority and low-income populations within the Buyer Service Area would benefit from a supplemented water source; therefore, transfers would have a beneficial effect on minority and low-income populations in the Buyer Service Area.

3.11.2.5 Alternative 4: No Groundwater Substitution

3.11.2.5.1 Seller Service Area

Cropland idling transfers could disproportionately and adversely affect minority and low-income farm workers in the Seller Service Area. Under the No Groundwater Substitution Alternative, effects on farm workers from cropland idling would be the same as those under the Proposed Alternative. Farm worker job losses as a result of crop idling transfers are within historic annual fluctuation in farm worker employment. In most transfer years, fewer acres would be idled than those described here and effects to farm worker employment would be less. All farm worker effects of the No Groundwater Substitution Alternative would be temporary. Cropland idling under the No Groundwater Substitution Alternative would not result in an adverse and disproportionately high effect to farm workers.

Crop shifting transfers could adversely and disproportionately affect minority and low-income populations in the Seller Service Area. Under the No Groundwater Substitution Alternative, effects on farm workers from crop shifting would be the same as those under the Proposed Alternative. For crop shifting transfers, farmers would switch from a higher water use crop to a lower water use crop, such as wheat, and sell the excess water for transfer. In general, crop shifting would have smaller labor effects relative to crop idling, because the farmer continues to produce a crop and must hire farm labor. Therefore, crop shifting in the Seller Service Area would have a beneficial effect on minority and low-income populations.

3.11.2.5.2 Buyer Service Area

Use of cropland modification transfers could adversely and disproportionately affect minority and low-income farm workers in the Buyer Service Area. Under the No Groundwater Substitution Alternative, effects on minority or low-income populations in the Buyer Service Area would be the same as those under the Proposed Project. Minority and low-income populations within the Buyer Service Area would benefit from a supplemented water source; therefore, transfers would have a beneficial effect on minority and low-income populations in the Buyer Service Area.

3.11.3 Comparative Analysis of Alternatives

Table 3.11-14 summarizes the potential effects of each of the action alternatives and the No Action/No Project Alternative.

Table 3.11-14. Comparative Analysis of the Alternatives

Potential Effect	Alternative	Conclusion
Cropland idling transfers could adversely and disproportionately affect minority and low-income farm workers in the Seller Service Area.	2, 3	No disproportionately high or adverse effect
Crop shifting transfers could adversely and disproportionately affect minority and low-income farm workers in the Seller Service Area.	2, 3	No disproportionately high or adverse effect
Use of cropland modification transfers could adversely and disproportionately affect minority and low-income farm workers in the Buyer Service Area.	2, 3, 4	Beneficial

3.11.3.1 No Action/No Project Alternative

There would be no changes to the existing environmental justice conditions in the Seller Service Area. In the Buyer Service Area, farmers would continue to face water shortages and in response, would continue to idle fields. These actions would affect farm worker employment similar to existing conditions.

3.11.3.2 Alternative 2: Full Range of Transfers (Proposed Action)

Cropland idling transfers under the Proposed Action could decrease farm labor demands in environmental justice affected areas; however, these effects would be temporary in nature and minimal compared to total farm labor. Effects to the Buyer Service Area would be beneficial; as proposed transfers would increase water supplies in environmental justice affected areas and support farm worker and other employment opportunities.

3.11.3.3 Alternative 3: No Cropland Modifications

Alternative 3 does not include cropland modification transfers. The potential effects on minority and low-income populations in the Seller Service Area from these actions as described under the Proposed Action would not occur.

Because other transfers would still occur, including groundwater pumping, effects to the Buyer Service Area would be the same as those described under the Proposed Action.

3.11.3.4 Alternative 4: No Groundwater Substitution

Alternative 4 would have the same effects in both the Seller and Buyer Service Areas as those described under the Proposed Action.

3.11.4 Cumulative Effects

The timeframe for the environmental justice cumulative effects analysis extends from 2015 through 2024, a ten year period. The relevant geographic study area for the cumulative effects analysis is the same area of analysis as shown in Figure 3.11-1. The following section analyzes the cumulative effects using both the project and the projection methods, which are further described in Chapter 4. Chapter 4 describes the projects included in the cumulative condition and growth and development trends in the area of analysis.

The cumulative analysis for environmental justice considers projects and conditions that could affect employment and income for minority and low-income populations in the area of analysis.

The following sections describe potential environmental justice effects for each of the proposed alternatives.

3.11.4.1 Alternative 2: Full Range of Transfers (Proposed Action)

Cropland idling and crop shifting transfers under the Proposed Action in combination with other projects could cumulatively adversely and disproportionately affect minority and low-income populations in the Seller Service Area. Under the Proposed Action, some sellers would implement crop idling and or shifting measures in order to transfer water to buyers south of the Delta.

Similar to the water transfers in the Proposed Action, State Water Project (SWP) contractors could also implement water transfers that include crop idling and shifting measures. The transfers would be voluntary and on a year-to-year basis. The majority of SWP transfers would occur from sellers within the Feather River region, mostly in Butte and Sutter counties.

Cropland idling transfers within Butte and Sutter counties could result in additional crops to be taken out of production, further decreasing available employment for farm workers in the area. Under the Proposed Action, Butte and Sutter counties crop idling transfers could result in the idling of a maximum 12,569 acres, including a maximum of 10,769 acres of rice lands. This would decrease 54 farm worker jobs during the transfer year, and approximately 0.01 percent of total farm employment in the region. Cumulative effects could add an additional 37,111 acres of rice to be idled, which could reduce employment by an additional 133 jobs. The total cumulative effects would be minor relative to the regional baseline. Employment effects would be temporary, and because of the temporary nature of effects and the relatively low percentage of farm worker losses relative to total agricultural employment, crop idling would not cause a cumulative adverse and disproportionately high effect to minority and low-income farm workers.

Repeated SWP crop idling transfers within a small geographic area could result in adverse and disproportionately high cumulative effects to low-income and minority populations. During these years, the buyers would focus CVP crop idling transfers in locations outside of Sutter and Butte County. Therefore, the Proposed Action would not contribute to cumulative effects to minority and low-income farm workers.

Changes in agricultural land conversion and land protection programs could also affect farm worker employment in the cumulative condition. Section 3.9, Agricultural Land Use, describes several programs aimed at protecting agricultural and open space lands. The 2008 Farm Bill provides financial incentives and technical assistance to keep land in agricultural production (USDA 2008). These programs would help farmers keep their land in private ownership and continue agricultural production in the long-term under the cumulative condition, which would protect jobs for minority and low-income farm workers.

Additionally, counties proposing crop idling transfers include agricultural elements in their local general plans that outlay policies and guidelines to preserve and protect agricultural resources and limit urban development and agricultural land conversions. Examples of these policies and programs include tax and economic incentives, the continued existence of large, contiguous areas of agricultural zoning, Williamson Act and Farmland Security Zone Programs, Right-to-Farm ordinances, and buffer zone requirements. These programs would also protect farm worker employment under the cumulative condition.

Agricultural land is being converted in support of urban development in the Seller Service Area. Permanent land conversions could decrease farm worker employment in the cumulative condition. Population projections generally reflect future development conditions, which assume conversion of undeveloped lands in order to accommodate projected increases in population. Section 3.9.6.1 includes population and land use projections for municipal areas in the Sellers Service Area. Development that converts farm land to non-agricultural uses would affect minority farmworker employment; however, urban development would likely include low-income housing and develop new job opportunities for minority and low-income populations. The Proposed Action in combination with other cumulative actions that could remove farmland from production could have a cumulatively adverse and disproportionate effect on minority and low-income employment. The Proposed Action would only involve temporary crop idling; therefore, the Proposed Action's incremental contribution to these cumulative effects would not be cumulatively considerable.

Water transfers under the Proposed Action in combination with other projects could cumulatively adversely or disproportionately affect minority and low-income residents in the Buyer Service Area. The Proposed Action would increase water supplies for agricultural uses in the Buyer Service Area, which would support farm worker employment. Farm protection programs and local general plan policies would preserve land in agricultural production; however, water supplies may not be available for irrigation. If water is not available, farmers may choose to idle land, which would reduce demands for farm worker employment. Refuge transfers could purchase water from sellers in the San Joaquin Valley near the Buyers Service Area that make water available through cropland idling, but this would represent a very small change in land use.

The loss of farmland to expanding urban uses could affect minority and low-income employment under the cumulative condition. Figure 3.11-2 shows that in 2012, these counties combined employed between about 75,000 and 160,000 people in the agricultural labor market. These counties populations are also projected to grow at some of the fastest rates in the Buyer Service Area

(Department of Finance 2007). This could reduce demand for agricultural employment as land is converted to urban uses.

Although urban development can potentially reduce available agricultural land, it also has the potential to provide additional job and economic opportunities for minority and low-income populations. Under the cumulative condition, agricultural to urban land use conversions could result in an adverse or disproportionate effect on minority and low-income populations in the Buyer Service Area; however, urban development could also provide additional economic and job opportunities for minority and low-income populations.

3.11.4.2 Alternative 3: No Cropland Modifications

Cropland idling and crop shifting transfers under Alternative 3 in combination with other projects could cumulatively adversely and disproportionately affect minority and low-income populations in the Seller Service Area. Since there would be no cropland modifications under Alternative 3 there would be no cumulative effect to minority and low-income populations.

Water transfers under Alternative 3 in combination with other cumulative projects could adversely or disproportionately affect minority and low-income residents in the Buyer Service Area. Cumulative effects in the Buyer Service Area under Alternative 3 would be the same as those described under the Proposed Action.

3.11.4.3 Alternative 4: No Groundwater Substitution

Cropland idling and crop shifting transfers under Alternative 4 in combination with other projects could cumulatively adversely and disproportionately affect minority and low-income populations in the Seller Service Area. Cumulative cropland modification effects under Alternative 4 would have the same effects as those experienced under the Proposed Action.

Water transfers under Alternative 4 in combination with other projects could cumulatively adversely or disproportionately affect minority and low-income residents in the Buyer Service Area. Cumulative effects in the Buyer Service Area would be the same as those described under the Proposed Action.

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Section 3.12
Indian Trust Assets

This section presents the Indian Trust Assets (ITAs) within the area of analysis and discusses potential effects on ITAs from the proposed alternatives.

ITAs are defined as legal interests in property held in trust by the United States government for Indian tribes or individuals, or property protected under U.S. Law for Indian tribes or individuals. An Indian trust has three components: 1) the trustee, 2) the beneficiary, and 3) the trust asset. ITAs can include land, minerals, federally-reserved hunting and fishing rights, federally-reserved water rights, and in-stream flows associated with a reservation or Rancheria. Beneficiaries of the Indian trust relationship are federally-recognized Indian tribes with trust land; the U.S. is the trustee. By definition, ITAs cannot be sold, leased, or otherwise encumbered without approval of the U.S. The characterization and application of the U.S. trust relationship have been defined by case law that supports Congressional acts, executive orders, and historic treaty provisions.

It is the general policy of the Department of the Interior (DOI), Bureau of Reclamation (Reclamation) to carry out activities in a manner that protects ITAs and avoids adverse effects whenever possible (Reclamation Indian Trust Asset Policy, July 2, 1993). In the event an effect is identified, consultation with affected federally recognized tribal governments proceeds through the Bureau of Indian Affairs (BIA), the Office of the Solicitor, and the Office of American Indian Trust (OAIT).

Groundwater substitution transfers could affect ITAs by increasing groundwater depth and increasing groundwater pumping costs, or stream depletion near ITA sites. Lower groundwater elevations and increased pumping costs could interfere with the exercise of federally-reserved Indian rights. An increase in groundwater pumping could cause an increase in stream flow temperatures which could affect fish which in turn could interfere with the exercise of federally-reserved Indian rights. Cropland idling, crop shifting, reservoir release and conservation transfers would not result in effects to ITAs; therefore, these measures are not further discussed in this analysis. Water purchase agreements are structured to recognize local leadership and work cooperatively with water associations, local government, and local interests, including tribes.

3.12.1 Affected Environment/Environmental Setting

This section describes the area of analysis, regulatory requirements, and environmental setting relevant to ITAs.

3.12.1.1 Area of Analysis

The area of analysis for ITAs includes the reservations or Rancherias that overlay the Sacramento Valley Groundwater Basin where groundwater substitution transfers could occur. In addition, the area of analysis includes reservations or Rancherias within the Buyer Service Area that could benefit from use of transfer water. Figure 3.12-1 shows the area of analysis.

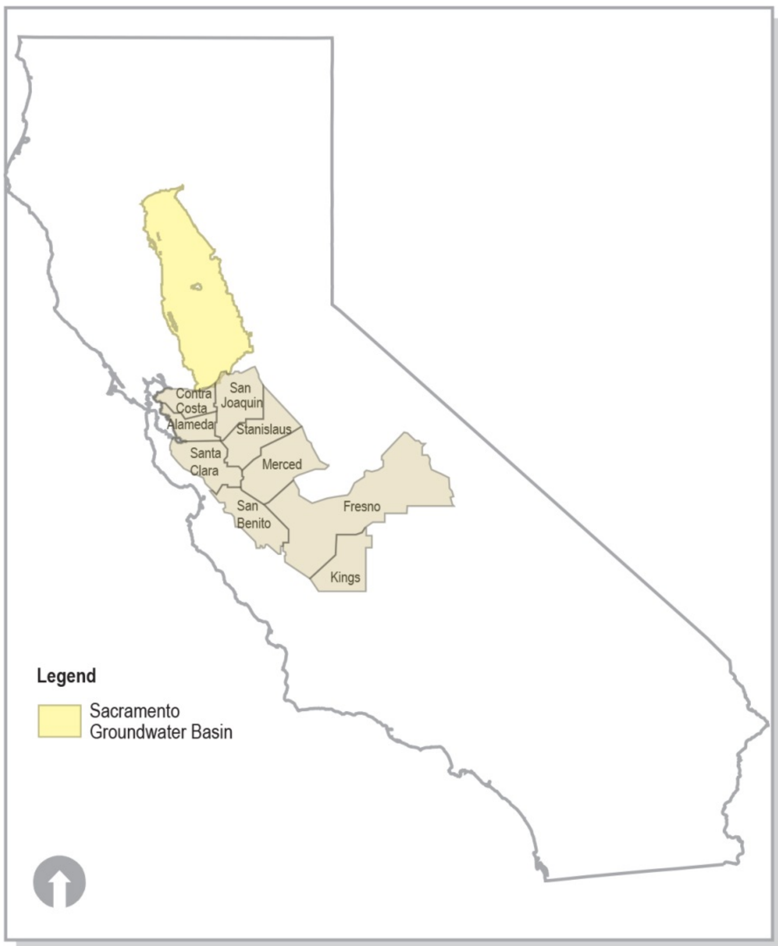


Figure 3.12-1. ITAs Area of Analysis

3.12.1.2 Regulatory Setting

This section describes the applicable laws and rules relating to ITAs. ITAs are regulated by the federal government; therefore, state and regional/local policies do not apply.

President William J. Clinton's 1994 memorandum, "Government-to-Government Relations with Native American Tribal Governments," directed the Bureau of Reclamation (Reclamation) to assess the effects of its programs on tribal trust resources and federally-recognized tribal governments. Reclamation is tasked with actively engaging federally-recognized tribal governments and consulting with such tribes on a government-to-government level (59 Federal Register 1994). Order number 3215, *Principles for the Discharge of the Secretary's Trust Responsibility*, assigns responsibility for ensuring protection of ITAs to the heads of bureaus and offices (Reclamation 2012). Reclamation is required to "protect and preserve Indian trust assets from loss, damage, unlawful alienation, waste, and depletion" (Reclamation 2012). Reclamation is responsible for assessing whether transfers would have the potential to affect ITAs.

It is the general policy of the DOI to perform its activities and programs in such a way as to protect ITAs and avoid adverse effects whenever possible (Reclamation 2012). Reclamation complies with procedures contained in Departmental Manual Part 512 (DOI 1995), which are guidelines that protect tribal resources and require Secretary of the Interior approval before sale of land, natural resources, water, or other assets. Federally-reserved water rights held in trust for tribes by the U.S. are ITAs that are restricted from being separated from tribes and individual Indians without the approval of the Secretary of the Interior.

3.12.1.3 Existing Conditions

The following section describes the existing ITAs within the area of analysis for both the Seller Service Area and Buyer Service Area.

3.12.1.3.1 Seller Service Area

The northernmost indigenous people in the Sacramento Valley region were the Achowami, Atsugewi, Ajumawi, Wintun, Pit River, and the Yana (San Diego State University 2002). Descendants of these tribes live on the Big Bend, Burney Tract, Montgomery Creek, Redding, and Roaring Creek Rancherias in Shasta County (San Diego State University 2002, Redding Rancheria 2000).

Maidu and Wintun people inhabited the area of the Colusa Basin (Camp Dresser & McKee Inc. 1995; Glenn-Colusa Irrigation District, California Department of Fish & Game, Reclamation, U.S. Army Corps of Engineers 1998). The Wintun Tribe comprises three divisions: Patwin, Nomlaki, and Wintu. Present-day descendants of the Wintun live on the Colusa and Cortina Rancherias in Colusa County and the Rumsey Rancheria in Yolo County. Wintun-Wailaki descendants in Glenn County live on the Grindstone Creek Rancheria (San Diego State University 2002). The Paskenta Band of Nomlaki Indians has a tract of trust land in Tehama County (U.S. Census Bureau 2010).

An integrated group of both Maidu and Miwok Indians, historically inhabited parts of the Sierra Nevada Foothills near the American River. Descendants of the tribe, now recognized as the United Auburn Indian Community, hold trust land in Placer County known as the Auburn Rancheria (United Auburn Indian Community, Auburn Rancheria N.D.).

The Shingle Springs Band of Miwok Indians, also descendants of the Miwok and Maidu Indians, in addition to the Nisenan Indians, inhabits parts of El Dorado County, just southwest of the Auburn Rancheria (Shingle Springs Band of Miwok Indians 2012). There are no reservations or Rancherias in Sacramento County (U.S. Census Bureau 2010).

Evidence indicates the Wintun and Maidu people inhabited areas near the Feather River for thousands of years, including portions of the Central Valley and western slopes of the Sierra Nevada to the north and northeast of the Sutter Buttes (City of Oroville 1995; Butte County 1998). Descendants of the Maidu live on the Mooretown and Berry Creek Rancherias in Butte County (San Diego State University 2002). The Enterprise Rancheria is currently a landless tribe of Maidu descendants, but has filed an application for a fee-to-trust transfer and casino and hotel project to be located in Yuba County (70 Federal Register 10138). The Mechoopda Indian Tribe of the Chico Rancheria recently acquired land in fee status in Butte County. There are no reservations or Rancherias in Sutter County (U.S. Census Bureau 2010).

3.12.1.3.2 Buyer Service Area

East Bay Municipal Utility District (MUD)
East Bay MUD provides water services to residents of Alameda and Contra Costa Counties. The Lytton Band of Pomo Indians holds trust land in the City of San Pablo, in Contra Costa County, where they own and operate the San Pablo Lytton Casino (San Pablo Lynton 2011, Rivera 2012). The tribe is serviced by East Bay MUD (Riveria 2012). Alameda County contains no reservations or Rancherias (U.S. Census Bureau 2010).

Contra Costa Water District (WD)
Contra Costa WD also provides water services to residents of Contra Costa County. Although, the Lytton Rancheria is located in Contra Costa County, it is served by the East Bay MUD. There are no other reservations or Rancherias within the Contra Costa WD service boundaries.

San Luis & Delta-Mendota Water Authority (SLDMWA)
No reservations or Rancherias exist in the SLDMWA service area (U.S. Census Bureau 2010).

3.12.2 Environmental Consequences/Environmental Impacts

This section presents assessment methods performed to analyze ITA effects and presents the potential ITA effects for the proposed alternatives.

3.12.2.1 Assessment Methods

Reclamation guidance states that, "Actions that could impact the value, use or enjoyment of the ITA should be analyzed as part of the ITA assessment. Such actions could include interference with the exercise of a reserved water right, degradation of water quality where there is a water right, impacts to fish or wildlife where there is a hunting or fishing right, [and] noise near a reservation when it adversely impacts uses of reservation lands" (Reclamation 2012).

Groundwater substitution is the only transfer method that could impact ITAs. To determine potentially affected reservations and Rancherias, the locations of reservations and Rancherias were overlaid with a map of the Sacramento Valley Groundwater Basin where groundwater substitution transfers could occur. Reservations and Rancherias were identified using a reservation boundary database (U.S. Census Bureau 2010). All identified ITAs within a groundwater substitution basin could be potentially affected by groundwater substitution transfers. ITAs found outside of the groundwater basin would not be affected by groundwater substitution and are not further analyzed in this section.

The following ITAs fall within the boundaries of the Sacramento Valley Groundwater Basin:

- Auburn Rancheria
- Chico Rancheria
- Colusa
- Cortina
- Paskenta
- Rumsey

After determining the tribes that fall within the groundwater basin, their location was compared to changes in groundwater levels from the groundwater model to determine if there would be any effects to ITAs.

Additionally, locations of the above identified tribes were further examined for their proximity to existing streambeds which could experience reductions in stream flow temperatures due to stream flow depletion associated with groundwater recharge from groundwater substitution transfers. Of the tribes identified in the Sacramento Valley Groundwater Basin, only the Chico Rancheria is located near a streambed, Butte Creek.

3.12.2.2 Alternative 1: No Action/No Project

3.12.2.2.1 Seller Service Area

There would be no effects to ITAs in the Seller Service Area. Groundwater substitution would not occur under the No Action/No Project Alternative; therefore, groundwater depth and pumping costs and stream flow temperatures in the Seller Service Area would continue to fluctuate similar to existing conditions. The No Action/No Project Alternative would have no change from existing conditions for ITAs in the Seller Service Area.

3.12.2.2.2 Buyer Service Area

Limited water supplies could cause adverse effects on ITAs in the Buyer Service Area. The only ITAs present in the Buyer Service Area include the Lytton Band of Pomo Indians, serviced by the East Bay MUD. Under the No Action/No Project Alternative, Central Valley Project (CVP) shortages could reduce water supplies to East Bay MUD in dry and critical years. Depending on the shortage, East Bay MUD may need to implement water shortage contingency measures, such as mandatory conservation. The Lytton Band of Pomo Indians would likely be subject to these measures as an East Bay MUD customer. These reductions in deliveries would be the same as currently experienced and represent no change from existing conditions.

3.12.2.3 Alternative 2: Full Range of Transfers (Proposed Action)

3.12.2.3.1 Seller Service Area

Groundwater substitution transfers could adversely affect ITAs by decreasing groundwater levels, which would potentially interfere with the exercise of a federally-reserved water right use, occupancy, and or character. Under the Proposed Action, groundwater substitution transfers would increase depth to groundwater and could increase groundwater pumping costs.

Auburn Rancheria, Cortina, and Rumsey lie on the border of the basin; therefore, effects from groundwater substitution would be less than those experienced by Chico Rancheria, Colusa and Paskenta, since they are more centrally located in the basin.

Figure 3.12-2 shows the potential groundwater level drawdown under the Proposed Action and the potential ITAs within the Sacramento Basin. The groundwater level changes would be very small near these sites, and would likely not be noticeable. Section 3.3, Groundwater Resources provides detailed information on the simulation used to develop the groundwater level information.

Because groundwater substitution would have negligible effect to groundwater near ITAs, the Proposed Action would not affect the ITAs' federally-reserved water rights.

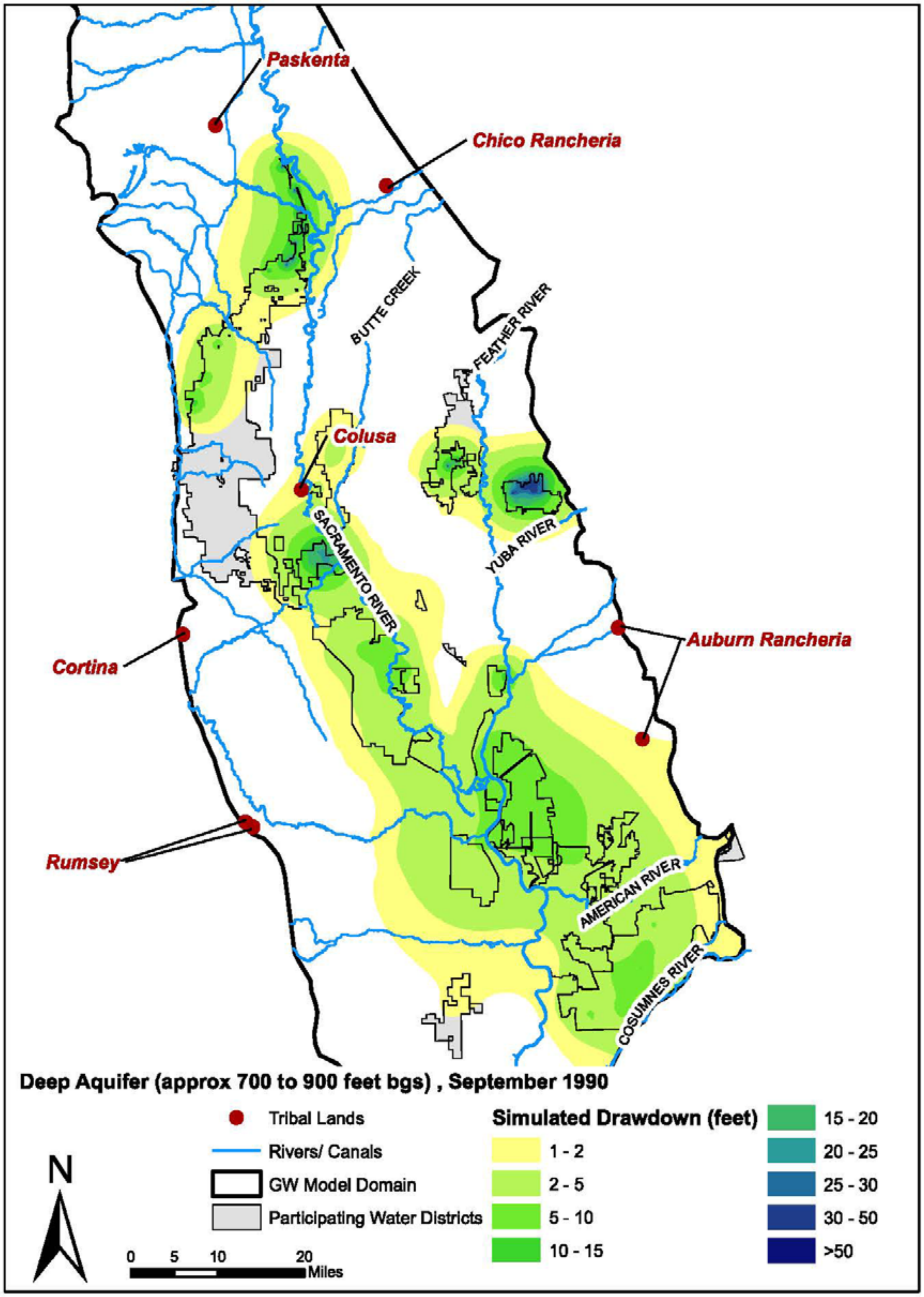
Groundwater substitution transfers could adversely affect ITAs by reducing the health of tribal members by decreasing water supplies. Under the Proposed Action, groundwater substitution in the Sacramento Valley Groundwater Basin would not reduce groundwater table elevations near project ITA sites; therefore, groundwater substitution would also not decrease water supplies or affect the health of tribal members under the Proposed Action. Because the changes in groundwater levels would be negligible near ITA sites, the Proposed Action would not decrease water supplies to ITAs, thereby reducing the health of tribal members.

Groundwater substitution transfers could affect ITAs by affecting fish and wildlife where there is a federally-reserved hunting, gathering, or fishing right. Under the Proposed Action, groundwater substitution in the Sacramento Valley Groundwater Basin would result in very small changes to groundwater table elevations near ITA sites; therefore, groundwater substitution would not affect fish and wildlife where there is a federally-reserved hunting, gathering, or fishing right. For more information on groundwater substitution effects on aquatic and terrestrial resources in other project areas, see Section 3.7, Fisheries and Section 3.8, Vegetation and Wildlife. Because groundwater substitution would not measurably reduce groundwater elevations near project ITAs, the Proposed Action would not affect fish and wildlife where there is a federally-reserved hunting, gathering, or fishing right.

Groundwater substitution transfers could adversely affect ITAs by causing changes in stream flow temperatures or stream depletion, which would potentially interfere with the exercise of a federally-reserved Indian right. Under the Proposed Action, groundwater substitution transfers in the Sacramento Valley Groundwater Basin could result in an increase in groundwater recharge in the Seller Service Area which could cause small reductions in local base flows in nearby streams.

Chico Rancheria lies near Butte Creek along the border of the Sacramento Valley Groundwater Basin; thus, effects from groundwater substitution, including changes in steam flow temperatures would be less than if the ITAs were located more centrally in the basin. Figure 3.12-2 shows the potential groundwater level drawdown under the Proposed Action and the potential ITAs within the Sacramento Basin. The groundwater level changes would be very small, and would likely not noticeably increase groundwater recharge effects. Section 3.3, Groundwater Resources provides detailed information on the simulation used to develop the groundwater level information.

Because groundwater substitution would have negligible effects, the effects of groundwater recharge on streams near ITAs would also be negligible. The Proposed Action would not affect ITAs' federally-reserved water rights.



Source: Department of Water Resources 2012 and U.S. Census Bureau 2010.

Figure 3.12-2. ITAs and Groundwater Basins

3.12.2.3.2 Buyer Service Area

Use of groundwater substitution transfers could affect ITAs. The Lytton Band of Pomo Indians is the only tribe with federal trust land in the Buyer Service Area and receives water services from Easy Bay MUD, a potential buyer. Under the Proposed Action, East Bay MUD would receive water transfers from willing sellers in the Seller Service Area. Transfers would help East Bay MUD supplement its water supply during dry years, in order to serve its customers, including the Lytton Rancheria. The tribe would benefit from a supplemented water source; therefore, the Proposed Action would have a beneficial effect on ITAs in the Buyer Service Area.

3.12.2.4 Alternative 3: No Cropland Modifications

3.12.2.4.1 Seller Service Area

Effects to ITAs in the Seller Service Area would be the same as under the Proposed Action.

3.12.2.4.2 Buyer Service Area

Effects to ITAs in the Buyer Service Area would be the same as under the Proposed Action.

3.12.2.5 Alternative 4: No Groundwater Substitution

3.12.2.5.1 Seller Service Area

The No Groundwater Substitution Alternative does not include groundwater substitution transfers. Because groundwater substitution would not occur, the No Groundwater Substitution Alternative would have no effect on ITAs.

3.12.2.5.2 Buyer Service Area

Effects to ITAs in the Buyer Service Area would be the same as under the Proposed Action.

3.12.3 Comparative Analysis of Alternatives

Table 3.12-1 lists the potential effects to ITAs of each of the action alternatives. The following text supplements the table by describing the magnitude of the effects under the action alternatives and No Action/No Project Alternative.

Table 3.12-1. Comparative Analysis of Alternatives

Potential Impact	Alternative(s)	Significance	Proposed Mitigation	Significance after Mitigation
CVP shortages could adversely affect ITAs in the Buyer Service Area.	1	No effect	None	No effect
Groundwater substitution transfers could adversely affect ITAs by decreasing groundwater levels, which would potentially interfere with the exercise of a federally-reserved water right use, occupancy, and or character	2, 3	No effect	None	No effect
Groundwater substitution transfers could adversely affect ITAs by reducing the health of tribal members by decreasing water supplies	2, 3	No effect	None	No effect
Groundwater substitution transfers could affect ITAs by affecting fish and wildlife where there is a federally-reserved hunting, gathering, or fishing right.	2, 3	No effect	None	No effect
Groundwater substitution transfers could adversely affect ITAs by causing changes in stream flow temperatures or stream depletion, which would potentially interfere with the exercise of a federally-reserved Indian right	2, 3	No effect	None	No effect
Use of groundwater substitution transfers could affect reservations or Rancherias in the Buyer Service Area to reduce CVP shortages.	2, 3, 4	Beneficial	None	Beneficial

3.12.3.1 No Action/No Project Alternative

Under the No Action/No Project Alternative, there would be no impacts to ITAs in the Seller Service Area. CVP water shortages could reduce East Bay MUD supplies in dry and critical years, but the shortages would be the same as those that occur under existing conditions

3.12.3.2 Alternative 2: Full Range of Transfers (Proposed Action)

The Proposed Action includes increased groundwater pumping in the Seller Service Area. Groundwater levels underlying reservations and Rancherias in the area of analysis would be negligible and would not affect ITAs. Water transfers would provide water to East Bay MUD during dry and critical years, which would increase water supplies available for the Lytton Band of Pomo Indians in the East Bay MUD service area.

3.12.3.3 Alternative 3: No Cropland Modifications

Impacts to ITAs under the No Cropland Modification Alternative would be the same as the Proposed Action.

3.12.3.4 Alternative 4: No Groundwater Substitution

There would be no impacts in the Seller Service Area as a result of Alternative 4. Effects in the Buyer Service Area would be the same as the Proposed Action.

3.12.4 Environmental Commitments/Mitigation Measures

Reclamation's policy is to protect and avoid adverse impacts to ITAs whenever possible. The analysis has not identified any potential impacts to ITAs; therefore, no specific mitigation measures are included. However, if any unanticipated impacts arise during project implementation, Reclamation shall initiate government-to-government consultation to determine interests, concerns, effects, and appropriate mitigation measures. Reclamation will take the lead on consultation with the tribes. Potentially affected tribes and the BIA, OAIT, Regional Solicitor's Office, Reclamation's Native American Affairs Office, and or Regional Native American Affairs coordinator may be involved in identifying ITAs (Reclamation 2012). The agencies will discuss appropriate avoidance and/or minimization strategies on a government-to-government basis. Separate measures may be required for different types of trust assets, including federally-reserved water, land, minerals, fishing, and gathering rights.

Measures necessary to reduce effects will be developed in consultation with the affected federally recognized tribe(s) before implementation. Other measures will be used as determined appropriate through tribal consultation. Consultation and minimization measures would reduce any potential adverse effects on ITAs.

3.12.5 Potentially Significant Unavoidable Impacts

There are no expected significant and unavoidable impacts to ITAs.

3.12.6 Cumulative Effects

The ITAs cumulative analysis focuses only on those programs that potentially affect groundwater in the Seller Service Area and the Buyer Service Area.

3.12.6.1 Alternative 2: Full Range of Transfers (Proposed Action)

3.12.6.1.1 Seller Service Area

Groundwater substitution transfers in combination with other cumulative projects could adversely affect ITAs in the Seller Service Area. Proposed groundwater substitution transfers in combination with existing and foreseeable future groundwater substitution programs and projects could affect ITAs if wells were to be over pumped and dried out on tribal lands, or increase pumping costs. This could interfere with the exercise of a federally-reserved water right, reduce the health of tribal members by decreasing water supplies, and or effect fish and wildlife where there is a federally-reserved hunting, gathering, or fishing right.

State Water Project transfers could also acquire water through groundwater substitution, but these transfers would only be about 6,800 AF. Section 3.3.6.1.1 in the Groundwater Resources analysis describes other existing and foreseeable projects that could affect groundwater resources in the Seller Service Area. The groundwater substitution elements of these programs in conjunction with proposed groundwater substitution transfers could reduce groundwater levels and increase pumping costs in the Seller Service Area. If continuous groundwater substitution from multiple projects and programs were to cause over pumping or increased pumping costs near ITAs located in the Sacramento Valley Groundwater Basin, it could result in an adverse cumulative effect.

If potential impacts to ITAs are identified, tribal consultation will then precede any formal groundwater transfer in the vicinity of the identified tribes. Government-to-government consultation shall take place to determine interests, concerns, effects, and appropriate mitigation measures. Consultation may involve the BIA, the regional Solicitor's Office, and Department of Water Resources. Since government-to-government consultations with potentially affected tribes and the development of appropriate minimization measures would be completed prior to the implementation of groundwater substitution transfers, the Proposed Action's contribution to potential cumulative effects on ITAs in the Seller Service Area would be minimized.

3.12.6.1.2 Buyer Service Area

Groundwater substitution transfers in combination with other cumulative projects could adversely affect ITAs in the Buyer Service Area. Groundwater substitution transfers would provide water to East Bay MUD that could be used to serve the Lytton Band of Pomo Indians. In the future, East Bay MUD would likely experience increased demands as populations increase; however, East Bay MUD has planned for the increased demands so they would not likely adversely affect deliveries to the Lytton Band of Pomo Indians.

3.12.6.2 Alternative 3: No Cropland Modifications

The cumulative impacts of Alternative 3 would be the same as those for the Proposed Action.

3.12.6.3 Alternative 4: No Groundwater Substitution

3.12.6.3.1 Seller Service Area

Alternative 4 does not include groundwater substitution transfers; therefore, there are no actions that could contribute to the cumulative condition in the Seller Service Area.

3.12.2.6.2 Buyer Service Area

The cumulative impacts of Alternative 4 in the Buyer Service Area would be the same as those for the Proposed Action.

3.12.7 References

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Section 3.13
Cultural Resources

This section discusses cultural resources within the area of analysis. It describes the affected environment, potential environmental impacts that may result from implementation of alternatives, and proposes mitigation measures to offset the effects of those alternatives.

3.13.1 Affected Environment/Environmental Setting

This section provides an overview of the area of analysis, the regulatory setting associated with cultural resources, and the existing conditions within the area of analysis. The existing conditions consist of archaeological, ethnographic, and historic background and a summary of the potential cultural resource types within the area of analysis that may be affected by the action alternatives.

3.13.1.1 Area of Analysis

The area of analysis for cultural resources includes all reservoirs in the Seller Service Area and San Luis Reservoir. In order to better describe the area of analysis for cultural resources, however, it is more meaningful to define the area of analysis according to culturally distinguishable geographic regions. Those regions include the following:

- The Sacramento Valley (from Shasta Reservoir to the Delta, including some western Sierra foothills)
- The San Joaquin Valley (Kings County to the Delta, including some western Sierra foothills).

The two regions were defined on the basis of their prehistoric, ethnographic, and historic period culture history. In certain instances, the culture histories of these regions overlapped, and they were therefore discussed collectively as the Central Valley. Figure 3.13-1 illustrates the area of analysis for cultural resources.

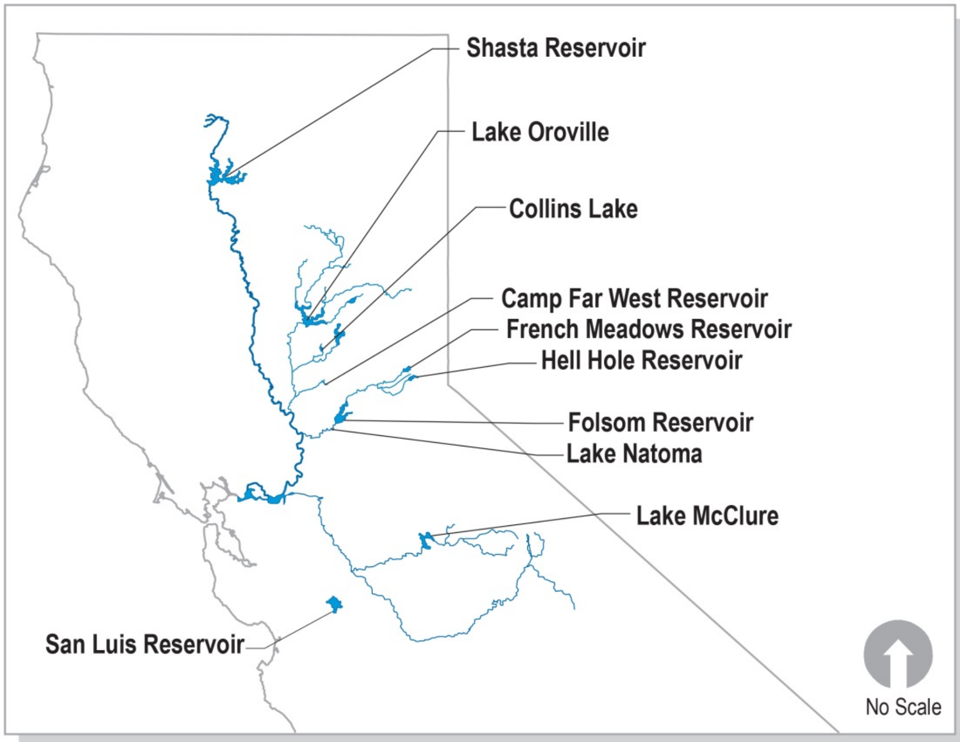

Figure 3.13-1. Cultural Resources Area of Analysis

3.13.1.2 Regulatory Setting

3.13.1.2.1 Federal

Federal laws and regulations for cultural resources include but are not limited to:

- National Historic Preservation Act (NHPA) of 1966, as amended: requires Federal agencies to consider the effects of their actions on historic properties.

- Archaeological Resources Protection Act of 1979 (ARPA): requires permitting for the excavation of cultural resources and identifies criminal and civil penalties for collecting and destruction of cultural resources on Federal land.

- Native American Graves Protection and Repatriation Act (NAGPRA): addresses the rights on lineal descendants, Indian Tribes, and Native Hawaiian organizations to Native American cultural items, including human remains, funerary objects, sacred objects, and objects of cultural patrimony.

- Executive Order 13007: requires Federal agencies responsible for the management of Federal lands to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and avoid adversely affecting the physical integrity of such sacred sites.

Because the proposed water transfers would use existing facilities and land uses would remain the same (within historic ranges of use), there are no obligations under Section 106 of the NHPA as the undertaking does not have the potential to effect historic properties, pursuant to 36 Code of Federal Regulations 800.3(a)(1).

3.13.1.2.2 State

The California Environmental Quality Act (CEQA) requires lead agencies to determine if a proposed project would have a significant effect on archaeological resources.

The California Register of Historical Resources (CRHR) is "an authoritative listing and guide to be used by state and local agencies, private groups, and citizens in identifying the existing historical resources of the state and to indicate which resources deserve to be protected, to the extent prudent and feasible, from substantial adverse change" (California Public Resources Code [PRC] Section 5024.1[a]). Criteria for eligibility to the CRHR are based on National Register of Historic Places (NRHP) criteria (PRC Section 5024.1[b]). Certain resources are determined by the statute to be automatically included in the California CRHR, including California properties formally determined eligible for, or listed in, the NRHP.

3.13.1.2.3 Regional/Local

Relevant regional or local cultural resources regulations include but are not limited to those adopted by the counties in the area of analysis. Each county has established its own goals, objectives policies, actions, implementation programs, and ordinances that are presented in county general plans and in some cases in county ordinance codes.

3.13.1.3 Existing Conditions

This section describes existing conditions for cultural resources within the area of analysis. All data regarding existing conditions were collected through an examination of archival and current literature pertinent to the area of analysis. Because action alternatives associated with the project do not involve physical construction-related impacts to cultural resources, no project specific cultural resource studies were conducted in preparation of this Environmental Impact Statement/Environmental Impact Report (EIS/EIR).

3.13.1.3.1 Archaeological Background

A wide range of prehistoric and historic period cultural resources may be present in the area of analysis. Prehistoric cultural resources in the Central Valley and Delta may include archaeological site types ranging from small lithic or midden scatters to large, mounded village sites. Although many smaller, discrete archaeological sites have remained undisturbed, historic period and modern landscape development have destroyed most known examples of larger prehistoric village sites (Rosenthal et al. 2007:147).

Historic period cultural resources in the Central Valley may include those associated with early Spanish expeditions, Spanish settlements (Missions, Pueblos, military), or Mexican Ranchos. Resources related to California's Gold Rush, such as mining machinery, sluices, tailings, cabins, and mills are also common in the region. Other historic period sites may include those pertaining to cattle ranching, agricultural production, early transportation, water development, and townsite development.

Central Valley

Due to the alternating periods of erosion and deposition that have characterized California's Central Valley and Delta regions, many of the Pleistocene landscapes that might hold evidence relating to the earliest human occupation of the region have been eroded away or subsumed by more recent alluvial deposits. Archaeological data about early human occupation of the region have come largely from isolated finds on remnant landforms; such finds have included artifacts found in the southernmost extent of San Joaquin Valley thought to date to the Paleo-Indian Period (11,550–8550 Before Christ [BC]). Evidence for the Lower Archaic Period (8850–5550 BC) in the Central Valley and Delta is also sparse, although shells from the Pacific Coast and obsidian from the Sierra Nevada found at sites dating to this period suggest that regional interaction spheres were established early in the region's prehistory (Rosenthal et al. 2007:151–152).

Archaeological sites dating to the Middle Archaic Period (5550-550 BC) have provided some of the oldest evidence for well-defined cultural traditions in the region. Evidence for increased residential stability, logistical organization, riverine adaptations, and far ranging regional exchange during the Middle Archaic has been recovered (Rosenthal et al. 2007:153-155). The Windmiller Pattern (1850-750 BC), which shows a widespread uniformity of burial practices, is characteristic of the period. The Upper Archaic (550 BC- Anno Domini [AD] 1100) was marked by cultural, economic, and technological diversity. This period also saw the development of large mounded villages in the Delta and lower Sacramento Valley (Rosenthal et al. 2007:156).

During the Emergent Period (AD 1100 to the historic period), native peoples living in the Central Valley and Delta developed the cultural traditions noted at the time of contact with Euro-Americans. These included technological advances such as the bow and arrow and the fish weir. Indigenous trade networks also appear to have changed in the Emergent Period, as shell beads assumed the role of currency throughout much of the region. The population of the Central Valley and Delta regions, which had been growing steadily since the Middle Archaic, continued to climb in the Emergent Period; this growth correlated with an intensification of hunting, gathering, and fishing, as well as increased socio-political complexity (Rosenthal et al. 2007:257-259).

Sierra Nevada

Sierra Nevada prehistoric archaeological deposits were first found during the Gold Rush era. Deposits consisting of mortars, charmstones, pestles, and human remains were among the cultural resources discovered in the 1850s and 1860s (Moratto 1984). In the mid-nineteenth century, mining led to the discovery of many prehistoric sites. In the later nineteenth and twentieth centuries, dam construction within the Sierra Nevada also led to the discovery of numerous archaeological sites.

In 1952, a total of 26 Northern Sierra sites were recorded by University of California Berkeley archaeologists T. Bolt, A.B. Elsasser, and R.F. Heizer. Two archaeological cultures were identified from this survey: the Martis Complex (centered in the Martis Valley) and the Kings Beach Complex (centered in the Lake Tahoe area). The Martis Complex was unusual for its use of basalt rather than obsidian in tool making. Dates from the tools suggest that the complex dated from 4000-2000 BC to AD 500 (Moratto 1984). The Kings Beach Complex (AD 500-1800) was distinguished by flaked obsidian and silicate implements, small projectiles points, the bow and arrow, and occasional scrapers and bedrock mortars (Moratto 1984).

In 1970, Ritter compared various Lake Oroville area sites to the Martis Valley and Kings Beach sites to help develop a chronology for the Lake Oroville area. As so derived, the Lake Oroville chronology spans a period of about 3,000 years and consists of the Mesilla, Bidwell, Sweetwater, and Oroville Complexes, as well as the ethnographic Maidu era (Moratto 1984).

The Mesilla Complex was identified as a sporadic occupation of the foothills. People associated with this complex hunted with atlatls and processed their food in mortar bowls and on millingstones. Shell beads, charmstones, and bone pins show a close relationship between the Mesilla Complex and the Sacramento Valley cultures between 1000 BC and AD 1 (Moratto 1984).

After the Mesilla Complex, the cultural sequence continued with the Bidwell Complex from AD 1-800. The Bidwell Complex people lived in permanent villages, hunted deer and smaller game with slate and basalt projectile points, fished, ground acorns on millingstones, and collected fresh water mussels. A new cultural element for this complex was the manufacture of steatite cooking vessels (Moratto 1984).

The Sweetwater Complex (AD 800-1500) was defined by new cultural items and forms, which included particular shell ornament types; wider use of steatite for cups, bowls and smoking pipes; and, small, lighter projectile points that indicated the use of bows and arrows for hunting (Moratto 1984).

The Oroville Complex is significant because it represents the protohistoric Nisenan (AD 1500 to 1833) (Moratto 1984). The Nisenan culture was characterized by bedrock mortars for acorn processing, dance halls, and burials placed in tightly flexed positions on their sides marked with stone cairns. The Lake Oroville Chronology sequence ended with the historic era and abandonment of traditional settlements in the nineteenth century (Moratto 1984).

3.13.1.3.2 Ethnography

When European colonization of California began, the Central Valley and Sierra foothills were home to an estimated 100,000 people who spoke at least eight different indigenous languages, including Wintu, Yana, Nomlaki, Konkow, River Patwin, and Nisenan in the Sacramento Valley and adjacent Sierra foothills, and Miwok and Yokuts in the San Joaquin Valley and adjacent Sierra foothills. Groups speaking these languages shared many common cultural practices associated with technology, subsistence, ceremonial life, and social organization. Downstream from the Delta, the Costanoans—or Ohlone, as their descendants prefer to be called—inhabited the eastern shores of San Francisco Bay, as well as the San Francisco peninsula and the coastal areas south to Point Sur (for detailed information on particular ethnolinguistic groups see entries in Heizer 1978).

The principal form of social organization among the native groups of the Central Valley was the tribelet, which often included a primary village associated with several outlying hamlets. Most settlements consisted of houses and granaries made of locally available materials (typically bark or tule), as well as semi-subterranean ceremonial structures. Many villages were occupied year-round, except during the fall acorn harvest. Among the Nomlaki and some Yokuts groups, however, people spent most of the year in dispersed family camps in order to utilize diverse ecological zones, coming together only during the winter when they shared surpluses and performed important ceremonies (Lightfoot et al. 2009: 303).

Native Californians living in the Central Valley used a wide variety of resources. Acorns were an important food crop throughout much of prehistory, and oak stands were often owned on the individual, family, or tribelet level. Tule, or bulrush, was another principal plant and was used to make clothing, thatch houses, and construct watercraft. For basketry, which was one of the most important items of material culture in the region, native people used tule, ferns, and grasses. The native people ate the small seeds of a number of plants, as well as berries and greens. As elsewhere in California, native people in the Central Valley relied on prescribed burning to maintain a diverse landscape and to encourage the growth of desired species. Communal hunts of deer, rabbit, and squirrels were also common in the region. The diets for people living along Central Valley rivers and sloughs also included waterfowl and diverse fish species (Lightfoot et al. 2009: 303-338).

Sacramento Valley and Sierra Foothills

The area of analysis lies within the ethnographic territories of the Nisenan, Plains and Southern Sierra Miwok, Northern Yokuts, and Konkow.

The Nisenan, often referred to as the Southern Maidu in anthropological literature, were classified as the southern linguistic group of the Maidu tribe; together with the Maidu and Konkow, they formed a subgroup of the California Penutian linguistic family (Wilson and Towne 1978). The Nisenan linguistic group has been further subdivided based on dialect into Northern Hill Nisenan, spoken in the Yuba River drainage; Southern Hill Nisenan, spoken along the American River; and Valley Nisenan, dominant along a portion of the Sacramento River Valley between the American and Feather Rivers (Beals 1933; Kroeber 1925, 1929).

Prior to Euro-American contact, Nisenan territory extended west into the Sacramento Valley to encompass the lower Feather River drainage; north to include the Yuba River watershed; south to include the whole of the Bear and American River drainages and the upper reaches of the Cosumnes River; and east to the crest of the Sierra Nevada (Wilson and Towne 1978).

The Konkow, also known as Northwestern Maidu, occupied territory below the high Sierra in the foothills where the south, middle, north, and west branches of the Feather River converge. Konkow territory included the upper Butte and Chico creeks and part of the Sacramento Valley along the lower courses of the same drainages (Kroeber 1925).

Plains Miwok belong to the Eastern Miwok division of the Miwokan subgroup of the Utian language family (Levy 1978a:398). The Plains Miwok occupied the lower portion of the Cosumnes and Mokelumne rivers and both banks of the Sacramento River between the modern towns of Rio Vista and Freeport (Levy 1978a:398).

San Joaquin Valley

The Northern Valley Yokuts occupied the northern San Joaquin Valley and possessed a territory that extended from the point where the San Joaquin River turns north up the Central Valley to a point between the Calaveras and Mokelumne rivers (Wallace 1978:462); from east to west their territory spanned from the Sierra foothills to the crest of the Diablo Range (Wallace 1978:462). The northern territorial boundary between the Northern Valley Yokuts and the Plains Miwok is contested and remains less clearly defined (Wallace 1978:462).

The Southern Sierra Miwok belong to the Eastern Miwok division of the Miwokan subgroup of the Utian language family (Levy 1978a:398). The Southern Sierra Miwok occupied the upper Merced and Chowchilla river drainages (Levy 1978a398).

3.13.1.3.3 History

Although the Central Valley was not settled by the Spanish as part of the mission system or the associated presidio and pueblo establishments, the Spanish did explore portions of the San Joaquin and Sacramento Valleys. Expeditions to the Delta region began in the 1770s, and large portions of the

Central Valley were explored further in the early nineteenth century as the Spanish sought to convert the native inhabitants and to punish native raiding parties. After winning its independence from Spain, the Mexican government divided much of its territory in California into individual land grants. Although these ranchos, as they came to be known, were located primarily near the coast, several ranchos were also granted along the banks of the Sacramento and San Joaquin rivers. During the Mexican period, Anglo-American trappers made their way into the Central Valley. Jedediah Smith, one of the most notable early explorers, traversed the San Joaquin and Sacramento valleys in the 1820s (Beck and Haase 1974; Hoover et al. 1990).

In the 1840s, increasing numbers of Anglo-Americans began arriving in California, and many of their major trails crossed the Central Valley. After 1848, the Gold Rush era population explosion transformed the region. Cities along the San Joaquin and Sacramento rivers grew quickly to serve as supply centers and transportation links between San Francisco and the goldfields along the eastern tributaries. By 1849, the placer mines of the foothills were thick with miners; most were men, who hailed from many occupations and ethnicities. Over time, however, many Chinese and Hispanic miners left the goldfields and sought work in other industries such as agriculture and ranching (Hoover et al. 1990; Rawls and Bean 1998:91–103). The Central Valley was also the site of important early developments in oil and gas drilling.

By the late nineteenth century, the Central Valley's role as a great agricultural producer was already established. The demand for water for gold mining and agriculture led to the development of numerous water conveyance systems in the Central Valley. Early, privately financed systems were dwarfed by the early twentieth century systems created by municipalities, such as the Hetch Hetchy Aqueduct, as well as those developed by the Federal government, including the Central Valley Project (CVP) (Beck and Haase 1974).

Sacramento Valley

Constituting the northern portion of the Central Valley, the Sacramento Valley was the site of early Euro-American settlement. In 1839, John Sutter constructed a fort at the mouth of the American River and the east bank of the Sacramento River. There he engaged in a host of enterprises including raising grain and livestock, irrigation, and flour milling (Hoover et al. 1990). His property's strategic location made it a natural destination from the Sierra trails, and he did more to open California to American immigration than any other individual (Hoover et al. 1990:286–287; Lewis Publishing 1891:192–197).

In 1848, James Marshall, Sutter's foreman, discovered gold while constructing a mill at the South Fork of the American River. The gold seekers who began pouring into California as word of Marshall's discovery spread, created a tent city on Sutter's property around his fort. By the Fall of 1849, the nascent city housed 2,000 residents and had become a central stopover point; Sacramento was a point of embarkation to not only the American River mines, but to those on the Feather, Yuba, and Bear rivers, and a natural place for miners to outfit themselves (Hoover et al. 1990:291).

Miners began working the sand bars upstream from Marysville on both the Feather and Yuba Rivers as early as 1848, and scores of mining camps sprang up along the American River in Sacramento, Placer, and El Dorado counties. Many briefly became important towns in the early 1850s only to dwindle or disappear with the surface gold deposits. Gold Rush speculators formed Marysville, the Yuba County seat, in 1850 on land purchased from Sutter. Strategically located at the confluence of the Feather and Yuba rivers, and at the head of navigation for the Feather River, Marysville was also close to the mines. With its accessibility from emerging urban centers and the mines, the town grew rapidly in its first decades and became an important regional commercial center (Hoover et al. 1990:495, 493; Delay 1924:133–137). Oroville, originally Ophir City (est.1849), was the most important of these towns; it became the Butte County seat in 1856 (Lewis Publishing 1891:117–118). Another significant camp was Mormon Island, which today lies under Folsom Reservoir. The Town of Folsom was established in 1855 at the location of Negro Bar, which was originally prospected by African Americans in 1849. Folsom’s prosperity peaked in the 1860s when it served as the northern terminus of California’s first passenger railroad, as well as the western terminus of the Pony Express (Hoover et al. 1990:289).

Early river mining involved diverting streams from their natural channels by utilizing dams, ditches, and flumes. These structures required miners to begin working together in large numbers, often forming joint stock companies in which each miner invested his labor for a share in potential profits.

After the ditch systems were no longer needed for mining, they were frequently repurposed for agricultural irrigation, and were an invaluable resource for early developers of hydro-electric power in the Sierras (JRP Historical 2000:33, 62).

Some of the most notable river diversions for mining took place on the Feather River above Oroville (Hittell 1861:79) and along the American River. Among the structures that resulted from these efforts were the Big Bend Tunnel on the Feather River, the Natoma Ditch on the American River, the Excelsior Canal Company ditch system on the Yuba River, the Iowa Hill Ditch on the North Fork of the American River, and the El Dorado Canal on the South Fork of the American River (JRP 2000; Brown 1868; Meade 1901). In addition to the ditch systems, mining companies created dozens of reservoirs on the Upper Yuba River for dry season water storage, which by the turn of the century had an aggregate water storage capacity of over a billion cubic feet (Brown 1868; Meade 1901).

The Sawyer decision in 1884 all but ended hydraulic mining in California. As in other Gold Country locales, the Depression brought a limited revival of placer mining to the American River. Mechanized dredging took the place of hydraulic mining on the Feather and Yuba rivers in the early twentieth century, profitably extracting gold from the old tailings, while during the Depression the unemployed once again panned for gold (Hoover et al. 1990:540–541; Hittell 1898:83, 269; Delay 1924:256).

The Gold Rush population boom stimulated agricultural production throughout the Sacramento Valley. Sacramento Valley areas were initially exploited for cattle and wheat production. Citrus groves, rice, hops, and a variety of other crops became common as the area was settled more densely, and the area has remained an agricultural powerhouse. Though the higher-elevation drainages of the American River are somewhat better suited to agriculture, pioneers planted vegetable patches near Coloma as early as 1849. As mining declined, agricultural activities increased, with many mining ditches were actually repurposed for irrigation. In 1855, agricultural crops were being cultivated in Placer, Yuba, Sutter, and El Dorado counties. ~~Lumber extraction, first practiced in conjunction with mining, replaced mining as the leading local industry in areas above 3,000 feet (Department of Water Resources [DWR] 1964:9–10).~~

In addition to its strategic position along navigable rivers, Sacramento played an important role in the development of regional and national railroad networks. The Sacramento Valley Railroad (SVRR) was the first commercial railroad in California. Completed in 1856, the SVRR ran between Sacramento and Folsom; original plans to extend it as far as Marysville were never realized. In 1860, Theodore Judah, an American railroad engineer, began looking for financial backers for what would become the Central Pacific Railroad (CPRR); he found them in Sacramento Governor Leland Stanford, Charles Crocker, Mark Hopkins, and C.P. Huntington. The CPRR ultimately formed the western leg of the first transcontinental railroad in the United States. The project was authorized by Congress in 1862 and completed in 1869, with Sacramento serving as the CPRR's western terminus (Burg 2007:18–19; Willis 1913:184).

Water development in the Sacramento Valley continued to evolve in tandem with population expansion and expanding transportation networks. That development took the form of irrigation, hydroelectric, and reclamation projects. These projects often began as private ventures, but due to the scale of many of these ventures, they were ultimately taken over by government agencies or eclipsed by government projects. Many water development projects were closely aligned with townsite and regional development. For instance, Horatio Livermore constructed the first dam at Folsom in 1867 in an effort to create an industrial town there. Livermore's multi-purpose system included canals to carry logs to local mills and to provide crop irrigation. The Folsom Power Plant became operational in 1895; it was the first hydroelectric power plant in the Central Valley, and it operated continuously from 1895 to 1952 (Hughes 1983:269–270; JRP Historical 2000:58; Hoover et al. 1990:290).

The California State Legislature authorized the State Water Project (SWP), (then known as the Feather River Project), in 1951. Devastating flooding in the

Sacramento Valley in 1955, which was particularly severe in Marysville and Yuba City, contributed to popular support of the idea that damming the Feather River would prevent future flooding. Oroville Dam was built in response as a multi-purpose project intended to generate power, conserve water, control flooding, and create recreational opportunities (JRP Historical 2000:49, 82; DWR 1974:65– 67).

San Joaquin Valley

Exploration from the central coast into the San Joaquin Valley began with the Gabriel Moraga expeditions of 1806, 1808, and 1810, which brought the Spanish to the Merced and San Joaquin rivers and likely through Pacheco Pass (Hoover et al. 1990:198). By the beginning of the nineteenth century, the Spanish had established an interior north-south road called El Camino Viejo. The route ran from the Los Angeles coast north along the western edge of the San Joaquin Valley to the Patterson Pass (near the modern City of Tracy) and then west to San Antonio (currently East Oakland) (Hoover et al. 1990:85).

Following independence from Spain, Mexican activities in the San Joaquin Valley consisted largely of retaliatory expeditions meant to answer raids by Miwok and Yokut tribes on Mexican colonists. In the 1840s, the Mexican government began issuing land grants in the San Joaquin Valley. Land Grants the vicinity of the project area included Thompson’s Rancho, Rancheria del Rio Estanislao, El Pescador, Orestimba Rancho, Rancho del Puerto, and Sanjon de Santa Rita (granted to Francisco Soberanes in 1841) (Beck and Haase 1974).

Gold mining in the Southern Sierra mining region of the Sierra foothills began with the Gold Rush in 1848. As in other parts of the Sierras, the Gold Rush brought a flood of miners to the western Sierra foothills. By the 1850s, the fever of the Gold Rush had died down and many people relocated to the growing cities in the San Joaquin Valley and other parts of the state. Mining in the foothills and the Sierras transitioned from an emphasis on individual placer mining to small and large scale operations including dredging on the Merced and Tuolumne rivers, hydraulic mining, and lode mining for gold and other ores during the nineteenth and early twentieth century (California Department of Transportation [Caltrans] 2008). Hydraulic mining led to the development of ditches and canals, which later were repurposed for irrigation and hydroelectric systems (JRP and Caltrans 2000:38–50).

Early settlement in San Joaquin Valley occurred along streams and rivers. The early town of Dover was located on the San Joaquin River, five miles north of the mouth of the Merced River. Dover was established in 1844 when Jose Castro attempted to build a fort there, which was later occupied by Americans in 1866 (Hoover et al. 1990: 203). It was later abandoned in favor of Hills Ferry, which was established on the confluence of the Merced River and the San Joaquin River in 1860. Hills Ferry was a crossing point on the San Joaquin River. The coming of the railroad changed the settlement patterns in the San

Joaquin Valley, drawing people away from the waterways to the rails (Hoover et al. 1990:200).

As the gold mining industry in California declined in the 1860s, agriculture and ranching expanded to become important industries for the state economy. Farming in the San Joaquin Valley was characterized by cattle and sheep ranching, grain farming, and irrigation agriculture. Cattle ranching was especially important in the San Joaquin Valley, and companies such as Miller & Lux and the Kern County Land Company controlled millions of acres of rangeland (Hoover et al. 1990:200). With the completion of the transcontinental railway in 1869, farmers in the Central Valley began to export their fruit, nut, and vegetable crops to the rest of the nation.

The demand for water for gold mining and agriculture led to the development of numerous water conveyance systems in the Central Valley. In the San Joaquin Valley, large private land holders drove the movement to irrigate their land which led to the formation of private water companies. Water for irrigation in Madera, Merced, Fresno, and Stanislaus counties came from the Merced and Tuolumne rivers, which facilitated the construction of the San Joaquin and Kings River Canal from Mendota. This canal was the largest single irrigation system in the state in the 1880s (Beck and Haase 1974:76). Although private water companies still exist, privately financed systems have since been dwarfed by the municipal and federal systems and projects that began in earnest in the early twentieth century—including the CVP (Beck and Haase 1974).

3.13.1.3.4 Summary of Potential Cultural Resource Types

A wide range of prehistoric and historic period cultural resources may be present in the Seller or Buyer Service Areas analyzed in this EIS/EIR. Cultural resources may comprise landscapes, districts, sites, buildings, structures, objects, or isolated finds relating to American history, prehistory, architecture, archaeology, engineering, or culture.

Archaeological resources include prehistoric (pre-contact) and historic period (post-contact) cultural resources. Prehistoric resources are the physical remains that result from human activities that predate European contact with native peoples in America. Prehistoric archaeological sites may include villages, campsites, lithic or artifact scatters, fishing sites, roasting pits/hearths, milling features, rock art (petroglyphs/pictographs, intaglios), rock features (circles, blinds, etc.), and/or burials. Historic period archaeological sites are the physical remains of human activity during the historic period (post-contact to 50 years before present). Historic period sites may include the remnants of structures (foundations, cellars, privies), built objects, refuse deposits, subsurface hollow-filled features, landscape modifications, and/or complexes consisting of multiple feature types. Historic archaeological sites may include townsites, homesteads, agricultural or ranching features, mining-related features, refuse concentrations, and/or refuse scatters.

Ethnographic resources include sites, areas, and materials important in Native American or religious, spiritual, or traditional uses. These resources can encompass the sacred character of physical locations (mountain peaks, springs, and burial sites) or particular native plants, animals, or minerals that are gathered for use in traditional ritual activities. These resources are identified by Native American stakeholders and can be classified as a Traditional Cultural Property, which can be evaluated for eligibility for the NRHP.

Prehistoric cultural resources in the Central Valley include various types of archaeological sites ranging from small lithic scatters to large mounded village sites, although in the case of the latter, historic period and modern landscape modifications have destroyed most known examples (Rosenthal et al. 2007:147). Cultural resources that relate to ethnographically documented villages or personages, or sites that represent Traditional Cultural Properties, may also exist. Historic period cultural resources in the Central Valley may include those associated with early Spanish expeditions, Spanish settlements (missions, pueblos, or military presidios) or Mexican ranchos. Resources related to California's Gold Rush, such as mining machinery, sluices, tailings, cabins, and mills are common in the region. Other historic period sites include those pertaining to ranching, agriculture, early transportation, water development, and townsite development.

In the Sacramento River Division, about 2,300 historic sites have been recorded. Between the Sacramento/Sutter County boundary and Freeport along the Sacramento River, there are three historic sites and at least 42 historic structures along this segment of the Sacramento River. The town of Freeport has the potential to be determined an important historical resource. There are 13 historic and one multi-component sites on the American River between Folsom Dam and the Sacramento River.

3.13.2 Environmental Consequences/Environmental Impacts

These sections describe the environmental consequences/environmental impacts on cultural resources associated with each alternative.

3.13.2.1 Assessment Methods

The criteria for determining the historical significance of cultural resources are the CRHR eligibility criteria as defined at Section 5024.1 of the California PRC.

An impact is considered significant if a project would have an effect that may change the historical significance of the resource (PRC Section 21084.1). Demolition, replacement, substantial alteration, and relocation of historic properties are actions that would change the historical significance of a property eligible for listing or listed on the CRHR.

To evaluate if a potential impact to cultural resources could occur, the Transfer Operations Model output for the three action alternatives were used. Changes in elevations of any reservoirs that could be affected by the alternatives were compared to elevation changes that would occur under the No Action/No Project Alternative.

3.13.2.2 Significance Criteria

Because the proposed water transfers would use existing facilities and land uses would remain the same (within historic ranges of use), there are no obligations under Section 106 of the NHPA as the undertaking does not have the potential to effect historic properties, pursuant to 36 Code of Federal Regulations 800.3(a)(1).

Cultural resource significance is evaluated in terms of eligibility for listing on the NRHP. CEQA defines a significant historical resource as "a resource listed or eligible for listing on the [CRHR]" (PRC Section 5024.1).

Reservoir fluctuations that exceed historical elevations were used as the primary tool used to determine project effects. Reservoir processes, specifically the human, mechanical and biochemical impacts identified by Ware (1989), can positively or negatively impact the preservation of cultural resources and individual artifact classes. Erosion, flood events, and reservoir processes can cause the transport and redeposition of certain classes of cultural materials, thereby altering the nature of archaeological sites.

Significant impacts would be determined when operations expose previously submerged resources, increasing their vulnerability to vandalism and other factors; and expose resources to increased cycles of inundation (erosion) and drawdown.

3.13.2.3 Alternative 1: No Action/No Project Alternative

Surface water facilities would operate in the same manner as existing conditions and no impacts to cultural resources would occur. Under the No Action/No Project Alternative, surface water facilities would continue to operate in the same manner as under existing operations. Individual agencies would continue to manage cultural resources in a manner consistent with State and Federal laws.

Effects that are currently underway (i.e., disturbance to cultural resources by looters, vehicles, wave action erosion, sedimentation, changing water levels, redistribution of cultural materials, etc.) would continue. Water and irrigation districts would continue to operate their systems as they do under the existing conditions, moving water frequently between facilities. Cultural resources would be subject to currently existing effects, and the No Action/No Project Alternative would reflect the system as it is presently operating.

3.13.2.4 Alternative 2: Full Range of Transfers (Proposed Action)

Transfers that draw down reservoir surface elevations at CVP and SWP reservoirs beyond historically low levels could affect cultural resources. The Proposed Action would slightly affect reservoir elevation in CVP and SWP reservoirs and reservoirs participating in stored reservoir water transfers. Water transfers have the potential to affect cultural resources, if transfers result in changing operations beyond the No Action/No Project Alternative. Reservoir surface water elevation changes could expose previously inundated cultural resources to vandalism and/or increased wave action and erosion.

Table 3.13-1 presents changes in elevation under the Proposed Action relative to the No Action/No Project Alternative. Water could be made available for transfer during the irrigation season of April through September. The model results indicate that elevations would be very similar to those under the No Action/No Project Alternative under all hydrologic conditions. The reservoir surface elevation changes under the Proposed Action for these reservoirs would be within the normal operations and would not be expected to expose previously inundated cultural resources to vandalism or increased wave action and wind erosion. Impacts to cultural resources at Shasta, Oroville and Folsom reservoirs would be less than significant.

Table 3.13-1. Changes in CVP and SWP Reservoir Elevations between the No Action/No Project Alternative and the Proposed Action (in feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Shasta Reservoir												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-0.4	-0.4	-0.3	-0.2	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1
D	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.2	0.6	1.8	1.4	-0.2	-0.2
C	-0.2	-0.3	-0.3	-0.3	-0.3	-0.3	-0.2	1.2	3.7	0.4	-0.5	-0.5
Lake Oroville												
W	-0.5	-0.5	-0.3	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2
AN	-2.2	-2.2	-2.1	-1.4	-1.1	0.1	0.0	0.0	0.0	-0.4	-0.3	-0.3
BN	-0.3	-0.4	-0.6	-0.5	-0.5	-0.3	-0.3	-0.3	-0.4	-0.6	-0.7	-0.8
D	-0.7	-0.7	-0.6	-0.6	-0.6	-0.4	-0.4	0.5	0.6	0.0	-1.2	-0.7
C	-1.7	-2.2	-2.3	-2.3	-2.1	-1.8	-1.9	-1.7	-1.4	-0.9	-2.9	-3.0
Folsom Reservoir												
W	0.2	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
AN	-0.5	-0.6	-0.5	-0.1	0.0	0.0	0.0	0.0	0.0	-0.1	-0.3	-0.5
BN	-0.3	-0.4	-0.6	-0.5	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.2	-0.2
D	0.3	0.2	-0.1	-0.2	-0.3	-0.1	-0.1	0.8	1.4	1.4	1.6	1.8
C	1.1	0.8	0.6	0.5	0.6	-0.1	0.0	0.5	1.5	1.5	1.0	1.4

Note: Negative numbers indicate that the Proposed Action would decrease reservoir elevations compared to the No Action/No Project Alternative; positive numbers indicate that the Proposed Action would increase reservoir elevations.

Key: W = wet; AN = above normal; BN = below normal; D = dry; C = critical

Stored reservoir release transfers that draw down reservoir surface elevations at local reservoirs beyond historically low levels could affect cultural resources. Under the Proposed Action, stored reservoir release transfers could affect elevations at participating reservoirs, which could affect the cultural resources of the reservoir. The surface elevation changes under the Proposed Action for these reservoirs could expose previously inundated cultural resources to vandalism, increased wave action, and wind erosion. The reservoirs, however, would not drop below the conservation pool at any of the facilities and expose cultural resources existing below the conservation pool. Changes in water levels are expected to be in line with normal operations and impacts would be less than significant.

3.13.2.5 Alternative 3: No Cropland Modifications

Transfers that draw down reservoir surface elevations at CVP and SWP reservoirs beyond historically low levels could affect cultural resources. Table 3.13-2 presents changes in elevation under Alternative 3 relative to the No Action/No Project Alternative. Water could be made available for transfer during the irrigation season of April through September. The model results indicate that elevations would be very similar to those under the No Action/No Project Alternative under all hydrologic conditions. The reservoir surface elevation changes under Alternative 3 for these reservoirs would be within the normal operations and would not be expected to expose previously inundated cultural resources to vandalism or increased wave action and wind erosion. Impacts to cultural resources at Shasta, Oroville and Folsom reservoirs would be less than significant.

Table 3.13-2. Changes in CVP and SWP Reservoir Elevations between the No Action/No Project Alternative and Alternative 3 (in feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Shasta Reservoir												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-0.4	-0.4	-0.3	-0.2	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1
D	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.2	0.4	1.3	0.9	-0.2	-0.2
C	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.2	0.5	1.8	-0.2	-0.5	-0.5
Lake Oroville												
W	-0.5	-0.5	-0.3	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2
AN	-2.2	-2.2	-2.1	-1.4	-1.1	-0.1	-0.1	-0.1	0.0	-0.4	-0.3	-0.3
BN	-0.3	-0.4	-0.6	-0.5	-0.5	-0.3	-0.3	-0.3	-0.4	-0.6	-0.7	-0.8
D	-0.7	-0.7	-0.6	-0.6	-0.6	-0.4	-0.4	-0.4	0.5	0.0	-1.2	-0.7
C	-1.7	-2.2	-2.3	-2.3	-2.1	-1.8	-1.9	-1.8	-1.5	-1.8	-2.9	-3.0

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Folsom Reservoir												
W	0.2	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
AN	-0.5	-0.6	-0.5	-0.1	0.0	0.0	0.0	0.0	0.0	-0.1	-0.3	-0.5
BN	-0.3	-0.4	-0.6	-0.5	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.2	-0.2
D	0.3	0.2	-0.1	-0.2	-0.3	-0.1	-0.1	0.8	1.4	1.4	1.6	1.8
C	1.1	0.8	0.6	0.5	0.6	-0.1	0.0	0.5	1.5	1.5	1.0	1.4

Note: Negative numbers indicate that Alternative 3 would decrease reservoir elevations compared to the No Action/No Project Alternative; positive numbers indicate that Alternative 3 would increase reservoir elevations.

Key: W = wet; AN = above normal; BN = below normal; D = dry; C = critical

Stored reservoir release transfers that draw down reservoir surface elevations at local reservoirs beyond historically low levels could affect cultural resources. Water transfers with stored reservoir water would be the same as the Proposed Action. Changes in water levels are expected to be in line with normal operations and impacts would be less than significant.

3.13.2.6 Alternative 4: No Groundwater Substitution

Transfers that draw down reservoir surface elevations at CVP and SWP reservoirs beyond historically low levels could affect cultural resources. Table 3.13-3 presents changes in elevation under the Proposed Action relative to the No Action/No Project Alternative. Water could be made available for transfer during the irrigation season of April through September. The model results indicate that elevations would be very similar to those under the No Action/No Project Alternative under all hydrologic conditions. The reservoir surface elevation changes under Alternative 4 for these reservoirs would be within the normal operations and would not be expected to expose previously inundated cultural resources to vandalism or increased wave action and wind erosion. Impacts to cultural resources at Shasta, Oroville and Folsom reservoirs would be less than significant.

Table 3.13-3. Changes in CVP and SWP Reservoir Elevations between the No Action/No Project Alternative and Alternative 4 (in feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Shasta Reservoir												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.7	0.4	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	2.4	0.4	0.0	0.0
Lake Oroville												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	-0.1	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.9	-0.5	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.8	0.0	0.0

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Folsom Reservoir												
W	0.6	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-0.2	-0.3	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.6	0.5	0.0	0.0	-0.1	0.0	0.0	0.6	1.0	1.3	1.7	2.0
C	1.4	1.2	1.1	1.0	1.1	0.4	0.1	0.5	1.1	1.0	1.4	1.9

Note: Negative numbers indicate that Alternative 4 would decrease reservoir elevations compared to the No Action/No Project Alternative; positive numbers indicate that Alternative 4 would increase reservoir elevations.

Key: W = wet; AN = above normal; BN = below normal; D = dry; C = critical

Stored reservoir release transfers that draw down reservoir surface elevations at local reservoirs beyond historically low levels could affect cultural resources. Water transfers with stored reservoir water would be the same as the Proposed Action. Changes in water levels are expected to be in line with normal operations and impacts would be less than significant.

3.13.3 Comparative Analysis of Alternatives

Table 3.13-4 summarizes the effects of each of the action alternatives. The following text supplements the table by describing the magnitude of the effects under the action alternatives and No Action/No Project Alternative.

Table 3.13-4. Comparison of Alternatives

Potential Impact	Alternatives	Significance	Proposed Mitigation	Significance After Mitigation
Surface water facilities would operate in the same manner as existing conditions and no impacts to cultural resources would occur.	1	NCFEC	None	NCFEC
Transfers that draw down reservoir surface elevations beyond historically low levels could affect cultural resources.	2, 3, 4	LTS	None	LTS
Stored reservoir release transfers that draw down reservoir surface elevations at local reservoirs beyond historically low levels could affect cultural resources.	2, 3, 4	LTS	None	LTS

Key:
LTS = less than significant.
NCFEC = no change from existing conditions

3.13.3.1 No Action/No Project Alternative

Surface water facilities would operate in the same manner as existing conditions and no impacts to cultural resources would occur.

3.13.3.2 Alternative 2: Full Range of Transfers (Proposed Action)

Reservoir surface water elevation changes as a result of reservoir draw down could expose previously inundated cultural resources to vandalism and/or increased wave action and erosion. No impacts would occur at CVP, SWP and local reservoirs. Impacts would be less than significant.

3.13.3.3 Alternative 3: No Cropland Modification

Similar to the Proposed Action, no impacts would occur at CVP, SWP, and local reservoirs. Impacts would be less than significant.

3.13.3.4 Alternative 4: No Groundwater Substitution

Similar to the Proposed Action, no impacts would occur at CVP, SWP, and local reservoirs. Impacts would be less than significant.

3.13.4 Environmental Commitments/Mitigation Measures

There would be no significant impacts to cultural resources from implementation of the No Action/No Project Alternative or the action alternatives. Therefore, no environmental commitments/mitigation measures are proposed.

3.13.5 Potentially Significant Unavoidable Impacts

None of the action alternatives would result in potentially significant and unavoidable impacts on cultural resources.

3.13.6 Cumulative Effects

This cumulative effects assessment considers other programs or projects that could impact cultural resources within the same timeframe as the action alternatives considered in this EIS/EIR. Although cultural resources typically manifest as discrete archaeological sites, structures, or objects, the combination of programs or projects within a region can result in the cumulative loss of these resources and their data potential for archaeological research. Similarly, for historic landscapes, districts, and other geographically expansive areas, the combined effects of numerous programs or projects in disparate locations can result in a loss of integrity that diminishes the quality of the individual resources.

3.13.6.1 Alternative 2: Full Range of Transfers (Proposed Action)

Transfers, in combination with other cumulative projects, could draw down CVP and SWP reservoir surface elevations beyond historically low levels and affect cultural resources. Proposed transfers in combination with other cumulative projects could affect cultural resources in CVP and SWP reservoirs if multiple projects occurred in the same year, exacerbating the effects on reservoir elevation. Water operations in response to drought conditions could also result in lower reservoir elevations. The CVP and SWP reservoirs levels fluctuate frequently in response to normal water supply operations and hydrologic year types. Cultural resources within the operating zones are typically exposed to fluctuating water levels. All changes to reservoirs and rivers from the cumulative projects would remain within established water flow, water quality, and reservoir level standards. Therefore, the Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact related to cultural resources in CVP and SWP reservoirs.

Transfers, in combination with other cumulative projects, could draw down local reservoir surface elevations beyond historically low levels and affect cultural resources. Reservoir elevations in local reservoirs fluctuate frequently due to water supply operations. Water transfers could further reduce water levels and expose cultural resources, but any fluctuations are expected to be within the operating zones of the reservoirs. Therefore, the Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact related to cultural resources in non-Project reservoirs.

3.13.6.2 Alternative 3: No Cropland Modifications

The cultural resource impacts under Alternative 3 would be very similar to the Proposed Action. As under the Proposed Action, the cumulative impacts to cultural resources would be less than significant.

3.13.6.3 Alternative 4: No Groundwater Substitution

The cultural resource impacts under Alternative 4 would be very similar to the Proposed Action. As under the Proposed Action, the cumulative impacts to cultural resources would be less than significant.

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Section 3.14 Visual Resources

This section describes the existing aesthetic and visual resources within the area of analysis and discusses potential effects on visual resources from the proposed alternatives.

3.14.1 Affected Environment/Environmental Setting

3.14.1.1 Area of Analysis

The area of analysis for visual resources includes areas where cropland idling and crop shifting, groundwater substitution, reservoir release, and conservation transfers could occur in the Seller Service Area and areas that could receive water for agricultural uses in the Buyer Service Area. The counties included in the visual resources area of analysis are shown in Figure 3.14-1.

In addition to the counties, the area of analysis in the Seller Service Area includes: Sacramento, Feather, Bear, Yuba, American, Merced, and San Joaquin rivers, and Shasta, Oroville, Natoma, McClure, Camp Far West, Collins Lake, French Meadows, Hell Hole, Folsom, and New Bullards Bar reservoirs. The area of analysis in the Buyer Service Area includes: San Luis Reservoir.

3.14.1.2 Regulatory Setting

3.14.1.2.1 Federal

National Wild and Scenic Rivers Act (NWSRA) (16 U.S. Code [USC] 1271 et seq.)

Created by Congress in 1968, the NWSRA protects selected rivers which "possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values" for generational enjoyment. Rivers or river segment protected by the Act are classified by the system as wild, scenic, or recreational depending on impoundments, condition of shorelines, and accessibility. Federal management of selected rivers is provided by the U.S. Bureau of Land Management, U.S. Forest Service (USFS), U.S. Fish and Wildlife Service and the National Park Service. While designation helps conserve the special character these rivers possess, it does not necessarily limit all types of developments and users. Management is encouraged to

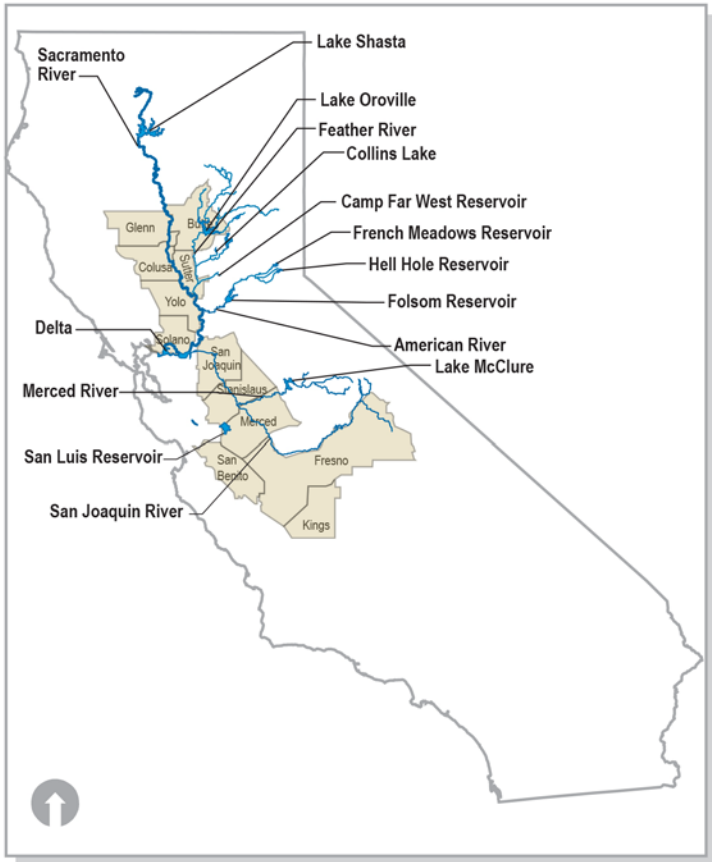

Figure 3.14-1. Visual Resource Area of Analysis

involve landowners, river users, and the general public when developing goals for river protection (National Wild and Scenic Rivers System [NWSRS] 2012). Portions of the American River, Feather River and Merced rivers, each included in this analysis, are designated as part of the NWSRS.

3.14.1.2.2 State

California Wild and Scenic Rivers Act (CWSRA) (Public Resources Code 5093.50-5093.70)

The goal of the CWSRA is to protect selected rivers "which possess extraordinary scenic, recreational, fishery, or wildlife values shall be preserved in their free-flowing state, together with their immediate environments, for the benefit and enjoyment of the people of the state." Rivers or river segment protected under the CWSRA are categorized in similar fashion as the NWSRA. A management plan is developed for the river segment and adjacent land according to its categorization. The CWSRA is administrated by the California Natural Resources Agency. Portions of the American River, included in this analysis, are designated as a California Wild and Scenic River System.

State Scenic Highways

The goal of the California Scenic Highway Program is to preserve and enhance the state's natural scenic resources. The laws governing the program establishes the State's responsibility to protect and enhance the states scenic resources by identifying portions of the State highway system and adjacent scenic corridors which require special conservation treatment. California Department of Transportation (Caltrans) manages the Scenic Highway Program but responsibility for developments along scenic corridors lies with local governmental agencies (Caltrans 2012). These state regulations are applicable to visual resources throughout the project area as seen from state scenic highways. State Scenic Highways included within this area of analysis include:

- A three mile stretch of State Route (SR) 151 from Shasta Dam to near Summit City
- Pacheco Pass (SR 152) (along San Luis Reservoir)

3.14.1.3 Existing Conditions

The following section describes the existing visual resources within the area of analysis. The presentation of information in this section is organized by service area, then by river region, which discusses both the river and reservoirs.

3.14.1.3.1 Seller Service Area

The Seller Service Area is bordered on the east by the Sierra Nevada, on the northwest by the Coast Ranges, and on the south by the Sacramento-San Joaquin Delta. Agriculture in the Sacramento Valley, forests in the upper watersheds, and grasslands and woodlands in the foothills characterize the region visually. Other low-elevation characteristics include occasional wetlands, vernal pools, and riparian areas. Much of the upper watershed on the east side of the Central Valley is forested, which limits views for motorists traveling through the area. Reservoirs in the region increase the level of scenic attractiveness at their maximum operating levels.

The following section describes visually sensitive areas, the landscape character, and scenic attractiveness of water bodies and adjacent scenic routes in the Seller Service Area.

Sacramento River Region

The Sacramento River originates above Shasta Reservoir in the north and flows through the Sacramento Valley to the Delta. Agriculture, a Class C visual resource (See Section 3.14.2.1.1 for a description of scenic attractiveness classifications), dominates the land uses near the river along the valley floor, while the upper watershed has retained its oak woodland, grasslands, forests, and rural character. Rice is one of the prominent crops grown in the Sacramento Valley and is noticeable along Interstate 5 (I-5) corridor. The Sacramento Valley also has many acres of field crops and orchards. An example of scenery surrounding the Sacramento River is shown in Figure 3.14-2.

Figure 3.14-2. Sacramento River

Shasta Reservoir is in the Shasta-Trinity National Forest in Shasta County and is the largest manmade reservoir in California. Lands adjacent to Shasta Reservoir consist primarily of steep slopes, upland vegetation, and coniferous forests (Class A and B visual resources). The shorelines of Shasta Reservoir vary from steep and rocky banks to coves of wooded flats. Figure 3.14-3 provides a view of the scenery surrounding Shasta Reservoir.

Figure 3.14-3. Shasta Dam and Shasta Reservoir

A three mile stretch of SR 151 from Shasta Dam to near Summit City is designated as a state scenic highway. This portion of road provides views of the Sacramento River, Shasta Reservoir, and distant hills.

In Sacramento County, a portion of SR 160 from the Contra Costa County line to the southern city limit of Sacramento is designated as a state scenic route. This road offers a glimpse of historic Delta agricultural areas and small towns along the Sacramento River (California Scenic Highway Mapping System [CSHMS] 2012). Views along this portion of roadway are considered Class A and B visual resources.

Feather River Region

Oroville Dam and Reservoir offer dramatic visual scenery surrounded by the Sierra Nevada foothills. Lake Oroville State Recreation Area (SRA) visitor center includes a 47-foot-high observation tower with two high-powered telescopes designed to give panoramic views of the dam and lake. Area views are also seen from developed facilities around the lake such as campgrounds, picnic areas, marinas, and boat launch areas (California Department of Parks and Recreation [CDPR] 2012). The recreational areas have Class A and B visual resources as does the reservoir. Figure 3.14-4 provides a view of the Lake Oroville area.

The lower Feather River terrain is generally flat. Riparian vegetation lines the river, with grassland and croplands in the adjacent agricultural areas. The southern portion of the Feather River, near Marysville, is adjacent to large areas of rice fields, as well as other field crops, which are considered Class C visual resources.

Figure 3.14-4. Lake Oroville

Yuba River Region

The Yuba River flows into the Feather River near Marysville. In this area agricultural lands are a dominant feature as well as grasslands and barren land, Class C visual resources. Collins Lake is in Yuba County in the foothills between Marysville and Grass Valley. The reservoir has 12 miles of shoreline with many varieties of trees and shrubs, as well as wildflowers. The reservoir and surrounding area are considered Class A and B visual resources.

American River Region

The American River originates in the Sierra Nevada and flows southwest to Folsom Reservoir and then into the Sacramento River near the City of Sacramento. Main tributaries include the North, Middle, and South Fork. These tributaries are known for their deep canyons, trails, and white water rafting are considered Class A and B high visual quality resources. Figure 3.14-5 provides a view of the Upper American River Region.

French Meadow Reservoir is along the Middle Fork of the American River in Placer County. The reservoir has a shoreline consisting of many varieties of trees and shrubs, as well as wildflowers. The vegetation provides suitable habitat for many wildlife species, and has opportunities for wildlife viewing. The reservoir and surrounding area are considered Class A and B visual resources.

Figure 3.14-5. Upper American River

Hell Hole Reservoir is located in El Dorado County on the Rubicon River, which flows to the Middle Fork of the American River. The reservoir has a 15-mile shoreline of rugged canyon walls. The reservoir's clear water adds to its visual character of the landscape and the shoreline is suitable for wildlife and bird viewing. The reservoir and surrounding area are considered Class A and B visual resources. Figure 3.14-6 provides a view of the visual resources surrounding Hell Hole Reservoir.

Figure 3.14-6. Hell Hole Reservoir

The North, Middle, and South Fork tributaries drain towards Folsom Reservoir. Folsom Reservoir is surrounded by rolling grasslands and wooded foothills. Figure 3.14-7 provides a view of Folsom Reservoir.

Figure 3.14-7. Folsom Reservoir

Folsom Reservoir SRA and Folsom Powerhouse State Historic Park offer multiple recreational opportunities and views of the reservoir. Folsom

Reservoir contrasts sharply with the nearby rolling grassland and wooded foothill landscapes. About seven miles downstream of Folsom Dam on the American River is Lake Natoma formed by Nimbus Dam. Lake Natoma regulates the releases from Folsom Dam made for power generation. The shoreline contains gravel banks, large boulders, and riparian vegetation. Both Lake Natoma and Folsom Reservoir are considered Class A and B visual resources.

The lower American River provides a variety of visual experiences, including steep bluffs, terraces, islands, backwater areas, and riparian vegetation. Figure 3.14-8 provides an aerial view of the lower American River. The water surface, gravel banks, natural grasses, smaller plants, and variety of trees along the river create a natural setting designated as a "protected area" in the American River Parkway Plan by Sacramento County for native plant restoration and habitat protection (Sacramento County 2008). The American River reach through Sacramento is a federally designated Wild and Scenic River. While the river flows through an urban area, the river is buffered by the American River Parkway. Sacramento County's American River Parkway Plan helps preserve the open spaces and natural resources along the American River that "provide Parkway users with a highly-valued natural setting and feeling of serenity, in the midst of a developed urban area" (Sacramento County 2008). The lower American River is considered a Class A visual resource.

Figure 3.14-8. Lower American River

Merced River Region

Lake McClure is a reservoir in the Sierra Nevada foothills on the Merced River. The lake has 80 miles of shoreline and is surrounded by pine and oak woodlands. The reservoir and facilities offer Class A and B visual resources.

The lower Merced River generally flows southwest from Lake McClure out of the foothills to the San Joaquin River. The land upstream from the San Joaquin River is generally flat and primarily used for agricultural purposes such as field crops and livestock, a Class C visual resource.

3.14.1.3.2 Buyer Service Area

Visual resources that could be affected in the Buyer Service Area include San Luis Reservoir and agricultural areas of San Luis & Delta-Mendota Water Authority participating member agencies.

San Luis Reservoir lies in the western San Joaquin Valley, along historic Pacheco Pass (SR 152), a state scenic highway. The reservoir lies within the San Luis Reservoir SRA, which is surrounded by undeveloped open spaces, and has views of distant rolling hills and the Diablo Range (CDPR 2012). Within the San Luis Reservoir SRA a visitor center at the Romero Overlook offers information on the reservoir and provides telescopes for viewing the area around the reservoir. In the spring, the reservoir area offers wildflower-viewing opportunities (CDPR 2012). The reservoir and facilities offer Class A and B visual resources. Figure 3.14-9 provides an aerial view of the region surrounding San Luis Reservoir.

Figure 3.14-9. San Luis Reservoir and O'Neill Forebay

The majority of the Buyer Service Area is primarily designated for agriculture uses, including tree and row crops, typically a Class C visual resource. The agricultural lands of the Buyer Service Area include tree and row crops, grain, hay, and pasture. Short-term fallow fields also make up a large portion of the Buyer Service Area in any given season.

3.14.2 Environmental Consequences/Environmental Impacts

The following sections describe the environmental consequences/environmental impacts associated with each alternative.

3.14.2.1 Assessment Methods

This section presents the assessment methods applied to evaluate visual resources. Visual resource analysis tends to be subjective and generally expressed qualitatively. In order to analyze the importance of an impact on a visual resource, it is necessary to first classify the value of that visual resource.

3.14.2.1.1 Scenery Management System (SMS)

Assessment methods relied on the SMS developed by the U.S. Department of Agriculture (USDA), USFS in 1995 and outlined in *Landscape Aesthetics: A Handbook for Scenery Management, Agriculture Handbook Number 701*. The SMS helps determine landscapes and landscape character that are important for scenic attractiveness, based on commonly held perceptions of the beauty of landform, vegetation pattern, composition, surface water characteristics, and land use patterns.

The SMS is applied to the alternatives using the following steps:

- **Identify visually sensitive areas.** Sensitivity is considered highest for views seen by people driving to or from recreational activities, or along routes designated as scenic corridors. Views from relatively moderate to high-use recreation areas are also considered sensitive. For this analysis, rivers and reservoirs are considered visually sensitive areas. The analysis also evaluates effects to views of productive agricultural lands.

- **Define the landscape character.** Landscape character gives an area it's visual and cultural image, and consists of the combination of physical, biological, and cultural attributes that make each landscape identifiable or unique. Landscape character refers to images of the landscape that can be defined with a list of scenic attributes.

  The USDA defines these as the following:

  - Landform Patterns and Features: Includes characteristic landforms, rock features, and their juxtaposition to one another.

  - Surface Water Characteristics: The relative occurrence and distinguishing characteristics of rivers, streams, lakes, and wetlands. Includes features such as waterfalls and coastal areas.

- Vegetation Patterns: Relative occurrence and distinguishing characteristics of potential vegetative communities and the patterns formed by them.

- Land Use Patterns and Cultural Features: Visible elements of historic and present land use which contribute to the image and sense of place. Agriculture in the Central Valley contributes to the landscape character of the region.

- **Classify scenic attractiveness.** Scenic attractiveness classifications are a key component of the SMS and are used to classify visual features into the following categories:

  - **Class A, Distinctive –** Areas where landform, vegetation patterns, water characteristics, and cultural features combine to provide unusual, unique, or outstanding scenic quality. These landscapes have strong positive attributes of variety, unity, vividness, mystery, intactness, order, harmony, uniqueness, pattern, and balance.

  - **Class B, Typical –** Areas where landform, vegetation patterns, water characteristics, and cultural features combine to provide ordinary or common scenic quality. These landscapes have generally positive, yet common, attributes of variety, unity, vividness, mystery, intactness, order, harmony, uniqueness, pattern, and balance. Normally they would form the basic matrix within the ecological unit.

  - **Class C, Indistinctive** – Areas where landform, vegetation patterns, water characteristics, and cultural land use have low scenic quality. Often water and rockform of any consequence are missing in class C landscapes. These landscapes have weak of missing attributes of variety, unity, vividness, mystery, intactness, order, harmony, uniqueness, pattern, and balance.

Class A and B visual resources typically include state or federal parks, recreation, or wilderness areas. Rivers and reservoirs are typically considered Class A or B visual resources. Class C resources generally include areas that have low scenic quality and contain more common landscapes, such as agricultural lands. This analysis evaluates the effects to landscape character from cropland idling but does not evaluate the effects on scenic attractiveness from cropland idling transfers because agricultural is considered a Class C resource.

3.14.2.1.2 Transfers Operation Model

To determine visual effects on rivers and reservoirs, changes in reservoir elevations and river flows under the alternatives are compared to the No Action/No Project Alternative. This analysis uses hydrologic operations modeling to provide estimated changes in reservoir elevation, reservoir storage, and river flows. Appendix B describes the operations modeling methods and assumptions.

As stated above, reservoirs are generally Class A or B visual resources when their water surface elevations are near to or at their maximum. An adverse visual effect to reservoirs would occur if surface water elevation levels decreased to a level such that shoreline riparian vegetation were reduced or the "bathtub" ring was substantially larger than under the existing conditions or the No Action/No Project Alternative. As drawdown occurs during the summer and fall, an increasing area of shoreline devoid of vegetation appears in the area between the normal high water mark and the actual lake level. The exposed rock and soil of the drawdown zone contrasts with the vegetated areas above the high water level and with the lake's surface. See Figure 3.14-10 for a visual of Shasta Reservoir experiencing a bathtub ring effect; notice the exposed rock beneath the high water mark. As a consequence of reservoir operations, the level of scenic attractiveness tends to decline in July and August with increasing drawdown.

Source: Department of Water Resources (DWR) 2012

Figure 3.14-10. The "Bathtub Ring" Effect at Shasta Reservoir

A river would be adversely affected visually if the decrease in flow resulted in exposure of the riverbed, reduction of riparian vegetation along the banks, or changes to any important visual features of the river. Seasonal variations in flow levels of the rivers within this region provide for a wide range of aesthetic opportunities. Most of the rivers in this region have low flow regulations in place. Flow requirements for the various rivers and streams may be found in State Water Resources Control Board water right permits or licenses, Federal Energy Regulatory Commission hydropower licenses, and interagency agreements. Because minimum flow requirements exist and the flows are managed, riparian vegetation along the rivers reflects the results of current management practices. These practices include the use of levees for flood control, managed floodplains and overflow bypasses, and controlled releases from reservoirs. These practices may result in a narrow riparian corridor. Nonetheless, riparian vegetation remains an important visual aspect to all streams and river corridors. Water, shade, and dense cover distinguish the riparian areas from the surrounding land. Increased river flows typically improve visual resources by creating a fuller river, and improving riparian habitat along the river's banks. Reductions in river flows could result in substantial exposure of the river bed, reduction of riparian vegetation along the banks or changes to important visual features of the river.

3.14.2.2 Significance Criteria

Impacts on visual resources would be considered potentially significant if transfers would:

- Substantially degrade the existing landscape character and scenic attractiveness of Class A and B visual resources.

3.14.2.3 Alternative 1: No Action/No Project

3.14.2.3.1 Seller Service Area

There would be no impacts to existing landscape character or scenic attractiveness of Class A and B visual resources in the Seller Service Area. Under the No Action/No Project Alternative, water transfers would not be implemented. Any effects on visual resources in the Seller Service Area relating to lowered reservoir levels and decreased river flows would be the same as existing project operations. Therefore, the No Action/No Project Alternative reflects that of the affected environment and there would be no change from existing conditions on visual resources in the Seller Service Area.

3.14.2.3.2 Buyer Service Area

There would be no impacts to existing landscape character or scenic attractiveness of Class A and B visual resources in the Buyer Service Area. During dry years, the No Action/No Project Alternative could experience increased amounts of cropland idling because of decreased water supplies. Agricultural land is generally considered a Class C visual resource and by definition would not have an impact on Class A and B visual resources. There would be no change in visual resources compared to existing conditions under the No Action/No Project Alternative.

3.14.2.4 Alternative 2: Full Range of Transfers (Proposed Action)

3.14.2.4.1 Seller Service Area

Water transfers could degrade the existing landscape character or scenic attractiveness of Class A and B visual resources at Central Valley Project (CVP) and State Water Project (SWP) reservoirs. Under the Proposed Action, water supply operations related to water transfers could affect reservoir elevations in Shasta, Oroville, and Folsom reservoirs. Decreased reservoir elevations could affect the landscape character and scenic attractiveness of the reservoir. Table 3.14-1 shows the changes in reservoir elevations at these three reservoirs. The changes from the No Action/No Project Alternative would be minor, and the visual effect of the increased bathtub ring would not be noticeable. The impact to visual resources would be less than significant.

Table 3.14-1. Changes in CVP and SWP Reservoir Elevations between the No Action/No Project Alternative and the Proposed Action (in feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Shasta Reservoir												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-0.4	-0.4	-0.3	-0.2	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1
D	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.2	0.6	1.8	1.4	-0.2	-0.2
C	-0.2	-0.3	-0.3	-0.3	-0.3	-0.3	-0.2	1.2	3.7	0.4	-0.5	-0.5
Lake Oroville												
W	-0.5	-0.5	-0.3	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2
AN	-2.2	-2.2	-2.1	-1.4	-1.1	0.1	0.0	0.0	0.0	-0.4	-0.3	-0.3
BN	-0.3	-0.4	-0.6	-0.5	-0.5	-0.3	-0.3	-0.3	-0.4	-0.6	-0.7	-0.8
D	-0.7	-0.7	-0.6	-0.6	-0.6	-0.4	-0.4	0.5	0.6	0.0	-1.2	-0.7
C	-1.7	-2.2	-2.3	-2.3	-2.1	-1.8	-1.9	-1.7	-1.4	-0.9	-2.9	-3.0
Folsom Reservoir												
W	0.2	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
AN	-0.5	-0.6	-0.5	-0.1	0.0	0.0	0.0	0.0	0.0	-0.1	-0.3	-0.5
BN	-0.3	-0.4	-0.6	-0.5	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.2	-0.2
D	0.3	0.2	-0.1	-0.2	-0.3	-0.1	-0.1	0.8	1.4	1.4	1.6	1.8
C	1.1	0.8	0.6	0.5	0.6	-0.1	0.0	0.5	1.5	1.5	1.0	1.4

Note: Negative numbers indicate that the Proposed Action would decrease reservoir elevations compared to the No Action/No Project Alternative; positive numbers indicate that the Proposed Action would increase reservoir elevations.
Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Water transfers could degrade the existing landscape character or scenic quality of Class A and B visual resources along surface water bodies. Decreased river flows could affect the visual quality of these rivers. Table 3.14-2 shows changes in river flows on the Sacramento, Feather, American, and Merced rivers. As described above, reservoir operators would need to continue releases to meet downstream flow and water quality standards; these required releases would prevent any changes from substantially changing the visual quality of the channel.

Changes in river flows under the Proposed Action would be within normal river flow fluctuation and would not result in a notable difference in the landscape character of the river. The Proposed Action would have a less-than-significant impact on the landscape character and scenic attractiveness of existing visual resources along the Sacramento, Feather, American, and Merced rivers.

Table 3.14-2. Changes in River Flows between the No Action/No Project Alternative and the Proposed Action (in cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Sacramento River at Wilkins Slough												
W	-8.9	-5.1	-8.0	-10.7	-6.3	-5.3	-5.0	-3.2	-1.9	-2.4	-1.4	-1.3
AN	-8.3	-8.2	-27.2	-19.6	-18.2	-7.9	-8.2	-44.3	-2.6	7.2	7.2	7.8
BN	-4.5	-3.7	-3.5	-3.5	-3.5	-3.3	-4.3	0.0	0.0	-3.3	0.0	-3.0
D	-11.0	-14.1	-10.1	-11.0	-7.9	-7.6	-53.1	-33.5	-252.6	465.6	758.9	162.0
C	-21.5	-15.8	-15.2	-14.1	-5.2	-15.1	-0.2	-114.5	-274.4	1,517.7	838.4	356.1
All	-11.5	-9.3	-13.0	-12.6	-8.3	-8.1	-13.0	-38.5	-102.2	394.8	307.3	102.6
Lower Feather River												
W	0.2	-13.8	-32.1	-25.8	-52.4	-16.4	-10.4	-9.1	-3.5	-1.1	7.1	6.4
AN	16.3	-11.7	-9.9	-55.2	-55.8	-196.8	-15.5	-58.8	-22.0	86.1	-39.3	-31.2
BN	5.3	5.4	13.4	-5.0	-7.5	-9.6	-9.2	-7.2	0.0	0.7	10.7	4.0
D	-1.9	-10.0	-8.2	-13.3	-25.2	-35.2	-7.9	-109.4	-16.0	120.1	240.8	-35.7
C	-11.0	-8.5	-0.3	-18.5	-56.0	-21.1	-0.6	-0.5	-31.3	113.9	318.3	49.2
All	0.7	-10.5	-14.8	-26.1	-46.3	-52.1	-8.8	-33.7	-14.5	59.4	104.4	1.0
American River at H Street												
W	16.4	38.7	-39.7	-56.2	-22.4	-2.7	-1.3	8.3	-13.7	4.1	-1.6	3.5
AN	21.2	12.1	0.9	-173.0	-235.7	-34.9	-1.3	-1.3	1.8	32.7	36.5	41.0
BN	12.1	11.9	21.5	-0.4	-79.4	-0.5	-0.4	-0.5	12.3	13.6	-0.3	8.2
D	25.4	8.9	43.7	-53.1	-22.0	-73.9	-114.5	-63.7	-0.9	130.5	80.0	56.9
C	51.5	40.0	30.3	16.9	17.0	25.8	-23.3	19.4	-45.9	195.1	141.3	82.4
All	25.8	27.4	0.2	-57.9	-55.2	-14.9	-25.7	-4.3	-13.8	71.4	49.0	36.1
River at San Joaquin River												
W	0.0	0.0	0.0	0.0	-41.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	-81.3	0.0	0.0	-84.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	127.5	71.4	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	85.0	47.6	0.0	0.0	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	36.4	20.4	0.0	0.0	0.0	0.0
All	0.0	0.0	0.0	0.0	-15.9	-14.4	30.0	16.8	-14.8	0.0	0.0	0.0

Note: Negative numbers indicate that the Proposed Action would decrease river flows compared to the No Action/No Project Alternative; positive numbers indicate that the Proposed Action would increase river flows.
Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Stored reservoir release transfers could substantially degrade the existing landscape character or scenic attractiveness of Class A and B visual resources at participating reservoirs. Under the Proposed Action, stored reservoir release transfers could affect elevations at participating reservoirs, which could affect the visual quality of the reservoir. The reservoirs, however, would not drop below the conservation pool at any of the facilities (which defines the bottom of the bathtub ring).

Under the Proposed Action, elevation changes would be of an insufficient magnitude to result in perceptible changes to the visual quality of the reservoirs. Under the Proposed Action, reservoir release would have a less-than-significant impact on the landscape character and scenic attractiveness of existing visual resources at participating reservoirs.

Cropland idling transfers could substantially degrade the existing landscape character and scenic attractiveness of Class A and B visual resources. Agricultural lands are typically considered a Class C visual resource and by definition would not have an impact on Class A and B visual resources. Under the Proposed Action, crop idling would have a less-than-significant impact on the landscape character and scenic attractiveness of existing visual resources in the Sacramento River Region.

3.14.2.4.2 Buyer Service Area

Water transfers could substantially degrade the existing landscape character and quality in the Buyer's Service Area. The conveyance of transfer water through existing conveyance channels in the Buyers Service Area could be visible from adjacent land, vantage points, and roadways. Flows would be similar to what is normally flowing in these channels but would occur for a longer period of time, and could potentially extend into the summer months during years when transfer water is available. Because the conveyance channels are generally located within and near agricultural areas, they are considered Class C resources. Any changes in flow in conveyance channels would not affect Class A or B resources. The effects of increased flows in export conveyance channels would have a less-than-significant impact on visual resources in the Buyers Service Area.

3.14.2.5 Alternative 3: No Cropland Modifications

This section describes the potential visual resources effects of the No Cropland Modifications Alternative.

3.14.2.5.1 Seller Service Area

Water transfers could degrade the existing landscape character or scenic attractiveness of Class A and B visual resources at CVP and SWP reservoirs. Under Alternative 3, water supply operations related to water transfers could affect reservoir elevations in Shasta, Oroville, and Folsom reservoirs (similar to the Proposed Action). Decreased reservoir elevations could affect the landscape character and scenic attractiveness of the reservoir. Table 3.14-3 shows the changes in reservoir elevations at these three reservoirs. The changes from the No Action/No Project Alternative would be minor, and the visual effect of the increased bathtub ring would not be noticeable. The impact to visual resources would be less than significant.

Table 3.14-3. Changes in CVP and SWP Reservoir Elevations between the No Action/No Project Alternative and Alternative 3 (in feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Shasta Reservoir												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-0.4	-0.4	-0.3	-0.2	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1
D	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.2	0.4	1.3	0.9	-0.2	-0.2
C	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.2	0.5	1.8	-0.2	-0.5	-0.5
Lake Oroville												
W	-0.5	-0.5	-0.3	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2
AN	-2.2	-2.2	-2.1	-1.4	-1.1	-0.1	-0.1	-0.1	0.0	-0.4	-0.3	-0.3
BN	-0.3	-0.4	-0.6	-0.5	-0.5	-0.3	-0.3	-0.3	-0.4	-0.6	-0.7	-0.8
D	-0.7	-0.7	-0.6	-0.6	-0.6	-0.4	-0.4	-0.4	0.5	0.0	-1.2	-0.7
C	-1.7	-2.2	-2.3	-2.3	-2.1	-1.8	-1.9	-1.8	-1.5	-1.8	-2.9	-3.0
Folsom Reservoir												
W	0.2	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
AN	-0.5	-0.6	-0.5	-0.1	0.0	0.0	0.0	0.0	0.0	-0.1	-0.3	-0.5
BN	-0.3	-0.4	-0.6	-0.5	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.2	-0.2
D	0.3	0.2	-0.1	-0.2	-0.3	-0.1	-0.1	0.8	1.4	1.4	1.6	1.8
C	1.1	0.8	0.6	0.5	0.6	-0.1	0.0	0.5	1.5	1.5	1.0	1.4

Note: Negative numbers indicate that Alternative 3 would decrease reservoir elevations compared to the No Action/No Project Alternative; positive numbers indicate that Alternative 3 would increase reservoir elevations.

Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Water transfers could degrade the existing landscape character or scenic quality of Class A and B visual resources along surface water bodies. Under Alternative 3, decreased river flows could affect the visual quality of these rivers. Table 3.14-4 shows changes in river flows on the Sacramento, Feather, American, and Merced rivers. Changes in river flows under Alternative 3 would be within normal river flow fluctuation and would not result in a notable difference in the landscape character of the river. Alternative 3 would have a less-than-significant impact on the landscape character and scenic attractiveness of existing visual resources along the Sacramento, Feather, American, and Merced rivers.

Table 3.14-4. Changes in River Flows between the No Action/No Project Alternative and Alternative 3 (in cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Sacramento River at Wilkins Slough												
W	-8.9	-5.1	-8.0	-10.7	-6.3	-5.3	-5.0	-3.2	-1.9	-2.4	-1.4	-1.3
AN	-8.3	-8.2	-27.2	-19.6	-18.2	-7.9	-8.2	-44.3	-2.6	7.2	7.2	7.8
BN	-4.5	-3.7	-3.5	-3.5	-3.5	-3.3	-4.3	0.0	0.0	-3.3	0.0	-3.0
D	-11.0	-14.1	-10.1	-11.0	-7.9	-7.6	-53.1	-33.5	-248.9	294.9	452.1	75.6
C	-21.5	-15.8	-15.2	-14.1	-5.2	-15.1	-0.2	-119.3	-273.7	715.3	251.9	102.1
All	-11.5	-9.3	-13.0	-12.6	-8.3	-8.1	-13.0	-39.5	-101.5	199.5	132.4	35.1
Lower Feather River												
W	0.2	-13.8	-32.1	-25.8	-52.4	-16.4	-10.4	-9.1	-3.5	-1.1	7.1	6.4
AN	16.3	-11.7	-9.9	-55.2	-55.8	-196.8	-15.5	-58.8	-22.0	86.1	-39.3	-31.2
BN	5.3	5.4	13.4	-5.0	-7.5	-9.6	-9.2	-7.2	0.0	0.7	10.7	4.0
D	-1.9	-10.0	-8.2	-13.3	-25.2	-35.2	-7.9	-106.9	-16.0	102.1	228.7	-40.7
C	-11.0	-8.5	-0.3	-18.5	-56.0	-21.1	-0.6	-0.5	-29.5	185.5	197.5	40.6
All	0.7	-10.5	-14.8	-26.1	-46.3	-52.1	-8.8	-33.3	-14.1	71.0	77.4	-1.6
American River at H Street												
W	16.4	38.7	-39.7	-56.2	-22.4	-2.7	-1.3	8.3	-13.7	4.1	-1.6	3.5
AN	21.2	12.1	0.9	-173.0	-235.7	-34.9	-1.3	-1.3	1.8	32.7	36.5	41.0
BN	12.1	11.9	21.5	-0.4	-79.4	-0.5	-0.4	-0.5	12.3	13.6	-0.3	8.2
D	25.4	8.9	43.7	-53.1	-22.0	-73.9	-114.5	-63.7	-0.9	130.5	80.0	56.9
C	51.5	40.0	30.3	16.9	17.0	25.8	-23.3	20.5	-44.3	191.3	142.5	82.4
All	25.8	27.4	0.2	-57.9	-55.2	-14.9	-25.7	-4.1	-13.5	70.6	49.3	36.1
Merced River at San Joaquin River												
W	0.0	0.0	0.0	0.0	-41.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	-81.3	0.0	0.0	-84.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	127.5	71.4	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	85.0	47.6	0.0	0.0	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	36.4	20.4	0.0	0.0	0.0	0.0
All	0.0	0.0	0.0	0.0	-15.9	-14.4	30.0	16.8	-14.8	0.0	0.0	0.0

Note: Negative numbers indicate that Alternative 3 would decrease river flows compared to the No Action/No Project Alternative; positive numbers indicate that Alternative 3 would increase river flows.
Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Stored reservoir release transfers could substantially degrade the existing landscape character or scenic attractiveness of Class A and B visual resources participating reservoirs. The impacts to visual resources at reservoirs participating in stored reservoir water transfers would be the same under Alternative 3 as the Proposed Action; these impacts would be less than significant.

3.14.2.5.2 Buyer Service Area

Water transfers could substantially degrade the existing landscape character and quality in the Buyer's Service Area. The impacts to visual resources in the

Buyer Service Area would be the same under Alternative 3 as the Proposed Action; these impacts would be less than significant.

3.14.2.6 Alternative 4: No Groundwater Substitution

This section describes the potential visual resources effects of the No Groundwater Substitution Alternative.

3.14.2.6.1 Seller Service Area

Water transfers could degrade the existing landscape character or scenic attractiveness of Class A and B visual resources at CVP and SWP reservoirs. Under Alternative 4, water supply operations related to water transfers could affect reservoir elevations in Shasta, Oroville, and Folsom reservoirs (similar to the Proposed Action). Decreased reservoir elevations could affect the landscape character and scenic attractiveness of the reservoir. Table 3.14-5 shows the changes in reservoir elevations at these three reservoirs. The changes from the No Action/No Project Alternative would be minor, and the visual effect of the increased bathtub ring would not be noticeable. The impact to visual resources would be less than significant.

Table 3.14-5. Changes in CVP and SWP Reservoir Elevations between the No Action/No Project Alternative and Alternative 4 (in feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Shasta Reservoir												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.7	0.4	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	2.4	0.4	0.0	0.0
Lake Oroville												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	-0.1	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.9	-0.5	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.8	0.0	0.0
Folsom Reservoir												
W	0.6	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-0.2	-0.3	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.6	0.5	0.0	0.0	-0.1	0.0	0.0	0.6	1.0	1.3	1.7	2.0
C	1.4	1.2	1.1	1.0	1.1	0.4	0.1	0.5	1.1	1.0	1.4	1.9

Note: Negative numbers indicate that Alternative 4 would decrease reservoir elevations compared to the No Action/No Project Alternative; positive numbers indicate that Alternative 4 would increase reservoir elevations.
Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Water transfers could degrade the existing landscape character or scenic quality of Class A and B visual resources along surface water bodies. Under Alternative 4, decreased river flows could affect the visual quality of these rivers. Table 3.14-6 shows changes in river flows on the Sacramento, Feather, American, and Merced rivers. Changes in river flows under Alternative 4 would be within normal river flow fluctuation and would not result in a notable difference in the landscape character of the river. Alternative 4 would have a less-than-significant impact on the landscape character and scenic attractiveness of existing visual resources along the Sacramento, Feather, American, and Merced rivers.

Table 3.14-6. Changes in River Flows between the No Action/No Project Alternative and Alternative 4 (in cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Sacramento River at Wilkins Slough												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-73.8	279.9	279.9	89.1
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-31.7	-108.3	1,024.0	516.0	255.9
All	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-6.5	-35.3	260.2	155.6	68.4
Lower Feather River												
W	0.0	0.0	-6.3	-6.3	0.0	-3.9	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	-40.7	0.0	-16.8	0.0	-33.6	0.0	54.2	-40.7	-14.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	-12.0	-19.5	0.0	-24.3	0.0	-2.1	237.2	-66.0
C	0.0	0.0	0.0	0.0	-44.6	-5.8	0.0	0.0	-13.2	62.2	127.2	12.4
All	0.0	0.0	-2.4	-9.6	-11.3	-9.1	0.0	-10.2	-2.7	22.0	60.9	-11.6
American River at H Street												
W	9.7	36.2	-28.6	-18.6	-20.7	-1.1	0.0	9.6	-13.5	-0.5	-0.8	0.0
AN	10.4	4.4	1.7	-132.1	-233.9	-33.2	0.3	0.1	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	20.8	11.7	57.6	-52.2	-21.2	-72.2	-113.6	-24.3	0.0	55.6	33.9	32.2
C	36.5	28.6	31.5	18.2	18.3	26.8	26.8	38.6	-6.8	97.4	59.6	55.8
All	16.7	22.6	6.0	-35.9	-48.8	-13.5	-14.5	7.3	-6.6	29.7	17.9	17.2
Merced River at San Joaquin River												
W	0.0	0.0	0.0	0.0	-41.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-84.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	162.6	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	69.7	0.0	0.0
All	0.0	0.0	0.0	0.0	-15.9	0.0	0.0	0.0	-14.8	43.1	0.0	0.0

Note: Negative numbers indicate that Alternative 4 would decrease river flows compared to the No Action/No Project Alternative; positive numbers indicate that Alternative 4 would increase river flows.
Key: Sac Yr Type = year type, W = wet, AN = above normal, BN = below normal, D = dry, C = critical

Stored reservoir release transfers could substantially degrade the existing landscape character or scenic attractiveness of Class A and B visual resources participating reservoirs. The impacts to visual resources at reservoirs participating in stored reservoir water transfers would be the same under Alternative 4 as the Proposed Action; these impacts would be less than significant.

Cropland idling transfers could substantially degrade the existing landscape character and scenic attractiveness of Class A and B visual resources. The impacts to visual resources at from cropland idling transfers would be the same under Alternative 4 as the Proposed Action; these impacts would be less than significant.

3.14.2.6.2 Buyer Service Area

Water transfers could substantially degrade the existing landscape character and quality in the Buyer's Service Area. The impacts to visual resources in the Buyer Service Area would be the same under Alternative 4 as the Proposed Action; these impacts would be less than significant.

3.14.3 Comparative Analysis of Alternatives

Table 3.14-7 summarizes the effects of each of the action alternatives. The following text supplements the table by describing the magnitude of the effects under the action alternatives and No Action/No Project Alternative.

Table 3.14-7. Comparative Analysis of Alternatives

Potential Impacts	Alternative(s)	Significance	Proposed Mitigation	Significance after Mitigation
There would be no impacts to existing landscape character or scenic attractiveness of Class A and B visual resources in the Seller Service Area	1	NCFEC	None	NCFEC
There would be no impacts to existing landscape character or scenic attractiveness of Class A and B visual resources in the Buyer Service Area	1	NCFEC	None	NCFEC
Water transfers could degrade the existing landscape character or scenic attractiveness of Class A and B visual resources at CVP and SWP reservoirs	2, 3, 4	LTS	None	LTS
Water transfers could degrade the existing landscape character or scenic quality of Class A and B visual resources along surface water bodies	2, 3, 4	LTS	None	LTS
Stored reservoir release transfers could substantially degrade the existing landscape character or scenic attractiveness of Class A and B visual resources participating reservoirs	2, 3, 4	LTS	None	LTS
Cropland idling transfers could substantially degrade the existing landscape character and scenic attractiveness of Class A and B visual resources	2, 4	LTS	None	LTS
Water transfers could substantially degrade the existing landscape character and quality in the Buyer's Service Area	2, 3, 4	LTS	None	LTS

Key: LTS = less than significant, None = no mitigation

3.14.3.1 No Action/No Project Alternative

There would be no impacts on visual resources.

3.14.3.2 Alternative 2: Full Range of Transfers (Proposed Action)

Water transfers under the Proposed Action could affect reservoir elevations and river flows in the area of analysis; however, reported changes in elevation and flow would generally be within normal seasonal fluctuations and would not be expected to result in substantial changes to visual resources.

3.14.3.3 Alternative 3: No Cropland Modifications

Alternative 3 would not include cropland idling, so the minor visual effects associated with idle fields would not occur. The remaining potential effects to visual resources would be the same as the Proposed Action.

3.14.3.4 Alternative 4: No Groundwater Substitution

Effects to visual resources would be the same under Alternative 4 as the Proposed Action.

3.14.4 Environmental Commitments/Mitigation Measures

There are no significant visual resource impacts; therefore no mitigation measures are required.

3.14.5 Potentially Significant Unavoidable Impacts

There are no expected significant and unavoidable impacts to visual resources.

3.14.6 Cumulative Effects

The timeline for the visual resources cumulative effects analysis extends from 2015 through 2024, a ten year period. The relevant geographic study area for the cumulative effects analysis is the same area of analysis as shown in Figure 3.14-1. The following section analyzes the cumulative effects using the project method, which is further described in Chapter 4. Chapter 4 describes the projects included in the cumulative condition.

The cumulative analysis for visual resources considers projects and conditions that could affect landscape character or scenic attractiveness of existing visual resources within the area of analysis.

3.14.6.1 Alternative 2: Full Range of Transfers (Proposed Action)

3.14.6.1.1 Seller Service Area

Water transfers, in combination with other cumulative projects, could degrade the existing landscape character or scenic attractiveness of Class A and B visual resources. Proposed cropland modifications and groundwater substitution transfers in combination with other cumulative projects could affect visual resources if multiple transfers occurred in the same year, elevating the effects on reservoir elevation and river flows. This could substantially degrade the existing landscape character or scenic attractiveness of Class A and B visual resources in the Sacramento River Region.

Existing and foreseeable water acquisition programs with potential to affect reservoir elevation and river flows in the Seller Service Area include the SWP Transfers, which are described in Chapter 4. The proposed additional transfers could contribute to the additional fluctuation of reservoir elevation and river flows, if transfers occurred within the same year. Increased elevation and river flows typically improve visual resources by creating a fuller reservoir or river, and improving riparian habitat along shorelines. Reductions in elevation and river flows could result in substantial exposure of a reservoir's bathtub ring, or the riverbed, reduction in riparian vegetation along the shore or change important visual features a part of the reservoir or river. All changes to reservoirs and rivers from the cumulative projects would remain within established water flow, water quality, and reservoir level standards. Therefore, the Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact related to visual resources.

3.14.6.2 Alternative 3: No Cropland Modifications

The visual impacts under Alternative 3 would be very similar to the Proposed Action. As under the Proposed Action, the cumulative impacts to visual resources would be less than significant.

3.14.6.3 Alternative 4: No Groundwater Substitution

The visual impacts under Alternative 4 would be very similar to the Proposed Action. As under the Proposed Action, the cumulative impacts to visual resources would be less than significant.

3.14.7 References

CDPR. 2012. San Luis Reservoir SRA. Accessed on: 07 19 2012. Available at: http://www.parks.ca.gov.

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Section 3.15 Recreation

This section presents the existing recreational opportunities within the area of analysis and discusses potential effects on recreation from the proposed alternatives. Transfers could affect reservoir levels and river flows, which could affect user days at each recreation resource in the area of analysis.

3.15.1 Affected Environment/Environmental Setting

This section provides a description of the recreational facilities with the potential to be affected by the action alternatives and an overview of the regulatory setting associated with recreation.

3.15.1.1 Area of Analysis

Figure 3.15-1 shows the rivers and reservoirs in the area of analysis for recreation. In the Seller Service Area, the area of analysis includes rivers, reservoirs, waterfront parks, and other recreational amenities that would be affected by changes to the associated river flow and/or reservoir levels as a result of water transfers. In the Buyer Service Area, the only recreation facility that could be affected by water transfers is San Luis Reservoir. The water would be conveyed to buyers through canals and aqueducts that are not recreational facilities; therefore, these conveyance structures are not part of the area of analysis.

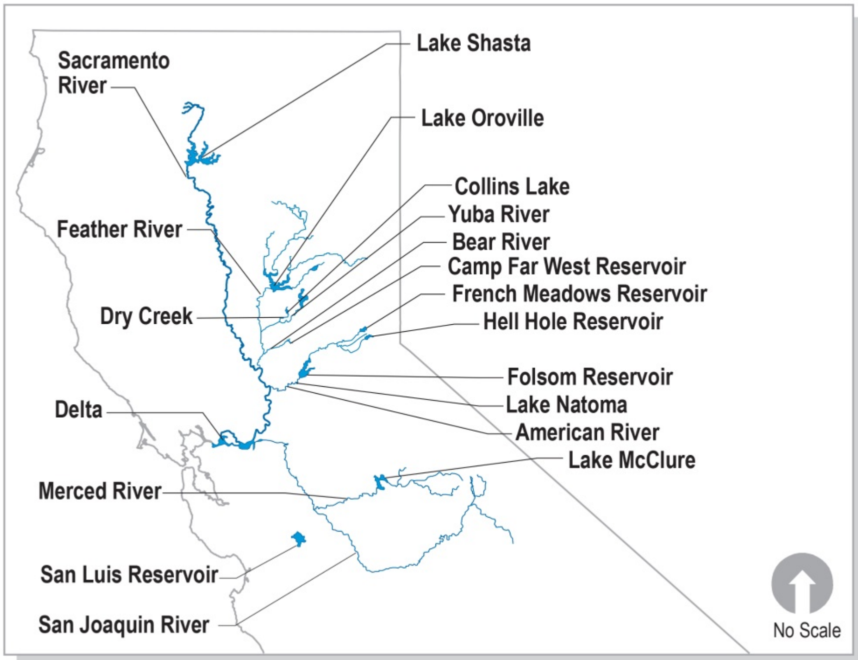

Figure 3.15-1. Recreation Area of Analysis

3.15.1.2 Regulatory Setting

There are no state or federal regulations relevant to recreation for the analysis of long-term water transfers.

3.15.1.3 Existing Conditions

The following section describes the existing recreational areas and types of recreational opportunities within the area of analysis.

3.15.1.3.1 Seller Service Area

Sacramento River

Shasta Reservoir is the major reservoir on the Sacramento River. Shasta Reservoir is managed by the U.S. Forest Service (USFS) Shasta-Trinity National Forest (NF), Shasta Unit. Popular water-related recreational activities at Shasta Reservoir include boating, water-skiing, swimming, and fishing. Both public and private boat launch facilities are available. Table 3.15-1 lists the public boat launches and the number of lanes available at different lake levels. The busiest visitor season is between May and September (USFS Shasta-Trinity NF 2014). In 2008, approximately 47,847 day use tickets were sold at Shasta-Trinity National Recreation Area (NRA) (USFS Natural Resource Manager Shasta-Trinity NRA 2014).

Table 3.15-1. Shasta Reservoir Water Elevation Requirements for Boat Launching

Boat Launch Site	Launching Lanes Available (lake drawdown below elevation 1,067 in feet)
Antlers	4 lanes from 0 to 50 4 lanes from 50 to 75
Bailey Cove	2 lanes from 0 to 50
Centimudi	4 lanes from 0 to 50 4 lanes from 50 to 75 3 lanes from 75 to 95 2 lanes from 95 to 115 2 lanes from 115 to 140 2 lanes from 140 to 160 2 lanes from 160 to 210
Hirz Bay	3 lanes from 0 to 50 3 lanes from 50 to 75 2 lanes from 75 to 95 1 lane from 95 to 115
Jones Valley	4 lanes from 0 to 50 2 lanes from 50 to 75 2 lanes from 75 to 95 2 lanes from 95 to 115 2 lanes from 115 to 140 1 lanes from 140 to 160 1 lanes from 160 to 210
Packers Bay	4 lanes from 0 to 50 2 lanes from 50 to 75 2 lanes from 75 to 95 2 lanes from 95 to 115
Sugarloaf	2 lanes from 75 to 95 2 lanes from 95 to 115 2 lanes from 115 to 140 2lanes from 140 to 160

Source: ShastaLake.com 2014

The Sacramento River encompasses many water dependent recreational areas. Along most of the upper Sacramento River, fishing, rafting, canoeing, kayaking, swimming, and power boating are popular activities. Boating and rafting opportunities are dependent on optimal river flows above 5,000 cubic feet per second (Bureau of Land Management [BLM] n.d.).

Large recreational areas along the river between Red Bluff and Sacramento are owned and/or managed by private companies and several federal, state and local agencies including the California Department of Parks and Recreation (CDPR), Bureau of Reclamation (Reclamation), USFS, U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife, Sutter County, Glenn County, Tehama County, Yolo County, Sacramento County, City of Red Bluff. These areas include parks, wildlife refuges, fishing and hunting accesses, wildlife viewing areas, campsites, and boat launch facilities. California State Park day use and camping visitor statistics are available for some recreation areas for fiscal year 2011/2012. Bidwell-Sacramento River State Recreation Area (SRA) reported 51,211 visitors and Colusa-Sacramento River SRA reported 11,725 visitors (CDPR 2012).

3.15.1.3.2 American River

Figure 3.15-2 shows the American River and associated tributaries and reservoirs within the area of analysis. Hell Hole and French Meadows reservoirs are upstream of Folsom Reservoir within the Tahoe NF and managed by the Placer County Water Agency.

Recreational opportunities at Hell Hole Reservoir include: camping, boating and fishing. One boat ramp is available on the west side and is best used in the late spring to mid-summer because the water level of lake drops later in the summer. Usually, only small boats are seen on the reservoir due to its remote location. The boat ramp at Hell Hole is accessible when the surface water elevation is at 4,530 feet or above. Hydrologic data indicates that the boat ramp has remained open during the recreation season in most water year types except during dry and critically dry years where the ramp may close in mid-August and early September respectively. Placer County Water Agency conducted vehicle counts from May 2007 through May 2008 at all developed recreation facilities including the boat ramp and parking areas. Over the year, an average of 4.3 vehicles with boat trailers, with a maximum of 13 vehicles with boat trailers, were counted on weekdays; and an average of 8.1 vehicles with boat trailers, with a maximum of 21 vehicles with boat trailers, were present at Hell Hole Reservoir (Placer County Water Agency 2010).

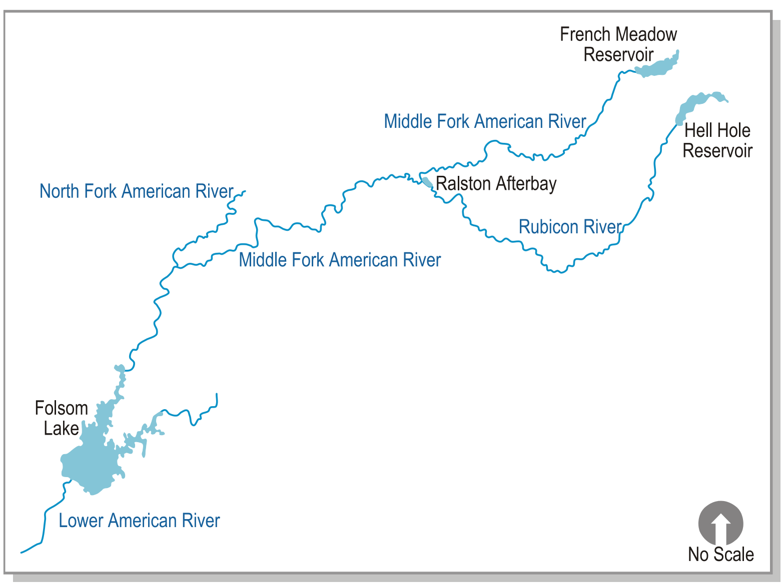

Figure 3.15-2. North and Middle Forks of the American River

Recreational opportunities at French Meadows Reservoir include: camping, picnicking, fishing and boating. The boat ramp at French Meadows Reservoir is accessible when the surface water elevation is at 5,200 feet or above (Placer County Water Agency 2010). Boat ramps are available on both the south and north shores, although water levels drop in the summer months (Placer County Commerce 2014). Hydrologic data indicates that the boat ramps have remained open during the recreation season in all water year types except during critically dry years where the ramp may close in early August. Placer County Water Agency conducted vehicle counts from May 2007 through May 2008 at all developed recreation facilities including the boat ramp and parking areas. Over the year, an average of 2.1 vehicles with boat trailers, with a maximum of nine vehicles with boat trailers, were counted on weekdays; and an average of 4.5 vehicles with boat trailers, with a maximum of 13 vehicles with boat trailers, were present at French Meadows Reservoir (Placer County Water Agency 2010).

Folsom Reservoir is within the Folsom Reservoir SRA. Boating, fishing and waterskiing are the primary water related activities at Folsom Reservoir. Table 3.15-2 describes the various boat ramps and guidance for usability according to surface water elevation. Hiking, biking, camping, picnicking, and horseback riding are also popular activities within the SRA. Lake Natoma, downstream of Folsom Dam, is also within the Folsom Reservoir SRA. Non-motorized boats and motorized boats with a maximum speed limit of five miles per hour are allowed on Lake Natoma. The lake is popular for rowing, kayaking, fishing, and canoeing. The California State University, Sacramento Aquatics Sports Center is located on Lake Natoma and offers a variety of non-motorized boating activities. It also hosts rowing competitions each year (CDPR 2013b). Visitor attendance at Folsom SRA was 1,491,025 and included day use and camping visitors for fiscal year 2011/2012 (CDPR 2012).

Table 3.15-2. Folsom Reservoir Water Elevation Guidelines for Boat Launching

Boat Launch Site	Surface Water Elevations (in Feet)
Granite Bay	Low Water – 2 lanes between 369 and 396 Stage 1 - 2 lanes between 397and 430 Stage 2 – 8 lanes between 420 and 438 Stage 3 – 10 lanes between 430 and 452. Stage 4 – 2 lanes between 450 and t465 5% - 4 lanes between 408 and465
Folsom Point	2 lanes between 405 and 465 above
Browns Ravine	4 lanes between 399 and 465 4 lanes between 380 and 435
Rattlesnake Bar	2 lanes between 428 and 465
Peninsula	Old Ramp - 1 lane between 410 and465 New Ramp - 2 lanes between 434 and 465

Source: Folsom Lake Marina 2014.

The north fork of the American River from 0.3 miles upstream of Heath Springs to 1,000 feet upstream of the Colfax-Iowa Hill Bridge, and the lower American River from the confluence with the Sacramento River to Nimbus Dam have been designated as National Wild and Scenic Rivers (National Wild & Scenic Rivers System 2014).

Along the entire American River, whitewater boating is ideal during the boating season with many commercial rafting operations and private boaters. The north fork is popular for boating between April and June and provides more advanced boating levels. The middle and south forks are more popular during the summer months with less advanced terrain and some flat water along the south fork. Other recreational opportunities include kayaking, fishing, biking, hiking and horseback riding (The American River 2014).

3.15.1.3.3 Yuba River

Numerous rivers, creeks, tributaries, and reservoirs along the Yuba River offer recreation opportunities and receive extensive use. Boating on the North Yuba River is challenging and recommended for expert boaters during the spring and is known for good fishing during the rest of year. The South Yuba River offers many activities including boating, camping, fishing, hiking and horseback riding. The South Yuba River has been designated as a California Wild and Scenic River (California Legislative Council 2014). Visitor attendance at the South Yuba River State Park was 662,930 visitors during fiscal year 2011/2012 (CDPR 2012).

Merle Collins Reservoir, also known as Collins Lake, is a year-round recreation area offering camping with lakefront recreational vehicle sites, fishing, boating, and day-use beach area. A boat launch, marina and rental boats are available. Every spring, over 50,000 trout ranging from three to eight pounds are planted (Collins Lake 2014). Visitor days in 2011 included 24,379 persons for day use and 128,112 persons for overnight camping (Young 2014).

Fishing in Dry Creek is hindered in the summer and fall because flows are very low or nonexistent. The water temperatures near its confluence with the Yuba River are not attractive to salmon, which do not enter Dry Creek from the Yuba River (Browns Valley Irrigation District [ID] 2009).

3.15.1.3.4 Feather River

Lake Oroville is within the Lake Oroville SRA. Recreational opportunities on the lake include: camping, picnicking, horseback riding, hiking, sail and power boating, water skiing, fishing, swimming, boat-in camping, floating campsites and horse camping (CDPR 2013a). Water levels at the lake affect the number of accessible boat launch ramps and car-top boat launches, swimming beaches and boat-in camps are available to the public. Table 3.15-3 describes the different launch ramps and the availability for launching based on lake elevations. In fiscal year 2011/2012, 1,095,188 visitors were recorded at Lake Oroville SRA, which includes day use and camping.

Table 3.15-3. Lake Oroville Water Elevation Requirements for Boat Launching

Boat Launch Site	Surface Water Elevation (in Feet)
Bidwell Canyon	7 lanes from 850 to 900 5 lanes from 802 to 850 4 lanes from 781 to 802 2 lanes from 735 to 781 3 lanes from 680 to 745
Loafer Creek	8 lanes from 800 to 900 2 lanes from 775 to 800
Spillway Boat Launch	12 lanes from 810 to 900 8 lanes from 726 to 820 2 lanes from 695 to 726 1 lane from 685 to 695
Lime Saddle	8 lanes from 702 to 900
Enterprise	2 lanes from 820 to 900

Source: California Department of Water Resources 2014.

Popular recreational activities along the Lower Feather River include swimming, fishing, hiking, camping, nature viewing, picnicking, and bicycling (USFS Plumas NF 2014). The middle fork of the Feather River is designated as a Wild and Scenic River within the National Wild and Scenic River System from its tributary streams to one kilometer south of Beckwourth, California (National Wild & Scenic Rivers System 2014).

The Bear River is a tributary to the Lower Feather River and provides many recreational activities including camping, swimming, picnicking, kayaking and rafting, and horseback riding upstream of Camp Far West Reservoir. Downstream of Camp Far West, the land is mostly privately owned and developed for agriculture (Sacramento River Watershed Program 2014).

Recreational opportunities available at Camp Far West Reservoir include: camping, boating, swimming, water skiing, jet skiing, hiking, biking, fishing and horseback riding. The north shore of the lake is accessible year-round and the south shore is only open mid-May to September. The reservoir has two boat ramps, one on the north shore and the other on the south shore (Nevada County 2009).

3.15.1.3.5 Merced River

Recreational activities along the Merced River include rafting, hiking, swimming, picnicking, wildlife viewing, and camping at several camp grounds (BLM 2014). The main stem of the Merced River has been designated as a National Wild and Scenic River from its source to Lake McClure, and the south fork from its source to the confluence with the main stem (National Wild and Scenic River System 2014). Approximately 5,000 commercial whitewater boaters and 20,000 campers visit the Merced River upstream of Lake McClure each year (Horn 2014). Downstream of Lake McClure, the Merced River travels through mostly private land, although some limited public access is available.

Lake McClure and Lake McSwain are owned by the Merced ID. Recreational opportunities at Lake McClure and Lake McSwain include camping, fishing, boating, wildlife viewing, swimming, and picnicking. A boat ramp and marina provide boating amenities year round (Merced ID 2012). Table 3.15-4 shows the surface water elevations needed in Lake McClure to keep the boat ramps operational. In 2010, there were 1,397,190 visitors at Lake McClure and 482,030 visitors to Lake McSwain. These counts include each visit during any portion of a 24-hour period (Merced ID 2012).

Table 3.15-4. Lake McClure Water Elevation Requirements for Boat Launching

Boat Launch Site	Surface Water Elevations (in Feet)
Bagby	794 and above
Horseshoe Bend	759 and above
McClure Point	651 and above
Southern Barrett Cove	631 and above
Northern Barrett Cove	591 and above
Piney Creek	591 and above

Source: San Joaquin River Group Authority 1999

3.15.1.3.6 San Joaquin River Region

The area surrounding the San Joaquin River downstream of the Merced River consists mainly of private agricultural lands; therefore, public recreation is limited.

The San Joaquin River National Wildlife Refuge (NWR) encompasses a section of the San Joaquin River between the Tuolumne and Stanislaus rivers and is over 7,000 acres. The NWR offers a trail and educational free-roam exploration area as well as a wildlife-viewing platform (USFWS 2013).

3.15.1.3.7 Delta Region

Many recreational opportunities are available within the Delta. Large recreation areas include the Brannan Island and Franks Tract SRAs. Figure 3.15-3 shows the Delta region and some of the recreation areas. Visitor attendance at Brannan Island SRA was 66,680 visitors, including day use and campers during fiscal year 2011/2012. During the same period, visitor attendance at Franks Tract SRA was recorded as 62,089 visitors (CDPR 2012).

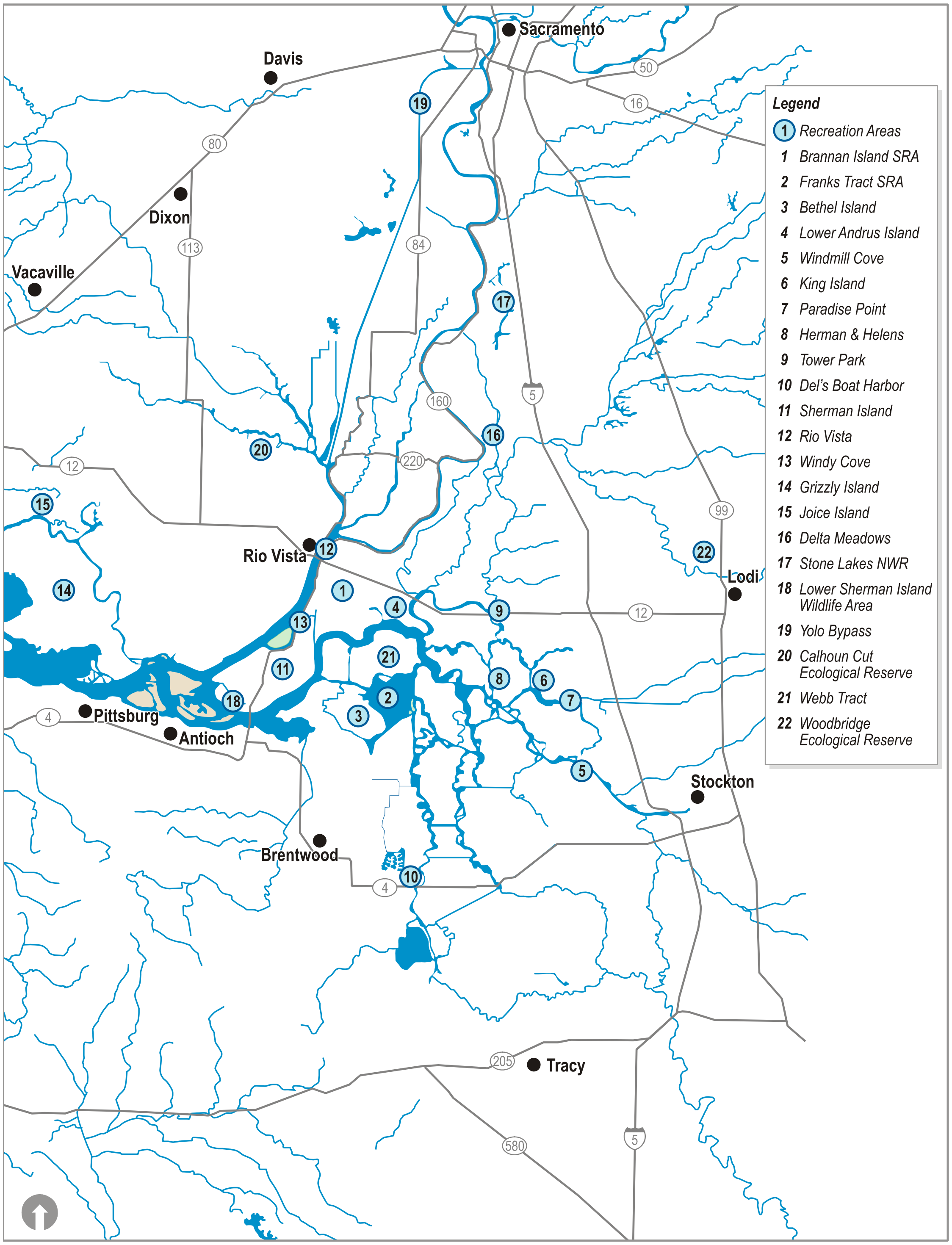

Figure 3.15-3. Sacramento-San Joaquin Delta Major Recreation Areas

Boating, fishing, windsurfing, water skiing and kayaking are some of the water-related recreational opportunities in the Delta. The California Delta Chambers & Visitors Bureau lists approximately 50 public and private marinas on their website each offering a different mix of amenities including: fuel, launching, bait, groceries, propane, restaurants, night clubs, boat sales, marine repair, campgrounds, boat storage, guest docks and boating supplies for sale. Sport fishing is one of the main attractions to the Delta where striped bass, sturgeon, catfish, black bass, salmon, and American shad are caught. Various commercial fishing guides and charter boats are also available for hire (California Delta Chambers & Visitors Bureau 2014).

3.15.1.3.8 Buyer Service Area

San Luis Reservoir is the only recreation area in the Area of Analysis in the Buyer Service Area. San Luis Reservoir SRA is open year round (Figure 3.15-4) and includes San Luis Reservoir, O’Neill Forebay and Los Banos Creek Reservoir, although Los Banos Creek Reservoir would not be affected by the project. San Luis Reservoir SRA provides for activities such as boating, boardsailing, fishing, camping, and picnicking. Boat access is available via one four-lane boat ramp at the Basalt area at the southeastern portion of the reservoir and at Dinosaur Point at the northwestern portion of the reservoir (Reclamation and CDPR 2012). The boat ramp at Basalt becomes inconvenient to use at low reservoir levels (at elevation 340 feet); the boat ramp at Dinosaur Point is difficult to access at elevation 360 feet. There are no designated swimming areas or beaches at San Luis Reservoir, but O’Neill Forebay (with its stable surface elevation) has swimming, boating, fishing, and camping opportunities (San Joaquin River Group 1999). Visitor attendance during fiscal year 2011/2012 at San Luis SRA was 149,890 visitors including campers (CDPR 2012).

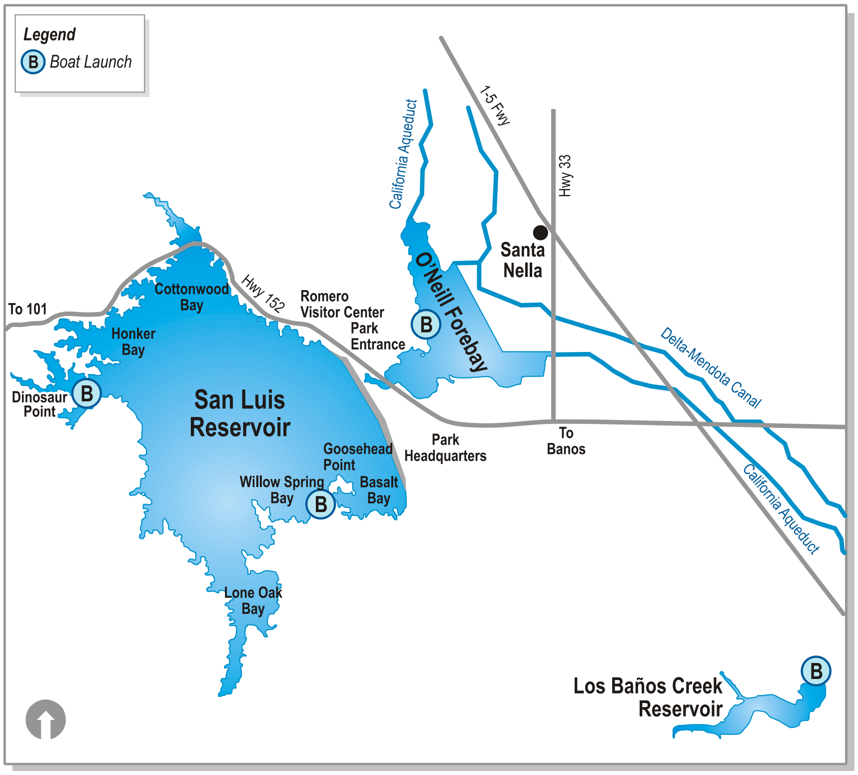

Figure 3.15-4. San Luis Reservoir San Luis SRA

3.15.2 Environmental Consequences/Environmental Impacts

This section describes the assessment methods and environmental consequences/environmental impacts associated with each alternative.

3.15.2.1 Assessment Methods

The effects analysis uses both quantitative and qualitative methods to assess changes in recreational opportunities and use of affected facilities. Quantitative methods include consideration of thresholds at which recreational opportunities are affected (e.g., the reservoir level at which boat ramps become unusable). Qualitative methods used to assess recreation effects include consideration of potential effects on the availability, accessibility, and quality of recreation sites.

The quantitative analysis relies on hydrologic modeling output that estimates changes to river flow and reservoir water surface elevations under the alternatives. Surface water elevation data is not available for all reservoirs included in the area of analysis. Where this data is not available, effects are evaluated based on transfer quantities, changes in water storage, and the timing of proposed transfers under the various action alternatives.

Recreational opportunities at reservoirs would be affected if reservoir levels decline such that boat ramps become unusable. Boat ramp usability was chosen as the limiting factor because it is a quantifiable measurement and lower reservoir levels would generally affect boat ramps prior to affecting other recreational activities (e.g., swimming or fishing). If boat ramps remain usable, it is assumed that there would be sufficient water levels in the reservoir to sustain all other recreational activities. In those cases where boat ramp usability is not a good indicator of ability to use other recreational facilities, this assessment includes a qualitative discussion.

Recreational opportunities in rivers and streams would be affected if flow rates increase or decrease substantially affecting whitewater rafting, kayaking, fishing, swimming and other water depending activities. Change in flow rates is a quantifiable measurement and drastic increases or decreases would affect water-related activities, which could affect visitor attendance.

Recreation at NWRs would not be affected by the any of the proposed alternatives because water supply to these areas would not change. ~~There would be no impacts to wildlife populations or access to NWRs.~~ Impacts to vegetation and wildlife resources and NWRs are discussed in Section 3.7. ~~Impacts to NWRs are not discussed further.~~

3.15.2.2 Significance Criteria

Impacts on recreation would be considered potentially significant if long-term water transfers would result in:

- Changes in reservoir water surface elevation or river flow rates that would result in substantial changes to the type, amount, or availability of recreation opportunities.

3.15.2.3 Alternative 1: No Action/No Project

There would be no changes in recreation under the No Action/No Project Alternative. Under the No Action/No Project Alternative, recreational opportunities in the Seller and Buyer Service Areas would not be affected by water transfers. Therefore, there would be no impacts to recreation under the No Action/No Project Alternative.

3.15.2.4 Alternative 2: Full Range of Transfers (Proposed Action)

Changes in surface water elevation at Shasta, Folsom, Merle Collins, Oroville, and Camp Far West reservoirs and Lake McClure as a result of water transfers could affect reservoir-based recreation. The results of modeling for these reservoirs under the Proposed Action is shown in Table 3.15-5, which indicates elevations would be very similar to those under the No Action/No Project Alternative under all hydrologic conditions. There would be no changes to the timing of boat ramp closures under existing conditions. These changes would have no impact to the recreational setting or visitor attendance at Shasta, Folsom and Oroville reservoirs.

Reservoir releases at Merle Collins Reservoir (Collins Lake) would result in lower reservoir levels of less than one foot in October and November during wet years and in January and February during dry years; and between one foot and 2.8 feet between in July and December in dry years. It is not likely that these small changes in surface water elevation would cause a significant impact to boating and fishing at Collins Lake as these transfers would already occur during drier years under existing conditions. Browns Valley ID already releases water from Collins Lake for irrigation purposes at other times during the year and the recreation activities continue to operate during these release times. These changes would have no impact to the recreational setting or visitor attendance at Collins Lake. Impacts to Collins Lake recreation as a result of the Proposed Action would be less than significant.

Changes to the average surface water elevation at Camp Far West could be up to 8.5 feet in average surface water elevation. These changes would be imperceptible and would not affect recreational activities at Camp Far West Reservoir because the lake already fluctuates in excess of 8.5 feet throughout the year because of releases under existing conditions.

At Lake McClure, under the Proposed Action the Bagby Boat Ramp would be open 11 months during below normal years instead of 12 months, and open one month instead of three months in dry years compared to existing conditions. The usability of the other five boat ramps would not change, so an alternative exists during the months when the Bagby Boat Ramp would be closed, making the effect to recreation less than significant. These changes would have no impact to the recreational setting or visitor attendance at Lake McClure or Lake McSwain.

Therefore, effects under the Proposed Action to recreation at these reservoirs would be less than significant.

Table 3.15-5. Changes in Shasta, Folsom, Oroville, Camp Far West, and Lake McClure Reservoir Elevations between the No Action/No Project Alternative and the Proposed Action (in feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Shasta Reservoir												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-0.4	-0.4	-0.3	-0.2	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1
D	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.2	0.6	1.8	1.4	-0.2	-0.2
C	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.2	1.2	3.7	0.4	-0.5	-0.5
Merle Collins Reservoir												
W	-0.6	-0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
D	-1.6	-1.2	-1.0	-0.9	-0.2	0.0	0.0	0.0	0.0	-1.6	-2.4	-2.8
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lake Oroville												
W	-0.5	-0.5	-0.3	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2
AN	-2.2	-2.2	-2.1	-1.4	-1.1	-0.1	-0.1	-0.1	0.0	-0.4	-0.3	-0.3
BN	-0.3	-0.4	-0.6	-0.5	-0.5	-0.3	-0.3	-0.3	-0.4	-0.6	-0.7	-0.8
D	-0.7	-0.7	-0.6	-0.6	-0.6	-0.4	-0.4	0.5	0.6	0.0	-1.2	-0.7
C	-1.7	-2.2	-2.3	-2.3	-2.1	-1.8	-1.9	-1.7	-1.4	-0.9	-2.9	-3.0
Folsom Reservoir												
W	0.2	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
AN	-0.5	-0.6	-0.5	-0.1	0.0	0.0	0.0	0.0	0.0	-0.1	-0.3	-0.5
BN	-0.3	-0.4	-0.6	-0.5	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.2	-0.2
D	0.3	0.2	-0.1	-0.2	-0.3	-0.1	-0.1	0.8	1.4	1.4	1.6	1.8
C	1.1	0.8	0.6	0.5	0.6	-0.1	0.0	0.5	1.5	1.5	1.0	1.4
Camp Far West Reservoir												
W	-1.4	-0.6	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-3.3	-3.1	-2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-1.2	-1.9
C	-5.4	-4.1	-3.5	-3.0	-1.3	-0.5	-0.4	-0.4	-0.4	-3.7	-5.3	-8.5
Lake McClure												
W	-0.6	-0.6	-0.6	-0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-6.4	-6.6	-6.5	-4.4	-3.8	-2.5	-2.2	-1.7	-0.9	-1.0	-1.1	-1.2
BN	0.0	0.0	0.0	0.0	0.0	0.0	-1.7	-2.7	-2.7	-3.1	-3.5	-3.6
D	-1.2	-1.3	-1.2	-1.2	-1.1	-1.1	-2.1	-2.6	-2.8	-3.2	-3.6	-3.8
C	0.0	0.0	0.0	0.0	0.0	0.0	-1.0	-1.6	-1.8	-2.1	-2.7	-2.9

W = wet
AN = above normal
BN = below normal
D = dry
C = critically dry

Changes in surface water elevations at Hell Hole and French Meadows Reservoirs as a result of water transfers could affect reservoir-based recreation. Recreational users at Hell Hole and French Meadows Reservoirs, include campers, boaters and fishermen. Under existing conditions, each boat ramp at both Hell Hole and French Meadows reservoirs are only useable until the late spring to mid-summer, at which time water begins to be released from the reservoirs. These reservoirs are not accessible during the winter due to snow and other hazardous conditions.

Under the Proposed Action, release of stored water would occur from July through September similar to existing conditions. Camping, shore fishing, swimming, and non-motorized boating would be unaffected under the Proposed Action. These changes would have no impact to the recreational setting or visitor attendance at Hell Hole or French Meadows reservoirs.

Releases under the Proposed Action would be on a similar schedule as under existing conditions, although more water could be released than under existing conditions especially during critically dry years. This increase in water releases would affect the usability of the boat ramps causing one or both boat ramps to be unusable earlier in the year. However, during dry and critically dry years, the boat ramps already close earlier than in other water year types. There are many opportunities in the region for boating at nearby reservoirs. If the boat ramps are unusable for a short time, boaters can visit alternate sites to launch boats. Short-term effects to boat launching at Hell Hole and French Meadows reservoirs would not result in a substantial decrease in recreation opportunities. This impact would be less than significant.

Changes in river flows from water transfers could affect river-based recreation on the Sacramento, Yuba, Feather, American, San Joaquin, and Merced rivers. The peak recreation activity at these surface water bodies is in the spring, summer and early fall months. Boating is most popular during the spring and summer months. Changes in river flows under the Proposed Action may result in flows below existing conditions in April and May; however, flows must continue to meet in-stream standards. These changes would not result in a notable difference to affect recreation opportunities on the river. Changes in flows under the Proposed Action would not prevent any water-related recreation activity, including rafting, fishing, swimming, and power boating, from occurring on the rivers. The Proposed Action would have a less-than-significant impact on recreational activities along the Sacramento, Feather, American, San Joaquin, and Merced rivers.

Changes in average flow in the Delta could affect river-based recreation. The Delta is a popular boating and fishing area. Water transfers would increase flows into the Delta during the July through September period and slightly decrease flows during other months. The changes in flow under the Proposed Action would not have any noticeable effect to recreation in the Delta. These changes would have no impact to the recreational setting or visitor attendance in the Delta. Therefore, effects to recreation in the Delta would be less than significant.

3.15.2.4.1 Buyer Service Area

Changes in surface water elevation at San Luis Reservoir as a result of water transfers could affect reservoir-based recreation. Under the Proposed Action, transfer water could be temporarily stored in San Luis Reservoir. These slight changes would have minimal affects to any water related activity and would not affect land-based recreation. The boat ramps would remain usable for the same number of months as the No Action/No Project Alternative. These changes would have no impact to the recreational setting or visitor attendance at the San Luis Reservoir SRA. Therefore, there would be no impact to recreation at San Luis Reservoir under the Proposed Action.

3.15.2.5 Alternative 3: No Cropland Modifications

This section describes the potential visual resources effects of the No Cropland Modifications Alternative.

3.15.2.5.1 Seller Service Area

Changes in surface water elevation at Shasta, Folsom, Merle Collins, Oroville, and Camp Far West reservoirs and Lake McClure as a result of water transfers could affect reservoir-based recreation. Table 3.15-6 summarizes changes in elevation under Alternative 3 relative to the No Action/No Project Alternative. At Shasta, Folsom and Oroville reservoirs, there would be very minor changes in elevation and there would be no effect to the usability of boat ramps at these reservoirs.

Changes to surface water elevations at Merle Collins and Camp Far West Reservoirs and Lake McClure would be the same as described for the Proposed Action. Effects to recreation would be less than significant.

Table 3.15-6. Changes in Shasta, Folsom, Oroville, Camp Far West, and Lake McClure Reservoir Elevations between the No Action/No Project Alternative and Alternative 3 (in feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Shasta Reservoir												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-0.4	-0.4	-0.3	-0.2	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1
D	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.2	0.4	1.3	0.9	-0.2	-0.2
C	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.2	0.5	1.8	-0.2	-0.5	-0.5
Merle Collins Reservoir												
W	-0.6	-0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	-1.6	-1.2	-1.0	-0.9	-0.2	0.0	0.0	0.0	0.0	-1.5	-2.4	-2.8
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lake Oroville												
W	-0.5	-0.5	-0.3	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2
AN	-2.2	-2.2	-2.1	-1.4	-1.1	-0.1	-0.1	-0.1	0.0	-0.4	-0.3	-0.3
BN	-0.3	-0.4	-0.6	-0.5	-0.5	-0.3	-0.3	-0.3	-0.4	-0.6	-0.7	-0.8
D	-0.7	-0.7	-0.6	-0.6	-0.6	-0.4	-0.4	0.4	0.5	0.0	-1.2	-0.7
C	-1.7	-2.2	-2.3	-2.3	-2.1	-1.8	-1.9	-1.8	-1.5	-1.8	-2.9	-3.0
Folsom Reservoir												
W	0.2	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
AN	-0.5	-0.6	-0.5	-0.1	0.0	0.0	0.0	0.0	0.0	-0.1	-0.3	-0.5
BN	-0.3	-0.4	-0.6	-0.5	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.2	-0.2
D	0.3	0.2	-0.1	-0.2	-0.3	-0.1	-0.1	0.8	1.4	1.4	1.6	1.8
C	1.1	0.8	0.6	0.5	0.6	-0.1	0.0	0.5	1.5	1.5	1.0	1.4

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Camp Far West Reservoir												
W	-1.4	-0.6	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-3.3	-3.1	-2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-1.2	-1.9
C	-5.4	-4.1	-3.5	-3.0	-1.3	-0.5	-0.4	-0.4	-0.4	-3.1	-5.3	-8.5
Lake McClure												
W	-0.6	-0.6	-0.6	-0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-6.4	-6.6	-6.5	-4.4	-3.8	-2.5	-2.2	-1.7	-0.9	-1.0	-1.1	-1.2
BN	0.0	0.0	0.0	0.0	0.0	0.0	-1.7	-2.7	-2.7	-3.1	-3.5	-3.6
D	-1.2	-1.3	-1.2	-1.2	-1.1	-1.1	-2.1	-2.6	-2.8	-3.2	-3.6	-3.8
C	0.0	0.0	0.0	0.0	0.0	0.0	-1.0	-1.6	-1.8	-2.1	-2.7	-2.9

W = wet
AN = above normal
BN = below normal
D = dry
C = critically dry
Note: Negative numbers indicate that Alternative 3 would decrease reservoir elevations compared to the No Action/No Project Alternative; positive numbers indicate that Alternative 3 would increase reservoir elevations.

Changes in surface water elevations at Hell Hole and French Meadows Reservoirs as a result of water transfers could affect reservoir-based recreation. Effects to recreation at Hell Hole and French Meadows reservoirs would be the same as the described for the Proposed Action. Effects would be less than significant.

Changes in river flows from water transfers could affect river-based recreation on the Sacramento, Yuba, Feather, American, San Joaquin, and Merced rivers. The peak recreation activity at these surface water bodies is in the spring, summer and early fall months. Boating is most popular during the spring and summer months. Changes in river flows under Alternative 3 would be within normal river flow fluctuation and would not result in a notable difference to affect recreation opportunities on the river. Changes in flows would not prevent any water-related recreation activity, including rafting, fishing, swimming, and power boating, from occurring on the rivers. Alternative 3 would have minimal to no effect to flows in rivers designated as Wild and Scenic. Alternative 3 would have a less-than-significant impact on recreational activities along the Sacramento, Feather, American, San Joaquin, and Merced rivers.

Changes in average flow in the Delta could affect river-based recreation. The Delta is a popular boating and fishing area. Water transfers would increase flows into the Delta during the July through September period and slightly decrease flows during other months. The changes in flow under Alternative 3 would not have any noticeable effect to recreation in the Delta. Therefore, effects to recreation in the Delta would be less than significant.

3.15.2.5.2 Buyer Service Area

Changes in surface water elevation at San Luis Reservoir as a result of water transfers could affect reservoir-based recreation. Under the Alternative 3, transfer water could be temporarily stored in San Luis Reservoir, which would temporarily increase storage. These slight changes would have minimal effects elevations and any water related recreation. The boat ramps would remain usable for the same number of months as the No Action/No Project Alternative. Therefore, there would be no impact to recreation at San Luis Reservoir under Alternative 3.

3.15.2.6 Alternative 4: No Groundwater Substitution

This section describes the potential visual resources effects of the No Groundwater Substitution Alternative.

3.15.2.6.1 Seller Service Area

Changes in surface water elevation at Shasta, Folsom, Merle Collins, Oroville, and Camp Far West reservoirs and Lake McClure as a result of water transfers could affect reservoir-based recreation. Table 3.15-7 summarizes changes in elevation under Alternative 4 relative to the No Action/No Project Alternative. At Shasta, Folsom and Oroville reservoirs, there would be very minor changes in elevation and there would be no effect to the usability of boat ramps at these reservoirs.

Changes to surface water elevations at Merle Collins and Camp Far West Reservoir and Lake McClure would be the same as described for the Proposed Action. Effects to recreation would be less than significant.

Table 3.15-7. Changes in Shasta, Folsom, Merle Collins, Oroville, Camp Far West, and Lake McClure Reservoir Elevations between the No Action/No Project Alternative and Alternative 4 (in feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Shasta Reservoir												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.7	0.4	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	2.4	0.4	0.0	0.0
Folsom Reservoir												
W	0.6	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-0.2	-0.3	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.6	0.5	0.0	0.0	-0.1	0.0	0.0	0.6	1.0	1.3	1.7	2.0
C	1.4	1.2	1.1	1.0	1.1	0.4	0.1	0.5	1.1	1.0	1.4	1.9

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Merle Collins Reservoir												
W	-0.6	-0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	-1.6	-1.2	-1.0	-0.9	-0.2	0.0	0.0	0.0	0.0	-2.4	-2.4	-2.8
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lake Oroville												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	-0.1	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.9	-0.5	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.8	0.0	0.0
Camp Far West Reservoir												
W	-1.4	-0.6	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-3.3	-3.1	-2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.3	-1.8	-1.9
C	-5.4	-4.1	-3.5	-3.0	-1.3	-0.5	-0.4	-0.4	-0.4	-3.7	-5.3	-8.5
Lake McClure												
W	-0.6	-0.6	-0.6	-0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-5.2	-5.4	-5.2	-3.3	-2.9	-2.5	-2.2	-1.7	-0.9	-1.0	-1.1	-1.2
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	-1.2	-1.3	-1.2	-1.2	-1.1	-1.1	-1.0	-0.9	-0.9	-3.2	-3.6	-3.8
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2.1	-2.7	-2.9

W = wet
AN = above normal
BN = below normal
D = dry
C = critically dry
Note: Negative numbers indicate that Alternative 4 would decrease reservoir elevations compared to the No Action/No Project Alternative; positive numbers indicate that Alternative 4 would increase reservoir elevations.

Changes in surface water elevations at Hell Hole and French Meadows Reservoirs as a result of water transfers could affect reservoir-based recreation. Effects to recreation at Hell Hole and French Meadows reservoirs would be the same as the described for the Proposed Action. Effects would be less than significant.

Changes in river flows from water transfers could affect river-based recreation on the Sacramento, Yuba, Feather, American, San Joaquin, and Merced rivers. The peak recreation activity at these surface water bodies is in the spring, summer and early fall months. Boating is most popular during the spring and summer months. Changes in river flows under Alternative 4 would be within normal river flow fluctuation and would not result in a notable difference to affect recreation opportunities on the river. Changes in flows would not prevent any water-related recreation activity, including rafting, fishing, swimming, and power boating, from occurring on the rivers. Alternative 4 would have minimal to no effect to flows in rivers designated as Wild and Scenic. Alternative 4 would have a less-than-significant impact on recreational activities along the Sacramento, Yuba, Feather, American, San Joaquin, and Merced rivers.

Changes in average flow in the Delta could affect river-based recreation. The Delta is a popular boating and fishing area. Water transfers would increase flows into the Delta during the July through September period and slightly decrease flows during other months. The changes in flow under Alternative 4 would not have any noticeable effect to recreation in the Delta. Therefore, effects to recreation in the Delta would be less than significant.

3.15.2.6.2 Buyer Service Area

Changes in surface water elevation at San Luis Reservoir as a result of water transfers could affect reservoir-based recreation. Under the Alternative 4, transfer water could be temporarily stored in San Luis Reservoir, which would temporarily increase storage. These slight changes would have minimal effects elevations and any water related recreation. The boat ramps would remain usable for the same number of months as the No Action/No Project Alternative. Therefore, there would be no impact to recreation at San Luis Reservoir under Alternative 4.

3.15.3 Comparative Analysis of Alternatives

Table 3.15-8 summarizes the effects of each of the action alternatives. The following text supplements the table by comparing the effects of the action alternatives and No Action/No Project Alternative.

Table 3.15-8. Comparison of Alternatives

Potential Impact	Alternative(s)	Significance	Proposed Mitigation	Significance after Mitigation
There would be no changes in recreation under the No Action/No Project Alternative.	1	NCFEC	None	NCFEC
Changes in surface water elevation at Shasta, Folsom, Merle Collins, Oroville, Camp Far West, and Lake McClure reservoirs as a result of water transfers could affect reservoir-based recreation.	2, 3, 4	LTS	None	LTS
Changes in surface water elevations at Hell Hole and French Meadows Reservoirs as a result of water transfers could affect reservoir-based recreation.	2, 3, 4	LTS	None	LTS

Potential Impact	Alternative(s)	Significance	Proposed Mitigation	Significance after Mitigation
Changes in river flows from water transfers could affect river-based recreation on the Sacramento, Yuba, Feather, American, San Joaquin, and Merced rivers.	2, 3, 4	LTS	None	LTS
Changes in average flow into the Delta from the San Joaquin River from water transfers could affect river-based recreation.	2, 3, 4	NI	None	NI
Changes in surface water elevation at San Luis Reservoir as a result of water transfers could affect reservoir-based recreation	2, 3, 4	NI	None	NI

Key:
LTS = less than significant
NCFEC = no change from existing conditions
NI = no impact

3.15.3.1 Alternative 1: No Action/No Project

There would be no impacts on recreation resources.

3.15.3.2 Alternative 2: Full Range of Transfers (Proposed Action)

Water transfers under the Proposed Action could affect reservoir elevations and river flows in the area of analysis; however, changes in elevation and flow would generally be within normal monthly fluctuations and would not be expected to result in any substantial reductions in recreation opportunities in the area of analysis.

3.15.3.3 Alternative 3: No Cropland Modifications

This alternative would have similar recreation effects as the Proposed Action.

3.15.3.4 Alternative 4: No Groundwater Substitution

Under this alternative, less water would be transferred relative to the Proposed Action. Effects on reservoir elevations and river flows would still occur, but at a lesser rate than the Proposed Action.

3.15.4 Environmental Commitments/Mitigation Measures

There are no significant recreation impacts; therefore no mitigation measures are required.

3.15.5 Potentially Significant Unavoidable Impacts

There are no expected significant and unavoidable impacts to recreation.

3.15.6 Cumulative Effects

The timeline for the recreation cumulative effects analysis extends from 2015 through 2024, a ten-year period. The relevant geographic study area for the cumulative effects analysis is the same area of analysis as described above in Section 3.15.1.1. The following section analyzes the cumulative effects using the project method, which is further described in Chapter 4. Chapter 4 describes the projects included in the cumulative condition. The cumulative analysis for recreation considers projects that could affect reservoir elevation, river flow, or could result in physical impacts on recreation areas within the area of analysis that might restrict or reduce recreational opportunities or affect the recreational setting.

3.15.6.1 Alternative 2: Full Range of Transfers (Proposed Action)

The Proposed Action, in combination with other cumulative projects could affect river- and reservoir-based recreation. Existing and foreseeable water acquisition programs with potential to affect reservoir elevation and river flows in the Seller Service Area include the State Water Project Transfers, which are described in Chapter 4. The proposed additional transfers could contribute to the additional fluctuation of reservoir elevation and river flows, if transfers occurred within the same year. Increased elevation and river flows typically improve recreation opportunities by creating a fuller reservoir or river, and improving riparian habitat along shorelines. Reductions in elevation and river flows could result in elevations dropping below boat ramps, making them unusable. All changes to reservoirs and rivers from the cumulative projects would remain within established water flow, water quality, and reservoir level standards. Therefore, the Proposed Action in combination with other cumulative projects would not result in a cumulative significant impact to recreation.

3.15.6.2 Alternative 3: No Cropland Modifications

The recreation impacts under Alternative 3 would be very similar to the Proposed Action. As under the Proposed Action, the cumulative impacts to recreation would be less than significant.

3.15.6.3 Alternative 4: No Groundwater Substitution

The recreation impacts under Alternative 4 would be very similar to the Proposed Action. As under the Proposed Action, the cumulative impacts to recreation would be less than significant.

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Section 3.16 Power

This section presents the existing hydroelectric generation facilities within the area of analysis and discusses potential effects on hydroelectric generation from the proposed alternatives. The discussion of potential impacts of the alternatives on hydroelectric power includes generation from potential water seller facilities and the hydroelectric facilities of the State Water Project (SWP) and Central Valley Project (CVP).

3.16.1 Affected Environment/Environmental Setting

Water storage within the service area of the potential sellers is extensively developed for hydroelectric generation and the release of water from reservoirs is coordinated to optimize power generation along with other reservoir operational considerations (e.g., flood, temperature, or flow management). In the area of analysis, hydropower is generated by several of the willing sellers or sellers receive their water from the CVP/SWP storage facilities that generate power. Water transfers have the potential to alter the elevation of the hydroelectric power reservoirs and this resulting head change can affect hydroelectric power generation efficiency.

3.16.1.1 Area of Analysis

The area of analysis for the evaluation of potential effects of long-term water transfers on hydroelectric generation includes the reservoirs of the CVP/SWP, which supply water to potential sellers in the Sacramento, American, and Feather River systems. Also in the area of analysis are hydroelectric generation facilities belonging to the South Sutter Water District (WD), Placer County Water Agency, and the Merced Irrigation District (ID).

In the potential Buyer Service Area, the analysis includes the pumping plants of the CVP/SWP that also provide hydroelectric power generation. Figure 3.16-1 shows the area of analysis.

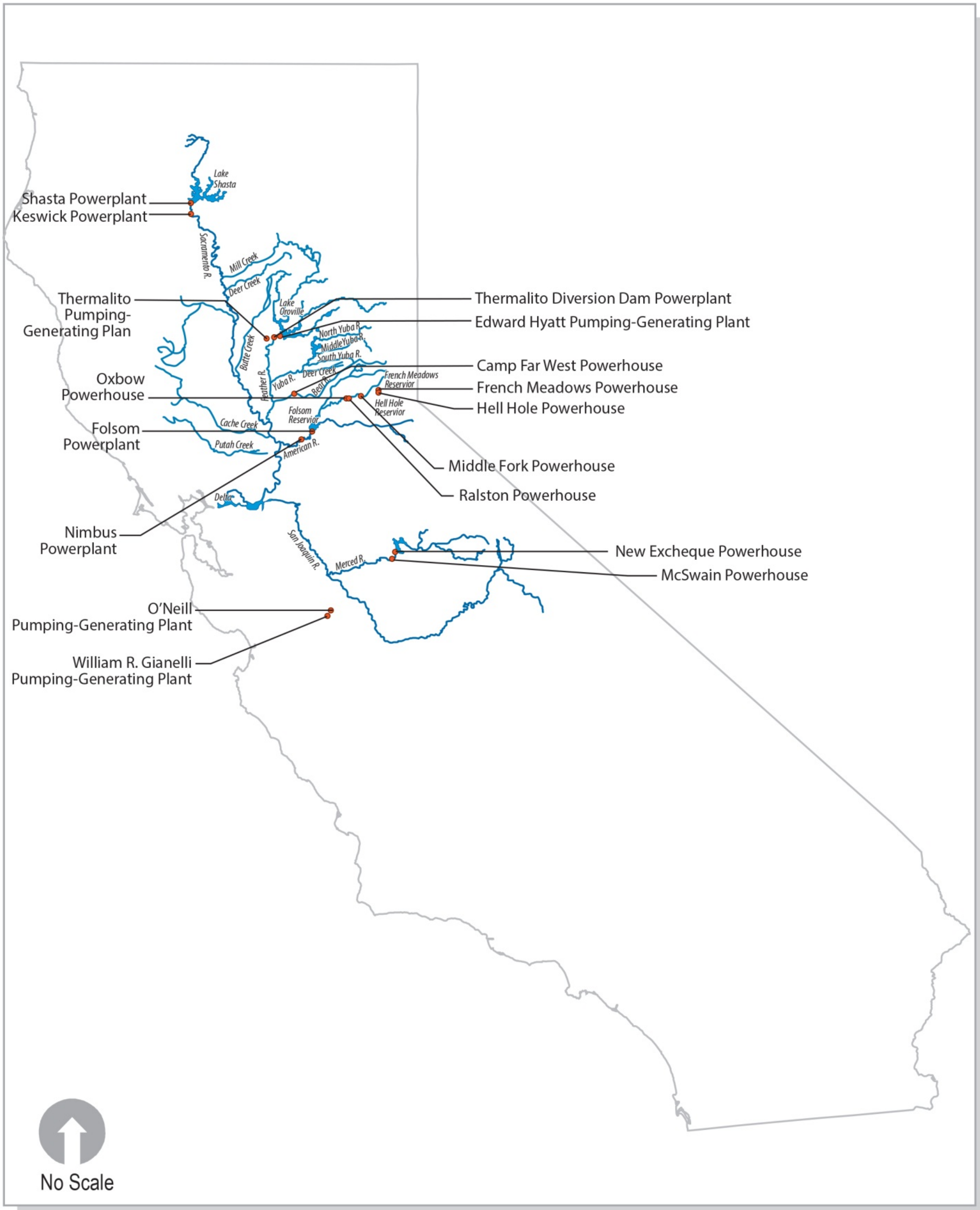

Figure 3.16-1. Area of Analysis

3.16.1.2 Regulatory Setting

Hydroelectric power is regulated by the Federal and State governments. The Federal Energy Regulatory Commission (FERC) regulates non-Federal hydroelectric power projects and provides the power generator flexibility to produce power in response to system demand, hydrology, and operational and maintenance requirements in accordance with other applicable laws and regulation. The U.S. Army Corps of Engineers (USACE) has responsibility to ensure that reservoirs will continue to be operated for flood control. The California Public Utilities Commission regulates privately owned hydroelectric facilities and maintains several operations and maintenance standards with which hydroelectric power supplies must comply. The California Independent System Operator Corporation is an impartial operator of the statewide wholesale power grid with responsibility for system reliability through scheduling available transmission capacity. Outside of the general regulatory provisions for operations of hydroelectric power facilities, there are no specific Federal, State or local regulations that would apply to hydropower facilities if a reservoir owner participates in a water transfer program as described in the proposed alternatives.

There are many other regulatory requirements including water quality, ecosystem health, flood control, and water system operations that affect how reservoirs and hydroelectric projects are operated that are described in other sections of this document.

3.16.1.3 Existing Conditions

The following section describes the existing hydroelectric generation facilities within the area of analysis. In the Seller Service Area, these include the hydroelectric facilities of the CVP/SWP, and the hydroelectric facilities belonging to the local agencies and districts involved in water transfers. In the Buyer Service Area, the hydroelectric facilities include the dual pumping and generating facilities of the CVP/SWP's San Luis Reservoir.

3.16.1.3.1 Seller Service Area

CVP

The CVP has nine hydroelectric facilities in the Seller Service Area. Facilities potentially affected by transfers are shown in Table 3.16-1 and discussed further below. Five of the hydroelectric generating facilities are not on a river system potentially affected by water transfers and consequently are not discussed further.

Table 3.16-1. CVP Hydroelectric Facilities Potentially Affected by a Water Transfers

CVP Hydroelectric Facilities	Installed Capacity (MW)	Annual Average Generation 2001-2007 megawatt-hour	Potentially affected by transfers?
Seller Service Area			
Shasta Powerplant	663	1,978,000	Yes
Trinity Powerplant	140	358,974	No
Judge Francis Carr Powerplant	155	288,122	No
Spring Creek Powerplant	180	274,224	No
Keswick Powerplant	117	418,952	Yes
Lewiston Powerplant	0.35	3,335	No
Folsom Powerplant	198	425,862	Yes
Nimbus Powerplant	14	51,097	Yes
New Melones Powerplant	300	524,292	No
Buyer Service Area			
O'Neill Pumping-Generating Plant	25	5,404	Yes
William R. Gianelli Pumping-Generating Plant (Federal share)	424	126,409	Yes

Source: Reclamation 2007

Shasta Powerplant **-** Shasta Reservoir captures water from the Sacramento River basin for delivery to CVP water users and for power generation. Shasta Reservoir is the largest reservoir of the CVP with a storage capacity of 4,500,000 acre-feet (AF). Shasta Powerplant is located just below Shasta Dam and primarily provides peaking power and generally runs when demand for electricity is high. Its power is dedicated first to meeting the requirements of CVP facilities. The remaining energy is marketed to various preferred customers in Northern California. The maximum operational capacity of the station is 612 megawatts (MW), and it produces a net average of 1,978,024 MW-hours annually (Reclamation 2009a).

Keswick Powerplant **-** The Keswick Powerhouse is downstream of Shasta Dam and is used as a reregulating facility for releases from Shasta Powerhouse. It is a run of the river facility, providing uniform flows to the Sacramento River. The facility has an installed capacity of 117 MW with a net average of 418,952 MW-hours annually (Reclamation 2009b).

Folsom Powerplant - Folsom Dam and Reservoir are a major water management facility located within the greater Sacramento metropolitan area with a storage capacity of 1,010,000 AF. Folsom Powerplant is a peaking hydroelectric facility at the foot of Folsom Dam. Folsom Dam was constructed by USACE and, on completion, was transferred to Reclamation for coordinated water supply and flood control operations. It is an integral part of the CVP and is a key flood control structure protecting the Sacramento metropolitan area. Folsom Powerplant provides a large degree of local voltage control and is increasingly relied on to support local loads during system disturbances. The facility has an installed capacity of 198 MW with a net average of 425,862 MW-hours annually (Reclamation 2013a).

Nimbus Powerplant - Nimbus Dam forms Lake Natoma to act as an afterbay for Folsom Powerplant. It allows dam operators to coordinate power generation and flows in the lower American River during normal reservoir operations. Lake Natoma has a surface area of 500 acres and its elevation fluctuates between four to seven feet daily. Nimbus Powerplant has an installed capacity of 13.5 MW, with a net average of 51,097 MW-hours annually. The powerplant is a run-of-the-river plant providing baseload and station service backup for Folsom Powerplant (Reclamation 2013b).

SWP

Lake Oroville Facilities - Lake Oroville is an important part of the SWP located on the Feather River. The reservoir has a capacity of 3.5 million AF and releases water for SWP needs. The project is operated under FERC license Project No. 2100. Water releases generate power at three powerplants: Edward Hyatt Pumping-Generating Plant, Thermalito Diversion Dam Powerplant, and Thermalito Pumping-Generating Plant. The California Department of Water Resources (DWR) schedules hourly releases through the Oroville Facilities to maximize the amount of energy produced when power values are highest. Because the downstream water supply does not depend on hourly releases, water released for power in excess of local and downstream requirements is conserved by pumpback operation during off-peak times into Lake Oroville (DWR 2012). The total installed capacity of the Lake Oroville hydroelectric facilities is 762 MW. The Hyatt Pumping-Generating Plant is the largest of three power plants with a licensed generating capacity of 645 MW; followed by the 114 MW Thermalito Pumping-Generating Plant and the three MW Thermalito Diversion Dam Powerplant. The average annual generation for the Oroville Facilities is 2,382,000 MW-hours (DWR 2013).

Placer County Water Agency

Placer County Water Agency operates the Hell Hole and French Meadows reservoirs on the Middle Fork American River for water supply and power generation and generates on average 1,039,078 MW-hours of energy annually. The project is operated under FERC license Project No. 2079 with an installed capacity of 224 MW from power diversions on the Middle Fork of the American and Rubicon rivers. The project includes the following power and water storage features:

- 134,993 AF French Meadows Reservoir and French Meadows powerhouse discharging water to Hell Hole Reservoir.
- 207,590 AF Hell Hole Reservoir and Hell Hole Powerhouse discharging to the Rubicon River.
- Middle Fork Powerhouse diverting water at Hellhole Reservoir and discharging the water into the Middle Fork American River.

- Ralston Powerhouse diverting water from the Middle Fork American and discharging at the confluence of the Middle Fork American and the Rubicon rivers.

- Oxbow Powerhouse on the Ralston Powerhouse afterbay discharging water into the Middle Fork American River.

On February 23, 2011, Placer County Water Agency filed an application with FERC for a new license to operate and maintain its Middle Fork American River Project No. 2079. As part of the filing, Placer County Water Agency filed a proposal to increase the storage capacity of Hell Hole Reservoir by approximately 7,600 AF increasing both water storage and average annual generation (Placer County Water Agency 2013).

South Sutter WD

South Sutter WD operates Camp Far West Reservoir with a storage capacity of 104,400 AF. South Sutter WD generates approximately seven MW of power at the Camp Far West Powerhouse located at the reservoir. Power generated at Camp Far West Powerhouse is wholesaled to Sacramento Municipal Utilities District. Camp Far West Powerhouse generates power under FERC license 2997 issued in 1981.

Merced ID

Merced ID operates the Merced River Hydroelectric Project (under FERC Project No. 2179) on the Merced River, which generates power and provides water supply from Lake McClure and McSwain Reservoir. Project 2179 stores approximately 1,034,330 AF of water and generated on average 3,510,000 MW-hours of power annually. The installed capacity of the Project is 103.5 MW. Power generation provides peak, base, and load shaping (Merced ID 2012). The project includes the following power and water storage features:

- New Exchequer Dam and Lake McClure – Lake McClure, formed by New Exchequer Dam is on the Merced River approximately 62 miles from the confluence with the San Joaquin River. Lake McClure has a total storage capacity of 1,024,600 AF.

- New Exchequer Powerhouse – The New Exchequer Powerhouse is at the base of New Exchequer Dam on the south side of Merced River with an installed capacity of 94.5 MW.

- McSwain Dam and Reservoir - McSwain Dam creates the McSwain Reservoir on the Merced River approximately 56 miles upstream of the confluence with the San Joaquin River, McSwain has a total storage capacity of 9,730 AF. The McSwain Reservoir operates as a reregulation reservoir for the New Exchequer Powerhouse.

- McSwain Powerhouse – The McSwain Powerhouse is at the base of McSwain Dam on the north side of the Merced River with an installed capacity of 9.0 MW and operates primarily to supply base load.

In February 2012, Merced ID filed an application with FERC for a new license to operate and maintain its Merced River Hydroelectric Project No. 2179.

3.16.1.3.2 Buyer Service Area

This section includes the potential affect to power generation by water transfers in the Buyer Service Area. Water transfers would be moved south of the Delta through pumps belonging to the East Bay Municipal Utility District on the Sacramento River at Freeport; pumps operated by Contra Costa WD in the Delta, the CVP's Jones Pumping Plant, or the SWP's Banks Pumping Plant. None of these pumping plants have complementary power generation facilities and would therefore not affect hydroelectric power generation. Water moved through the CVP or SWP pumping plants (Jones and Banks) could be stored in San Luis Reservoir of the San Luis Unit of the CVP West San Joaquin Division where power generation does occur complementary to pumping.

San Luis Reservoir serves as a pump-storage reservoir for both the CVP and the SWP using the Gianelli and O'Neill pumping-generating plants to fill San Luis Reservoir. The two plants provide the dual functions of generating electricity and pumping water.

The O'Neill Pumping-Generating Plant lifts water from CVP Delta-Mendota Canal into the O`Neill Forebay. When water is released from the forebay to the Delta-Mendota Canal, these units operate as generators. O'Neill Pumping-Generating Plant has an installed capacity of 25 MW and an average annual generation of approximately 5,400 MW-hours.

The Gianelli Pumping-Generating Plant lifts water from the O'Neill Forebay and discharges it into San Luis Reservoir. The Gianelli Pumping-Generating Plant has an installed capacity of 424 MW. When water is released from San Luis Reservoir, it is directed though the Gianelli Pumping-Generating Plant. The average annual generation of the plant is approximately 126,400 MW-hours, with the monthly generation at zero through most of the winter, spiking up to over 50,000 MW-hours in May, and dropping slowly back to zero by September (Reclamation 2008).

3.16.2 Environmental Consequences/Environmental Impacts

These sections describe the environmental consequences/environmental impacts associated with each alternative.

3.16.2.1 Assessment Methods

Hydroelectric power generation is dependent on water releases. If water releases out of hydroelectric facilities are reduced or increased, power generation may be reduced or increased, respectively.

To analyze these impacts, potential changes to water releases out of hydroelectric facilities are evaluated within the area of analysis. Significant reduction in power generation could impact power recipients and the cost of power.

3.16.2.2 Significance Criteria

Impacts on power generation would be considered potentially significant if the project would:

- Result in long-term adverse effects on power supplies.

The significance criteria described above apply to all power generating facilities that could be affected by the project. Changes in power generation are determined relative to existing conditions (for the California Environmental Quality Act) and the No Action/No Project Alternative (for the National Environmental Policy Act).

3.16.2.3 Alternative 1: No Action/No Project

There would be no effects to the generation of power under the No Action/No Project Alternative. Under the No Action/No Project Alternative, changes in hydrologic conditions could affect the annual generation of power. These changes, however, would be the same as those that occur under existing conditions.

3.16.2.4 Alternative 2: Full Range of Transfer Measures (Proposed Action)

Acquisition of water via groundwater substitution or cropland idling may cause changes in power generation from CVP and SWP reservoirs. Transfer operations could affect power generation by changing reservoir releases or by changing reservoir elevations.

Transfers would change reservoir releases because of additional water stored in early summer and streamflow depletion. In some years, sellers may start transferring water from cropland idling or groundwater substitution in April, May, or June, before Delta export capacity is available. If possible, Reclamation or DWR could store this water in upstream reservoirs, if excess capacity is available, until export capacity is available in July, August, or September. This “backing up” transfer water would decrease reservoir releases early in the season and increase releases later in the season. Releases could also be affected by streamflow depletion downstream from the reservoirs. Reclamation and DWR will release additional flows to meet downstream standards and/or maintain exports when streamflow is decreased as a result of groundwater recharge associated with groundwater substitution transfers.

Reclamation and DWR would then capture additional flow during the eventual wetter periods, which would decrease releases. Table 3.16-2 shows the changes in reservoir releases from Keswick, Thermalito, and Nimbus (the power regulating facilities associated with Shasta, Oroville, and Folsom reservoirs, respectively.) At these three facilities, reservoir releases increase and decrease in different months over time, but have very little overall change in the long term. Because the releases have very little overall change in the long term, power generation would also not change substantially in the long term.

Table 3.16-2. Changes in Reservoir Releases between the No Action/No Project Alternative and the Proposed Action (in cubic feet per second)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Keswick Reservoir Releases												
W	-3.5	-0.2	-3.3	-5.9	-1.2	0.0	0.9	2.0	2.5	1.5	2.2	2.2
AN	0.9	0.0	-19.4	-9.9	-9.5	0.0	0.9	-36.5	4.3	2.5	2.4	2.7
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	3.5	0.0	3.1	0.0
D	0.8	-3.2	0.0	-2.5	0.0	0.0	-107.9	-191.7	-455.3	233.1	528.2	2.2
C	0.0	2.8	0.0	0.0	9.4	0.0	-43.6	-466.1	-755.3	971.0	293.9	0.0
Feather River below Thermalito												
W	8.3	-5.4	-16.4	-9.0	-40.8	0.0	0.0	0.0	4.6	6.0	13.3	12.2
AN	29.4	1.1	2.0	0.0	-39.5	-162.9	0.0	0.0	-9.3	96.9	-29.8	-22.5
BN	10.2	10.0	17.9	0.0	0.0	0.0	0.0	0.0	5.4	4.7	14.1	7.0
D	10.7	1.7	3.7	0.0	0.0	0.0	0.0	-105.1	-12.1	43.5	168.1	-70.0
C	10.7	11.1	17.5	0.0	7.7	3.8	11.6	-1.8	-36.5	-84.9	233.4	0.8
Nimbus Reservoir Releases												
W	17.1	39.4	-38.7	-54.9	-20.7	-1.1	0.0	9.6	-12.6	5.1	-0.8	4.2
AN	22.0	12.8	1.7	-171.3	-233.9	-33.2	0.3	0.1	3.0	20.3	23.9	27.9
BN	12.4	12.2	21.9	0.0	-78.9	0.0	0.0	0.0	12.7	14.0	0.0	8.5
D	26.2	9.6	44.5	-52.2	-21.2	-73.0	-113.6	-76.3	-14.0	94.0	58.4	34.6
C	43.9	41.2	31.5	18.2	18.3	26.8	-22.3	20.5	-44.8	152.4	107.1	55.8

Note: Negative numbers indicate that the Proposed Action would decrease reservoir releases compared to the No Action/No Project Alternative; positive numbers indicate that the Proposed Action would increase reservoir releases.

W = Wet Year
AN = Above Normal Year
BN = Below Normal Year
D = Dry Year
C = Critical Year

Transfers would also change reservoir elevations in these three reservoirs (see Table 3-16.3) because of backing up water in storage and streamflow depletion. The lower surface elevations would translate to reduced head and would therefore slightly decrease the head component of generation efficiency at each facility. Although the loss of head pressure would reduce the efficiency of the turbines, and therefore the amount of electricity that can be produced, the power loss would be minimal because of the small difference between elevations. As a result, there would be no long-term adverse effects on power supplies. Therefore, the impacts to power generation associated with the transfers would be less than significant.

Table 3.16-3. Changes in CVP and SWP Reservoir Elevations between the No Action/No Project Alternative and the Proposed Action (in feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Shasta Reservoir												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-0.4	-0.4	-0.3	-0.2	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1
D	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.2	0.6	1.8	1.4	-0.2	-0.2
C	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.2	1.2	3.7	0.4	-0.5	-0.5
Oroville Reservoir												
W	-0.5	-0.5	-0.3	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2
AN	-2.2	-2.2	-2.1	-1.4	-1.1	-0.1	-0.1	-0.1	0.0	-0.4	-0.3	-0.3
BN	-0.3	-0.4	-0.6	-0.5	-0.5	-0.3	-0.3	-0.3	-0.4	-0.6	-0.7	-0.8
D	-0.7	-0.7	-0.6	-0.6	-0.6	-0.4	-0.4	0.5	0.6	0.0	-1.2	-0.7
C	-1.7	-2.2	-2.3	-2.3	-2.1	-1.8	-1.9	-1.7	-1.4	-0.9	-2.9	-3.0
Folsom Reservoir												
W	0.2	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
AN	-0.5	-0.6	-0.5	-0.1	0.0	0.0	0.0	0.0	0.0	-0.1	-0.3	-0.5
BN	-0.3	-0.4	-0.6	-0.5	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.2	-0.2
D	0.3	0.2	-0.1	-0.2	-0.3	-0.1	-0.1	0.8	1.4	1.4	1.6	1.8
C	1.1	0.8	0.6	0.5	0.6	-0.1	0.0	0.5	1.5	1.5	1.0	1.4

Note: Negative numbers indicate that the Proposed Action would decrease reservoir elevations compared to the No Action/No Project Alternative; positive numbers indicate that the Proposed Action would increase reservoir elevations.

W = Wet Year

AN = Above Normal Year

BN = Below Normal Year

D = Dry Year

C = Critical Year

Acquisition of water via stored reservoir water may cause changes in power generation from the facilities that provide water. Releasing water from non-Project reservoirs for stored reservoir water transfers would generate additional power during the period when water is released. After the release, less power would be generated while the reservoir is refilling in subsequent wet seasons. This operation would reduce overall supplies slightly, but it would primarily just change the timing of power generation. In the long-term, this operation would not substantially reduce power supplies; therefore, this impact would be less than significant.

3.16.2.5 Alternative 3: No Cropland Modifications

Acquisition of water via groundwater substitution or cropland idling may cause changes in power generation from CVP and SWP reservoirs. Similar to the Proposed Action, transfer operations in Alternative 3 could affect power generation by changing reservoir releases or by changing reservoir elevations. Table 3.16-4 shows changes in reservoir releases from Keswick, Thermalito, and Nimbus (the power regulating facilities associated with Shasta, Oroville, and Folsom reservoirs, respectively.) At these three facilities, reservoir releases increase and decrease in different months over time, but have very little overall change in the long term. Because the releases have very little overall change in the long term, power generation would also not change substantially in the long term.

Table 3.16-4. Changes in Reservoir Releases between the No Action/No Project Alternative and Alternative 3 (in cubic feet per second)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Keswick Reservoir Releases												
W	-3.5	-0.2	-3.3	-5.9	-1.2	0.0	0.9	2.0	2.5	1.5	2.2	2.2
AN	0.9	0.0	-19.4	-9.9	-9.5	0.0	0.9	-36.5	4.3	2.5	2.4	2.7
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	3.5	0.0	3.1	0.0
D	0.8	-3.2	0.0	-2.5	0.0	0.0	-107.9	-108.1	-324.9	196.2	355.2	2.2
C	0.0	2.8	0.0	0.0	9.4	0.0	-43.6	-225.1	-382.1	561.9	100.7	0.0
Feather River below Thermalito												
W	8.3	-5.4	-16.4	-9.0	-40.8	0.0	0.0	0.0	4.6	6.0	13.3	12.2
AN	29.4	1.1	2.0	0.0	-39.5	-162.9	0.0	0.0	-9.3	96.9	-29.8	-22.5
BN	10.2	10.0	17.9	0.0	0.0	0.0	0.0	0.0	5.4	4.7	14.1	7.0
D	10.7	1.7	3.7	0.0	0.0	0.0	0.0	-102.6	-12.1	34.4	162.6	-70.0
C	10.7	11.1	17.5	0.0	7.7	3.8	11.6	-1.8	-34.7	15.8	110.3	0.8
Nimbus Reservoir Releases												
W	17.1	39.4	-38.7	-54.9	-20.7	-1.1	0.0	9.6	-12.6	5.1	-0.8	4.2
AN	22.0	12.8	1.7	-171.3	-233.9	-33.2	0.3	0.1	3.0	20.3	23.9	27.9
BN	12.4	12.2	21.9	0.0	-78.9	0.0	0.0	0.0	12.7	14.0	0.0	8.5
D	26.2	9.6	44.5	-52.2	-21.2	-73.0	-113.6	-76.3	-14.0	94.0	58.4	34.6
C	43.9	41.2	31.5	18.2	18.3	26.8	-22.3	21.5	-43.2	148.6	108.4	55.8

Note: Negative numbers indicate that Alternative 3 would decrease reservoir releases compared to the No Action/No Project Alternative; positive numbers indicate that Alternative 3 would increase reservoir releases.

W = Wet Year

AN = Above Normal Year

BN = Below Normal Year

D = Dry Year

C = Critical Year

Transfers would also change reservoir elevations in these three reservoirs (see Table 3-16.5) because of backing up water in storage and streamflow depletion. The lower surface elevations would translate to reduced head and would therefore slightly decrease the head component of generation efficiency at each facility, but the elevation changes would be small and would not result in long-term adverse effects on power supplies. Therefore, the impacts to power generation associated with the transfers would be less than significant.

Table 3.16-5. Changes in CVP and SWP Reservoir Elevations between the No Action/No Project Alternative and Alternative 3 (in feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Shasta Reservoir												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-0.4	-0.4	-0.3	-0.2	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1
D	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.2	0.4	1.3	0.9	-0.2	-0.2
C	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.2	0.5	1.8	-0.2	-0.5	-0.5
Oroville Reservoir												
W	-0.5	-0.5	-0.3	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2
AN	-2.2	-2.2	-2.1	-1.4	-1.1	-0.1	-0.1	-0.1	0.0	-0.4	-0.3	-0.3
BN	-0.3	-0.4	-0.6	-0.5	-0.5	-0.3	-0.3	-0.3	-0.4	-0.6	-0.7	-0.8
D	-0.7	-0.7	-0.6	-0.6	-0.6	-0.4	-0.4	0.4	0.5	0.0	-1.2	-0.7
C	-1.7	-2.2	-2.3	-2.3	-2.1	-1.8	-1.9	-1.8	-1.5	-1.8	-2.9	-3.0
Folsom Reservoir												
W	0.2	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
AN	-0.5	-0.6	-0.5	-0.1	0.0	0.0	0.0	0.0	0.0	-0.1	-0.3	-0.5
BN	-0.3	-0.4	-0.6	-0.5	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.2	-0.2
D	0.3	0.2	-0.1	-0.2	-0.3	-0.1	-0.1	0.8	1.4	1.4	1.6	1.8
C	1.1	0.8	0.6	0.5	0.6	-0.1	0.0	0.5	1.5	1.5	1.0	1.4

Note: Negative numbers indicate that Alternative 3 would decrease reservoir elevations compared to the No Action/No Project Alternative; positive numbers indicate that Alternative 3 would increase reservoir elevations.
W = Wet Year
AN = Above Normal Year
BN = Below Normal Year
D = Dry Year
C = Critical Year

Acquisition of water via stored reservoir water may cause changes in power generation from the facilities that provide water. Similar to the Proposed Action, Alternative 3 would shift the power generation timing in the facilities that release water for stored reservoir water transfers. In the long-term, this operation would not substantially reduce power supplies; therefore, this impact would be less than significant.

3.16.2.6 Alternative 4: No Groundwater Substitution

Acquisition of water via groundwater substitution or cropland idling may cause changes in power generation from CVP and SWP reservoirs. Similar to the Proposed Action, transfer operations in Alternative 4 could affect power generation by changing reservoir releases or by changing reservoir elevations. Alternative 4, however, would only change reservoir operations by backing up water into storage. Alternative 4 does not include groundwater substitution transfers and would therefore not have effects associated with streamflow depletion. Table 3.16-6 shows changes in reservoir releases from Keswick, Thermalito, and Nimbus (the power regulating facilities associated with Shasta, Oroville, and Folsom reservoirs, respectively.) At these three facilities, reservoir releases increase and decrease in different months over time, but have very little overall change in the long term. Because the releases would have very little overall change in the long term, power generation would also not change substantially in the long term.

Table 3.16-6. Changes in Reservoir Releases between the No Action/No Project Alternative and Alternative 4 (in cubic feet per second)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Keswick Reservoir Releases												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-86.2	-204.4	142.0	142.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-279.4	-483.7	627.7	119.8	0.0
Feather River below Thermalito												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	54.2	-40.7	-14.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-24.3	0.0	-99.0	219.6	-75.6
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-13.2	-65.5	107.9	0.0
Nimbus Reservoir Releases												
W	9.7	36.2	-28.6	-18.6	-20.7	-1.1	0.0	9.6	-13.5	-0.5	-0.8	0.0
AN	10.4	4.4	1.7	-132.1	-233.9	-33.2	0.3	0.1	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	20.8	11.7	57.6	-52.2	-21.2	-72.2	-113.6	-24.3	0.0	55.6	33.9	32.2
C	36.5	28.6	31.5	18.2	18.3	26.8	26.8	38.6	-6.8	97.4	59.6	55.8

Note: Negative numbers indicate that Alternative 4 would decrease reservoir releases compared to the No Action/No Project Alternative; positive numbers indicate that Alternative 4 would increase reservoir releases.

W = Wet Year

AN = Above Normal Year

BN = Below Normal Year

D = Dry Year

C = Critical Year

Table 3.16-7 shows changes in reservoir elevations associated with backing up water into storage. This action would increase water in storage during the summer months, which could temporarily increase power generation. Overall, the impacts to power generation associated with the transfers would not result in long-term adverse effects on power supplies and would be less than significant.

Table 3.16-7. Changes in CVP and SWP Reservoir Elevations between the No Action/No Project Alternative and Alternative 4 (in feet)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Shasta Reservoir												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.7	0.4	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	2.4	0.4	0.0	0.0
Oroville Reservoir												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	-0.1	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.9	-0.5	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.8	0.0	0.0
Folsom Reservoir												
W	0.6	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	-0.2	-0.3	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.6	0.5	0.0	0.0	-0.1	0.0	0.0	0.6	1.0	1.3	1.7	2.0
C	1.4	1.2	1.1	1.0	1.1	0.4	0.1	0.5	1.1	1.0	1.4	1.9

Note: Negative numbers indicate that Alternative 4 would decrease reservoir elevations compared to the No Action/No Project Alternative; positive numbers indicate that Alternative 4 would increase reservoir elevations.

W = Wet Year
AN = Above Normal Year
BN = Below Normal Year
D = Dry Year
C = Critical Year

Acquisition of water via stored reservoir water may cause changes in power generation from the facilities that provide water. Similar to the Proposed Action, Alternative 4 would shift the power generation timing in the facilities that release water for stored reservoir water transfers. In the long-term, this operation would not substantially reduce power supplies; therefore, this impact would be less than significant.

3.16.3 Comparative Analysis of Alternatives

Table 3.16-8 lists the effects of each of the action alternatives and compares them to the existing conditions and No Action/No Project Alternative.

Table 3.16-8. Comparative Analysis of Alternatives

Potential Impact	Alternatives	Significance	Proposed Mitigation	Significance after Mitigation
There would be no effects to the generation of power under the No Action/No Project Alternative	1	NCFEC	None	NCFEC
Acquisition of water via groundwater substitution or crop idling may cause changes in power generation from CVP and SWP reservoirs	2, 3, 4	LTS	None	LTS
Acquisition of water via stored reservoir water may cause changes in power generation from the facilities that provide water	2, 3, 4	LTS	None	LTS

Notes:
LTS = Less than significant
NCFEC = no change from existing conditions

3.16.3.1 Alternative 1: No Action/No Project Alternative

There would be no impacts on power generation.

3.16.3.2 Alternative 2: Full Range of Transfers (Proposed Action)

Water transfers under the Proposed Action could change reservoir elevations and releases; however, these changes would generally shift the timing of generation rather than reducing it. The transfers would not result in long-term adverse effects on power supplies and the effects on power generation would be less than significant.

3.16.3.3 Alternative 3: No Cropland Modifications

This alternative would have similar effects on power generation as the Proposed Action. The effects to power generation would be less than significant.

3.16.3.4 Alternative 4: No Groundwater Substitution

Alternative 4 would not include groundwater substitution transfers, so the streamflow depletion effects on reservoir elevations and releases in the other two action alternatives would not occur. Effects on reservoir elevations and releases associated with storing and conveying water transfers would still occur, but they would be focused during the transfer period. The effects on power generation would be less than significant.

3.16.4 Environmental Commitments/Mitigation Measures

There are no mitigation measures needed to reduce impacts of the alternatives.

3.16.5 Potentially Significant Unavoidable Impacts

None of the action alternatives would result in potentially significant unavoidable impacts on power supplies.

3.16.6 Cumulative Effects

The timeframe for the Long-Term Water Transfers cumulative analysis extends from 2015 through 2024, a ten year period. The cumulative effects analysis for power considers SWP water transfers, the Lower Yuba River Accord, CVP the Municipal and Industrial Water Shortage Policy, and the San Joaquin River Restoration Program. Chapter 4 further describes these projects and policies.

3.16.6.1 Alternative 2: Full Range of Transfers

Acquisition of water via groundwater substitution or crop idling may cause changes in power generation from CVP and SWP reservoirs. The cumulative projects could result in small operational changes that could affect power generation. None of these projects focus on reoperating reservoirs, but small changes could result from the cumulative projects. Similar to the changes described above for Long-Term Water Transfers, the operational changes are not likely to have a substantial effect on power generation, either incrementally or cumulatively. Therefore, the Proposed Action in combination with other cumulative projects would not result in a cumulative significant impact to power generation.

3.16.6.2 Alternative 3: No Cropland Modification

Cumulative effects would be the same or less than those described for the Proposed Action.

3.16.6.3 Alternative 4: No Groundwater Substitution

Cumulative effects would be the same or less than those described for the Proposed Action.

3.16.7 References

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Section 3.17
Flood Control

This section describes existing flood control facilities within the area of analysis and discusses potential effects on flooding and flood control from the proposed alternatives.

All forms of transfers described in Chapter 2 (groundwater substitution, stored reservoir releases, cropland idling/shifting and conservation transfers) could affect flooding and flood control within the area of analysis.

3.17.1 Affected Environment/Environmental Setting

This section provides a description of current flood control and hydrologic systems with the potential to be affected by the action alternatives. Pertinent regulatory requirements are described below.

3.17.1.1 Area of Analysis

The flood control area of analysis includes conveyance and storage facilities in the Seller and Buyer Service Areas. Effects are assessed in the following regions:

- Seller Service Area: Shasta Reservoir, Sacramento River, Lake Oroville, Feather River, Merle Collins Reservoir, Camp Far West Reservoir, Yuba River, Hell Hole and French Meadow Reservoirs, Middle Fork American River, Folsom Reservoir, Lower American River, Sacramento-San Joaquin Delta, Lake McClure, Merced River, and San Joaquin River.

- Buyer Service Area: San Luis Reservoir.

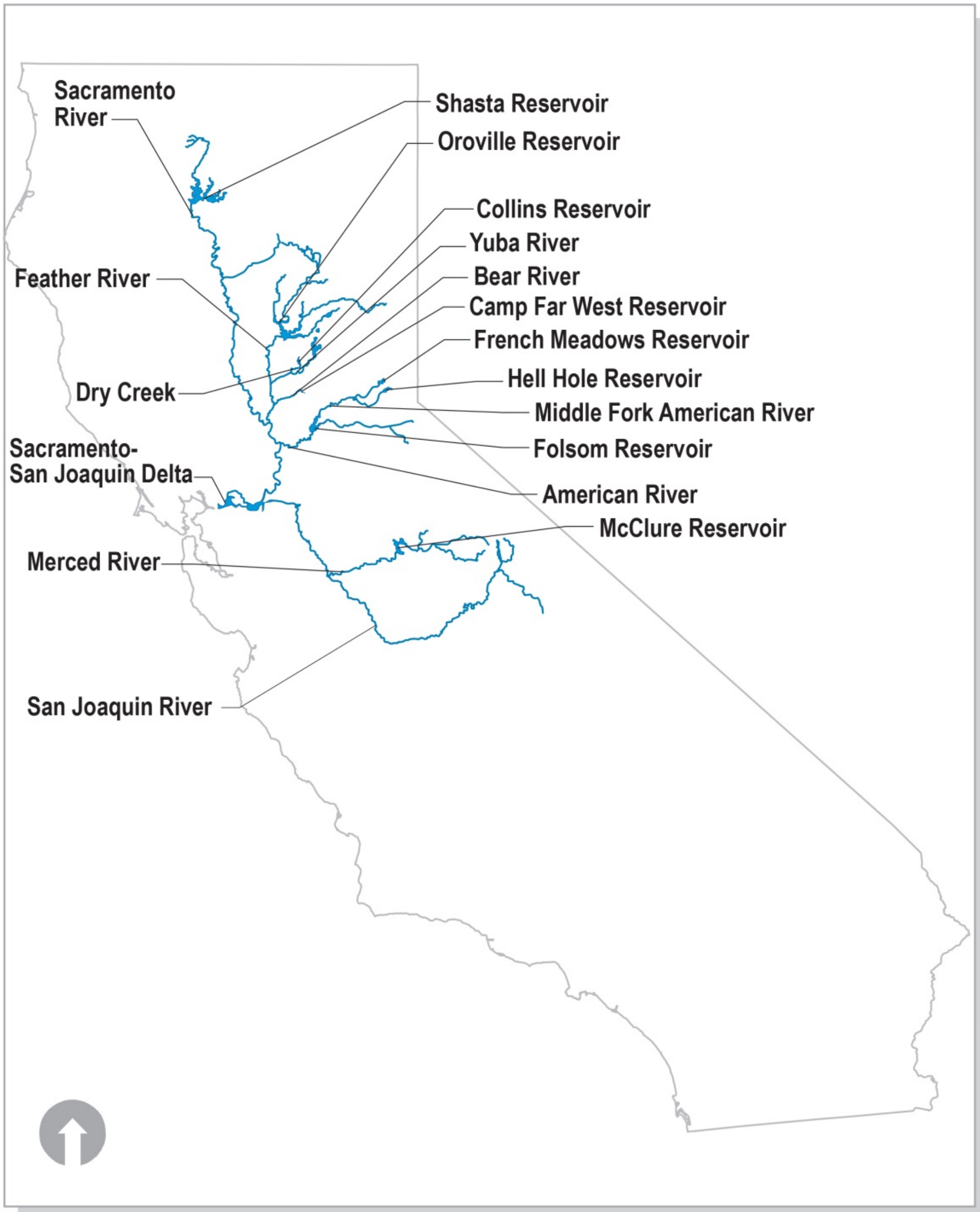

Figure 3.17-1. Flood Control Area of Analysis

3.17.1.2 Regulatory Setting

The National Flood Insurance Program (NFIP) The NFIP is regulated by the Flood Insurance and Mitigation Administration under the Federal Emergency Management Agency (FEMA). The program was established as part of the National Flood Insurance Act of 1968 and includes three components: Flood Insurance, Floodplain Management and Flood Hazard Mapping (FEMA 2002).

Through the voluntary adoption and enforcement of floodplain management ordinances, communities across the United States participate in the NFIP. The

NFIP makes available federally backed flood insurance to homeowners, renters and business owners in participating communities. The NFIP promotes regulations designed to reduce flood risks through sound floodplain management. NFIP maps identify floodplains and assist communities when developing floodplain management programs and identifying areas at risk of flooding.

In 1973, the Flood Disaster Protection Act was passed by Congress. The result of this was the requirement for community participation in the NFIP to receive federal financial assistance for acquisition or construction of buildings and disaster assistance in floodplains. It also "required federal agencies and federally insured or regulated lenders to require flood insurance on all grants and loans for acquisition or construction of buildings in designated Special Flood Hazard Areas" within participating communities (FEMA 2002).

Later, in 1994, the two acts were amended with the National Flood Insurance Reform Act, which included a requirement for FEMA to assess its flood hazard map inventory at least once every five years. FEMA prepares floodplain maps based on the best available science and technical information available. However, changes to the watershed or the availability of new information may cause the need for a map revision. When a revision is required, the applicable community works with FEMA to develop the map revision through a Letter of Map Amendment or a Letter of Map Revision (FEMA 2002).

In order for communities to participate in the NFIP they must adopt and enforce floodplain management criteria.

3.17.1.3 Affected Environment

Flood risk in California is generally highest from late October through March, which marks the rainy season. Levees, rivers, channels, dams, and reservoirs are common structural measures for flood damage reduction throughout the State. Levees confine water flows within a channel. The integrity of a levee and the maximum design flow capacity of the channel dictate a levee's effectiveness.

Dams and reservoirs can be operated to reduce flows downstream by capturing inflows and controlling releases. The amount of water stored in a reservoir at any point in time (conservation storage) is governed by U.S. Army Corps of Engineers (USACE) criteria stated in the flood control project's water control manual. The water elevation associated with the top of conservation storage can vary depending on time of year, upstream storage, and the type of storm (rain or snow) that is occurring. In addition to the conservation storage, each reservoir that provides flood control must reserve flood damage reduction space at certain times of the year. This amount varies by flood control project (Resources Agency 1999). This reserved flood damage reduction space ensures that during a large storm event, high amounts of precipitation and runoff can be captured and stored in the reservoir without overtopping the dam or requiring the release of more water than the downstream channels and levees have been designed to convey.

Many agencies have a role in designing, constructing, managing, regulating, and/or operating flood damage reduction facilities, including the Bureau of Reclamation, the USACE, the California Department of Water Resources (DWR), and the Central Valley Flood Protection Board. FEMA oversees the NFIP, which helps provide protection from flood-related damages through its flood insurance program, floodplain management, and flood hazard mapping.

3.17.1.3.1 Seller Service Area

In the Seller Service Area, a variety of infrastructure provides flood damage reduction along the Sacramento and San Joaquin Rivers and their tributaries including the Yuba, Feather, American, and Merced Rivers. These structures include reservoirs, rivers, channels, and levees.

Sacramento River Region

Shasta Reservoir

Shasta Reservoir is the primary reservoir providing flood protection on the upper Sacramento River. The reservoir was formed in 1948 after the construction of the Shasta Dam and is primarily filled from inflows from the Sacramento, Pit, and McCloud Rivers. Reclamation owns and operates the dam and reservoir as part of the Central Valley Project (CVP). Shasta Reservoir has a capacity of 4.55 million acre-feet (AF) and a surface area of 30,000 acres (Reclamation 2012).

Shasta Dam provides flood control for downstream communities along the Sacramento River and water storage for irrigation in the Sacramento and San Joaquin valleys. The normal operating water level at the dam is 522.5 feet. The dam’s outlets have a combined capacity of 81,000 AF at a water level of 1,065 feet (Reclamation 2012). Dam operations include a maximum flood control space of 1.3 million AF. This capacity must be available starting October 1 in anticipation of winter storms. Large winter rainstorms historically result in maximum flows between December and March (USACE 1999). Dam operations also restrict releases by not exceeding flows of 79,000 cubic feet per second (cfs) and 100,000 cfs in the Sacramento River below Keswick Dam and at Bend Bridge, respectively (Reclamation 2012). Water releases are required to provide suitable conditions for the conservation of salmon in the Sacramento River. In 1997, Reclamation built a temperature control device that allows water releases at temperature suitable for downstream salmon.

About nine miles downstream of Shasta Dam is Keswick Dam, which helps reregulate flow releases for the power plants. Keswick Dam’s normal operating hydraulic level is 587 feet with a maximum of 601.6 feet. At normal operating level, the total water storage is 23,000 AF with a release capacity of 250,000 cfs at the dam’s outlets (Reclamation 2012).

Sacramento River

Downstream of Shasta Reservoir, the Sacramento River flows southwards to the Delta. The Sacramento River system is leveed from Ord Ferry to the southern tip of Sherman Island in the Delta. Flood control on the Sacramento River system is also managed by a system of weirs and bypasses constructed by the USACE. The system includes five bypasses: the Butte Basin, Sutter Bypass, Yolo Bypass, Tisdale Bypass, and Sacramento Bypass. Moulton and Colusa Weirs feed floodwaters into the Butte Basin Bypass, Tisdale Weir flows into Sutter Bypass, and Fremont Weir and Sacramento Bypass flow into the Yolo Bypass. The Yolo Bypass carries five-sixths of the volume of the Sacramento River at peak flood flows. The bypasses are large tracts of undeveloped or minimally-developed land. Development within the bypasses typically is limited to agricultural activities that require minimal infrastructure. Water released to the bypass system flows south into the Delta, in effect creating a short-term storage system for the floodwaters. Water released to the bypass system also infiltrates into the ground, recharging groundwater supplies, although this volume is small compared to the total volume of a flood. When flooding occurs, the weir and bypass system diverts water to protect the levee system and free flood storage capacity in the reservoirs. The Sacramento River levee and bypass system has a maximum conveyance capacity of 600,000 cfs, which is much greater than the capacity of the actual Sacramento River channel. Approximately 110,000 cfs is conveyed in the river and almost 500,000 cfs is channeled into the Yolo Bypass (DWR Undated).

Feather River Region

Oroville Reservoir

Oroville Reservoir holds winter and spring runoff for release into the Feather River. During wet years, Oroville reservoir aids in reducing downstream flooding. The current lake was formed in 1969 after the construction of the Oroville Dam and is primarily filled from inflows from the North Fork, Middle Fork, West Branch, and South Forks of the Feather River. DWR owns and operates the dam as part of the State Water Project (SWP). Oroville Reservoir has a capacity of 3.5 million AF at an elevation of 900 feet and a surface area of 15,810 acres (DWR 2012a).

Oroville Reservoir is a key unit in the SWP but also provides flood control for upper portions of the Feather River watershed including Marysville, Yuba City, Oroville, and smaller communities. Controlled releases from Oroville Reservoir combine downstream with flows from the Yuba and Bear Rivers to create the largest tributary to the Sacramento River downstream of Shasta Reservoir. Dam operations follow a Water Control Plan that include a maximum flood control space of 750,000 AF and a minimum of 375,000 AF by mid-October each year, as set by USACE. The USACE also sets downstream flow limits of 150,000 cfs north of Honcut Creek, 180,000 cfs above the mouth of the Yuba River, and 320,000 cfs south of the Bear River (DWR 2012a).

Feather River

The main stem of the Feather River begins downstream of Oroville Dam and generally flows in a south and southwest direction. Long portions of the Feather River have levees on both sides of its banks. On the east bank a levee extends from the confluence with the Sacramento River to Hamilton Bend near the City of Oroville. The west bank extends from the Sacramento River confluence to Honcut Creek. The Feather River design channel capacity from Thermalito Afterbay to the Yuba River is 210,000 cfs, and is 300,000 cfs from the Yuba River to the Bear River (DWR 2010).

Yuba River Region

New Bullards Bar Reservoir

New Bullards Bar Reservoir is a large reservoir located on the North Fork Yuba River. The reservoir was created by the completion of the New Bullards Bar Dam in 1967. The dam and reservoir are currently operated by Yuba County Water Agency. The reservoir provides flood protection to Marysville and Yuba City as well as agricultural land (USACE 1999). The reservoir has a maximum 960,000 AF of storage with 170,000 AF reserved for flood damage reduction between the end of October and the end of March (DWR 2010; Northern California Water Association 2012). The amount of flood damage reduction storage in the reservoir varies from mid-September through October (depending on early season rainfall) and from the end of March through May (depending on the amount of snowfall in the watershed).

Yuba River

The Yuba River originates in the Sierra Nevada and flows to the Feather River downstream of Lake Oroville near the City of Marysville. The channel capacity of the Yuba River from New Bullards Bar Reservoir to its confluence with the Feather River is 120,000 cfs according to its Operation and Maintenance Manual (DWR 2010). Downstream of the New Bullards Bar Dam, the North, Middle, and South Forks of the Yuba River converge and pass the Englebright Dam built in 1941. Englebright reservoir does not have any dedicated flood storage space and is not used for flood control purposes (Reclamation et al. 2007).

Downstream of Englebright Dam, the Yuba River converges with Dry Creek which drains from Merle Collins Reservoir (Collins Lake). Collins Lake is approximately 25 miles northeast of Marysville and is in the Virginia Ranch Reservoir watershed. Collins Lake has a maximum capacity of 57,000 AF and 1,009 surface acres on Dry Creek, a tributary of the Yuba River (Browns Valley Irrigation District [ID] Undated). Flows in Dry Creek are regulated by Browns Valley ID's operations of the Merle Collins Reservoir (Reclamation et al. 2007)). Browns Valley ID manages Collins Lake water levels, and there are no formal flood damage reduction operations on Collins Lake. Levees along the Yuba River extend from the confluence with the Feather River and continue up past Marysville on both banks of the river.

Bear River and Camp Far West Reservoir

The Bear River is a tributary of the Feather River. Upstream of its confluence with Dry Creek, the design channel capacity is 30,000 cfs. Downstream of Dry Creek, the Bear River design channel capacity is 40,000 cfs. Levees extend on both sides of the Bear River (DWR 2010).

Camp Far West Reservoir receives water from Bear River and Rock Creek. The reservoir has a maximum capacity of 104,000 AF, a maximum surface area of approximately 2,002 acres and 29 miles of shoreline (Sacramento Area Council of Governments 2011; Placer County 2008).

American River Region

Folsom Reservoir

Folsom Reservoir is located in the foothills of the Sierra Nevada about 25 miles northeast of Sacramento's metropolitan area. Folsom Reservoir was created by the completion of Folsom Dam in 1956 by the USACE. The reservoir is located on the American River downstream of the convergence of the North Fork and Middle Fork American River. Reclamation operates Folsom Dam for flood control and water supply in accordance to the USACE Water Control Manual as part of the CVP. Folsom Reservoir impounds approximately 977,000 AF at a reservoir water surface elevation of 466 feet on the American River. The design surcharge pool is 1,084,780 AF at an elevation of 475.4 feet with 5.1 feet of existing freeboard (Reclamation et al. 2006).

Folsom Reservoir is a key unit in the CVP and provides important flood protection for the entire Sacramento region. Management of the reservoir space reserved for flood control is seasonal. According to the Folsom Dam and Reservoir Water Control Manual of 1987, from June 1 through September 30 there is no space designated for flood control. From October 1 through November 17, the amount of space reserved for flood control increases uniformly until February 7. From February 8 through April 20 the flood reservation space is 400,000 AF, which can be reduced after March 15 if basin conditions are dry. From April 21 through May 31, the required flood space decreases uniformly until no flood space is required (Reclamation et al. 2006). A series of dam safety and flood damage reduction structural modifications are underway at Folsom Reservoir, including construction of a new auxiliary spillway. When complete, the modifications have the potential to increase the amount water that can be released from Folsom Dam. The USACE is revising the water control manual to incorporate these modifications.

Approximately seven miles downstream of Folsom Dam on the American River is Nimbus Dam. Nimbus Dam forms Lake Natoma and helps normalize the releases made through the Folsom Power plant at Folsom Dam. Lake Natoma has a capacity of 8,760 AF at elevation 125 feet and a surface area of 540 acres (Reclamation and California Department of Parks and Recreation [CDPR] 2007; Reclamation 2009).

American River
The main stem of the American River generally flows southwest from Folsom Dam. The downstream portions of the American River have levees from the confluence with the Sacramento River up to Sunrise Boulevard on the south bank and to Carmichael Bluffs on the north bank. The levees were constructed by the USACE in 1958 and are designed to accommodate a sustained flow rate of 115,000 cfs and a maximum capacity of 160,000 cfs for a short duration during emergencies, without resulting in levee failure and downstream flooding (Reclamation 2012; Reclamation et al. 2007).

Merced River Region

Lake McClure
Lake McClure and New Exchequer Dam are located in Mariposa County about 20 miles northeast of city of Merced and are operated by the Merced ID. The dam and lake provide flood protection to agricultural lands downstream of the dam and to the communities of Livingston, Snelling, Cressy, and Atwater (Reclamation et al. 2011). Lake McClure's maximum capacity is approximately 1.024 million AF with a surface area of 7,110 acres. Dam operations include a maximum flood management reservation of 350,000 AF between mid-October and mid-March. Six miles downstream of New Exchequer Dam is McSwain Dam and McSwain Lake, which serves as a forebay to regulate releases from Lake McClure (Merced ID 2012). Several smaller diversion dams are located on the river downstream of New Exchequer Dam and are used for irrigation purposes.

Merced River
The Merced River is the third largest tributary to the San Joaquin River. It originates in the Sierra Nevada and flows southwest to the Central Valley where it converges with the San Joaquin River near Turlock. The river above New Exchequer Dam, which forms Lake McClure, is free-flowing and unobstructed. Below Lake McClure, the Merced River flows mainly through irrigated agricultural lands. There are no Federal or State levees along the lower Merced River.

San Joaquin River Region

San Joaquin River
The San Joaquin River from the Merced River to the Delta contains approximately 100 miles of levees constructed by the USACE as part of the Lower San Joaquin River and Tributaries Project. The levees vary in height from six to 15 feet and were designed to contain floods occurring, on average, once every 60 years at the lower end of the project to floods occurring, on average, once every 100 years at the upper limits. Local levees are located along many sections of the river between these project levees (Reclamation et al. 2011). The design channel capacity of the San Joaquin River between the Merced River and the Tuolumne River is 45,000 cfs, and is 46,000 cfs between

the Tuolumne River and the Stanislaus River. From the Stanislaus River to Paradise Cut, the design capacity is 52,000 cfs (DWR 2010). From Paradise Cut to the Old River the design capacity is 37,000 cfs, and from the Old River to the Stockton Deep Water Shipping Channel in the Delta is 22,000 cfs (DWR 2010; Reclamation et al 2011).

Sacramento-San Joaquin Delta
The Sacramento-San Joaquin Delta (Delta) includes over 700 miles of sloughs and winding channels and approximately 1,100 miles of levees protecting over 538,000 acres of agricultural lands, homes, and other structures. These levees are operated and maintained by various agencies including Federal, State and local reclamation boards. Unlike the system of reservoirs and weirs that control the magnitude of flooding on the rivers upstream from the Delta, the flood damage reduction system in the Delta (with the exception of the Delta Cross Channel control gates) operates passively.

Since the construction of the CVP and SWP, and more importantly, the Yolo Bypass system, flood flows in the Delta have been more controlled than in earlier years although, Delta pumping is not a flood damage reduction operation. Flooding still occurs, but has been confined to the individual islands or tracts and is due mostly to levee instability or overtopping. The major factors influencing Delta water levels include high flows, high tide, and wind. The highest water stages occur December – February when these factors are compounded.

3.17.1.3.2 Buyer Service Area
The California Aqueduct (CA), a 444 mile long canal managed by DWR as part of the SWP, stretches from the Delta at Banks Pumping Plant to San Luis Reservoir, and 103 miles beyond the reservoir to Kettleman City. The Delta-Mendota Canal (DMC) is a 117 mile long canal managed by Reclamation as part of the CVP, and conveys water along the west side of the San Joaquin Valley from the Tracy Pumping Plant in the Delta to its terminus at the Mendota Pool. These facilities would be used to deliver transfer water from the Seller Service Area through the Sacramento-San Joaquin Delta and south to the Buyer Service Area. These facilities were not constructed for flood control purposes and do not manage floodwaters. There would be no flood control impacts on the CA, DMC, or Contra Costa Water District and East Bay Municipal Utility District (MUD) facilities from water transfers; therefore these are not discussed further.

San Luis Reservoir
San Luis Reservoir in Merced County is the largest off-stream storage reservoir in the United States. San Luis Reservoir provides approximately 2,028,000 AF of off-stream storage capacity. Reclamation manages 47.6 percent (966,000 AF) of the reservoir’s capacity for the CVP and DWR operates the remaining 52.4 percent (1,062,000 AF) for the SWP. The reservoir has a maximum water

surface elevation of 544 feet[1] and a minimum operating pool elevation of 326 feet (79,000 AF). Reclamation owns San Luis Reservoir and jointly operates it with DWR to provide seasonal storage for the CVP and the SWP. San Luis Reservoir is capable of receiving water from both the DMC and the CA, which enables the CVP and SWP to pump water into the reservoir during the wet season (October through March) and release water into the conveyance facilities during the dry season (April through September) when demands are higher.

San Luis Creek is the major drainage in the San Luis Reservoir area. San Luis Creek once flowed into the San Joaquin River. However, after completion of San Luis Dam, runoff from San Luis Creek is now captured in San Luis Reservoir and diverted for SWP and CVP uses. The potential for flooding is low in San Luis Reservoir because it is an off-stream storage reservoir (Reclamation and CDPR 2012).

3.17.2 Environmental Consequences/Environmental Impacts

3.17.2.1 Assessment Methods

The effects analysis uses both quantitative and qualitative methods to assess changes in flood control. The quantitative assessment methods used to identify impacts on flood control are based on hydrologic modeling and help determine whether changes in stream flows and reservoir storage could cause flooding or inundate areas in the watershed. Increased river flows and increased storage levels at reservoirs as a result of water transfers under each of the proposed alternatives were compared to existing and Future No Action/No Project river and reservoir capacities. Modeling results are not available for several rivers; therefore flows for these rivers are addressed qualitatively.

3.17.2.2 Significance Criteria

For the purposes of this Environmental Impact Statement/Environmental Impact Report, effects on flood control are considered significant if implementation of any of the alternatives would:

- Conflict with the flood damage reduction operation of a reservoir by decreasing flood conservation storage; or
- Increase river flows above channel design capacity and increase risks to levee stability through increased flood stages, excessive seepage and scour, or increased deposition.

[1] Relative to mean sea level.

3.17.2.3 Alternative 1: No Action/No Project

3.17.2.3.1 Seller Service Area

Reservoirs operations would remain the same as existing conditions with regards to flood control, including flood storage capacity and timing of releases. There would be no transfers within the Seller Service Area under the No Action/No Project Alternative. There would be no changes in reservoir storage in the Seller Service Area and risks associated with flood storage capacity would remain the same as existing conditions. There would be no impacts on flood control.

There would be no changes in river flows that could potentially compromise levee stability. There would be no water transfers within the Seller Service Area under the No Action/No Project Alternative. There would be no changes in river flows in the Seller Service Area and risks to levee stability would remain the same as existing conditions. There would be no impacts on flood control.

3.17.2.3.2 Buyer Service Area

There would be no changes to storage at San Luis Reservoir that could affect flood control. Under the No Action/No Project Alternative, water transfers would not occur. Storage in San Luis Reservoir would remain the same as existing conditions. There would be no impacts on flood control.

3.17.2.4 Alternative 2: Full Range of Transfers (Proposed Action)

3.17.2.4.1 Seller Service Area

Water transfers would change storage levels in CVP and SWP reservoirs and potentially affect flood control. Under the Proposed Action, CVP and SWP reservoirs could be used to store water during the transfer season before capacity is available to move the water through the Delta. This action could increase reservoir storage in Shasta, Oroville, and Folsom reservoirs. This increase in storage, however, would only occur during the irrigation season (April through September) during dry and critical years when transfers could occur. During other periods, reservoir levels would be slightly lower under the Proposed Action than the No Action/No Project Alternative because of the increased releases to address downstream streamflow depletion from groundwater substitution transfers. Table 3.17-1 shows the changes in reservoir storage in Shasta, Oroville, and Folsom reservoirs.

Table 3.17-1. Changes in CVP and SWP Reservoir Storage between the No Action/No Project Alternative and the Proposed Action (in thousands of AF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Shasta Reservoir												
W	-0.6	-0.6	-0.4	-0.1	0.0	0.0	-0.1	-0.2	-0.3	-0.4	-0.6	-0.7
AN	-4.6	-4.6	-3.4	-2.8	-2.3	-2.3	-2.3	-0.1	-0.4	-0.5	-0.7	-0.8
BN	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.3	-1.5	-1.5	-1.7	-1.7
D	-2.3	-2.1	-2.1	-2.0	-2.0	-2.0	4.4	16.2	43.3	29.0	-3.5	-3.6
C	-5.0	-5.2	-5.2	-5.2	-5.7	-5.7	-3.1	25.6	70.5	10.8	-7.3	-7.3
All	-2.6	-2.6	-2.3	-2.0	-2.0	-2.0	-0.3	8.0	21.9	7.0	-2.5	-2.6
Oroville Reservoir												
W	-4.1	-3.8	-2.8	-2.3	0.0	0.0	0.0	0.0	-0.3	-0.6	-1.5	-2.2
AN	-13.0	-13.0	-13.1	-13.1	-10.9	-0.9	-0.9	-0.9	-0.3	-6.3	-4.4	-3.1
BN	-3.2	-3.8	-4.9	-4.9	-4.9	-4.9	-4.9	-4.9	-5.2	-5.5	-6.4	-6.8
D	-5.1	-5.2	-5.5	-5.5	-5.5	-5.5	-5.2	1.9	3.4	0.7	-9.6	-5.5
C	-12.8	-13.5	-14.6	-14.6	-15.0	-15.2	-15.5	-14.4	-10.9	-5.7	-20.1	-20.1
All	-7.6	-7.7	-7.7	-7.4	-6.3	-4.5	-4.6	-3.1	-2.1	-2.7	-7.5	-6.9
Folsom Reservoir												
W	0.9	-1.5	-1.1	0.0	0.0	0.0	0.0	0.0	-0.1	-0.4	-0.4	-0.8
AN	-2.2	-2.9	-3.1	-0.9	0.0	0.0	0.0	0.0	-0.2	-1.4	-2.8	-4.5
BN	-2.5	-3.1	-4.4	-4.4	0.0	0.0	0.0	0.0	-0.8	-1.6	-1.6	-2.1
D	2.2	1.7	-1.1	-1.1	-2.0	-1.0	-1.0	7.5	12.0	10.2	10.9	12.6
C	6.1	4.0	2.5	1.4	0.4	-1.3	0.0	4.4	12.1	7.8	6.7	8.8
All	1.4	-0.2	-0.9	-0.3	-0.3	-0.4	-0.2	2.2	4.5	2.9	2.6	2.8

Note: Negative numbers indicate that the Proposed Action would decrease water in storage compared to the No Action/No Project Alternative; positive numbers indicate that the Proposed Action would increase water in storage.

The seasonal increases in reservoir storage would not affect flood control because they would not occur during the flood season or in the wetter years when reservoir levels are high. The decreases in storage could provide additional room to store flood flows, which could potentially benefit flood control. These decreased storage levels, however, are very small and would not provide a substantial benefit. Impacts on flood control in CVP and SWP reservoirs would be less than significant.

Water transfers would change storage levels in non-Project reservoirs and potentially affect flood control. Under the Proposed Action, stored reservoir water transfers would decrease carryover storage in non-Project reservoirs of willing sellers (Merle Collins, Camp Far West, Hell Hole, French Meadows, and McClure reservoirs). The decreased reservoir storage levels in these facilities could capture additional flood flows in years following water transfers. The ability to capture flood flows could have beneficial effects on flood control.

Water transfers could increase river flows and potentially affect flood capacity or levee stability. Water transfers in the Proposed Action could increase flows in rivers and in the Delta during the period when water transfers are conveyed from the sellers to the buyers (April through October for East Bay MUD, July through September for transfers conveyed through the Delta). During non-transfer periods, river flows may be slightly lower than under the No Action/No

Project Alternative because of streamflow depletion from groundwater substitution transfers. Table 3.17-2 shows changes in river flows on the major waterways in the Seller Service Area (Sacramento, Feather, American, and Merced rivers).

Table 3.17-2. Changes in River Flows between the No Action/No Project Alternative and the Proposed Action (in cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Sacramento River at Wilkins Slough												
W	-8.9	-5.1	-8.0	-10.7	-6.3	-5.3	-5.0	-3.2	-1.9	-2.4	-1.4	-1.3
AN	-8.3	-8.2	-27.2	-19.6	-18.2	-7.9	-8.2	-44.3	-2.6	7.2	7.2	7.8
BN	-4.5	-3.7	-3.5	-3.5	-3.5	-3.3	-4.3	0.0	0.0	-3.3	0.0	-3.0
D	-11.0	-14.1	-10.1	-11.0	-7.9	-7.6	-53.1	-33.5	-252.6	465.6	758.9	162.0
C	-21.5	-15.8	-15.2	-14.1	-5.2	-15.1	-0.2	-114.5	-274.4	1,517.7	838.4	356.1
All	-11.5	-9.3	-13.0	-12.6	-8.3	-8.1	-13.0	-38.5	-102.2	394.8	307.3	102.6
Lower Feather River												
W	0.2	-13.8	-32.1	-25.8	-52.4	-16.4	-10.4	-9.1	-3.5	-1.1	7.1	6.4
AN	16.3	-11.7	-9.9	-55.2	-55.8	-196.8	-15.5	-58.8	-22.0	86.1	-39.3	-31.2
BN	5.3	5.4	13.4	-5.0	-7.5	-9.6	-9.2	-7.2	0.0	0.7	10.7	4.0
D	-1.9	-10.0	-8.2	-13.3	-25.2	-35.2	-7.9	-109.4	-16.0	120.1	240.8	-35.7
C	-11.0	-8.5	-0.3	-18.5	-56.0	-21.1	-0.6	-0.5	-31.3	113.9	318.3	49.2
All	0.7	-10.5	-14.8	-26.1	-46.3	-52.1	-8.8	-33.7	-14.5	59.4	104.4	1.0
American River at H Street												
W	16.4	38.7	-39.7	-56.2	-22.4	-2.7	-1.3	8.3	-13.7	4.1	-1.6	3.5
AN	21.2	12.1	0.9	-173.0	-235.7	-34.9	-1.3	-1.3	1.8	32.7	36.5	41.0
BN	12.1	11.9	21.5	-0.4	-79.4	-0.5	-0.4	-0.5	12.3	13.6	-0.3	8.2
D	25.4	8.9	43.7	-53.1	-22.0	-73.9	-114.5	-63.7	-0.9	130.5	80.0	56.9
C	51.5	40.0	30.3	16.9	17.0	25.8	-23.3	19.4	-45.9	195.1	141.3	82.4
All	25.8	27.4	0.2	-57.9	-55.2	-14.9	-25.7	-4.3	-13.8	71.4	49.0	36.1
Merced River at San Joaquin River												
W	0.0	0.0	0.0	0.0	-41.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	-81.3	0.0	0.0	-84.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	127.5	71.4	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	85.0	47.6	0.0	0.0	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	36.4	20.4	0.0	0.0	0.0	0.0
All	0.0	0.0	0.0	0.0	-15.9	-14.4	30.0	16.8	-14.8	0.0	0.0	0.0

Note: Negative numbers indicate that the Proposed Action would decrease river flows compared to the No Action/No Project Alternative; positive numbers indicate that the Proposed Action would increase river flows.

The flow increases would only be during the dry season of dry and critical years, when flood flows are not present in the system. Decreased river flows during wetter periods could provide additional capacity for flood flows; however, these changes are small and would not provide a substantial benefit. Impacts on flood control in rivers in the Seller Service Area would be less than significant.

3.17.2.4.2 Buyer Service Area

Water transfers would change storage at San Luis Reservoir. Storage at San Luis Reservoir under the Proposed Action could change because the reservoir would be used to regulate transfers. Water level changes would occur during the months when transfers are moving through the Delta (July through September), which is typically when storage is lowest in San Luis Reservoir. Additionally, San Luis Reservoir is an off-stream storage reservoir and has little inflow from natural rivers; therefore the flood risk is generally quite low. Increases in storage would not exceed the maximum capacity of the reservoir and would have little to no effect on flood control. The effects of transfers from the Proposed Action would be less-than-significant for flood control at San Luis Reservoir.

3.17.2.5 Alternative 3: No Cropland Modifications

3.17.2.5.1 Upstream from Delta

Water transfers would change storage levels in CVP and SWP reservoirs and potentially affect flood control. Similar to the Proposed Action, Alternative 3 would increase reservoir levels in Shasta, Oroville, and Folsom reservoirs because they could store water during the transfer season before capacity is available to move the water through the Delta. Alternative 3 would also decrease reservoir levels compared to the No Action/No Project Alternative because of downstream streamflow depletion from groundwater substitution transfers. Table 3.17-3 shows the changes in reservoir storage in Shasta, Oroville, and Folsom reservoirs.

Table 3.17-3. Changes in CVP and SWP Reservoir Storage between the No Action/No Project Alternative and Alternative 3 (in thousands of AF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Shasta Reservoir												
W	-0.6	-0.6	-0.4	-0.1	0.0	0.0	-0.1	-0.2	-0.3	-0.4	-0.6	-0.7
AN	-4.6	-4.6	-3.4	-2.8	-2.3	-2.3	-2.3	-0.1	-0.4	-0.5	-0.7	-0.8
BN	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.3	-1.5	-1.5	-1.7	-1.7
D	-2.3	-2.1	-2.1	-2.0	-2.0	-2.0	4.4	11.1	30.4	18.3	-3.5	-3.6
C	-5.0	-5.2	-5.2	-5.2	-5.7	-5.7	-3.1	10.7	33.5	-1.1	-7.3	-7.3
All	-2.6	-2.6	-2.3	-2.0	-2.0	-2.0	-0.3	4.0	12.0	2.7	-2.5	-2.6
Oroville Reservoir												
W	-4.1	-3.8	-2.8	-2.3	0.0	0.0	0.0	0.0	-0.3	-0.6	-1.5	-2.2
AN	-13.0	-13.0	-13.1	-13.1	-10.9	-0.9	-0.9	-0.9	-0.3	-6.3	-4.4	-3.1
BN	-3.2	-3.8	-4.9	-4.9	-4.9	-4.9	-4.9	-4.9	-5.2	-5.5	-6.4	-6.8
D	-5.1	-5.2	-5.5	-5.5	-5.5	-5.5	-5.2	1.4	2.5	0.4	-9.6	-5.5
C	-12.8	-13.5	-14.6	-14.6	-15.0	-15.2	-15.5	-14.9	-12.3	-13.3	-20.1	-20.1
All	-7.6	-7.7	-7.7	-7.4	-6.3	-4.5	-4.6	-3.3	-2.6	-4.3	-7.5	-6.9
Folsom Reservoir												
W	0.9	-1.5	-1.1	0.0	0.0	0.0	0.0	0.0	-0.1	-0.4	-0.4	-0.8
AN	-2.2	-2.9	-3.1	-0.9	0.0	0.0	0.0	0.0	-0.2	-1.4	-2.8	-4.5
BN	-2.5	-3.1	-4.4	-4.4	0.0	0.0	0.0	0.0	-0.8	-1.6	-1.6	-2.1
D	2.2	1.7	-1.1	-1.1	-2.0	-1.0	-1.0	7.5	12.0	10.2	10.9	12.6
C	6.1	4.0	2.5	1.4	0.4	-1.3	0.0	4.3	12.0	7.9	6.7	8.8
All	1.4	-0.2	-0.9	-0.3	-0.3	-0.4	-0.2	2.2	4.5	2.9	2.6	2.8

Note: Negative numbers indicate that Alternative 3 would decrease water in storage compared to the No Action/No Project Alternative; positive numbers indicate that Alternative 3 would increase water in storage.

The seasonal increases in reservoir storage would not affect flood control because they would not occur during the flood season or in the wetter years when reservoir levels are high. The decreases in storage could provide additional room to store flood flows, which could potentially benefit flood control. These decreased storage levels, however, are very small and would not provide a substantial benefit. Under Alternative 3, impacts on flood control in CVP and SWP reservoirs would be less than significant.

Water transfers would change storage levels in non-Project reservoirs and potentially affect flood control. Under Alternative 3, stored reservoir water transfers would decrease carryover storage in non-Project reservoirs of willing sellers (Merle Collins, Camp Far West, Hell Hole, French Meadows, and McClure reservoirs). The decreased reservoir storage levels in these facilities could capture additional flood flows in years following water transfers. The ability to capture flood flows could have beneficial effects on flood control.

Water transfers could increase river flows and potentially affect flood capacity or levee stability. Similar to the Proposed Action, water transfers under Alternative 3 would increase flows in rivers and in the Delta during the period when water transfers are conveyed from the sellers to the buyers (April through October for East Bay MUD, July through September for transfers conveyed through the Delta). During non-transfer periods, river flows may be slightly lower than under the No Action/No Project Alternative because of streamflow depletion from groundwater substitution transfers. Table 3.17-4 shows changes in river flows on the major waterways in the Seller Service Area (Sacramento, Feather, American, and Merced rivers).

Table 3.17-4. Changes in River Flows between the No Action/No Project Alternative and Alternative 3 (in cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Sacramento River at Wilkins Slough												
W	-8.9	-5.1	-8.0	-10.7	-6.3	-5.3	-5.0	-3.2	-1.9	-2.4	-1.4	-1.3
AN	-8.3	-8.2	-27.2	-19.6	-18.2	-7.9	-8.2	-44.3	-2.6	7.2	7.2	7.8
BN	-4.5	-3.7	-3.5	-3.5	-3.5	-3.3	-4.3	0.0	0.0	-3.3	0.0	-3.0
D	-11.0	-14.1	-10.1	-11.0	-7.9	-7.6	-53.1	-33.5	-248.9	294.9	452.1	75.6
C	-21.5	-15.8	-15.2	-14.1	-5.2	-15.1	-0.2	-119.3	-273.7	715.3	251.9	102.1
All	-11.5	-9.3	-13.0	-12.6	-8.3	-8.1	-13.0	-39.5	-101.5	199.5	132.4	35.1
Lower Feather River												
W	0.2	-13.8	-32.1	-25.8	-52.4	-16.4	-10.4	-9.1	-3.5	-1.1	7.1	6.4
AN	16.3	-11.7	-9.9	-55.2	-55.8	-196.8	-15.5	-58.8	-22.0	86.1	-39.3	-31.2
BN	5.3	5.4	13.4	-5.0	-7.5	-9.6	-9.2	-7.2	0.0	0.7	10.7	4.0
D	-1.9	-10.0	-8.2	-13.3	-25.2	-35.2	-7.9	-106.9	-16.0	102.1	228.7	-40.7
C	-11.0	-8.5	-0.3	-18.5	-56.0	-21.1	-0.6	-0.5	-29.5	185.5	197.5	40.6
All	0.7	-10.5	-14.8	-26.1	-46.3	-52.1	-8.8	-33.3	-14.1	71.0	77.4	-1.6
American River at H Street												
W	16.4	38.7	-39.7	-56.2	-22.4	-2.7	-1.3	8.3	-13.7	4.1	-1.6	3.5
AN	21.2	12.1	0.9	-173.0	-235.7	-34.9	-1.3	-1.3	1.8	32.7	36.5	41.0
BN	12.1	11.9	21.5	-0.4	-79.4	-0.5	-0.4	-0.5	12.3	13.6	-0.3	8.2
D	25.4	8.9	43.7	-53.1	-22.0	-73.9	-114.5	-63.7	-0.9	130.5	80.0	56.9
C	51.5	40.0	30.3	16.9	17.0	25.8	-23.3	20.5	-44.3	191.3	142.5	82.4
All	25.8	27.4	0.2	-57.9	-55.2	-14.9	-25.7	-4.1	-13.5	70.6	49.3	36.1
Merced River at San Joaquin River												
W	0.0	0.0	0.0	0.0	-41.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	-81.3	0.0	0.0	-84.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	127.5	71.4	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	85.0	47.6	0.0	0.0	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	36.4	20.4	0.0	0.0	0.0	0.0
All	0.0	0.0	0.0	0.0	-15.9	-14.4	30.0	16.8	-14.8	0.0	0.0	0.0

Note: Negative numbers indicate that Alternative 3 would decrease river flows compared to the No Action/No Project Alternative; positive numbers indicate that Alternative 3 would increase river flows.

The flow increases would only be during the dry season of dry and critical years, when flood flows are not present in the system. Decreased river flows during wetter periods could provide additional capacity for flood flows; however, these changes are small and would not provide a substantial benefit.

Impacts on flood control in rivers in the Seller Service Area would be less than significant.

3.17.2.5.2 Buyer Service Area

Water transfers would change storage at San Luis Reservoir. Similar to the Proposed Action, storage at San Luis Reservoir under Alternative 3 could change because the reservoir would be used to regulate transfers. Because San Luis Reservoir is an off-stream storage reservoir and has little inflow from natural rivers and increases in storage would be at a time of year when the reservoir is typically low, increases in storage would have little to no effect on flood control. The effects of transfers from Alternative 3 would be less-than-significant for flood control at San Luis Reservoir.

3.17.2.6 Alternative 4: No Groundwater Substitution

3.17.2.6.1 Seller Service Area

Water transfers would change storage levels in CVP and SWP reservoirs and potentially affect flood control. Similar to the Proposed Action, Alternative 4 would increase reservoir levels in Shasta, Oroville, and Folsom reservoirs because they could store water during the transfer season before capacity is available to move the water through the Delta. However, Alternative 4 does not include groundwater substitution, so it would not affect reservoir levels during non-transfer periods. Table 3.17-5 shows the changes in reservoir storage in Shasta, Oroville, and Folsom reservoirs.

Table 3.17-5. Changes in CVP and SWP Reservoir Storage between the No Action/No Project Alternative and Alternative 4 (in thousands of AF)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Shasta Reservoir												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	17.5	8.7	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.2	46.0	7.4	0.0	0.0
All	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	12.5	3.1	0.0	0.0
Oroville Reservoir												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.3	-0.8	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	2.9	9.0	-4.5	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	2.6	6.6	0.0	0.0
All	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.1	2.4	-0.9	0.0

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Folsom Reservoir												
W	3.5	1.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2
AN	-0.3	-0.5	-0.7	-0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
BN	0.2	0.3	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	4.2	3.5	-0.1	-0.1	-1.0	0.0	0.0	5.2	8.9	9.5	11.7	13.5
C	8.5	7.2	5.7	4.6	3.6	1.9	0.3	3.6	9.1	8.2	10.0	12.1
All	3.8	2.5	1.5	0.8	0.6	0.4	0.1	1.7	3.4	3.4	4.1	4.8

Note: Negative numbers indicate that Alternative 4 would decrease water in storage compared to the No Action/No Project Alternative; positive numbers indicate that Alternative 4 would increase water in storage.

The seasonal increases in reservoir storage would not affect flood control because they would not occur during the flood season or in the wetter years when reservoir levels are high. Under Alternative 4, impacts on flood control in CVP and SWP reservoirs would be less than significant.

Water transfers would change storage levels in non-Project reservoirs and potentially affect flood control. Under Alternative 4, stored reservoir water transfers would decrease carryover storage in non-Project reservoirs of willing sellers (Merle Collins, Camp Far West, Hell Hole, French Meadows, and McClure reservoirs). The decreased reservoir storage levels in these facilities could capture additional flood flows in years following water transfers. The ability to capture flood flows could have beneficial effects on flood control.

Water transfers could increase river flows and potentially affect flood capacity or levee stability. Similar to the Proposed Action, water transfers under Alternative 4 would increase flows in rivers and in the Delta during the period when water transfers are conveyed from the sellers to the buyers (April through October for East Bay MUD, July through September for transfers conveyed through the Delta). However, Alternative 4 does not include groundwater substitution, so it would not affect river flows during non-transfer periods. Table 3.17-6 shows changes in river flows on the major waterways in the Seller Service Area (Sacramento, Feather, American, and Merced rivers).

Table 3.17-6. Changes in River Flows between the No Action/No Project Alternative and Alternative 4 (in cfs)

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Sacramento River at Wilkins Slough												
W	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-73.8	279.9	279.9	89.1
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-31.7	-108.3	1,024.0	516.0	255.9
All	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-6.5	-35.3	260.2	155.6	68.4

Sac Yr Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Lower Feather River												
W	0.0	0.0	-6.3	-6.3	0.0	-3.9	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	-40.7	0.0	-16.8	0.0	-33.6	0.0	54.2	-40.7	-14.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	-12.0	-19.5	0.0	-24.3	0.0	-2.1	237.2	-66.0
C	0.0	0.0	0.0	0.0	-44.6	-5.8	0.0	0.0	-13.2	62.2	127.2	12.4
All	0.0	0.0	-2.4	-9.6	-11.3	-9.1	0.0	-10.2	-2.7	22.0	60.9	-11.6
American River at H Street												
W	9.7	36.2	-28.6	-18.6	-20.7	-1.1	0.0	9.6	-13.5	-0.5	-0.8	0.0
AN	10.4	4.4	1.7	-132.1	-233.9	-33.2	0.3	0.1	0.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	6.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	20.8	11.7	57.6	-52.2	-21.2	-72.2	-113.6	-24.3	0.0	55.6	33.9	32.2
C	36.5	28.6	31.5	18.2	18.3	26.8	26.8	38.6	-6.8	97.4	59.6	55.8
All	16.7	22.6	6.0	-35.9	-48.8	-13.5	-14.5	7.3	-6.6	29.7	17.9	17.2
Merced River at San Joaquin River												
W	0.0	0.0	0.0	0.0	-41.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-84.0	0.0	0.0	0.0
BN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	162.6	0.0	0.0
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	69.7	0.0	0.0
All	0.0	0.0	0.0	0.0	-15.9	0.0	0.0	0.0	-14.8	43.1	0.0	0.0

Note: Negative numbers indicate that Alternative 4 would decrease river flows compared to the No Action/No Project Alternative; positive numbers indicate that Alternative 4 would increase river flows.

The flow increases would only be during the dry season of dry and critical years, when flood flows are not present in the system. Impacts on flood control in rivers in the Seller Service Area would be less than significant.

3.17.2.6.2 Buyer Service Area

Water transfers would change storage at San Luis Reservoir. Similar to the Proposed Action, storage at San Luis Reservoir under Alternative 4 could change because the reservoir would be used to regulate transfers. Because San Luis Reservoir is an off-stream storage reservoir and has little inflow from natural rivers and increases in storage would be at a time of year when the reservoir is typically low, increases in storage would have little to no effect on flood control. The effects of transfers from Alternative 4 would be less-than-significant for flood control at San Luis Reservoir.

3.17.3 Comparative Analysis of Alternatives

Table 3.17-7 summarizes the effects of each of the action alternatives. The following text supplements the table by comparing the effects of the action alternatives and No Action/No Project Alternative.

Table 3.17-7. Comparative Analysis of Alternatives

Potential Impacts	Alternative(s)	Significance	Proposed Mitigation	Significance after Mitigation
Reservoirs operations would remain the same as existing conditions with regards to flood control, including flood storage capacity and timing of releases	1	No change from existing conditions (NCFEC)	None	NCFEC
There would be no changes in river flows that could potentially compromise levee stability	1	NCFEC	None	NCFEC
There would be no changes to storage at San Luis Reservoir that could affect flood control	1	NCFEC	None	NCFEC
Water transfers would change storage levels in CVP and SWP reservoirs, potentially affecting flood control.	2, 3, 4	LTS	None	LTS
Water transfers ~~could~~ would change storage levels in non-Project reservoirs, potentially affecting flood control.	2, 3, 4	B	None	B
Water transfers could ~~change~~ increase river flows, potentially affecting flood capacity or levee stability.	2, 3, 4	B	None	B
Water transfers would change storage at San Luis Reservoir, potentially affecting flood control.	2, 3, 4	LTS	None	LTS

3.17.3.1 Alternative 1: No Action/No Project Alternative

There would be no impacts on flood control.

3.17.3.2 Alternative 2: Full Range of Transfers (Proposed Action)

Water transfers under the Proposed Action could change reservoir storage and river flows in the area of analysis; however, most of the changes would occur outside the flood season and would be well within the existing capacities of the reservoirs and channels. All effects on flood control would be less than significant.

3.17.3.3 Alternative 3: No Cropland Modifications

This alternative would have similar flood control effects as the Proposed Action. All effects on flood control would be less than significant.

3.17.3.4 Alternative 4: No Groundwater Substitution

Alternative 4 would not include groundwater substitution transfers, so the streamflow depletion effects on reservoir levels and river flows in the other two action alternatives would not occur. Effects on reservoir storage and river flows associated with storing and conveying water transfers would still occur, but they would be focused during the transfer period. All effects on flood control would be less than significant.

3.17.4 Environmental Commitments/Mitigation Measures

There are no significant flood control impacts; therefore no mitigation measures are required.

3.17.5 Potentially Significant Unavoidable Impacts

None of the alternatives would result in potentially significant and unavoidable impacts related to flood control.

3.17.6 Cumulative Effects

The timeline for the flood control cumulative effects analysis extends from 2015 through 2024, a ten year period. The relevant geographic study area for the cumulative effects analysis is the same area of analysis as shown above in Figure 3.17-1. The following section analyzes the cumulative effects using the project method, which is further described in Chapter 4. Chapter 4 describes the projects included in the cumulative condition. The cumulative analysis for flood control considers projects that could affect reservoir storage or river flow, or could otherwise compromise flood control facilities or flood management.

In addition to the cumulative projects in Chapter 4, several other efforts could affect the cumulative condition for flood management. Multiple areas in the Central Valley do not currently have adequate flood protection. The population at risk is over one million people, and the existing level of flood protection is among the lowest for metropolitan areas in the nation (DWR 2012b). In response to existing flood management concerns, multiple efforts are ongoing to improve conditions (DWR 2014):

- American River Watershed Project: construction of dam improvements at Folsom Dam (under the Folsom Joint Federal Project) and levee improvements on the American and Sacramento rivers (under the American River Common Features Project).

- Delta Levees System Integrity Program: levee repair, maintenance, and improvement within the Delta area.

- South Sacramento County Streams Program: improvements to Morrison Creek and Unionhouse Creek have improved flood management in the south Sacramento area.

- Yuba Feather Flood Protection Program: projects within the areas of the Yuba, Feather, and Bear rivers to reduce flooding and improve public safety.

- Urban Streams Protection Program: provides funding for urban flood management; recent focus has included levee improvements near Sacramento and Yuba City.

Multiple other small projects are also ongoing or planned to improve flood management in the Central Valley (DWR 2014).

3.17.6.1 Alternative 2: Full Range of Transfers (Proposed Action)

3.17.6.1.1 Seller Service Area

Water transfers would change storage levels in reservoirs and potentially affect flood control. In addition to the cumulative projects listed above, the projects in Chapter 4 (including SWP transfers, the CVP Municipal and Industrial Water Shortage Policy, the Lower Yuba River Accord, refuge transfers, and the San Joaquin River Restoration Program) have the potential to affect storage. These projects, however, would be unlikely to adversely affect storage during the flood season. Overall, the cumulative condition for flood control in the Central Valley includes many areas where existing flood management facilities are not adequate to provide flood protection to people and property. The cumulative condition has significant adverse effects relative to flood control. The Proposed Action would have a minimal effect on CVP and SWP reservoir storage and would be unlikely to affect flood conservation storage. The Proposed Action would have the potential to improve flood management in non-Project reservoirs; however, these improvements would not be sufficient to offset the multiple flood control issues and concerns in the cumulative condition. Therefore, the Proposed Action's incremental contribution would not be cumulatively considerable.

Water transfers could increase river flows and potentially affect flood capacity or levee stability. As described above, the cumulative condition has substantial issues and concerns related to flood management that result in a significant cumulative impact. Water transfers in the Proposed Action could increase flows in rivers and in the Delta during the period when water transfers are conveyed from the sellers to the buyers and decrease river flows because of streamflow depletion from groundwater substitution transfers. The flow increases would only be during the dry season of dry and critical years, when flood flows are not present in the system. Decreased river flows during wetter periods could provide additional capacity for flood flows; however, these changes are small and would not be adequate to substantially improve the cumulative condition.

The Proposed Action's incremental contribution would not be cumulatively considerable related to flood control.

3.17.6.1.2 Buyer Service Area

Changes in storage at San Luis Reservoir as a result of water transfers could affect flood control. Because San Luis Reservoir does not provide substantial flood management for local flows, the cumulative condition does not include many past, present, or future efforts in the reservoir aimed at flood control. The cumulative condition would be less than significant related to flood control.

3.17.6.2 Alternative 3: No Cropland Modifications

The flood control impacts (and magnitude of those impacts) under Alternative 3 would be very similar to the Proposed Action. As under the Proposed Action, the cumulative condition would have significant effects relative to flood control, but the incremental contribution from Alternative 3 would not be cumulatively considerable.

3.17.6.3 Alternative 4: No Groundwater Substitution

Alternative 4 would have similar (but slightly smaller) potential increases in river and reservoir levels compared to the Proposed Action. As under the Proposed Action, the cumulative condition would have significant effects relative to flood control, but the incremental contribution from Alternative 4 would not be cumulatively considerable.

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Chapter 4 Cumulative Effects Methodology

Cumulative effects are those environmental effects that on their own, may not be considered significant, but when combined with similar effects over time, result in significant adverse effects. Cumulative effects are an important part of the environmental analysis because they allow decision makers to look not only at the impacts of an individual proposed project, but the overall impacts to a specific resource, ecosystem, or human community over time from many different projects. This chapter describes the cumulative effects analysis for the Long-Term Water Transfers Environmental Impact Statement/Environmental Impact Report (EIS/EIR). Each resource section in Chapter 3 includes the complete cumulative effects analysis for that resource.

4.1 Regulatory Requirements

Both the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) require consideration of cumulative effects in an EIS/EIR. Additionally, the National Historic Preservation Act (NHPA) requires consideration of cumulative effects to historic properties.

4.1.1 NEPA

Cumulative effects are defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such actions” (40 Code of Federal Regulations [CFR] Section 1508.7).

NEPA regulations require an analysis of direct, indirect, and cumulative effects and define “effects” as “ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative” (40 CFR Section 1508.8). In addition, the NEPA regulations state that when determining the scope of an EIS, both connected and cumulative actions must be discussed in the same document as the Proposed Action (40 CFR Section 1508.25(a)(1) and (2)).

4.1.2 CEQA

Cumulative effects are defined in the CEQA Guidelines as:

> "Two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts.
>
> (a) The individual effects may be changes resulting from a single project or a number of separate projects.
>
> (b) The cumulative impact from several projects is the change in the environment which results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable probable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time." (CEQA Guidelines Section 15355)

According to the CEQA Guidelines, a lead agency must discuss the cumulative impacts of a project when a cumulative effect is significant and the project's incremental contribution to the cumulative effect would be "cumulatively considerable," that is, when the incremental effects of a project would be significant when viewed in connection with the effects of past, present, and probable future projects (CEQA Guidelines Section 15065(a)(3); Section 15130(a)).

If the combined cumulative impact associated with the project's incremental effect and the effects of other projects would not be significant, an EIR should briefly indicate why the cumulative impact is not significant (CEQA Guidelines Section 15130(a)(2)).

Additionally, an EIR can determine that a project's contribution to a significant cumulative impact will be rendered less than cumulatively considerable and therefore not significant. A project's contribution can also be less than cumulatively considerable if the project is required to implement or fund its fair share of a mitigation measure or measures designed to alleviate the cumulative impact. The lead agency must identify facts supporting this conclusion (CEQA Guidelines Section 15130(a)(3)).

4.1.3 NHPA

The regulations for Section 106 of the NHPA define "adverse effect" as an undertaking that "may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association." (36 CFR Section 800.5(a)(1)). "Adverse effects" explicitly include "reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative." (36 CFR Section 800.5(a)(1)). Cumulative effect under Section 106 of the NHPA applies only to those resources that are listed in or eligible for the National Register.

Section 3.13, Cultural Resources, evaluates effects to historic properties, including cumulative effects. NHPA is not further discussed in this chapter.

4.2 Methodology for Assessing Cumulative Effects

4.2.1 Area of Analysis

NEPA and CEQA require a defined geographic scope for a cumulative effects analysis (Council of Environmental Quality 1997; CEQA Guidelines 15130(b)(3)). The cumulative area of analysis for each resource in the EIS/EIR varies depending on the type of impacts that could occur and the nature of those impacts. The areas of analysis for some resource areas have clearly defined cumulative boundaries while others are more general in nature. Each resource area in Chapter 3 identifies a specific area of analysis for cumulative effects, and it may expand beyond the area of analysis identified for the Environmental Consequences/Environmental Impacts section for project related effects.

4.2.2 Timeframe

This EIS/EIR evaluates water transfers from 2015 through 2024, a ten-year period. Therefore, all projects considered in the cumulative analysis should be implemented and operational during the ten-year period to potentially result in cumulative effects.

4.2.3 Identifying Past, Present, and Future Actions and Projects Contributing to Cumulative Effects

CEQA Section 15130(b)(1) identifies two methods that may be used to analyze cumulative impacts:

1. "A list of past, present, and probable future projects producing related or cumulative impacts, including, if necessary, those projects outside the control of the agency," and/or

2. "A summary of projections contained in an adopted local, regional, or statewide plan or related planning document, that describes or evaluates conditions contributing to the cumulative effect. Such plans may include: a general plan, regional transportation plan, or plans for the reduction of greenhouse gas emissions. A summary of projections may also be contained in an adopted or certified prior environmental document for such a plan. Such projections may be supplemented with additional information such as a regional modeling program. Any such document shall be referenced and made available to the public at a location specified by the lead agency."

This EIS/EIR analyzes cumulative impacts using both CEQA methods identified above. These methods are expected to be sufficient to satisfy NEPA and CEQA requirements for identifying past, present, and future actions and projects that may contribute to cumulative effects. Most EIS/EIR resources use one method or the other, but several resource areas use a combination of both methods.

A variety of federal, state, county, and local government sources were reviewed to identify and collect information on past, present, and reasonably foreseeable actions in the project area that could contribute to cumulative effects. These include:

- City and County General Plans;
- Future population, housing, traffic, and other projections found in existing city and county general plans;
- Published reports, documents, and plans;
- Biological Management Plans (biological opinions, Habitat Conservation Plans, etc);
- Environmental documents (such as EIS/EIRs).
- Scoping comments; and
- Consultation with federal and state agencies.

A table or list is provided in each resource section that describes all applicable documents, plans, projects, and other cumulative actions that could contribute to cumulative effects on that specific resource. After the table or list, there is a discussion on the cumulative condition of that resource, referring to the past, present, and reasonably foreseeable future plans, projects, and other actions in the table or list, and what cumulative effects they are contributing to.

4.2.4 Cumulative Effects Determinations

To be consistent with CEQA requirements, there are three different possible impact statement outcomes for the cumulative effects analysis:

1. **There would be no significant cumulative effects**. This requires a discussion providing evidence to support this conclusion.
2. **There would be significant cumulative effects**. The Proposed Action's incremental contribution to the significant cumulative effects would not be cumulatively considerable. This requires a discussion on why the Proposed Action's incremental contribution would not be significant or cumulatively considerable. There may be mitigation implemented to reduce/avoid/minimize impacts, or the magnitude of

the impact may be very small, suggesting the Proposed Action's contribution to any significant effects would be minimal.

3. **There would be significant cumulative effects**. The Proposed Action's incremental contribution to the significant cumulative effects would be cumulatively considerable. This requires a discussion of all feasible mitigation. If no feasible mitigation is available, this impact remains cumulatively considerable (significant and unavoidable).

The EIS/EIR must identify potential mitigation measures if a project would result in cumulatively considerable effects.

4.3 Cumulative Projects Considered for All Resources

The following projects or programs are considered in the cumulative analysis for all environmental resources. Each resource section in Chapter 3 identifies additional projects or programs directly relevant to the resource.

4.3.1 State Water Project (SWP) Transfers

SWP contractors also implement transfers from agencies north of the Delta to SWP contractors south of the Delta. Table 4-1 indicates potential SWP transfers that could occur annually over the ten-year period, depending on need and export capacity. The contractors generally serve areas along the Feather River and receive SWP supplies for Lake Oroville.

Table 4-1. Potential SWP Sellers (Upper Limits)

	(Acre feet)	
Water Agency (County)	**Groundwater Substitution**	**Cropland Idling/ Crop Shifting**
Biggs-West Gridley WD (Butte)		32,190
Richvale ID (Butte)		12,000
Plumas Mutual Water Company (Yuba)	2,800	1,750
Sutter Extension WD (Sutter)	4,000	11,000
Western Canal WD (Butte and Glenn)		30,000
Total	6,800	86,930

Abbreviations:
ID: Irrigation District
WA: Water Agency
WD: Water District

Water transfers purchased by SWP contractors would largely be used for M&I uses. Some SWP contractors may purchase water for agricultural uses in the south San Joaquin Valley. Table 4-2 lists potential SWP buyers. SWP water transfers would have priority over Central Valley Project (CVP) transfers moved through SWP's Harvey O. Banks Pumping Plant.

Table 4-2. Potential SWP Buyers

Alameda County WD
Antelope Valley East Kern Water Agency
Castaic Lake Water Agency
Central Coast Water Authority
Desert Water Agency
Dudley Ridge Water District
Kern County Water Agency
Metropolitan Water District of Southern California
Mojave Water Agency
Napa County Flood Control and Water Conservation District
Oak Flat Water District
Palmdale Water District
San Bernardino Valley Municipal Water District
San Diego County Water Authority
Santa Clara Valley Water District
Tulare Lake Basin Water Storage District

4.3.2 CVP Municipal and Industrial (M&I) Water Shortage Policy (WSP)

Allocation of CVP water supplies for any given water year is based upon forecasted reservoir inflows and Central Valley hydrologic conditions, amounts of storage in CVP reservoirs, regulatory requirements, and management of Section 3406(b)(2) resources and refuge water supplies in accordance with implementation of the Central Valley Project Improvement Act (CVPIA). In some cases, M&I water shortage allocations may differ between CVP divisions due to regional CVP water supply availability, system capacity, or other operational constraints.

The purposes of the M&I WSP are to:

- Define water shortage terms and conditions applicable to all CVP M&I contractors.
- Establish a water supply level that (a) with M&I contractors' drought water conservation measures and other water supplies will sustain urban areas during droughts, and (b) during severe or continuing droughts will, as far as possible, protect public health and safety.
- Provide information to help M&I contractors develop drought contingency plans.

The M&I WSP and implementation guidelines are intended to provide detailed, clear, and objective guidelines for the distribution of CVP water supplies during water shortage conditions, thereby allowing CVP water users to know when, and by how much, water deliveries may be reduced in drought and other low water supply conditions. This increased level of predictability is needed by water managers and the entities that receive CVP water to better plan for and manage available CVP water supplies, and to better integrate the use of CVP water with other available non-CVP water supplies.

While the specific future policy and shortage allocation process is currently under evaluation, it is likely that both agricultural and M&I water service contractors will receive reduced allocations during shortage conditions. Reclamation will periodically reassess both the availability of CVP water supply and CVP water demand.

Reclamation is currently implementing the 2001 draft M&I WSP, as modified by Alternative 1B of the 2005 Environmental Assessment (Reclamation 2014). Table 4-3 summarizes the water shortage allocations currently being implemented by Reclamation.

Table 4-3. Existing Water Shortage Allocation Steps

Allocation Step	Allocation to Agricultural Water Service Contractors (% of contract total)	Allocation to M&I Water Service Contractors[1]
1	100% to 75%	100% of Contract Total
2	70%	95% of historical use
3	65%	90% of historical use
4	60%	85% of historical use
5	55%	80% of historical use
6	50% to 25%	75% of historical use
7	20%[2]	The maximum of: (1) 70% of M&I historical use or (2) unmet PH&S need up to 75% of historical use
8	15%[2]	The maximum of: (1) 65% of M&I historical use or (2) unmet PH&S need up to 75% of historical use
9	10%[2]	The maximum of: (1) 60% of M&I historical use or (2) unmet PH&S need up to 75% of historical use
10	5%[2]	The maximum of: (1) 55% of M&I historical use or (2) unmet PH&S need up to 75% of historical use
11	0%[2]	The maximum of: (1) 50% of M&I historical use or (2) unmet PH&S need up to 75% of historical use

Source: Reclamation 2014

Note:

[1] The historical use amount is determined by averaging the amount of water the contractor took during the last three years of unconstrained flow (or 100%) M&I allocation.

[2] Allocations to Agricultural water service contractors will be further reduced, if necessary, within the Contract Year to provide public health and safety water quantities to M&I water service contractors within the same Contract Year, provided CVP water is available.

Key:

PH&S = public health and safety

M&I = municipal and industrial

Reclamation is in the process of updating the M&I WSP and is currently preparing the ~~draft~~ EIS for alternatives to the current M&I WSP. ~~It is~~

~~anticipated that t~~The draft EIS ~~will be available~~was released for public review in late 2014.

4.3.3 Lower Yuba River Accord

The Lower Yuba River Accord (Yuba Accord) is a set of three agreements that resolve litigation over in-stream flow requirements on the Lower Yuba River. The three agreements include a Fisheries Agreement, a Water Purchase Agreement, and Conjunctive Use Agreements.

The Fisheries Agreement establishes higher in-stream flow requirements and a flow schedule during specific periods of the year to meet fish needs. The agreement also requires a groundwater substitution program to increase surface flows in the Lower Yuba River and calls for studies of Lower Yuba River fish or fish habitat, monitoring of flows or temperatures and salmon fry studies.

The Water Purchase Agreement establishes conditions when the Yuba County Water Agency would make water available for water supply reliability and fish and wildlife purposes. The agreement separates water purchases into four components with variations in pricing, purpose of use and schedule. For Component 1 Water Supplies, California Department of Water Resources (DWR) purchased 60,000 acre-feet (AF) per year for eight years for fish and wildlife purposes. Components 2, 3, and 4 Water Supplies are also purchased by DWR, but the actual amounts vary depending on hydrologic year types and allocation scenarios.

The Conjunctive Use Agreements require Yuba County Water Agency and seven member districts to implement conjunctive use measures to provide local water supplies in dry years to facilitate storage operations to meet in-stream flow requirements in the Lower Yuba River, as defined in the Fisheries Agreement.

Collectively, the agreements are expected to achieve the following environmental and economic benefits:

- Higher instream flow requirements to protect lower Yuba River Chinook salmon, steelhead, and other fish species, ranging from 260,000 AF in a dry year to more than 574,000 AF in a wet year, an increase of 25,000 AF in a dry year to more than 170,000 AF in a wet year.

- Improved water supply reliability for SWP and CVP water users, including a commitment of 60,000 AF of water per year for environmental purposes (Component 1 Water) and up to an additional 140,000 AF of water (Components 2, 3, and 4 Water) in dry years for the SWP and CVP customers. Presently, CVP customers receive a share of the Yuba Accord water via the San Luis & Delta-Mendota Water Authority (SLDMWA) which has an agreement with DWR.

- A $6 million long-term lower Yuba River fisheries monitoring, studies, and enhancement program.
- Improved water supply reliability for Yuba County farmers, along with a responsible conjunctive use program to improve water use efficiency for local farmers.
- A secure funding source for Yuba County Water Agency and local irrigation districts to finance conjunctive use and water use efficiency activities, levee strengthening, and other water management actions in Yuba County (Yuba County Water Agency 2008).

The Yuba Accord’s instream flow requirements may be modified when the Federal Energy Regulatory Commission issues a new long-term Federal Power Act license to Yuba County Water Agency for the Yuba Project, which will occur during or after 2016.

4.3.4 San Joaquin River Restoration Program (SJRRP)

In 1988, a coalition of environmental groups, led by the Natural Resources Defense Council (NRDC) filed a lawsuit, known as NRDC, et al., v. Kirk Rodgers, et al., challenging the renewal of long-term water service contracts between the United States and the CVP Friant Division contractors. On September 13, 2006, after more than 18 years of litigation, the Settling Parties, including NRDC, Friant Water Authority, and the United States Departments of the Interior and Commerce, agreed on the terms and conditions of a Settlement subsequently approved by the United States Eastern District Court of California on October 23, 2006. The San Joaquin River Restoration Settlement Act, included in Public Law 111-11 and signed into law on March 30, 2009, authorizes and directs the Secretary of the Interior to implement the Settlement. The Settlement establishes two primary goals:

1. Restoration Goal – To restore and maintain fish populations in “good condition” in the main stem San Joaquin River below Friant Dam to the confluence of the Merced River, including naturally reproducing and self-sustaining populations of salmon and other fish.
2. Water Management Goal – To reduce or avoid adverse water supply impacts on all of the Friant Division long-term contractors that may result from the Interim and Restoration flows provided for in the Settlement.

To achieve the Restoration Goal, the Settlement calls for a combination of channel and structural modifications along the San Joaquin River below Friant Dam, releases of water from Friant Dam to the confluence of the Merced River (referred to as Interim and Restoration flows), and reintroduction of Chinook salmon. To achieve the Water Management Goal, the Settlement calls for downstream recapture of Interim and Restoration flows from the San Joaquin

River and the Delta and recirculation of that water to replace reductions in water supplies to Friant Division long-term contractors resulting from the release of Interim and Restoration flows. Interim Flow releases began October 1, 2009. In addition, the Settlement establishes a Recovered Water Account and allows the delivery of surplus water supplies to Friant Division long-term contractors during wet hydrologic conditions.

The SJRRP will implement the Settlement consistent with the San Joaquin River Restoration Settlement Act. Agencies responsible for managing and implementing the SJRRP are Reclamation, National Oceanic and Atmospheric Administration Fisheries Service, DWR, and California Department of Fish and Wildlife. The Settlement includes a detailed timeline for developing and implementing SJRRP actions.

4.3.5 Refuge Water Supplies

A Report on Refuge Water Supply Investigations (Reclamation 1989) describes water needs and delivery requirements for National Wildlife Refuges (NWR), State Wildlife Management Areas, and the Grassland Resource Conservation District in the Central Valley of California. In this report, the average annual historical water supplies were termed “Level 2" (L2), and the supplies needed for optimum habitat management were termed “Level 4". Section 3406(d)(1) of the CVPIA requires the Secretary of the Interior to provide firm delivery of L2 water supplies to certain wildlife refuges in the Central Valley of California. Section 3406(d)(2) of the CVPIA further directs the Secretary to provide additional water supplies to meet Incremental Level 4 needs through the acquisition of water from willing sellers.

For refuge water transfers, Reclamation (as a “willing buyer”), in cooperation with willing sellers, negotiates and develops agreements to purchase water for transfer to CVPIA refuges and prepares the associated National Environmental Policy Act/Endangered Species Act environmental compliance documents, as applicable.

Before Reclamation can facilitate water transfers, it must first provide CVP water to meet all regulatory requirements mandated by the State Water Resources Control Board (Delta flow and water quality standards), CVPIA (specifically the “(b)(2) water” and refuge L2 water), and the Reasonable and Prudent Alternative actions listed in the USFWS’s (2008) and National Oceanic and Atmospheric Administration (NOAA) Fisheries’ (2009) respective Biological Opinions on the Coordinated Operations of the CVP and SWP. Reclamation must then meet its contractual obligations to CVP agricultural and municipal and industrial (M&I) water service contractors. If all these requirements are satisfied and excess pumping capacity is available, only then will Reclamation facilitate potential north-to-south water transfers. Water transfers under this EIS/EIR cannot affect Reclamation’s ability to deliver allocated CVP L2 water to refuges.

Table 4-4 shows Reclamation's refuge related water transfers ("re-allocation" regarding L2 supplies) from 2009 through 2013. Most of these transfers do not need to be moved through the Delta. Merced Irrigation District (ID) is one exception, but Merced ID has multiple means of delivering transferred water and it does not need to be conveyed through the Delta (see Section 2.3.2.3). Additionally, Reclamation has permanently purchased water from Corning, Thames, and Proberta Water Districts (WDs) that is moved through the Delta in some years; however, this water is more frequently used for refuges in the Sacramento Valley and is not conveyed through the Delta. Because the Level 4 refuge transfers typically do not rely on through-Delta conveyance, the action alternatives are not expected to affect the potential for refuges to receive these supplies.

Table 4-4. Refuge Transferred Water Supplies, 2009-2013

Seller	Water Transferred (AF)[1]	Notes
WY 2013		
Corning, Thames, and Proberta WDs	3,308	Permanently purchased NOD IL4 water transferred to the Kern NWR SOD
SJRECWA	19,500	Purchased IL4
Merced ID	7,256	Purchased for the East Bear Creek Unit of the San Luis NWR Complex as L2, then exchanged to meet SOD IL4 demands
WY 2012		
SJRECWA	25,000	Purchased IL4
Santa Clara Valley WD	10,000	Purchased IL4
Merced ID	3,480	Purchased for the East Bear Creek Unit of the San Luis NWR Complex as L2, then exchanged to meet SOD IL4 demands
WY 2011		
SJRECWA	50,333	Purchased IL4
Panoche WD	4,250	Purchased IL4
San Luis WD	5,000	Purchased IL4
Santa Clara Valley WD	10,000	Purchased IL4
Merced ID	1,627	Purchased for the East Bear Creek Unit of the San Luis NWR Complex as L2, then exchanged to meet SOD IL4 demands
East Side Canal and Irrigation Company	3,291	Purchased as L2, then exchanged to meet IL4 demands
WY 2010		
Corning, Thames, and Proberta WDs and Sacramento Valley NWR Complex	4,506	Permanently purchased NOD IL4 water and reallocated NOD conserved L2 water delivered to Kern NWR and GRCD
SJRECWA	35,714	Purchased IL4
Kern-Tulare WD	7,000	Purchased IL4
Panoche WD	10,000	Purchased IL4

Seller	Water Transferred (AF)[1]	Notes
Merced ID	500	Purchased for the East Bear Creek Unit of the San Luis NWR Complex as L2, then exchanged to meet SOD IL4 demands
Stevinson WD	4,080	Purchased for the East Bear Creek Unit of the San Luis NWR Complex as L2, then exchanged to meet SOD IL4 demands
WY 2009		
Sacramento Valley NWR Complex	5,342	NOD Conserved L2 water delivered to Kern NWR and the GCRD
SJRECWA	18,687	Purchased IL4
Stevinson WD	4,280	Purchased as L2, then exchanged to meet IL4 demands

Key:
AF – Acre-feet, GRCD – Grasslands Resource Conservation District, ID – Irrigation District, IL4 – Incremental Level 4, L2 – Level 2, NOD – North of Delta, NWR – National Wildlife Refuge, SJRECWA – San Joaquin River Exchange Contractors Water Authority, SOD – South of Delta, WD – Water District, WY – Water Year
Note 1: Gross amount of transferred water (IL4) and re-allocated L2. Conveyance losses from source to destination were incurred and are not represented here; therefore, the amount total does not reflect the amount delivered to the refuges.

4.4 References

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Chapter 5 Other Required Disclosures

Other required disclosures of environmental documents include irreversible and irretrievable commitment of resources; the relationship between short-term uses and long-term productivity; growth inducing impacts; significant and unavoidable impacts; and issues raised by the public. The summary of environmental impacts by alternative; and significant and unavoidable impacts and; the environmentally superior alternative are included in Chapter 2.

5.1 Irreversible and Irretrievable Commitment of Resources

According to the National Environmental Policy Act (NEPA), an environmental impact statement (EIS) must contain a discussion of irreversible and irretrievable commitment of resources that would result from the Full Range of Transfers Alternative (Proposed Action) if it was implemented (40 Code of Federal Regulations [CFR] Section 1502.16). The irreversible commitment of resources generally refers to the use or destruction of a resource that cannot be replaced or restored over a long period of time. The irretrievable commitment of resources refers to the loss of production or use of natural resources and represents lost opportunities for the period when the resource cannot be used. The California Environmental Quality Act (CEQA) also requires a discussion of any significant effect on the environment that would be irreversible if the project were implemented or would result in an irretrievable commitment of resources (CEQA Guidelines Sections 15126(c) and 15127).

Transfers from potential sellers upstream from the Delta to buyers in the Central Valley or Bay Area would involve the consumption of nonrenewable natural resources. These nonrenewable natural resources would consist of petroleum for fuels necessary to operate equipment used during groundwater pumping activities. The Full Range of Transfers Alternative (preferred alternative) would include the operation of diesel and natural gas-fueled agricultural engines during groundwater pumping activities.

5.2 Relationship Between Short-Term Uses and Long-Term Productivity

As required by NEPA (40 CFR Section 1502.16), this section describes the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity.

All three action alternatives provide water for transfer through cropland idling, groundwater substitution, crop shifting, conservation, and reservoir release actions. Different combinations of the transfer types would be used in each action alternative. The transfers are temporary as water is transferred from sellers to buyers on an annual basis. The transfers would require short term uses of energy for increased groundwater pumping for groundwater substitution transfers and increased pumping for transfers south of the Delta.

Transfers would benefit long-term productivity in the Buyer Service Area. Water transfers could reduce groundwater pumping in the Buyer Service Area, which could increase groundwater levels, decrease subsidence, and improve groundwater quality. Related beneficial effects would also occur for air quality by reducing windblown erosion (fugitive dust) on otherwise barren fields in the Buyer Service Area because water would be provided for irrigation. Additionally, agricultural land uses would be maintained in the Buyer Service Area with the transferred water. During dry years, water transfers would maintain agricultural productivity in the Buyer Service Area by providing water for irrigation and protect long-term production of permanent crops.

5.3 Growth Inducing Impacts

Both NEPA (Council on Environmental Quality NEPA Sections 1502.16(b) and 1508.8(b)) and CEQA (Section 15126.2(d)) describe the required analysis of direct and indirect impacts of growth-inducing impacts from projects. Section 1502.16(b) requires the analysis of indirect effects. Under NEPA, indirect effects as stated in Section 1508.8(b) include reasonably foreseeable growth inducing effects from changes caused by a project. CEQA Section 15126.2(b) requires an analysis of a project's influence on economic or population growth, or increased housing construction and the future developments' associated environmental impacts.

Direct growth-inducing impacts are usually associated with the construction of new infrastructure, housing, or commercial development. A project which promotes growth, such as new employment opportunities or infrastructure expansion (i.e. water supply or waste water treatment capabilities) could have indirect growth inducing effects. Generally, growth inducing impacts would be considered significant if the ability to provide needed public services by agencies is hindered, or, the potential growth adversely affects the environment.

Water proposed for transfer would be transferred from willing sellers to buyers to meet existing demands when there are shortages in Central Valley Project supplies. The proposed water transfers would not directly or indirectly affect growth beyond what is already planned. The term proposed for the transfers under the Proposed Action is 10 years beginning in 2015. The Proposed Action would not induce development growth or remove a barrier for growth because it is not a reliable source of water that could be used to approve development projects by local agencies. Therefore, the Proposed Action would have no growth inducing impacts.

5.4 Significant and Unavoidable Impacts

Significant and unavoidable adverse effects refer to the environmental consequences of an action that cannot be avoided by redesigning the project, changing the nature of the project, or implementing mitigation measures. NEPA requires a discussion of any adverse impacts that cannot be avoided (40 CFR Section 1502.15). The CEQA Guidelines require a discussion on significant environmental effects that cannot be avoided as well as those that can be mitigated but not reduced to an insignificant level (Section 15126.2(b) and Section 15126.2(a)). No significant and unavoidable adverse effects would occur from implementation of the action alternatives.

5.5 Controversies and Issues Raised by Agencies and the Public

CEQA requires the disclosure of controversial project issues raised by agencies and the public. Table 5-1 presents a summary of the project issues identified during the scoping period. The scoping report (Bureau of Reclamation and San Luis & Delta-Mendota Water Authority 2011) provides further information on issues identified by agencies and the public during the scoping process.

Table 5-1. Summary of Controversies and Issues Raised by Agencies and the Public.

Issue	Summary of Issue	Timeline for Addressing or Document/Section Addressing Issue
Alternatives Analyzed in the EIS/EIR	The range of alternatives considered in the EIS/EIR.	Chapter 2 Proposed Action and Description of the Alternatives
Cumulative Impacts	The cumulative effects analysis must include all water transfers and programs that result in additional groundwater pumping.	Chapter 4 Cumulative Effects Methodology
Economic Impacts	Crop idling causes economic impacts to local farmers and farm-related industries.	Chapter 3.10 Regional Economics
Groundwater Impacts	Water transfers could result in long-term impacts to groundwater by decreasing groundwater levels and adversely affecting third party groundwater users.	Chapter 3.3 Groundwater Resources
Impacts to Migratory Waterfowl	The EIS/EIR must analyze the potential impact to migratory waterfowl associated with idling rice, potential loss of wetlands, and impact of delivery to wetlands south of the Delta.	Chapter 3.8 Vegetation and Wildlife
Impacts to Historical Resources	The EIR/EIS must assess whether the project will have an adverse effect on historical resources within the area of analysis.	Chapter 3.13 Cultural Resources
Impacts to Recreation	The EIS/EIR should include analysis of how water transfers may affect the San Luis Reservoir State Recreation Area.	Chapter 3.15 Recreation
Impacts to Water Quality	Analysis must include water quality effects related to degraded water bodies, particularly issues related to mercury and dissolved oxygen	Chapter 3.2 Water Quality
Third Party Impacts	Water transfers could result in third-party impacts to adjacent water users, local economies, and fish and wildlife.	Chapter 3.1 Water Supply, Chapter 3.10 Regional Economics, Chapter 3.7 Fisheries, and Chapter 3.8 Vegetation and Wildlife

Key:
EIS/EIR = Environmental Impact Statement/Environmental Impact Report

5.6 References

U.S. Bureau of Reclamation and San Luis & Delta-Mendota Water Authority. 2011. Long-Term Water Transfers Environmental Impact Statement/ Environmental Impact Report. Scoping Report. May. Accessed on: 07 22 2014. Available online at: http://www.usbr.gov/mp/cvp/ltwt/scoping_report/index.html

Chapter 6 Consultation and Coordination

This chapter documents the consultation and coordination efforts that have occurred during development of the Long-Term Water Transfers Environmental Impact Statement/Environmental Impact Report (EIS/EIR).

6.1 Public Involvement

Both National Environmental Policy Act and California Environmental Quality Act encourage public involvement during preparation of EISs and EIRs. The following sections describe the public involvement opportunities that have occurred or will occur during the EIS/EIR process.

6.1.1 Public Scoping

On December 28, 2010, the Bureau of Reclamation (Reclamation) published a Notice of Intent in the Federal Register and on January 5, 2011, a Notice of Preparation for Long-Term Water Transfers was published with the California State Clearinghouse. Public scoping meetings were held between January 11 and 13, 2011 in the cities of Chico, Sacramento, and Los Banos, California. Reclamation and the San Luis & Delta-Mendota Water Authority (SLDMWA) prepared the "Long-Term Water Transfers EIS/EIR Public Scoping Report" (dated May 2011), which summarized the comments and concerns raised during the meetings, as well as public comments obtained during the public comment period.

6.1.2 Public Meetings

Reclamation and SLDMWA held public meetings after release of the Public Draft EIS/EIR to solicit public comments. Meetings were held in Sacramento, Los Banos, and Chico, California in October 2014. Reclamation and SLDMWA also provided a 60-day comment period for the public and agencies to submit written comments on the Public Draft EIS/EIR. Appendix J includes comment responses to all comments received at the public hearings and during the comment period.

6.2 Agency Coordination

The development of the Long-Term Water Transfers EIS/EIR has required coordination with a variety of local, Federal, and State agencies. The following sections describe these agencies and their roles in the process.

6.2.1 Buyers and Sellers

Reclamation and SLDMWA coordinated frequently with buyers and sellers to define transfer types and quantities, provide progress updates on modeling efforts, and discuss potential impacts and proposed mitigation measures. In addition to frequent communication on an individual basis with buyers and sellers, Reclamation facilitated several workshops with buyers and sellers to present preliminary information on the Long-Term Water Transfers EIS/EIR.

Reclamation and SLDMWA also coordinated with the buyers and sellers during development of the 2014 Water Transfers Environmental Assessment and Initial Study, which contributed to development of this EIS/EIR. The 2014 Water Transfers Finding of No Significant Impact and Mitigated Negative Declamation were published on April 11, 2014.

6.2.2 California Department of Water Resources (DWR)

Reclamation and SLDMWA coordinated with DWR throughout development of the EIS/EIR. Specifically, Reclamation and SLDMWA met with DWR to discuss groundwater and surface water modeling approaches and results, transfer types and quantities, and use of State Water Project facilities. DWR was also involved in briefings and reviews related to the Sacramento Valley Finite Element Groundwater Model (SACFEM2013) peer review. DWR’s input on the SACFEM2013 peer review process was utilized to make revisions to the model. DWR also provided input on administrative draft sections of the EIS/EIR.

6.2.3 Resource Agencies

Reclamation and SLDMWA have been coordinating efforts with U.S. Fish and Wildlife Service (USFWS) and California Department of Fish and Wildlife on the impacts analysis on special status species and environmental commitments. Reclamation will submit a Biological Assessment for USFWS review under Section 7 of the Federal Endangered Species Act.

Chapter 7
List of Preparers and Contributors

The following is a list of preparers who contributed to the development of the Long-Term Water Transfers Environmental Impact Statement/Environmental Impact Report.

Table 7-1. Federal Agencies

Preparers	Agency	Role In Preparation
Alex Aviles	Reclamation	Environmental Justice, Air Quality
Bob Collela	Reclamation	Project Description
Georgiana Gregory	Reclamation	Water Supply, Power, Flood Control
Russ Grimes	Reclamation	NEPA Guidance
Shelly Hattleberg	Reclamation	Coordination and Review, Agricultural Land Use, Visual, Air Quality, Climate Change
Brad Hubbard	Reclamation	NEPA Lead Agency Project Manager
John Hutchings	Reclamation	Flood Control, Power
Joshua Israel	Reclamation	Fisheries
Michael Inthavong	Reclamation	Regional Economics
Erma Leal	Reclamation	Project Description
Kirk Nelson	Reclamation	Groundwater
Elizabeth Kiteck	Reclamation	Central Valley Project Operations
Stanley Parrot	Reclamation	Groundwater
Laurie Perry	Reclamation	Cultural Resources
Patricia Rivera	Reclamation	Indian Trust Assets
Tim Rust	Reclamation	Water Supply
Scott Springer	Reclamation	Recreation
David Van Rijn	Reclamation	Vegetation and Wildlife
Natalie Wolder	Reclamation	Water Supply

Notes:
NEPA – National Environmental Policy Act

Table 7-2. Regional Agencies

Preparers	Agency	Role In Preparation
Frances Mizuno	San Luis & Delta-Mendota Water Authority	CEQA Lead Agency Project Manager

Notes:
CEQA – California Environmental Quality Act

Table 7-3. CDM Smith

Preparers	Degree(s)/Years of Experience	Experience and Expertise	Role In Preparation
Carrie Buckman, P.E.	M. Environmental Engineering 16 years experience	Water Resources Engineer	Project Manager, Project Description, Introduction
Selena Evans	M. Urban and Regional Planning 6 years experience	Environmental Planner	Visual Resources, Environmental Justice, and Indian Trust Assets
Donielle Grimsley	B.S. Biology 8 years experience	Environmental Scientist	Water Quality
Brian Heywood, P.E.	M.S. Civil Engineering 17 years experience	Senior Water Resource Engineer	Groundwater
Anusha Kashyap	M.S. Environmental Engineering 5 years experience	Environmental Engineer	Groundwater and Flood Control
Alexandra Kleyman	M.A. Environmental Policy and Urban Planning 5 years experience	Environmental Planner	Geology and Soils and Agricultural Land Use
Sami Nall, P.E.	M.S. Environmental Engineering 6 years experience	Environmental Engineer	Water Supply and Power
Christopher Park, AICP	M.S. City and Regional Planning 8 years experience	Water Resources Planner	Cumulative
Gwen Pelletier	M.S. Environmental Studies 14 years experience	Environmental Scientist	Air Quality, Greenhouse Gases
Gina Veronese	M.S. Agricultural and Resource Economics 13 years experience	Resource Economist	Regional Economics
Suzanne Wilkins, AICP	B.S. Business Administration 26 years experience	Water Resources Planner	Recreation

Table 7-4. Pacific Legacy

Preparers	Degree(s)/Years of Experience	Experience and Expertise	Role In Preparation
Lisa Holm	Ph.D., 20 years experience	Supervisor - Prehistoric/Historic Archaeology	Cultural Resources
John Holson	M.A., 35 years experience	Principal - Regulatory Compliance; Prehistoric/Historic Archaeology	Cultural Resources

Table 7-5. ICF International

Preparers	Degree(s)/Years of Experience	Experience and Expertise	Role In Preparation
Angela Alcala	BS 15 years experience	Wildlife Biology	Terrestrial Resources
Gerrit Platenkamp	PhD, MS, BS 22 years experience	Plant Ecology	Terrestrial Resources
Gregg Roy	BS 25 years experience	CEQA/NEPA	Terrestrial Resources, Aquatic Resources
Rick Wilder	PhD, BS 11 years experience	Fisheries Biology	Aquatic Resources

Table 7-6. MBK Engineers

Preparers	Degree(s)/Years of Experience	Experience and Expertise	Role In Preparation
Lee Bergfeld	M.S. Civil Engineering, 19 years experience	Hydrological Modeling	Transfers Operations Model, Groundwater Model
Walter Bourez	M.S. Civil Engineering, 25 years experience	Hydrological Modeling	Transfers Operations Model, Groundwater Model

Table 7-7. CH2M Hill

Preparers	Degree(s)/Years of Experience	Experience and Expertise	Role In Preparation
Peter Lawson	25 years experience	Hydrogeology	Groundwater Model
Nate Brown	19 years experience	Hydrogeology	Groundwater Model
Heather Perry	11 years experience	Hydrogeology	Groundwater Model
Lisa Porta	8 years experience	Groundwater Hydrology	Groundwater Model

Table 7-8. Resource Management Associates

Preparers	Degree(s)/Years of Experience	Experience and Expertise	Role In Preparation
Marianne Guerin	25 years experience	Delta Modeling	DSM2 modeling, Appendix C

Table 7-9. RMann Economics

Preparers	Degree(s)/Years of Experience	Experience and Expertise	Role In Preparation
Roger Mann	Ph.D. Agricultural Economics and Economics 37 years experience	Natural Resources Economist	Regional Economics Model

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