

RECLAMATION

Managing Water in the West

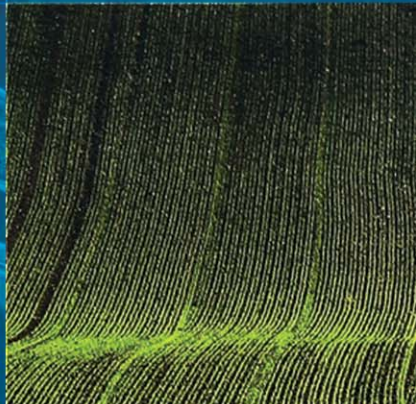
2010-2011 Water Transfer Program

Final Environmental Assessment

**U.S. Department of the Interior,
Bureau of Reclamation**

Mid-Pacific Region

February 2010



Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

2010-2011 Water Transfer Program

Final Environmental Assessment

Prepared for

**United States Department of the Interior
Bureau of Reclamation
Mid Pacific Region
Sacramento, California**

Prepared by

**CDM
ENTRIX
Pacific Legacy**



**U.S. Department of the Interior
Bureau of Reclamation
Sacramento, California**

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Abbreviations and Acronyms

APCD	Air Pollution Control District
AQMD	Air Quality Management District
ATCM	Airborne Toxic Control Measure
BA	Biological Assessment
BACT	Best Available Control Technology
BIA	Bureau of Indian Affairs
bhp	brake-horsepower
BMP	Best Management Practice
BO	Biological Opinion
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
CARB	California Air Resources Board
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CI	compression ignition
CH ₄	methane
CO	carbon monoxide
CO ₂	carbon dioxide
CO ₂ e	carbon dioxide equivalent
COA	Coordinated Operating Agreement
Corps	U.S. Army Corps of Engineers
CPG	Conaway Preservation Group
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CWA	Federal Clean Water Act
Delta	Sacramento-San Joaquin Delta
DOC	Department of Conservation
DPM	diesel particulate matter
DPS	Distinct Population Segment
DWR	Department of Water Resources
EA	Environmental Assessment
EFH	Essential fish habitat

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
FMMP	Farmland Mapping and Monitoring Program
FMP	Fishery Management Plan
FONSI	Finding of No Significant Impacts
FR	Federal Register
FRAQMD	Feather River Air Quality Management District
g/bhp-hr	grams per brake-horsepower hour
gpm	gallons per minute
GGS	giant garter snake
hp	horsepower
ID	Irrigation district
ITAs	Indian Trust Assets
km ²	square kilometers
kWh	kilowatt hour
M&I	municipal and industrial
MCL	maximum contaminant level
MWC	Mutual Water Company
mg/L	milligrams per liter
mm	millimeters
MTBE	methyl tertiary butyl ether
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Protection Act
NHPA	National Historic Preservation Act
NTU	nephelometric turbidity units
NMFS	National Marine Fisheries Service
NMHC	non-methane hydrocarbons
NO _x	nitrogen oxides
N ₂ O	nitrous oxide
NWR	National Wildlife Refuge
O ₃	ozone
PG&E	Pacific Gas and Electric
PM ₁₀	particulate matter 10 microns
PM _{2.5}	particulate matter 2.5 microns
PP	pumping plant
RD	Reclamation District

Reclamation	Bureau of Reclamation
RPM	Reasonable and Prudent Measures
SFNA	Sacramento Federal Ozone Nonattainment Area
SMAQMD	Sacramento Metropolitan Air Quality Management District
SO ₂	sulfur dioxide
SVWMP	Sacramento Valley Water Management Program
SWP	State Water Project
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
TOC	total organic compounds
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
VOC	volatile organic compounds
WA	Wildlife Area/Water Agency
WC	Water Company
WD	Water District
YSAQMD	Yolo-Solano Air Quality Management District

Chapter 1

Introduction

This document is an Environmental Assessment (EA) for water transfers in 2010 and 2011 that has been prepared by the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) to satisfy the requirements of the National Environmental Policy Act (NEPA) (42 United States Code §4231 et seq.), the Council of Environmental Quality's Regulations for Implementing Procedural Provisions of NEPA (40 Code of Federal Regulations §1500-1508) and the Department of the Interior's NEPA regulations (43 CFR Part 46).

The document describes the affected environment and the potential direct, indirect, and cumulative effects related to approval and facilitation of water transfers. This document also identifies measures that have been incorporated into the project to minimize or avoid project-related impacts. Minimization measures are analyzed according to the Department of Interior's NEPA regulations (43 Code of Federal Regulations §46.130).

1.1 Background

To help facilitate the transfer of water within the State, Reclamation and the Department of Water Resources (DWR) are considering whether they can approve and facilitate individual water transfers between willing sellers and buyers. Reclamation has approval authority over water transfers that involve CVP contractors or the use of CVP facilities. Reclamation would approve each transfer on an individual basis. This EA refers to transfers collectively as the 2010-2011 Water Transfer Program only for analysis purposes. Reclamation will not take part in the transfer negotiation process and has not set up any "program" to connect buyers and sellers. Buyers must find willing sellers of transfer water and negotiate transfer amount and price. Reclamation is responsible for reviewing and approving transfers and making sure that proposed Environmental Commitments and minimization measures are being implemented.

Most transfers would occur from willing sellers upstream from the Sacramento-San Joaquin Delta (Delta) to buyers that export water from the Delta. The transfer water would be conveyed, using CVP or SWP facilities, to water users that are at risk of experiencing water shortages in 2010 and 2011 and that require supplemental water supplies to meet anticipated demands. Reclamation would review and approve, as appropriate, proposed water transfers from CVP contractors in accordance with the Interim Guidelines for the Implementation of Water Transfers under the Central Valley Project Improvement Act (CVPIA) and State law.

Reclamation and DWR have facilitated transfers in past years. In 2009, DWR implemented a Drought Water Bank to purchase water from willing sellers and provide it to users that were experiencing shortages. Reclamation completed an Environmental Assessment on the CVP-related transfers requiring approval (Reclamation 2009). The administrative procedures for the 2010-2011 Water Transfer Program are different than those utilized by the 2009 Drought Water Bank. For the Drought Water Bank, DWR solicited participants and helped connect sellers and buyers. Water transfers in 2010 and 2011 would not have a similar intermediary. DWR is not initiating actions, and there is no central party soliciting sellers and buyers. Because Reclamation is not managing a bank or program, priority criteria for use of the water have not been identified. Use of water within the buyers' service areas must be used for beneficial uses, as required by law.

Water supplies from the 2010-2011 Water Transfer Program could be made available to water providers who divert water from CVP or SWP facilities either directly or by exchange with other water providers who have access to water supplies from the CVP or SWP. Reclamation will honor CVP contract provisions in determining access to Delta pumping capability if this capacity becomes constrained. Consistent with existing operational and regulatory restrictions in place for SWP operations, DWR will determine the availability of its facilities including the Delta pumping capacity for the conveyance of transfer water if such conveyance is needed.

1.2 Purpose and Need

California has experienced a severe drought in recent years that has threatened water supplies to many water districts. Local water districts are eager to identify additional supplies to avoid shortages for their customers. Water transfers are an opportunity to augment limited supplies. Transfers of water subject to Reclamation contract require Reclamation's approval according to the CVPIA and State law, as discussed above; therefore, Reclamation involvement in the transfer process is necessary. Additionally, Reclamation is considering facilitating transfers because supporting water users in need is consistent with the agency's vision.

The hydrologic conditions for 2010 and 2011 are not yet known, but it is likely that some California water providers will need to supplement local and imported supplies to meet essential demands because of past dry years and low reservoir storage levels. The nature of the supply shortage will likely severely limit supply for existing agricultural use and limit supply for municipal needs including minimum health and safety requirements. The purpose of the Proposed Action is to help facilitate the transfer of water within the State from willing sellers of water upstream of the Delta under Reclamation contract to buyers that are at risk of experiencing water shortages in 2010 and 2011.

1.3 Document Organization

The remainder of this document is organized as follows:

- **Chapter 2** – presents the No Action Alternative and the Proposed Action analyzed in this EA;
- **Chapter 3** – presents the Affected Environment and Environmental Consequences of the alternatives by resource area;
- **Chapter 4** – describes the consultation and coordination that occurred during the development of this document;
- **Chapter 5** – presents the list of preparers; and
- **Chapter 6** – includes the references cited in the document.

Chapter 2 Alternatives

2.1 No Action

Under the No Action Alternative, Reclamation would not approve the proposed transfers of water from CVP willing sellers upstream from the Delta to users in other basins in 2010 and 2011. However, other transfers that do not involve the CVP may occur under the No Action Alternative. Additionally, CVP transfers within basins would continue to occur 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 Alternative; however, they would need to complete individual NEPA and ESA compliance for each transfer to allow Reclamation to complete the evaluation of the transfers for approval.

Under the No Action Alternative, some agricultural and urban water users may face potential shortages in the absence of water transfers. These users may take alternative water supply actions in response to potential shortages, including increased groundwater pumping, cropland idling, reduction of landscape irrigation, or water rationing.

2.2 Proposed Action

The Proposed Action includes one-year or two-year water transfers in 2010 and 2011 over which Reclamation has approval authority. Reclamation has approval authority over transfers that require use of CVP facilities, transfers of CVP supplies, or transfers of base supplies from CVP contractors whose contracts require Reclamation approval of these transfers. Water transfers included in the Proposed Action represent only a portion of the expected overall transfers in 2010 and 2011. The remaining transfers are not dependent upon Reclamation's approval; this EA considers these transfers in the context of cumulative impacts.

The Proposed Action includes potential transfers of water from fifteen entities with CVP contracts located upstream from the Delta, listed in Table 2-1 and shown in Figure 2-1. Subject to approval in accordance with the Interim Guidelines for the Implementation of Water Transfers under the CVPIA and State law, Reclamation proposes to approve these transfers. Reclamation would evaluate each proposal individually, as it is received, to determine if it meets CVPIA and State law requirements. Reclamation has followed this process in

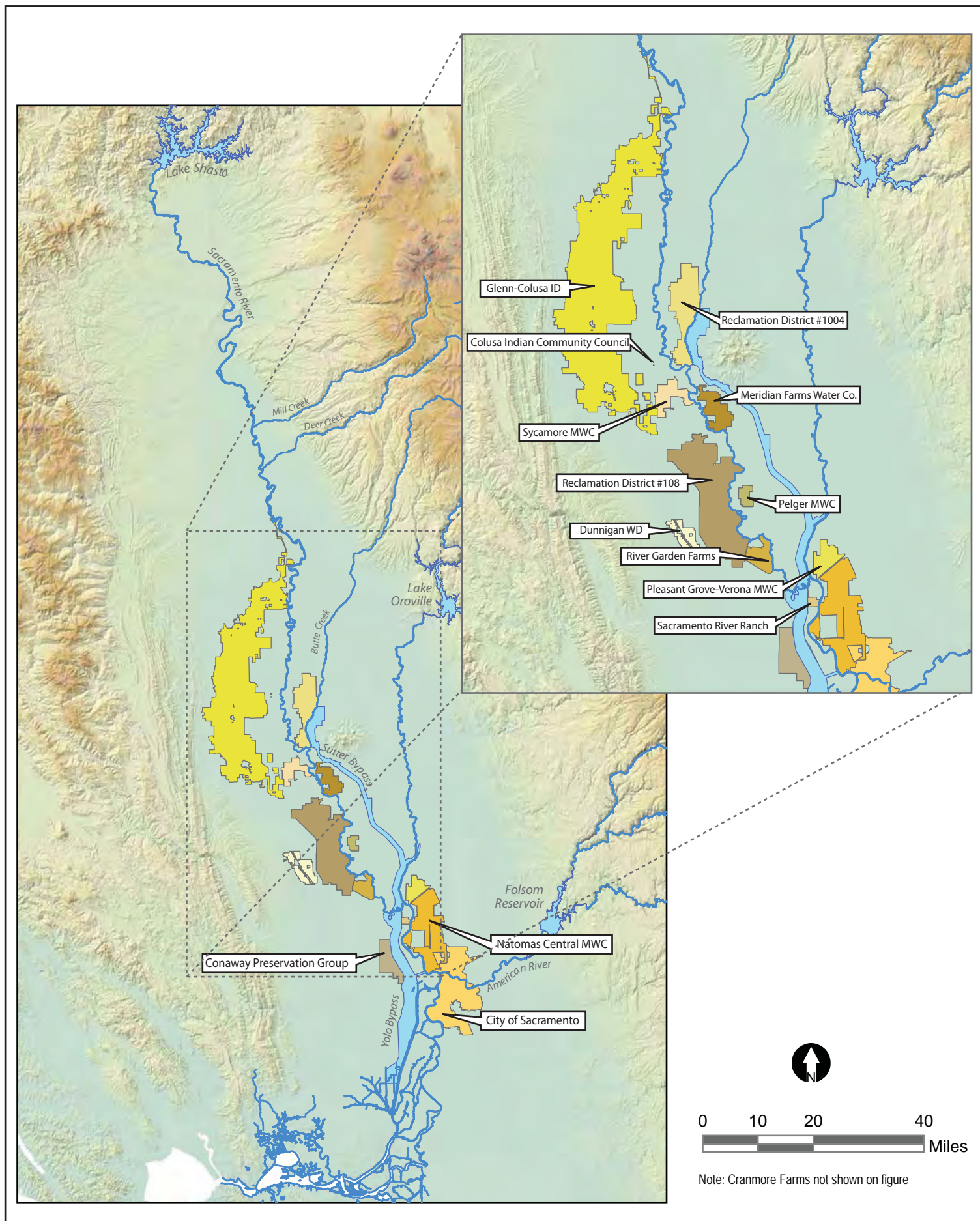


Figure 2-1. Potential Sellers

past years when approving transfers (such as in 2009 for the Drought Water Bank).

The Proposed Action could make water available to buyers from CVP contractors upstream from the Delta during the 2010 and 2011 water years only. Annually, a total of up to approximately 219,878 acre feet of water would be made available for transfer through groundwater substitution, cropland idling, and crop shifting. The existing CVP and SWP facilities could be used to convey transfer water to entities that require supplemental water supplies to meet anticipated demands or face potential water shortages. Water transfers that must move through the Delta would be assumed to lose an estimated 20 percent of the water obtained from the Sacramento River and its tributaries to carriage losses (water required to meet water quality and flow related objectives) in the Delta. Additional losses may be assessed for conveyance losses along the California Aqueduct and the Delta Mendota Canal.

Water transfers involving conveyance through the Delta would be implemented within the operational parameters of the Biological Opinions on the Continued Long-term Operations of the CVP/SWP (Opinions) (National Marine Fisheries Service 2009; U.S. Fish and Wildlife Service 2008) and any other regulatory restrictions in place at the time of implementation of the water transfers. Current operational parameters applicable to conveyance of transfer water include:

- A maximum amount of water transfers covered in the Opinions is 600,000 acre feet per year; and
- Transfer water will be conveyed through the SWP's Harvey O. Banks Pumping Plant (Banks PP) and CVP's C.W. "Bill" Jones Pumping Plant (Jones PP) during July through September only.

DWR and Reclamation would determine availability of Delta pumping capacity at the Banks PP, Barker Slough Pumping Plant (Barker Slough PP), and Jones PP throughout the transfer period.

2.2.1 Sellers

Table 2-1 lists agencies under contract with Reclamation that may be willing to sell water in 2010 and 2011. This list represents agencies that have expressed interest in current or prior year programs. The table also identifies potential maximum acre foot estimates for groundwater substitution and/or cropland idling/crop shifting transfers. The acre foot values reflect the potential upper limit of available water for transfer by each agency for each transfer type; however, actual purchases would depend on hydrology, interested buyers, and compliance with CVPIA transfer requirements. The maximum proposed value for groundwater substitution is 110,409 acre feet and the maximum proposed

value for cropland idling/crop shifting transfers is 109,469 acre feet. Because of the uncertainty of hydrologic and operating conditions in 2010 and 2011, it is likely that only a portion of the potential transfers identified in Table 2-1 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. 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 ESA analysis to allow Reclamation to complete the evaluation of the transfers.

Table 2-1. Potential Sellers (Upper Limits)

Acre feet		
Water Agency (County)	Groundwater Substitution	Cropland Idling/ Crop Shifting
Upstream from the Delta Region		
Sacramento River Area of Analysis		
Colusa Indian Community Council/Cachil Dehe Band of Wintun Indians	500	
Conaway Preservation Group (Yolo)	13,440	25,000
Cranmore Farms (Pinnacle Land Ventures, LLC or Broomieside Farms) (Sutter)	10,000	10,000
Dunnigan WD (Yolo)	1,500	1,500
Glenn-Colusa Irrigation District (Glenn and Colusa)	20,000	20,000
Meridian Farms (Sutter)	2,000	2,000
Natomas Central MWC (Sutter and Sacramento)	10,000	
Pelger MWC (Sutter)	3,750	3,750
Pleasant Grove-Verona MWC (Sutter)	10,000	4,000
Reclamation District 108 (Colusa and Yolo)	5,000	20,000
Reclamation District 1004 (Glenn and Colusa)	10,000	10,000
River Garden Farms (Yolo)	8,000	
Sacramento River Ranch (Yolo)	3,219	3,219
Sycamore MWC (Colusa)	10,000	10,000
American River Area of Analysis		
City of Sacramento (Sacramento)	3,000	
Totals	110,409	109,469

2.2.2 Buyers

Table 2-2 identifies potential buyers who may be interested in participating in the 2010 or 2011 water transfers. The buyers are separated into those that are upstream from the Delta or in the Export Service Area (areas served Jones PP, Banks PP, and other diversions from the Delta). Not all of these potential buyers may end up actually purchasing water from transfers. Purchase decisions depend on a number of factors, including, but not limited to, hydrology, water

demands, availability of other supplies, and transfer costs. A major concern to potential buyers is the ability to move the purchased water through the Delta to the buyer's service area. Export of the transfer water by Reclamation through the Delta is dependent on availability of capacity at the CVP or SWP pumping facilities and subject to other operational requirements. Available CVP and SWP capacity is severely limited due to operational and regulatory restrictions. The current pumping window for transfers through Banks PP and Jones PP is July through September. Pumping within this window can be further reduced based on specific hydrologic conditions and regulatory compliance or water quality issues. Reclamation cannot guarantee that a specific quantity of transfer capacity will be available.

Table 2-2. Potential Buyers

Export Service Area Region
CVP
City of Avenal
City of Coalinga
City of Huron
Contra Costa Water District
East Bay Municipal Utility District
San Luis & Delta Mendota Water Authority
Banta Carbona Irrigation District
Broadview Water District
Byron Bethany Irrigation District
Del Puerto Water District
Eagle Field Water District
James Irrigation District
Laguna Water District
Mercy Springs Water District
Oro Loma Water District
Pacheco Water District
Panoche Water District
Patterson Irrigation District
RD 1606
San Benito County Water District
Santa Clara Valley Water District
Tranquility Irrigation District
West Side Irrigation District
West Stanislaus Irrigation District
Westlands Water District
San Joaquin National Cemetery (Department of Veteran Affairs)
SWP
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

Table 2-2. Potential Buyers

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
Independent
Avenal State Prison
Upstream from the Delta Region
CVP
Bella Vista Water District
East Bay Municipal Utility District
Tehama-Colusa Canal Authority
Colusa County Water District
Corning Water District
Cortina Water District
Davis Water District
Dunnigan Water District
4M Water District
Glenn-Colusa Irrigation District
Glide Water District
Hothouse Water District
Kanawha Water District
Kirkwood Water District
Lagrande Water District
Orland-Artois Water District
Proberta Water District
Thomes Creek Water District
Westside Water District
SWP
City of Yuba City

Reclamation and DWR are assessing the need for a petition to the SWRCB to temporarily consolidate the CVP and SWP places of use similar to that filed by the Projects in 2009. Approval of a consolidated place of use would allow transfers from CVP contractors contemplated in this EA to SWP contractors served by Banks or Barker Slough PP that are outside the CVP authorized place of use. Reclamation would not approve any CVP water transfers to buyers outside of the CVP place of use unless the SWRCB approves a Petition for Change (either through a joint petition to consolidate the CVP and SWP places of use or through individual petitions for change) authorizing the delivery of water outside the CVP place of use.

The Joint Point of Diversion authorization contained in Water Rights Decision 1641 allows the CVP and SWP to use the other's facilities to divert or convey water under certain terms and conditions, but it does not allow delivery of that water outside that Project's existing authorized place of use. Without SWRCB approval of a Petition for Change, CVP water could only be delivered within the CVP authorized place of use.

2.2.3 Potential Water Transfer Methods

In 2010 and 2011, Reclamation could approve transfers from groundwater substitution or cropland idling/crop shifting, which are further described below. No other types of water transfers are covered by the evaluation in this EA for 2010 and 2011.

Reclamation approves transfers consistent with provisions of the CVPIA and State law that protect against injury to third parties as a result of water transfers. Several important CVPIA principles include requirements that the transfer will not violate the provisions of Federal or State law, will have no significant adverse effect on Reclamation's ability to deliver CVP water to its contractors, will be limited to water that would be consumptively used or irretrievably lost to beneficial use, will have no significant long-term adverse impact on groundwater conditions, and will not adversely affect water supplies for fish and wildlife purposes. Reclamation will not approve any water transfer for which these basic principles have not been adequately addressed.

Additional information about water rights protection and water transfers is located at http://www.waterboards.ca.gov/waterrights/water_issues/programs/water_transfers/ in a State Water Resources Control Board (SWRCB) staff document titled "A Guide to Water Transfers" (SWRCB 1999).

2.2.3.1 Groundwater Substitution

Groundwater substitution is a proposed method to make water available for transfer. Groundwater substitution transfers occur when sellers forego diversion of their surface water supplies and pump an equivalent amount of groundwater as an alternative supply. Reclamation assumes that stream flow losses during balanced conditions due to groundwater pumping for transfers would be 12 percent of the amount pumped for transfer (see Section 3.2 for more information). The quantity of water available for transfer would be reduced by the estimated stream flow losses. Sellers would not be paid for the quantity of groundwater pumping assumed to come at the expense of stream flow (12 percent depletion losses). Because the potential groundwater substitution transfers are primarily from agricultural users, the water from this acquisition method could be available during the irrigation season of April through October. Sellers could make transfers available during only a part of this time by switching between surface water sources and groundwater pumping if there are issues related to water supply availability or transportation capacity.

For transfers that must travel through the Delta to reach sellers, Reclamation and DWR would export transfer water only during July through September when capacity is determined to be available at the Jones PP or Banks PP. CVP transfer water conveyed at the Banks PP could occur upon the SWRCB's approval of Joint Points of Diversion. Conveyance of CVP water at Barker Slough PP would require SWRCB approval of a change in point of diversion.

Reclamation would attempt to retain surface water made available through groundwater substitution in upstream storage facilities until the Delta export pumps have the capacity available to convey water south. In general, to retain water made available through water transfers in upstream facilities, Reclamation and DWR would have had to declare the Delta is in a “balanced” water condition under the terms of the Coordinated Operating Agreement (COA). Reclamation and DWR would strive to facilitate the conveyance of additional transfer water through the export pumps during the summer months based on the availability of unused export capacity, but transfers could only be moved through the pumping facilities after the Project water needs are met. The risk of unused capacity not being available would be born by the transfer parties.

Some transfers may not need to move through the Delta export facilities subject to the July through September transfer window. For example, transfers could be diverted at Freeport or at Barker Slough to reach some potential buyers. These facilities are not restricted to moving transfers from July through September, and may be able to pump water for a longer period (subject to their specific requirements). Transfers made available by groundwater substitution may provide up to approximately 110,409 acre feet, but the buyers would receive less because of conveyance losses.

An objective in planning a groundwater substitution transfer is to ensure that groundwater levels recover to their typical spring high levels under average hydrologic conditions and the recovery does not come at the expense of stream flow during balanced conditions. Because groundwater levels generally recover at the expense of stream flow, the wells used in a transfer should be selected such that the stream flow losses resulting from groundwater recharge peak during the wet season, when losses to stream flow should not affect other legal users of water. It is recognized that an increase in groundwater pumping would affect the rate of groundwater recharge during balanced conditions, which would affect stream flow.

2.2.3.2 Cropland Idling/Crop Shifting

Cropland idling/crop shifting would make water available for transfer that would have been used for agricultural irrigation without the transfer.

Typically, the proceeds from the water transfer would pay farmers to idle land that they would have placed in production. Rice has been the crop idled most frequently in previous transfer programs.

Cropland idling water would be available on the same pattern throughout the growing season as it would have been consumed had a crop been planted. Most cropland idling/crop shifting transfers would occur in the Sacramento River area of analysis. For transfers that need to move through Jones PP or Banks PP, transfers could be conveyed July through September when capacity is determined to be available. Reclamation would attempt to retain water acquired from cropland idling in upstream reservoirs until the transfer water

could be released and exported through the Delta during July through September, with the same constraints as described for groundwater substitution. As with groundwater substitution, transfers diverted at other facilities may not be subject to the same constraints.

Crop shifting is another potential method to make water available for transfer in 2010 and 2011. Crop shifting acquisitions would pay farmers to substitute a crop with one that uses less water, and the amount of water conserved would be available for transfer. Because crop substitution has similar effects to cropland idling, it is included in the cropland idling discussion for the remainder of this document. Transfers made available by cropland idling/crop shifting by CVP contractors may provide up to approximately 109,469 acre feet, but the buyers would receive less because of conveyance losses.

The quantity of water made available for transfer through cropland idling or crop shifting will be calculated based on the evapotranspiration of applied water (ETAW). ETAW is the portion of applied surface water that is evaporated from the soil and plant surfaces and actually used by the crop. Table 2-3 shows crops that could be included in transfers and their associated ETAW. Crops in Table 2-3 include crops that could be planted as part of a crop shifting transfer; that is, crops with low ETAW and could be planted in the place of crops with higher ETAW. Not all crops would be considered for participation in a transfer. Pasture, deciduous orchard, alfalfa (in the Delta region), and vineyard crops would not be considered because a number of factors make it difficult to determine the real water savings, including a lack of authoritative ETAW values and substantial variability in cultural practices.

Table 2-3. Estimated ETAW Values (in acre feet/acre) For Various Crops Suitable for Idling or Shifting Transfers

Crop	ETAW
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
Rye Grass (Winter Irrigation)	0
Safflower	.7
Sudan Grass	3.0
Sugar Beets	2.5
Sunflower	1.4

Table 2-3. Estimated ETAW Values (in acre feet/acre) For Various Crops Suitable for Idling or Shifting Transfers

Crop	ETAW
Tomato	1.8
Vine Seed/ Cucurbits	1.1
Wheat (over wintered)	0.5
Wild Rice	2.0

Notes:

⁽¹⁾ Only alfalfa grown north of the American River will be allowed in the 2010-2011 Water Transfer Program but fields must be completely disced under, or prior to, July 1 of transfer year. Alfalfa is not allowed if it is grown in the foothills, in the Delta, in areas with high water tables, or land irrigated with water that does not come from the Sacramento or Feather Rivers or their tributaries.

2.3 Environmental Commitments

This section presents Environmental Commitments included in the Proposed Action to reduce potential environmental impacts from water transfers in 2010 and 2011. These Environmental Commitments are also included in the Biological Assessment (BA) prepared for the 2010-2011 Water Transfer Program. Appendix A summarizes Environmental Commitments of the Proposed Action.

- Transfers will be made in accordance with all applicable sections of the California Water Code.
- Transfers involving conveyance through the Delta will be implemented within the operational parameters of the Biological Opinions on Continued Long-term Operations of the CVP/SWP or any restrictions in place the time the transfer occurs (National Marine Fisheries Service 2009; U.S. Fish and Wildlife Service 2008; SWRCB D1641).
- Sellers will be required to maintain flows at the downstream end of their distribution system under the Proposed Action to minimize potential water supply effects to neighboring and downstream water users.
- Water transfers under the Proposed Action will be implemented in accordance with meeting flow and temperature requirements on the Sacramento River.
- Well reviews and monitoring and mitigation plans will be implemented under the Proposed Action to minimize potential effects of groundwater substitution. Well reviews, monitoring and mitigation plans will be coordinated and implemented in conjunction with local ordinances, basin management objectives, and all other applicable regulations. Reclamation and DWR have published draft technical information related to cropland idling/shifting and groundwater substitution

transfers titled Draft Technical Information for Water Transfers in 2010 (Reclamation and DWR 2009). This information is available at <http://www.water.ca.gov/drought/transfers/>.

- Carriage water necessary to comply with water quality objectives in the Delta will be assessed for each transfer involving conveyance of transfer water through the Delta. Reclamation has incorporated this measure into the Proposed Action to continue with standard CVP and SWP operating procedures.
- The water transfers in 2010 and 2011 will adopt the cropland idling conservation measures in the 2009 Drought Water Bank Biological Opinion, with some modifications. These measures are designed to minimize effects from crop idling water transfers. As part of the approval process, Reclamation will have access to the land to verify how the water transfer is being made available and to verify that the actions to protect the giant garter snake (GGS) are being implemented:
 - The block size of idled rice parcels will be limited to 320 acres in size with no more than 20 percent of rice fields idled cumulatively (from all sources of fallowing) in each county. The 320-acre blocks will not be located on opposite sides of a canal or other waterway, and will not be immediately adjacent to another fallowed parcel (a checkerboard pattern is the preferred layout).
 - Reclamation will provide a map(s) to the U.S. Fish and Wildlife Service (USFWS) in June of each year showing the parcels of riceland that are idled for the purpose of transferring water in 2010 and 2011. These maps will be prepared to comport to Reclamation's GIS standards.
 - Parcels participating in cropland idling will not include lands in the Natomas Basin.
 - Sellers will continue to voluntarily perform giant garter snake best management practices (BMP's), including educating all district personnel to recognize and avoid contact with giant garter snakes, clean only one side of a conveyance channel per year, provide rock-basking habitat in the system's water prisms, and raise flail mower blades to at least 6 inches above the canal operation and maintenance road surfaces.
 - The water seller will maintain a depth of at least two feet of water in the major irrigation and drainage canals (but never more than existing conditions) to provide movement corridors.

- A field proposed for a cropland idling transfer cannot be fallowed more than two consecutive irrigation seasons.
- As part of a Giant Garter Snake Baseline Monitoring and Research Strategy for the development of a GGS Conservation Strategy, Reclamation is part of the team proposing research goals to help quantify and evaluate the response of the GGS to riceland idling. The focus of the Strategy will be in the Colusa, Butte, Sutter, and Yolo Basins.
- In order to limit reduction in the amount of over-winter forage for migratory birds, including greater sandhill crane, transfers will avoid or minimize actions near known wintering areas in the Butte Sink (from Chico in the north to the Sutter Buttes in the south and from the Sacramento River in the west to Highway 99 in the east) that could adversely affect foraging and roosting habitat.
- As part of the review process for the identification of areas acceptable for cropland idling, Reclamation will review current species distribution/occurrence information from the Natural Diversity Database and other sources (including rookeries, breeding colonies, and concentration areas). Reclamation will then use the information to make decisions that will avoid cropland idling actions that could result in the substantial loss or degradation of suitable habitat in areas that support core populations of evaluated species that are essential to maintaining the viability and distribution of evaluated species, including black tern. Conservation measures proposed for GGS will also benefit the black tern.
- To ensure effects of cropland idling actions on western pond turtle habitat are avoided or minimized, water levels in drainage canals will be maintained to within 6 inches of existing conditions and canals will not be allowed to completely dry out.
- To minimize effects to the kit fox, water transferred will only be used to irrigate lands/crops that were under irrigation over the 3-year period prior to the transfer to ensure it is applied only to currently-cultivated lands.
- To minimize socioeconomic effects on local areas and to minimize effects on special-status species, Reclamation will not approve water transfers via cropland idling if more than 20 percent of recent harvested crop acreage in the county for each eligible crop, including rice, would be idled.

Chapter 3

Affected Environment and Environmental Consequences

This section discusses the affected environment and environmental consequences of the Proposed Action and the No Action Alternative. This section also presents minimization measures, when necessary, to reduce potential adverse effects to environmental resources. Appendix A summarizes the minimization measures.

The overall study area includes specific areas of analysis for each resource that may be directly or indirectly affected by the Proposed Action. In a general sense, these areas of analysis comprise (1) watersheds of rivers that may be involved in groundwater substitution or cropland idling; (2) rivers used to convey transferred water; (3) lands that may be used for cropland idling and adjacent lands; (4) groundwater basins that may be affected by groundwater substitution; (5) district, on-farm and CVP/SWP conveyance facilities; and (6) storage and conveyance facilities in areas that would receive water from program transfers. The affected environment section describes the area of analysis for each resource.

The Proposed Action would not affect the following resources: recreation, noise, hazardous and toxic waste, public health and safety, and transportation and traffic. Therefore, they are not analyzed further in this document.

3.1 Surface Water Resources

3.1.1 Affected Environment

3.1.1.1 Acquisition Areas

The Proposed Action would involve potential water transfers from CVP contractors in the Sacramento River hydrologic region. Table 2-1 lists the participating CVP sellers, which are further described below. The Proposed Action is not expected to adversely affect the values for which a component of the National Wild and Scenic Rivers System was established.

Sacramento River The Sacramento River flows south for 447 miles through the northern Central Valley of California, between the Pacific Coast Range and the Sierra Nevada. The chief tributaries to the Sacramento River are the Pit, Feather, McCloud and American Rivers.

Colusa Indian Community Council/Cachil Dehe Band of Wintun Indians The Colusa Indian Community Council/Cachil Dehe Band of Wintun Indians diverts water from the Sacramento River for agricultural uses under a Settlement Contract. The contract amount is for up to 180 acre feet annually. The Colusa Indian Community Council/Cachil Dehe Band of Wintun Indians could transfer water from both its CVP contract and water rights.

Cranmore Farms (Pinnacle Land Ventures, LLC or Broomieside Farms) Cranmore Farms diverts water for agricultural use from three diversion points off the Sacramento River. The Settlement Contract amount is for up to 10,070 acre feet annually.

Dunnigan Water District The Dunnigan Water District (WD) diverts water for irrigation and M&I use from the Sacramento River at the Red Bluff Diversion Dam. The district has a CVP contract with Reclamation. The water is delivered to the district through the Tehama-Colusa Canal. Dunnigan WD can divert up to 19,000 acre feet annually.

Conaway Preservation Group The Conaway Preservation Group (CPG), a private farming company, is the owner of the Conaway Ranch. Conaway Ranch is in Reclamation District (RD) 2035 and constitutes over 80 percent of the 20,445-acre service area of RD 2035. CPG is generally west of the Sacramento River in the Sacramento Valley in eastern Yolo County.

CPG's Settlement Contract water is a major contributor to the Conaway Ranch water supply during its annual operational term of April 1 through October 31. Diversions under water right permits from Willow Slough and Cache Creek, and pumping of groundwater from 23 wells supplements the contract water supply. After irrigation season, CPG's other water sources, including rights from the Sacramento River, Willow Slough, and Cache Creek, are used to meet Conaway Ranch's water needs.

Pursuant to Section 5 of the Conaway Ranch Settlement Agreement with Yolo County, written notification to Yolo County is required for short-term water transfer from Conaway Preservation Group outside of Yolo County.

Glenn-Colusa Irrigation District Glenn-Colusa Irrigation District (ID) has been diverting Sacramento River water since 1883 and was one of the first large-scale water users within the Sacramento Valley. Glenn-Colusa ID has a Settlement Contract with Reclamation. The district has 720,000 acre feet of base supply and 105,000 acre feet of CVP water. Glenn-Colusa ID conveys Sacramento River water through irrigation canals to approximately 141,000 acres. In addition, Glenn-Colusa ID conveys water to 20,000 acres of wildlife habitat comprising the Sacramento, Delevan, and Colusa National Wildlife Refuges.

Glenn-Colusa ID's Hamilton City pump station is approximately 100 miles north of the City of Sacramento. The pump station is on an oxbow off the main stem of the Sacramento River. Glenn-Colusa ID diverts a maximum of 3,000 cubic feet per second (cfs) from the Sacramento River, with the peak demand occurring in the spring (Glenn-Colusa ID 2009).

Meridian Farms Water Company The Meridian Farms Water Company (WC) provides irrigation water to three distinct service areas encompassing 9,150 total acres, with an estimated annual water delivery of 35,000 acre feet. Surface water diversions from the Sacramento River (located at Meridian, Drexler, and Grimes), drain water reuse, and groundwater pumping provide the water supply to Meridian Farms WC. Meridian Farms WC diverts surface water from the Sacramento River pursuant to its water rights and Settlement Contract with Reclamation.

Natomas Central Mutual Water Company Natomas Central Mutual Water Company (MWC) supplies water to about 31,575 acres primarily by surface water, reuse of tail water, and by one groundwater well. Natomas Central MWC diverts up to 120,200 acre feet from the Sacramento River during the irrigation season under a CVP Settlement Contract. Natomas Central MWC can also divert Sacramento River water during non-irrigation seasons for environmental water use (wetlands enhancement and rice straw decomposition). Such diversions outside the irrigation season are not a part of the Sacramento River Settlement Contract. Natomas Central MWC has two main pump stations on the Sacramento River: Prichard Lake Pumping Plant and Elkhorn Pumping Plant. Natomas Central MWC also diverts water from the Natomas Cross Canal along the Natomas Central MWC's northern boundary.

Pelger Mutual Water Company Pelger MWC diverts surface water from the Sacramento River near Robbins. This entity has appropriative water rights as well as a Sacramento River Settlement Contract with Reclamation for 8,860 acre feet. Pelger MWC recycles drain water back to irrigation ditches. During dry years, Pelger MWC's water supply is supplemented by groundwater from private landowners' wells.

Pleasant Grove-Verona Mutual Water Company Pleasant Grove-Verona MWC provides irrigation water for 7,330 acres of farmland through a contract with Reclamation for a total of 26,290 acre feet. Shareholders divert surface water from the Sacramento River and the Natomas Cross Canal under their individual water rights and pursuant to the Settlement Contract with Reclamation.

Reclamation District 108 RD 108 has a Settlement Contract with Reclamation to divert water from the Sacramento River. RD 108 operates seven pumping plants that divert water from the Sacramento River for irrigation, and one that diverts water from the Colusa Basin Drain as a supplemental irrigation supply.

Reclamation District 108's permit allows 75 cfs to be pumped from the Colusa Basin Drain.

Reclamation District 1004 RD 1004 is between the Sacramento River and Butte Creek, between Princeton to the north and Colusa to the south. RD 1004 has appropriative water rights as well as a Sacramento River Settlement Contract with Reclamation. Surface water sources available to RD 1004 include the Sacramento River, Butte Creek, and extensive recirculation of tail water. RD 1004's main pumping plant on the Sacramento River is near Princeton. RD 1004's appropriative water rights for Butte Creek allow diversions at several locations between White Mallard Dam and Butte Slough.

River Garden Farms River Garden Farms is in Yolo County on the west border of the Sacramento Valley. They have direct diversion water rights on the Sacramento River (near Knights Landing) to divert up to 32 cfs during the irrigation season. River Garden Farms also has a Sacramento River Settlement Contract with Reclamation for 29,800 acre feet.

Sacramento River Ranch Sacramento River Ranch is northwest of Sacramento in an unincorporated area of Yolo County and comprises 3,985 acres. Sacramento River Ranch's source of surface water is the Sacramento River and Knights Landing Ridge Cut. Five appropriative water rights cover a portion of the Sacramento River Ranch and adjacent lands. Pursuant to these licenses, Sacramento River Ranch has a maximum annual diversion quantity of 7,094 acre feet, which may be diverted from April through October. These water right licenses have historically been used by Sacramento River Ranch to provide water for irrigation purposes. In addition, a portion of Sacramento River Ranch is subject to a Settlement Contract with Reclamation, which authorizes the diversion and use of 4,000 acre feet per year from the Sacramento River.

Sycamore Mutual Water Company Sycamore MWC (also known as Sycamore Family Trust) is on the west side of the Sacramento River near Meridian. It has appropriative water rights, as well as a Sacramento River Settlement Contract with Reclamation for 31,800 acre feet.

American River The American River originates in the high Sierra Nevada just west of Lake Tahoe. Its three main forks, the South, Middle and North, flow through the Sierra foothills and converge east of Sacramento at Folsom Reservoir. The American River converges with the Sacramento River near Sacramento.

City of Sacramento The City of Sacramento provides water to users within city limits and to a small area outside of the city near Fruitridge. The City of Sacramento has water rights on both the Sacramento and American Rivers. The city also has an agreement with Reclamation regarding use of these water rights.

3.1.1.2 Conveyance Facilities

In California, lakes, rivers, and reservoirs receive their water from precipitation and runoff, which is available during the rainy season (typically November through April). Water users need water year-round, with increased water needs during the summer because of increased temperatures and agricultural uses. This imbalance is exacerbated by the differences in precipitation and demand between northern California and southern California. More than 70 percent of runoff originates in northern California, but more than 75 percent of urban and agricultural demand is south of Sacramento (DWR 1998). Because of the uneven distribution of the location of water supply and water demand, aqueducts and canals are used to transport water to users. The amount of water that can be transported south is dependent on annual hydrology, Delta pump capacity and regulatory restrictions, such as Biological Opinions (National Marine Fisheries Service 2009; U.S. Fish and Wildlife Service 2008).

Direct flows to the Delta drain over 40 percent of the State of California. The Sacramento River contributes roughly 75 to 80 percent of the Delta inflow in most years, while the San Joaquin River contributes about 10 to 15 percent. Precipitation also contributes an annual average inflow of 990,000 acre feet, approximately 5 percent of the annual inflow. The rivers flow through the Delta and into Suisun Bay. From Suisun Bay, water flows through the Carquinez Strait into San Pablo Bay, then south into San Francisco Bay, and then out to sea through the Golden Gate. In general, water that is not consumed or stored in northern California or pumped through the Delta to central and southern California flows out to the Bay and into the ocean.

Most water transfers originating upstream from the Delta and going to service areas in the San Francisco Bay Area, San Joaquin Valley, and Southern California require moving water through the Delta. Water conveyance through the Delta is a significant constraint. Constraints to conveying water through the Delta range from physical limitations to regulatory requirements. A series of regulations and agreements with the SWRCB, USFWS, National Marine Fisheries Service (NMFS), California Department of Fish and Game (CDFG), and U.S. Army Corps of Engineers (Corps) govern current SWP and CVP operations in the Delta. These regulations and agreements limit the schedule and volume of water that can be exported from the Delta based on Delta hydrodynamics, water quality, and potential impacts on fisheries. Table 3.1-1 shows monthly average pumping at Jones PP and Banks PP during 2009 to indicate pumping patterns throughout the year. Reclamation and DWR will ensure careful coordination of transfers with existing CVP and SWP operations in meeting water rights, water quality, and fishery protection measures when approving proposed water transfers.

Table 3.1-1. Average Monthly Delta Export Pumping in 2009

	Jones PP (cfs)	Banks PP (cfs)
January	2,072	2,395
February	1,912	1,978
March	2,863	2,820
April	1,407	1,324
May	1,040	986
June	1,310	511
July	3,910	6,220
August	4,114	4,030
September	4,094	2,441
October	3,949	2,001
November	2,833	1,506
December ¹	2,068	2,854

Source: DWR 2009a

Note 1: December averages include dates from 12/1/2009 through 12/17/2009

Some transfers would not require carriage water to move through the Delta, such as transfers to members of the Tehama-Colusa Canal Authority or East Bay Municipal Utility District (through the new Freeport diversion). These facilities are not subject to the same constraints as facilities within the Delta, but all transfers must adhere to standards and requirements associated with operating these facilities.

CVP/SWP facilities that could potentially be utilized under the Proposed Action include Shasta Reservoir and Folsom Reservoir, and SWP and CVP pumping and conveyance facilities, which would be used for conveying transfer water. The SWP operates its Banks PP in the southern Delta to lift water into the California Aqueduct for delivery to SWP customers in the south San Francisco Bay Area, San Luis Obispo and Santa Barbara Counties, the San Joaquin Valley, and southern California; and the Barker Slough Pumping Plant into the North Bay Aqueduct for delivery to SWP customers in Solano and Napa Counties. The CVP operates the Jones PP to lift water from the Southern Delta into the Delta-Mendota Canal to service CVP contractors in the San Joaquin Valley and the Tulare Basin. Under the Proposed Action, water may also be transferred from sellers upstream from the Delta to buyers upstream from the Delta, using existing district, CVP and SWP conveyance facilities, including the Tehama-Colusa Canal.

3.1.1.3 Receiving Areas

The Proposed Action would potentially transfer water to districts as identified in Table 2-2. These areas receive water from multiple sources, including the SWP, the CVP, local surface water sources, and groundwater. Most of these potential buyers would require water to be moved through the Delta.

3.1.2 Environmental Consequences

This section describes environmental consequences of the No Action Alternative and Proposed Action.

3.1.2.1 No Action

Under the No Action Alternative, other water transfers outside of the Proposed Action would likely occur and buyers would implement other projects and programs to increase water supplies, including conservation, recycled water, and groundwater use. However, during dry and critical water years, potential buyers could experience water shortages that could affect their ability to meet customer demands.

3.1.2.2 Proposed Action

Temporary changes in water right permits may be needed for some water transfers. Individual water right holders would be responsible for obtaining changes to water rights as needed.

Acquisition Areas

Acquisition of water via groundwater substitution or cropland idling would change the rate and timing of flows in the Sacramento River compared to the No Action Alternative. The rate and timing of changes to flows in the Sacramento River would depend on the amount of water potential sellers make available and the scheduled release of that water. However, all flow and temperature requirements, including Water Right Orders 90-5 and 91-1 temperature control planning requirements for the Sacramento River, would continue to be met under the Proposed Action. Most buyers will require water to be moved through the Delta and pumped at Jones PP or Banks PP, which do not have capacity for transfer water between April and June. Depending on hydrologic conditions, Reclamation would attempt to retain surface water made available in Shasta Reservoir until Delta export pumps have the capacity to convey water south. Reclamation could only store water if the Delta is in a “balanced” water condition under the terms of the COA.

If water cannot be stored, Shasta Reservoir would release flows on the same schedule as if they were being used to irrigate crops, but the flows would not be diverted because the crops would be idled. Sacramento River flows would increase below the historic point of diversion for districts participating in cropland idling.

If water is stored, the Sacramento River flows between Shasta Reservoir and the historic point of diversion could decrease in June. The decrease in flow corresponds only to the amount of water that the willing seller would have consumptively used under the No Action Alternative. The remaining river flow would supply other agencies’ water needs as it would under the No Action

Alternative because the flow changes associated with the transfer would not affect the timing and quantity of water releases for any non-participating entity.

During July through September, water from Shasta Reservoir would be released into the Sacramento River; however, those agencies that have sold water would divert less water from the river than they would under the No Action Alternative. The Sacramento River would therefore have increased flows downstream from those historic points of diversion; upstream from those points of diversion, Sacramento River flows would be the same as the No Action Alternative. Although there would be a change in timing and rate of river flows, the annual supply of water to users that are not participating in transfers would not decrease due to the Proposed Action.

In addition to the buyers that would require use of Jones PP or Banks PP to transfer water, several buyers may divert transferred water through other facilities, such as the Freeport Regional Water Project or Barker Slough Pumping Plant. These facilities do not have the same pumping constraints as the Jones PP and Banks PP, so they could potentially receive water from cropland idling on the schedule that the crop would have consumptively used the water if they are not otherwise constrained. Flows would increase on the Sacramento River between the sellers' points of diversion and the buyers' points of diversion. These transfers would also result in a change in timing and rate of river flow, but the annual supply of water to users not participating in transfers would not change compared to the No Action Alternative.

Acquisition of water via groundwater substitution from the City of Sacramento could change the rate and timing of flows in the American River compared to the No Action Alternative. The rate and timing of flow changes would depend on the amount of water the City of Sacramento would make available and the scheduled release of that water. Reclamation would attempt to store water made available April through June in Folsom Reservoir until released July through September. Groundwater would replace surface water released from Folsom Reservoir for use under the No Action Alternative. Surface water would therefore not be released from Folsom Reservoir to meet those water supply requirements. During July through September, water from Folsom Reservoir would be released into the Lower American River.

River flows would decrease between Folsom Reservoir and the historic diversion points for the City of Sacramento between April and June under the Proposed Action. The river flows would decrease only by the amount that would have been diverted by the City of Sacramento. River flows would increase when the transfers are released from Folsom Reservoir during July through September. The flow changes would not affect other agencies' water supplies because the timing and quantity of their water releases would be the same as under the No Action Alternative. Although there would be a change in

timing and rate of river flows, the annual supply of water to users that are not participating in transfers would not decrease.

River flows would follow different flow patterns if the buyers do not require the water to be exported from the Delta through Jones PP or Banks PP. Other facilities, such as Barker Slough Pumping Plant and the Freeport Regional Water Project, do not have the same pumping constraints as the Delta pumping facilities. These transfers could potentially proceed on the same schedule that the City of Sacramento would have used the water in the No Action Alternative if the pumping facilities are not otherwise constrained. These transfers would result in an increase in flow below the city's historic point of diversion until the buyers' point of diversion. Releases from Folsom Reservoir would be the same as the No Action Alternative.

Acquisition of water via cropland idling could reduce the water supply for users not participating in the transfer who rely on return flows from fields that, under the Proposed Action, would be idled. If farmers in Sutter, Glenn, Colusa, and Yolo Counties reduce diversions by the amount of water that would have been consumed by the idled crops, plus some portion of the system losses in field losses (deep percolation to groundwater or tailwater runoff), the transfer could diminish the amount of tailwater historically available to users downstream. Of the amount of water that is applied to a particular field, a portion percolates into the groundwater aquifer and a portion runs off the field back into the conveyance system. This "tailwater" that runs back into the conveyance system could then be used again by water users downstream of the conveyance system. Some downstream water users depend on tailwater that flows out of the service area of an upstream diverter. However, as stated in Section 2.3 Environmental Commitments, "Sellers will be required to maintain flows at the downstream end of their distribution system under the Proposed Action to minimize potential water supply effects to neighboring and downstream water users." Therefore, there would be no impact to downstream water users compared to the No Action Alternative.

Receiving Areas

The Proposed Action would likely result in increased water supplies in 2010 and 2011 in the buyers' 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. For transfers to agricultural users, water would only be delivered to lands that were previously irrigated within the past three years (based on the Environmental Commitment to protect the San Joaquin kit fox); therefore, the transfer water would help provide supplemental water to lands that are experiencing substantial shortages. 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 would be a beneficial effect.

3.2 Groundwater Resources

3.2.1 Affected Environment

3.2.1.1 Sacramento Valley Groundwater Basin

Groundwater substitution transfers would originate from the Sacramento Valley Groundwater Basin in Glenn, Colusa, Sutter, Yolo and Sacramento counties. Figure 3.2-1 shows all the subbasins within the Sacramento Valley Groundwater Basin. The entire basin is within Tehama, Glenn, Butte, Yuba, Colusa, Placer and Yolo Counties. The basin is bordered by Red Bluff Arch to the north (separating the basin from the Redding Basin), the Coast Ranges to the west, the Sierra Nevada to the east, and the Sacramento-San Joaquin Delta to the south.

Geology, Hydrogeology, and Hydrology The Sacramento Valley Groundwater Basin is a north-northwestern trending asymmetrical trough filled with as much as 10 miles of both marine and continental rocks and sediment (Page 1986). On the eastern side, the basin overlies basement bedrock that rises relatively gently to form the Sierra Nevada; the northern side of the basin rises to form the Cascade Range; while on the western side the underlying basement bedrock rises more steeply to form the Coast Ranges. Overlying the basement bedrock are marine sandstone, shale, and conglomerate rocks, which generally contain brackish or saline water (DWR 2001). The more recent continental deposits, overlying the marine sediments, contain freshwater. These continental deposits are generally 2,000 to 3,000 feet thick (Page 1986). The depth (below ground surface) to the base of freshwater typically ranges from 1,000 to 3,000 feet (Bertoldi 1991). Along the eastern and northeastern portion of the basin are the Tuscan and Mehrten formations, derived from the Cascade and Sierra Nevada. The Tehama Formation in the western portion of the basin is derived from Coast Range sediment. In most of the Sacramento Valley Groundwater Basin, the Tuscan, Mehrten, and Tehama formations are overlain with relatively thin alluvial deposits.

In the Sacramento Valley Groundwater Basin, freshwater is present primarily in the Tuscan, Mehrten, and Tehama formations and in alluvial deposits. Groundwater is recharged by deep percolation of applied water, rainfall, infiltration from streambeds, and lateral inflow along the basin boundaries. Average annual precipitation in the Sacramento Valley Groundwater Basin ranges from 13 to 26 inches, with the higher precipitation occurring along the eastern and northern edges of the basin. Typically, 80 to 90 percent of the basin's precipitation occurs from November to April. Further east in the Sierra Nevada, precipitation ranges from 40 to 90 inches, much in the form of snow.

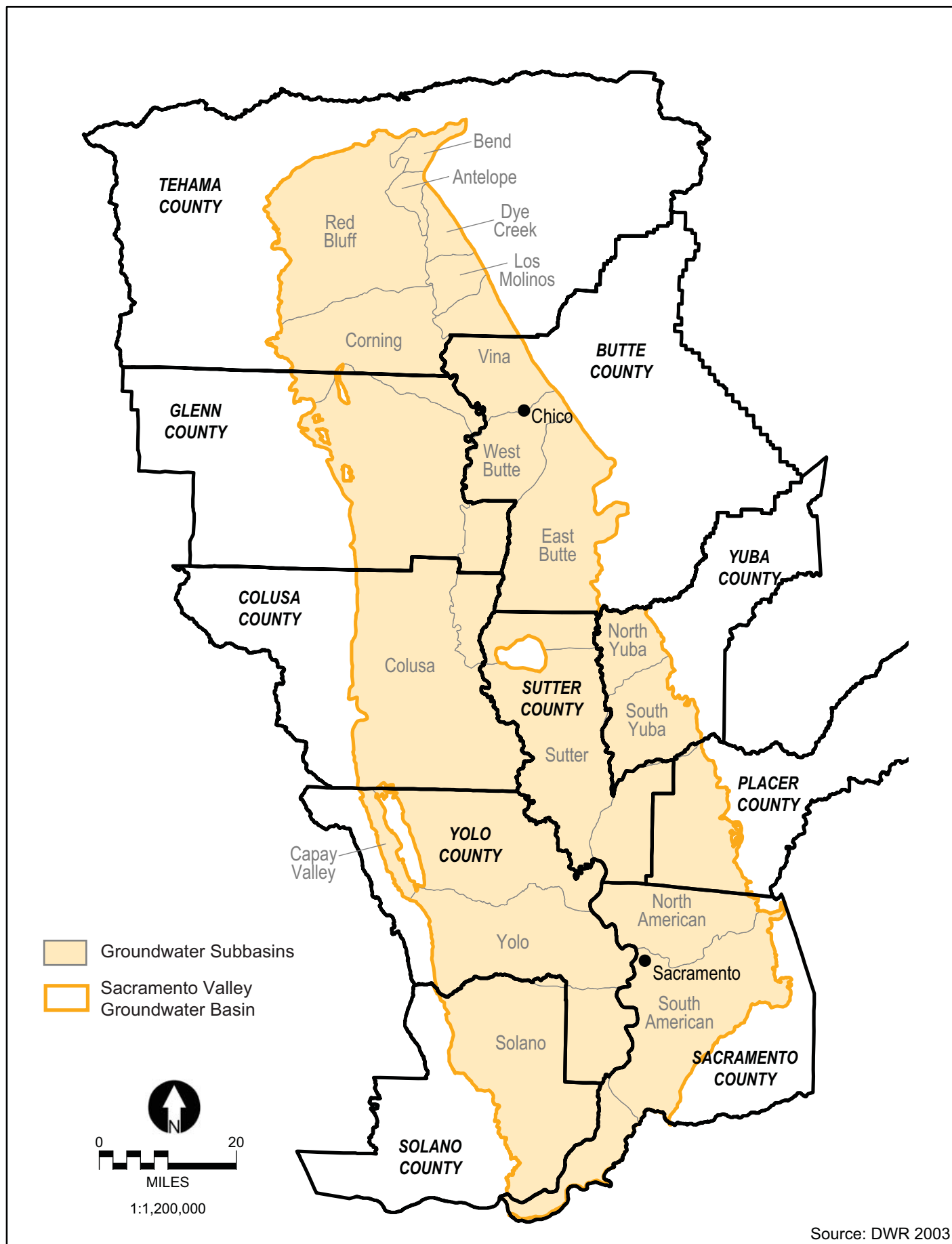


Figure 3.2-1. Sacramento Valley Groundwater Basin

The quantity and timing of snowpack melt are the predominant factors affecting the surface and groundwater hydrology, and peak runoff in the basin typically lags peak precipitation by one to two months (Bertoldi 1991).

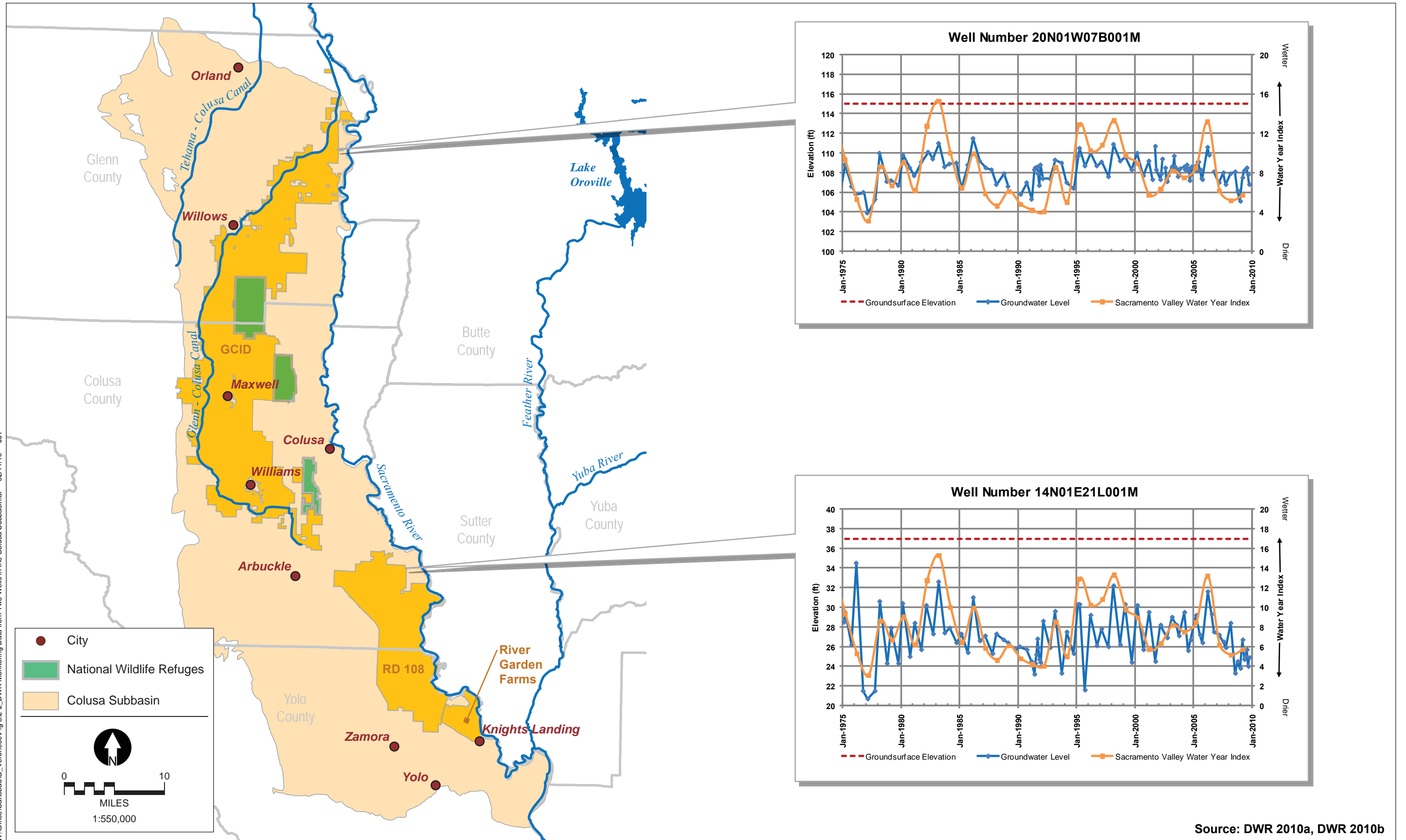
The main surface water feature in the Sacramento Valley Groundwater Basin is the Sacramento River, which has several major tributaries draining the Sierra Nevadas, and Cascade Ranges, including the Feather, Yuba, American, McCloud, and Pit Rivers. The Cascade Range is also drained by Battle, Mill, Big Chico, and Butte Creeks. Stony, Cache, and Putah Creeks drain the Coast Range and are the main west side tributaries to the Sacramento River.

Surface water and groundwater interact on a regional basis, and, as such, gains and losses to groundwater vary significantly geographically and temporally. In areas where groundwater levels have declined, such as in Sacramento County, streams that formerly gained water from groundwater now lose water to the groundwater system through seepage.

Groundwater Production, Levels, and Storage Irrigated agriculture in the Sacramento Valley Groundwater Basin is over 1.2 million acres (USDA 2009). Annual average groundwater production in the basin has recently been estimated to be about 2.5 million acre feet or more. Irrigation wells range from 100 to 600 feet deep, on average; some wells in the southern portion of the basin have been drilled beyond 1,000 feet (NCWA 2006).

Historically, groundwater levels in the Basin have remained steady, declining moderately during extended droughts and recovering to pre-drought levels after subsequent wet periods. DWR extensively monitors groundwater levels in the basin, with over 1,000 wells. The groundwater level monitoring grid includes active and inactive wells that were drilled by different methods, with different designs, for different uses. Types of well use include domestic, irrigation, observation, and other wells. The total depth of monitoring grid wells ranges from 18 to 1,380 feet below ground surface. Figure 3.2-2 shows groundwater level data from two select wells in DWR's monitoring grid relative to the Sacramento Valley Water Year Index.

In general, groundwater flows inward from the edges of the basin and south parallel to the Sacramento River. In some areas, there are groundwater depressions associated with extraction that influence local groundwater gradients. 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 Tehama-Colusa Canal, the delivery of surface water and reduction in groundwater extraction resulted in a recovery to historic groundwater levels by the mid to late-1990s (Reclamation 2004). Throughout the basin, individuals, counties, cities, and special legislative agencies manage and/or develop groundwater resources. Many agencies use groundwater to



Source: DWR 2010a, DWR 2010b

Figure 3.2-2. DWR Monitoring Data from Two Wells in the Colusa Subbasin

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supplement surface water; therefore, groundwater production is closely linked to surface water availability.

Land Subsidence Subsidence generally occurs in small increments during dry years when groundwater is increasingly pumped. DWR has implemented an ongoing program to monitor subsidence within the Sacramento Valley.

DWR and 20 participating local, state, and Federal agencies recently established a regional GPS geodetic control network in the Sacramento Valley, which allows land surface elevations to be precisely measured using a consistent vertical datum to monitor land subsidence as a result of underground water withdrawal (DWR 2008). The GPS network includes 339 survey monuments and extends across the Sacramento Valley, including Colusa, Sutter, Glenn, Butte, Yolo, Yuba, Tehama, and Placer Counties (DWR 2008).

Complementary to the regional GPS network, DWR monitors 13 extensometers in the Sacramento Valley (DWR 2008). Data from the GPS 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 land partially or fully rebounds as aquifers recharge in winter (DWR 2008). Out of the 13 extensometers, only three of them indicate that inelastic subsidence may be occurring:

- 09N03E08C004M, in Yolo County near Reclamation District 2035: 0.04 to 0.05 foot decline from 1992 to present;
- 11N01E24Q008M, in Yolo County near the Yolo-Zamora area: 0.4 to 0.5 foot decline from 1992 to present; and
- 21N02W33M001M, in Glenn County: 0.015 foot decline from 2005 to present.

The third extensometer has a very short period of record during only a dry period, so these results may be elastic and may not indicate long-term subsidence.

Historically, land subsidence occurred in the eastern portion of Yolo County and the southern portion of Colusa County, owing to groundwater extraction and geology. The earliest studies on land subsidence in the Sacramento Valley occurred in the early 1970s when the USGS, in cooperation with DWR, measured elevation changes along survey lines containing first and second order benchmarks. As much as 4 feet of land subsidence due to groundwater withdrawal has occurred since the 1950s. 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 aquifer sediments.

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, natural groundwater quality is influenced by streamflow and recharge from the surrounding Cascade and Sierra Nevada Ranges. Runoff from the Sierra Nevada and Cascade Ranges is generally of higher quality than runoff from the Coast Ranges, 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 saltwater intrusion, elevated levels of naturally occurring boron, nitrates, and other introduced chemicals. For nearly 60 years, DWR has provided groundwater monitoring to assess water quality issues throughout Central California via a network of approximately 400 monitoring wells. Water quality data is gathered and analyzed for temperature, pH, conductivity, minerals, nutrients, bacteria, organic compounds such as pesticides, and elements including iron and arsenic.

Total dissolved solids (TDS) in the region generally consist of inorganic salts and small amounts of organic matter. The California and EPA secondary drinking water standard for TDS is 500 milligrams per liter (mg/L), and the agricultural water quality goal for TDS is 450 mg/L. Generally, in the Sacramento Valley Groundwater Basin, TDS levels are between 200 and 500 mg/L (DWR 2003; Butte County Water Commission 2009). Along the eastern boundary of the basin, TDS concentrations tend to be less than 200 mg/L, indicative of the low level of TDS concentrations in Sierra Nevada runoff. Several areas in the basin have naturally occurring high concentrations of 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 Yuba Rivers.

From 1994 to 2000, DWR monitored water quality in 1,356 public supply water wells. Samples indicated that 1,282 wells, or 95 percent, met the primary maximum contaminant levels (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 included: 33 percent nitrates, 32 percent volatile and semivolatile organic compounds (mostly tetrachloroethylene, trichloroethylene, and benzene), 26 percent inorganic compounds (mostly manganese and iron), 5 percent radiological compounds (gross alpha 4), and 4 percent pesticides (di(2-ethylhexyl)phthalate) (DWR 2003).

Nitrate (measured as nitrogen) is regulated in drinking water and has an MCL of 10 mg/L. Nitrates found in groundwater could be due to fertilizer use, leachate from septic tanks, wastewater disposal, and natural deposits. In irrigation water, nitrate could be an asset because of its value as a fertilizer; however, algae growth and environmental problems could arise from concentrations exceeding 30 mg/L. Concentrations of nitrate as nitrogen exceeding 10 mg/L are found throughout the Central Valley; however, concentrations exceeding 30 mg/L are rare and localized (Bertoldi 1991). In the Sacramento Groundwater Basin, two areas of potential nitrate problems have been identified: one in northern Yuba and southern Butte counties, east of Sutter Buttes, and another in northern Butte and southern Tehama counties (DWR 2003).

In low concentrations, boron is important for plant growth, but it could adversely affect certain crops at concentrations as low as 0.5 mg/L. In the Central Valley, boron is usually from natural sources, such as marine deposits; in general, only localized portions of the Sacramento Valley Groundwater Basin have concentrations exceeding 0.75 mg/L (Bertoldi 1991). In Yolo County, some groundwater, especially in the Cache Creek fan, has high boron concentrations.

Arsenic and selenium are naturally occurring trace elements. The California drinking water standard for selenium is 0.05 mg/L. On January 22, 2001, EPA lowered the arsenic standard from 0.05 mg/L to 0.01 mg/L. For agricultural use, arsenic concentrations should not exceed 1 mg/L. Selenium is toxic to humans and animals at low concentrations and can accumulate in the environment and in wildlife (DWR Northern District 2002).

3.2.1.2 Regulatory Background

State Regulations 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. In general, groundwater and groundwater-related transfers are subject to a number of provisions in the Water Code. These provisions require compliance with: (1) Section 1220, (2) Section 1810, and (3) local groundwater management plans.

The State Water Code (Section 1745.10) requires that for short term water transfers, 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; or

The transferring water supplier approves the transfer and, in the absence of a groundwater management plan, determines that the transfer will not create, or contribute to, conditions of long-term overdraft in the groundwater basin.

State Water Code Section 1220 also 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 groundwater management plan, 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. The Water Code requires submission of well completion reports.

California Water Code Section 1810 protect against injury to third parties as a result of water transfers. Three fundamental principles include that use of a water conveyance facility is to be made with (1) no injury to other legal users of water; (2) no unreasonable effects on fish, wildlife or other in-stream beneficial uses of water; and (3) no unreasonable effects on the overall economy or the environment in the counties from which the water is transferred. These principles must be met for approval of water transfers. Other groundwater regulation is related primarily to water quality issues. These issues are addressed through a number of different legislative acts and are the responsibility of several different State agencies including:

- State Water Resource Control Board and nine Regional Water Quality Control Boards: 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: 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.

Local Regulations Existing groundwater management plans and local regulations in various areas can affect the potential transfer of water. Local groundwater management plans and county ordinances vary by region and the

authority/agency involved. These plans typically involve provisions to limit or prevent groundwater overdraft, regulate transfers, and protect groundwater quality. Potential sellers have begun coordination with their respective counties regarding the Proposed Action and will continue this coordination through the transfer approval process. Table 3.2-1 provides brief descriptions of the water transfer requirements for individual counties, in geographic order from north to south.

Table 3.2-1. Description of County Ordinances and Plans Pertaining to Groundwater Transfers

County	Description	Sources for More Information
Tehama	Ordinance requires a permit to extract groundwater for off-parcel use, prohibits mining of groundwater, and restricts the radius of influence associated with the operation of a well participating in transfer operations to the parcel on which the well is located, among other requirements.	Tehama County Health Agency, Environmental Health Division http://www.tehamacountywater.ca.gov/ http://www.tehamacountywater.ca.gov/exp_ord_1617.htm
Butte	Ordinance requires permits for groundwater extraction for use outside the County, and requires a permit for groundwater substitution pumping. Butte County also has a well spacing ordinance. The Butte County Water Commission advises the Board of Supervisors with technical information from the Butte County Water Advisory Committee and Technical Advisory Committee.	Butte County Department of Water and Resource Conservation http://www.buttecounty.net/Water%20and%20Resource%20Conservation.aspx
Glenn	Ordinance uses basin management objectives of groundwater levels, groundwater quality, and land subsidence to help define safe yield and overdraft of the basin. The ordinance is enforced by the Glenn County Board of Supervisors	Glenn County Department of Agriculture http://www.glenncountywater.org/about_us.aspx
Colusa	Ordinance requires a permit for extraction and export of groundwater, either directly or indirectly, for use outside of the County. Application for a transfer permit is filed with Colusa County Groundwater Commission, through the Director of the Planning and Building Department.	County Director of Planning and Building http://www.codepublishing.com/CA/colusacounty/ http://colusagroundwater.ucdavis.edu/index.htm
Sutter	Sutter County has no ordinance governing the extraction and export of groundwater. According to its general plan, Sutter County has a long-term interest in discouraging water transfer/export sales if they result in long-term supply losses.	Sutter County Planning Services http://www.co.sutter.ca.us/doc/government/depts/cs/ps/gp/gp_home
Yolo	Ordinance requires a permit for extraction and export of groundwater, including the extraction of groundwater to replace a surface water supply. Application for a permit should be filed with the Director of Community Development.	Director of Community Development http://www.yolocounty.org/Index.aspx?page=432#Title%2010
Sacramento	Ordinance requires a permit for groundwater or surface water to be transported in any manner outside the County. Application for a permit must be filed with the Director of the Sacramento Department of Water Resources.	Sacramento Department of Water Resources http://www.msa.saccounty.net/waterresources/drainage/docs/20051018Title3Zone41MASTERrev.pdf

Acquisition Areas The following agencies are listed in Section 2.2.1 as potential sellers via groundwater substitution.

Colusa Indian Community Council/Cachil Dehe Band of Wintun Indians The Colusa Indian Community Council/Cachil Dehe Band of Wintun Indians receives surface water from the Sacramento River to irrigate rice and walnuts. The community could transfer up to 500 acre feet through groundwater substitution using one private well that is approximately 1,000 feet deep.

Conaway Preservation Group CPG purchased the 17,300-acre Conaway Ranch in 2004. The Ranch has considerable groundwater resources, and currently holds rights to more than 50,000 acre feet of water from the Sacramento River. Farming activities on the ranch include mainly rice, but alfalfa, wheat, tomatoes, and safflower are also grown. This agency could transfer 13,440 acre feet through groundwater substitution. Yolo County Export Ordinance No. 1617 applies to CPG.

Cranmore Farms (Pinnacle Land Ventures, LLC or Broomieside Farms) Cranmore Farms receives surface supplies from the Sacramento River and could transfer up to 10,000 acre feet through groundwater substitution and/or 25,000 acre feet through cropland idling/crop shifting. Cranmore Farms' water supply for irrigation may be supplemented by groundwater from its two existing wells. Within the next year, Cranmore Farms may construct additional groundwater wells for use within the property. For the upcoming water transfers, it has yet to be determined which wells within Cranmore Farms would participate in a groundwater substitution program.

Dunnigan Water District Dunnigan WD receives surface water supplies from the Sacramento River to irrigate almonds, wine grapes, alfalfa, tomatoes, and rice. Dunnigan WD may transfer a maximum of 1,500 acre feet through groundwater substitution and/or cropland idling/crop shifting. Groundwater substitution would use six or seven irrigation wells that range from 775 to 920 feet deep. Yolo County Export Ordinance No. 1617 applies to Dunnigan WD.

Glenn-Colusa Irrigation District Glenn-Colusa ID receives surface water supplies from the Sacramento River and could transfer up to 20,000 acre feet through groundwater substitution and/or cropland idling/crop shifting.

Meridian Farms Water Company Meridian Farms WC receives surface water from the Sacramento River and could transfer up to 2,000 acre feet through groundwater substitution and/or cropland idling/crop shifting. Meridian Farms WC uses surface water to irrigate rice, tomatoes, wheat, alfalfa, hay, walnuts, beans, vineseed, corn, and sunflowers. For groundwater substitution transfers, Meridian Farms WC may use three wells that range from 145 to 192 feet deep, but the exact wells that may participate are not yet certain.

Natomas Central Mutual Water Company Natomas Central MWC receives surface water from the Sacramento River and could transfer up to 10,000 acre feet through groundwater substitution. Historically, Natomas Central MWC has relied on surface water diverted from the Sacramento River and, consequently, has relatively limited groundwater development. Natomas Central MWC has used groundwater as a supplement to surface supplies during dry years through the discretion of private landowners. Natomas Central MWC owns two wells; there are 61 privately-owned wells within the MWC's area.

Pelger Mutual Water Company Pelger MWC receives surface water supplies from the Sacramento River and could transfer up to 3,750 acre feet through groundwater substitution and/or cropland idling/crop shifting. Pelger MWC's water supply for irrigation may be supplemented by groundwater from private landowners' wells. Three private wells were used for participation in the 2009 Drought Water Bank, but it has yet to be determined which wells within Pelger MWC are planned for use in upcoming transfers.

Pleasant Grove-Verona Mutual Water Company Pleasant Grove-Verona MWC holds a Settlement Contract with Reclamation on behalf of its shareholders for diversions from the Sacramento River and the Natomas Cross Canal; and could transfer up to 10,000 acre feet through groundwater substitution and/or 4,000 acre feet through cropland idling/crop shifting. In the Pleasant Grove-Verona MWC area, groundwater is usually only used by individual shareholders to supplement surface water supply for short periods of time, typically during peak demand periods. Exceptions to this may occur in cases of reduced surface water availability. During these periods, shareholders may pump additional groundwater to make up for the reduced surface water availability. All groundwater wells within Pleasant Grove-Verona MWC are owned and operated by the individual shareholders.

Reclamation District 108 RD 108 is in the Colusa groundwater subbasin and receives surface water from the Sacramento River. RD 108 could transfer up to 5,000 acre feet through groundwater substitution and 20,000 acre feet through cropland idling/crop substitution. RD 108 has two wells they typically use in groundwater substitution transfers that are in Colusa County.

Reclamation District 1004 RD 1004 receives surface water from the Sacramento River and Butte Creek. RD 1004 could transfer up to 10,000 acre feet through groundwater substitution and/or cropland idling/crop shifting. Groundwater for the Proposed Action would be pumped from privately owned wells within RD 1004. RD 1004 maintains no records of pumping from the approximately 50 privately owned wells within the district. Colusa County Ordinance No. 615 is applicable to RD 1004.

River Garden Farms River Garden Farms receives surface water from the Sacramento River and could transfer up to 8,000 acre feet through groundwater

substitution. The groundwater substitution transfers could use seven wells owned privately by River Garden Farms. The wells range in depth from approximately 350 feet to 650 feet and could pump approximately 3,000 gallons per minute (gpm) to 1,800 gpm. Yolo County Export Ordinance No. 1617 applies to River Garden Farms.

City of Sacramento The City of Sacramento receives surface water from the American River and could transfer up to 3,000 acre feet through groundwater substitution. Groundwater extracted under the Proposed Action would most likely be extracted from wells owned by the City of Sacramento and Sacramento Suburban Water District. Groundwater provides 15 percent of the annual water supply within the city's retail service area (City of Sacramento 2008). The city may use up to 27 active municipal wells in the area that have casing depths ranging from 200 to 350 feet below ground surface.

Sacramento River Ranch Sacramento River Ranch's service area comprises approximately 3,985 acres in Yolo County and receives surface water from the Sacramento River to irrigate permanent and row crops, such as alfalfa, orchard grass, wheat, rice, tomatoes, corn, oats, and safflower. Sacramento River Ranch could transfer up to 3,219 acre feet through groundwater substitution and/or cropland idling/crop shifting. Sacramento River Ranch would pump groundwater for irrigation instead of diverting surface water, under its appropriative water rights licenses (1200, 9994, 9995, 9996, 9997) and Sacramento River Settlement Contract (Contract No. 14-06-200-2149A-R-1 with Reclamation, dated April 5, 2005). This contract approved the diversion and use of 4,000 acre feet per year (1,300 acre feet from July through September) from the Sacramento River. Sacramento River Ranch would likely use the same wells as used in past transfers (Wells GW-1 123448, GW-9 123447, and GW-10 33839). These wells are irrigation wells that are at least 150 feet deep and have pumping capacities of 3,500, 2,500, and 3,000 gpm, respectively.

Sycamore Mutual Water Company Sycamore MWC (also known as Sycamore Family Trust) receives surface water from the Sacramento River and could transfer up to 10,000 acre feet through groundwater substitution or cropland idling/crop substitution. Sycamore MWC uses surface water to irrigate rice, tomatoes, beans, vineseed, corn, alfalfa, and wheat. Water transfers could use four existing wells (approximately 900 feet deep) owned and operated by private landowners or potentially new wells.

3.2.2 Environmental Consequences

3.2.2.1 No Action

Under the No Action Alternative, Reclamation would not approve the proposed water transfers to buyers in 2010 and 2011. However, other transfers may occur

under the No Action Alternative. Some users in the export service area may face potential shortages in the absence of water transfers. These users may take alternative water supply actions in response to potential shortages, including increased groundwater pumping, cropland idling, reduction of landscape irrigation, or water rationing. These actions, particularly increased groundwater pumping, could cause groundwater levels to decline in the areas of the Central Valley and southern California served by the CVP and SWP.

3.2.2.2 Proposed Action

Acquisition Areas

Water transfers via groundwater substitution could affect groundwater hydrology. The potential effects would be decline in groundwater levels, interaction with surface water, land subsidence, and water quality impacts.

Groundwater Levels Increased groundwater substitution pumping may result in temporary declines of groundwater levels. Groundwater substitution pumping would typically occur during the irrigation season and the pumped groundwater would be used for crop irrigation.

Declining groundwater levels as a result of increased groundwater substitution pumping could cause: (1) increased groundwater pumping cost due to increased pumping depth, (2) decreased yield from groundwater wells due to reduction in the saturated thickness of the aquifer, and (3) decrease of the groundwater table to a level below the vegetative root zone, which could result in environmental effects.

Groundwater levels tend to decrease during the irrigation season and rebound in the wet winter months. A large portion of recharge in the basin is likely through percolation of natural runoff (DWR Northern District 2002). Because of the aquifers relatively short recovery period and because the Proposed Action is only a two year program, transfers in 2010 and 2011 would likely have a minimal effect on long-term groundwater level trends.

Groundwater substitution under the Proposed Action could result in temporary drawdown that exceeds historical seasonal fluctuations. Increased groundwater pumping could also cause localized declines of groundwater levels, or cones of depression, near pumping wells. To reduce these effects, willing sellers will be required to implement minimization measures, that include monitoring and mitigation programs, under the Proposed Action. The measures would monitor groundwater level fluctuations within the local pumping area. As part of the transfer approval process, Reclamation will review potential sellers' proposed monitoring and mitigation plans for consistency with applicable Federal, State and local regulations.

As discussed above, in many areas that may participate in the proposed 2010-2011 Water Transfer Program, groundwater data indicates that during normal and wet years, groundwater levels tend to recover to pre-irrigation levels. During dry years, however, groundwater use is typically increased and percolation from natural runoff is often lower than normal, causing groundwater levels to decline more than in normal and wet years. Furthermore, when dry years occur consecutively, groundwater levels are likely to decline throughout the dry period and then only recover after several normal or wet years. Historical water-level data illustrates this trend: groundwater levels tend to recover during normal and wet years, but the likelihood of full recovery decreases during dry years.

Because groundwater transfers under the Proposed Action would be occurring during a dry period, the transfer could contribute to groundwater levels declining over a period of several years, if there is not sufficient wet season recovery following the transfers. To reduce these effects, potential sellers will be required to evaluate groundwater levels prior to each 2010-2011 Water Transfer Program transfer as part of their monitoring plan. If groundwater levels prior to a proposed purchase were low relative to previous years, a pre-purchase evaluation would be performed to evaluate regional groundwater levels and potential drawdown. During the transfer approval process, Reclamation will review the preliminary groundwater level monitoring data and Reclamation will not approve transfers with substantial adverse regional effects.

Groundwater/Surface Water Interaction A basic principle in understanding the groundwater/surface water flow dynamics is that all groundwater originates as surface water at some point. Water typically enters the ground via recharge from the ground surface (e.g. as precipitation, snow melt) or from leakage through streambeds as shown in Figure 3.2-3. Therefore, all groundwater pumped through substitution pumping started off at the surface. The length of time required for the water to reach the groundwater system varies based on the local hydrogeologic conditions.

The implementation of groundwater substitution pumping can lower the groundwater table and may change the relative difference between the groundwater and surface water levels. This change has a direct impact on the volume that a seller receives credit for being transferred.

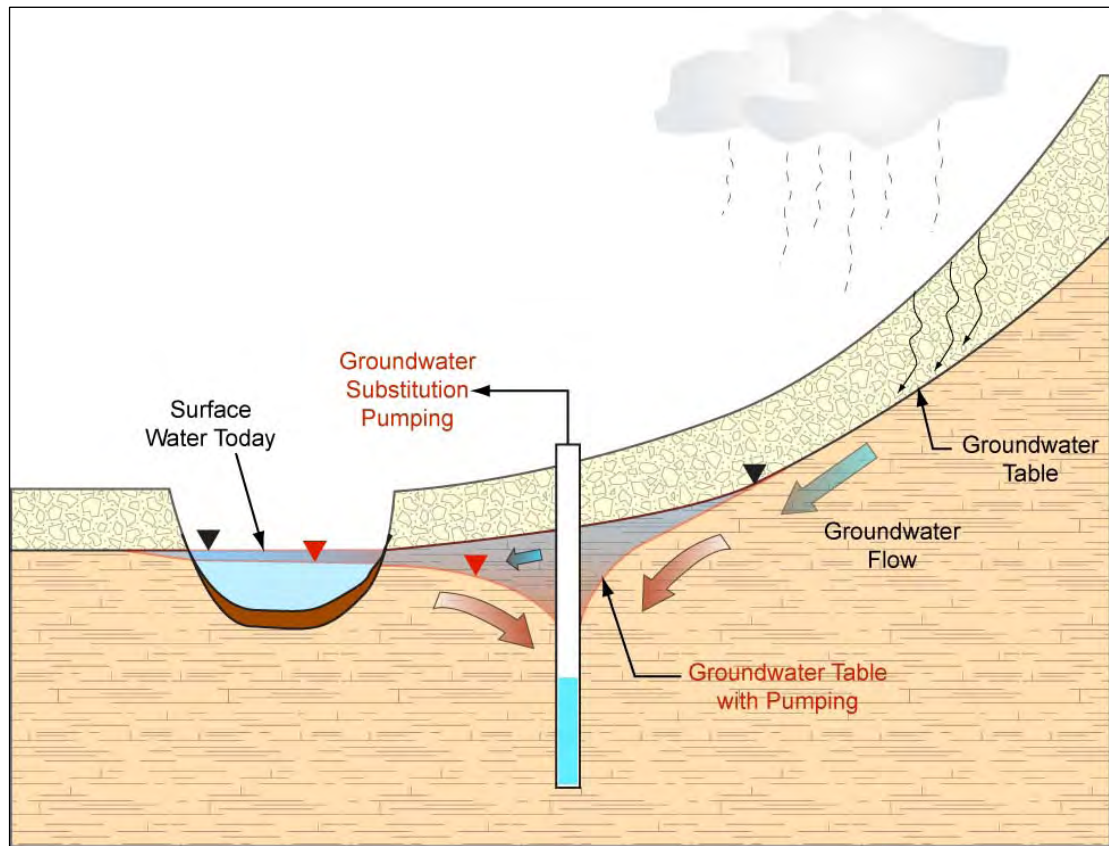


Figure 3.2-3: Schematic Linkage between Groundwater and Surface Water

In Figure 3.2-3, groundwater substitution pumping results in a change in the groundwater/surface water interaction characteristics. In this case, the water pumped from a groundwater well may have two impacts that reduce the amount of surface water compared to pre-pumping conditions. These mechanisms are:

- Induced leakage. The lowering of the groundwater table causes a condition where the groundwater table is lower than that the water level in the surface water. This condition causes leakage out of the surface water.
- Interception of groundwater. The placement of groundwater substitution pumping may intercept groundwater that may normally have discharged to the surface water (i.e., water that has already percolated into the ground may be pumped out prior to the water reaching the surface water and being allowed to enter the “gaining” stream).

Due to this depletion in streamflow, Reclamation recognizes that the volume of water that can be realistically transferred is not the same as the volume of groundwater pumped through a substitution action. The amount of water that

can justifiably be considered to be transferred is the volume of substitution pumping less the amount of induced leakage and the amount of intercepted groundwater flow. The minimization measures in Section 3.2.2.3 would reduce the potential for stream depletion associated with groundwater-surface water interaction.

Land Subsidence Inelastic land subsidence can occur where groundwater extraction causes consolidation of clay beds within an aquifer system. Although land subsidence may result in a substantial decline in ground surface elevation over a long period of time, it generally occurs very gradually and over a large area of the ground surface. As a consequence, substantial change to the appearance of the landscape may not result. It can, however, cause problems with flood control and water distribution systems. Subsidence can reduce the freeboard of levees, allowing water to over top them more easily. It also can change the grade, or even the direction of flow, in canals. In addition, subsidence may damage wells by collapsing well casings.

Groundwater extraction for groundwater substitution transfers would decrease groundwater levels, increasing the potential for subsidence. The potential for subsidence is small if the groundwater substitution pumping is small compared to overall pumping in a region. The minimization measures in Section 3.2.2.3 require all groundwater substitution transfers to monitor for subsidence or provide a credible analysis why it would be unlikely. The process of real-time subsidence monitoring will measure any changes in the ground surface elevation, whether subsidence is short-term or long-term.

Groundwater Quality The changes in groundwater flow patterns (e.g., direction, gradient) due to increased groundwater substitution pumping may result in changes in groundwater quality from the migration of reduced quality water.

Groundwater extraction under the Proposed Action would be limited to withdrawals during the irrigation season of the 2010 and 2011 water years. Extraction near areas of reduced groundwater quality concern would be avoided through the review of well data during the transfer approval process. Consequently, adverse effects from the migration of reduced groundwater quality would be anticipated to be minimal.

If monitoring indicated that adverse effects related to the degradation of groundwater quality from the transfer occurred, willing sellers in the region will be responsible for monitoring this degradation and mitigating any adverse effects in accordance with all applicable regulations.

Receiving Areas

Water transfers could increase groundwater levels in the buyer's service areas. Increased surface water supplies from water transfers could decrease

groundwater pumping in the buyer's service area. Under the No Action Alternative, some district and water users are pumping groundwater to meet water demands. The Proposed Action could allow users to reduce groundwater production and instead use surface water provided by the transfer. Groundwater levels would stop declining or decline less relative to the No Action Alternative. This would be a benefit to groundwater resources in the buyers' service areas.

3.2.2.3 Minimization Measures

The Draft Technical Information Papers for Water Transfers in 2010 (Reclamation and DWR 2009) provides guidance for the development of proposals for groundwater substitution water transfers. The objectives of this process are: to mitigate adverse environmental effects that occur; to minimize potential effects to other legal users of water; to provide a process for review and response to reported third party effects; and to assure that a local mitigation strategy is in place prior to the groundwater transfer. The seller will be responsible for assessing and minimizing or avoiding adverse effects resulting from the transfer within the source area of the transfer.

Each district will be required to confirm that the proposed groundwater pumping will be compatible with state and local regulations and groundwater management plans. Reclamation's transfer approval process and groundwater minimization measures set forth a framework that is designed to avoid and minimize adverse groundwater effects. Reclamation will verify that sellers adopt these minimization measures to minimize the potential for adverse effects related to groundwater extraction.

Well Review Process Potential sellers will be required to submit well data to Reclamation for review as part of the transfer approval process. Required information is detailed in the Draft Technical Information Papers for Water Transfers in 2010 (Reclamation and DWR 2009) for groundwater substitution transfers.

Well Locations Reclamation will continue to use the well acceptance criteria in Table 3.2-2 to minimize effects associated with groundwater-surface water interaction. Figure 3.2-4 shows approved well locations near major and minor surface water features in relation to the sellers' service areas. The Primary Approval Zones in the figure show the 1-mile zone within major surface water features and the ½-mile zone within the minor surface water features. The Secondary Approval Zones show the zones between 1 and 2 miles of the major features and ½ mile to 1 mile of the minor features. Table 3.2-2 lists criteria for acceptance of wells location in these zones.

Reclamation assumes that stream flow losses due to groundwater pumping for transfers are 12 percent of the amount pumped. Sellers may submit modeling information from approved models to demonstrate that this percentage should

be different. Reclamation continues to require well location and construction information to ensure that the criteria in Table 3.2-2 are met.

Table 3.2-2. Well Acceptance Criteria

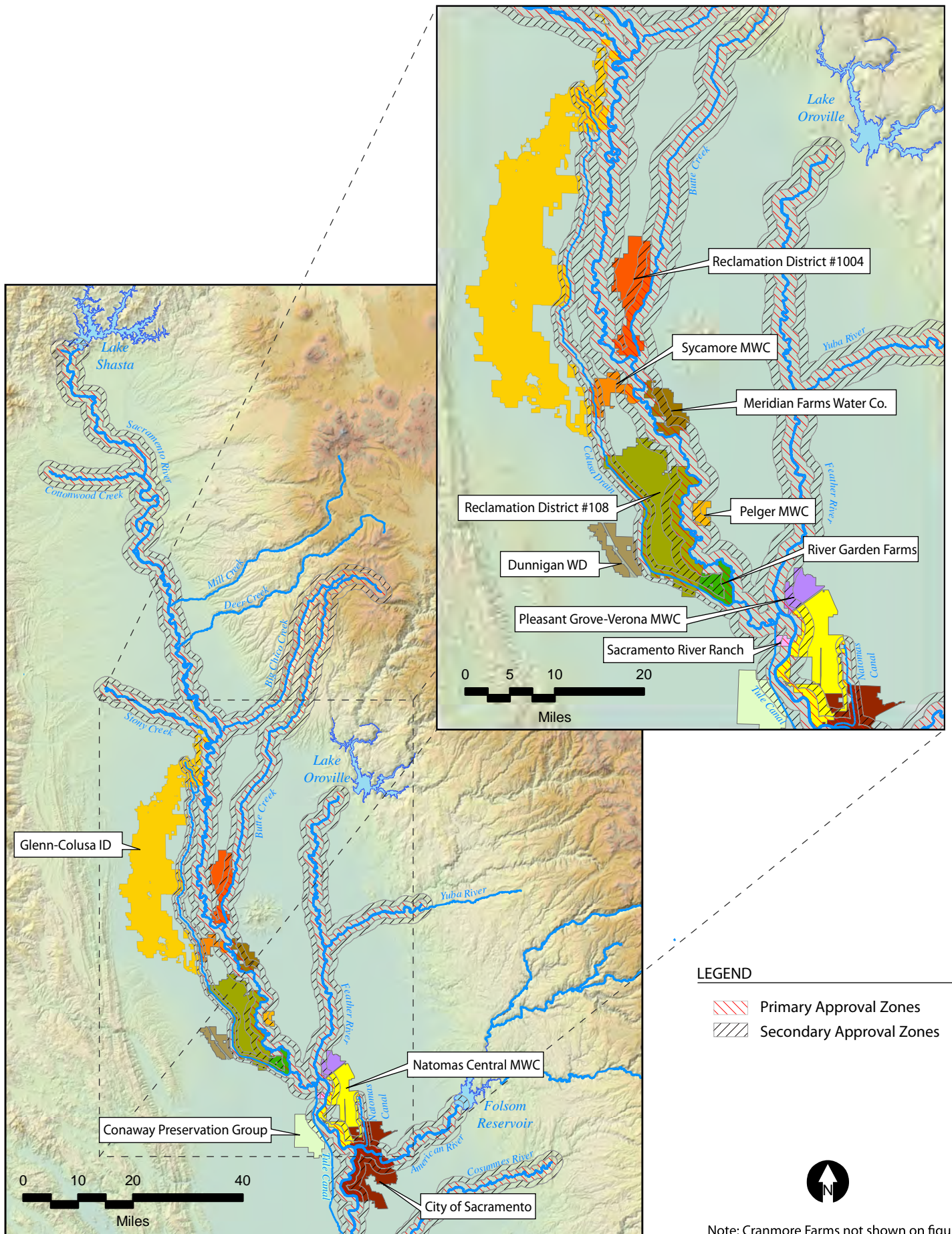
Well Location ⁽¹⁾	Criteria for Acceptance
Between one and two miles away from a major surface water tributary to the Delta	Well(s) may be accepted if: Sufficient information is submitted to demonstrate that the well is not connected to the surface water system tributary to the Delta, or The well perforations are deeper than 50 feet from the ground surface and sufficient information demonstrates that the well is not connected to the surface water system tributary to the Delta. They do not pose a risk of adversely affecting groundwater quality.
Within one mile of a major surface water tributary to the Delta	Well(s) may be accepted if: The uppermost perforation start below 150 feet bgs; or The uppermost perforations start between 100 and 150 feet bgs and the wells has a surface annular seal to at least 20 feet; a total of at least 50 percent fine-grained materials in the interval above 100 feet bgs; and at least one fine-grained layer that exceeds 40 feet in thickness in the interval above 100 feet bgs; or Sufficient information is submitted to demonstrate that the well is not connected to the surface water system tributary to the Delta.
Between one-half and one mile away from a minor surface water tributary to the Delta or a delineated wetland	Well(s) may be accepted if: Sufficient information is submitted to demonstrate that the well is not connected to the surface water system tributary to the Delta, or The well perforations are deeper than 50 feet from the ground surface and sufficient information demonstrates that the well is not connected to the surface water system tributary to the Delta. They do not pose a risk of adversely affecting groundwater quality.
Within one-half mile of a minor surface water tributary to the Delta or a delineated wetland	Well(s) may be accepted if: The uppermost perforation starts below 150 feet bgs; or The uppermost perforations start between 100 and 150 feet bgs and the wells has a surface annular seal to at least 20 feet; a total of at least 50 percent fine-grained materials in the interval above 100 feet bgs; and at least one fine-grained layer that exceeds 40 feet in thickness in the interval above 100 feet bgs; or Sufficient information is submitted to demonstrate that the well is not connected to the surface water system tributary to the Delta; or Sufficient information is submitted to demonstrate that the surface water feature does not flow during times when the Delta is in balanced conditions.

Map of major and minor surface water features and approval zones at:

<http://www.water.ca.gov/drought/docs/WellApprovalAreaBufferZoneMap.pdf>

⁽¹⁾ **Major** surface water features tributary to the Delta affected by groundwater pumping are: Sacramento River, Feather River, Big Chico Creek, Butte Creek, Cottonwood Creek, Stony Creek, Yuba River, including the Yuba Gold Fields, American River and the Cosumnes River.

Minor surface water features tributary to the Delta potentially affected by groundwater pumping are: Colusa Basin Drain, Tule/Toe Canal, and Natomas Cross Canal. Delineated wetlands are considered minor surface water features.



Source: DWR Draft Figure in Reclamation and DWR 2009.

Figure 3.2-4. Well Approval Zones for Major and Minor Surface Water Features and Sellers' Service Areas

Monitoring Plan Potential sellers will be required to complete and implement a monitoring plan that must, at a minimum, include the following components:

- *Monitoring Well Network.* The monitoring program will incorporate a sufficient number of monitoring wells to accurately characterize groundwater levels and response in the area before, during, and after transfer pumping takes place.
- *Flow Measurements.* All wells pumping to replace surface water designated for transfer shall be configured with a permanent instantaneous and totalizing flow meter (capable of measuring well discharge rates and volumes). Flow meter readings will be recorded upon initiation of pumping and at designated times, but no less than monthly, during the duration of the transfer.
- *Groundwater Levels.* The selling agency will collect measurements of groundwater levels in both production and monitoring wells. The seller will measure groundwater levels, no less than monthly, before, during and after the transfer. Post-transfer monitoring will continue until groundwater levels recover to pre-pumping levels or groundwater levels recover to seasonal highs in the spring of the year following the transfer, whichever comes earlier. The seller must measure water levels with a tape capable of measuring from a clearly marked reference point to the water surface in the well with a precision of at least plus or minus 0.1 feet.
- *Groundwater Quality.* For municipal sellers, the comprehensive water quality testing requirements of Title 22 should be 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. If specific conductance measurements exceed 900 micromhos/cm, additional water quality field testing and laboratory analysis may be required, at the seller's expense.
- *Land Subsidence.* The extent of required land subsidence monitoring will depend on the expected susceptibility of the area to land subsidence. Areas with documented land subsidence will require more extensive monitoring than other areas. Reclamation will work with the seller to develop the specifics of a mutually agreed upon subsidence monitoring effort.
- *Coordination of Monitoring.* The monitoring program will include a plan to coordinate the collection and organization of monitoring data, and communication with the well operators and other decision makers.

- *Monitoring Reports.* 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 program pumping. Post-program reporting will continue until water levels recover to pre-pumping levels or water levels recover to seasonal highs in the spring of the year following the transfer. Sellers will provide a final summary report to Reclamation evaluating the effects of the water transfer by June 1 of the year following the transfer.

Mitigation Plan Potential sellers will also be required to complete and implement a mitigation plan. 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 could include:

- Curtailment of pumping until natural recharge corrects the issue.
- Lowering of pumping bowls in third party wells affected by transfer pumping.
- Reimbursement for significant increases in pumping costs due to the additional groundwater pumping to support the transfer.
- Other actions as appropriate.

To ensure that mitigation programs will be tailored to local conditions, the mitigation plan must include the following elements:

1. A procedure for the seller to receive reports of purported environmental or third party effects. The seller must meet with the claimant of the impact within 5 business days of the claim and contact Reclamation of the impact within 10 business days of the claim.
2. A procedure for investigating any reported effect. The investigation must include analysis of groundwater elevations, pumping data, groundwater quality data, and other information relevant to the identified impact.
3. Development of mitigation options, in cooperation with the affected third parties, for legitimate effects. The seller shall strive to develop agreed upon mitigation measures within 20 business days of meeting with the claimant of the impact.
4. Assurances that adequate financial resources are available to cover reasonably anticipated mitigation needs.
5. Commitment to avoid or mitigate such effects during future transfers.

3.3 Water Quality

This section describes the affected environment and environmental consequences for water quality. The area of analysis for water quality includes the waterbodies with the potential to be affected by water transfers, including the Sacramento and American River systems and the Delta.

3.3.1 Affected Environment

The regulatory setting for the Proposed Action includes the Safe Drinking Water Act, Surface Water Treatment Rule, Stage 1 Disinfectants and Disinfection Byproducts Rule and Long-Term 1 Enhanced Surface Water Treatment Rule, Federal Clean Water Act (CWA), Porter-Cologne Act, Regional Water Quality Control Plans, Water Quality Control Plan for the San Francisco Bay/ Sacramento-San Joaquin Delta Estuary, State Water Resources Control Board Decision 1641 (Decision 1641), DWR Non-Project Water Acceptance Criteria, and U.S. Bureau of Reclamation Groundwater Acceptance Criteria.

Certain waterbodies in the Proposed Action's area of analysis are listed as water quality limited (impaired) as listed on the 303(d) list under the CWA for one or more of the constituents of concern. In addition to constituents of concern with regard to 303 (d) listed waterbodies, there are water quality constituents of concern with respect to drinking water. Water quality constituents of concern for drinking water relevant to the Proposed Action include total trihalomethanes (chloroform, bromodichloro-methane, bromoform, and chlorodibromomethane).

Beneficial uses are critical to water quality management in California. State law defines beneficial uses of California's waters that may be protected against quality degradation to include (but not 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)). Protection and enhancement of existing and potential beneficial uses are primary goals of water quality planning.

Further information on these regulations, constituents of concern and beneficial uses is included in the Water Quality chapter of the 2004 Final EWA EIS/EIR (Reclamation 2004, pgs 5-2 through 5-15).

3.3.1.1 Acquisition Areas

Sacramento River The Sacramento River Basin covers nearly 70,000 square kilometers (km²) in the north-central part of California (Reclamation 2009). Land cover in the mountainous parts of the basin is primarily forest, except in parts of the Coast Ranges where land cover is forestland and rangeland. Previous mining activities in the Klamath Mountains have resulted in acid mine drainage into Keswick Reservoir, along with the associated metals cadmium,

copper, and zinc. Mercury, from previous mining activities in the Coast Ranges, enters the Sacramento Valley through Cache Creek and Putah Creek, which drain into the Yolo Bypass. The Yolo Bypass reenters the lower Sacramento River through Cache Slough; and, during low-flow and storm water runoff conditions, mercury can be transported downstream to receiving waters.

Shasta Reservoir is on the upper Sacramento River in the Shasta Trinity National Forest. Water quality in Shasta Reservoir generally is considered to be of good quality.

The Sacramento River is the largest river in California, providing water for municipal, agricultural, recreation, and environmental purposes throughout northern and southern California.

American River The American River is a large tributary to the Sacramento River. Forestland constitutes a large percentage of land use or land cover in the American River basin. In the past, gold mining was substantial within the basin. Placer gold was first discovered in the American River in 1848, triggering the exploration and mining of gold that followed. The lower American River is listed as an impaired waterbody primarily from mercury lost during gold recovery. However, water quality in the lower American River is generally considered to be of good quality.

3.3.1.2 Delta Region

The Sacramento-San Joaquin Delta (Delta) is an important agricultural area, with more than 75 percent of the region's total production used for corn, grain, hay, and pasture. Although much of the Delta is used for agriculture, the land also provides habitat for wildlife.

The principal factors affecting Delta hydrodynamic conditions are: 1) river inflow from the San Joaquin and Sacramento River systems, 2) daily tidal inflow and outflow through the San Francisco Bay, and 3) export pumping from the south Delta through the SWP Banks Pumping Plant and CVP Jones Pumping Plant. Because tidal inflows are approximately equivalent to tidal outflows during each daily tidal cycle, tributary inflows and export pumping are the principal variables that define the range of hydrodynamic conditions in the Delta. Freshwater flows into the Delta from three major sources: the Sacramento River, the San Joaquin River, and the eastside streams.

The CVP and SWP are operated subject to the terms and conditions contained in their water rights permits issued by the SWRCB. Decision 1641 contains water quality and flow objectives that Reclamation and DWR are required to meet. The objectives are intended to protect the beneficial uses within the Delta including agricultural, municipal and industrial, and fish and wildlife beneficial uses (DWR 2006).

A portion of the flow that enters the Delta via the Sacramento River flows by various routes to the export pumps in the southern Delta. Some of this flow is drawn to the SWP and CVP pumps through interior Delta channels, facilitated by the CVP's Delta Cross Channel. Water that does not travel into the Central Delta continues towards the San Francisco Bay. Under certain conditions, additional Sacramento River water flows into the Central and South Delta. The Sacramento River water flows through Threemile Slough, around the western end of Sherman Island and up the San Joaquin River towards the export pumps. When freshwater outflow is relatively low, higher salinity water from the western Delta can be drawn into the Central and South Delta as tidal inflow from the San Francisco Bay. Under certain hydrologic conditions SWP and CVP exports cause flow from the Sacramento River to move toward the pumps resulting in "reverse flows" in the lower San Joaquin River. Prolonged reverse flow has the potential to adversely affect water quality in the Delta and at the export pumps by increasing salinity (Reclamation 2009).

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. Water quality constituents that are of specific concern with respect to drinking water, including salinity, bromide, and organic carbon.

3.3.2 Environmental Consequences

3.3.2.1 No Action Alternative

If the Proposed Action were not implemented, actions to protect water quality would continue under existing regulatory requirements. Water quality and water temperatures of rivers and reservoirs under the No Action Alternative would exhibit the same range of constituent levels and be subject to the same environmental, riverine, and oceanic influences and variations (e.g., tidal currents, wind patterns, oceanic inflow, climatic variations, water supply operations, and established inland flow regimes) that already are present. Therefore, there would be no substantial water quality effects associated with No Action Alternative.

3.3.2.2 Proposed Action

Acquisition Areas

Water transfers via groundwater substitution and cropland idling/crop shifting would alter surface water elevation and reservoir storage in Shasta Reservoir and Folsom Reservoir relative to the No Action Alternative. Reclamation would strive to store water made available during April through June in Shasta Reservoir or Folsom Reservoir, but it is very unlikely in Shasta Reservoir because of downstream flow and temperature requirements. Overall, Shasta Reservoir and Folsom Reservoir water surface elevation and reservoir storage

under the Proposed Action would be incrementally slightly higher than under the No Action Alternative. The magnitude of changes under the Proposed Action would be less than those identified for the EWA program in the 2004 Final EWA EIS/EIR, which was a maximum decrease of 19,000 acre feet, about 0.6 percent, during August in Shasta Reservoir (Reclamation 2004, pg 5-62) and a maximum decrease of 4,000 acre feet, about 0.6 percent, in July in Folsom Reservoir (Reclamation 2004, pg 5-66).¹ Because of the small, incremental changes relative to the size of the reservoirs, implementation of the Proposed Action would not adversely affect concentration of water quality constituents or water temperatures in Shasta Reservoir or Folsom Reservoir. As a result, any differences in water surface elevation and reservoir storage would not be of sufficient magnitude and frequency to adversely affect water quality, designated beneficial uses, or conflict with existing regulatory standards

Water transfers via groundwater substitution and cropland idling/crop shifting would not substantially decrease Sacramento River flow, relative to the No Action Alternative. Under the Proposed Action, Sacramento River flow at Keswick Dam and Freeport would be essentially equivalent to or greater than the flows under the No Action Alternative. The magnitude of changes under the Proposed Action would be less than those identified for the EWA program in the 2004 Final EWA EIS/EIR, which was a slight decrease in flow (less than 0.8 percent) in August and September below Keswick (Reclamation 2004, pg 5-75) and only increases in flow at Freeport (Reclamation 2004, pg 5-76). Increases in Sacramento River flow at Freeport during summer months would allow dilution of water quality constituents, including pesticides and fertilizers present in agricultural run-off. As a result, any differences in flow under the Proposed Action would not be of sufficient frequency and magnitude to adversely affect water quality.

Water transfers via groundwater substitution and cropland idling/crop shifting would not substantially increase Sacramento River water temperature, relative to the No Action Alternative. Water temperature in the Sacramento River would be essentially equivalent to water temperatures relative to the No Action Alternative. The magnitude of changes in temperature under the Proposed Action would be less than those identified for the EWA program in the 2004 Final EWA EIS/EIR, which did not indicate any changes in temperature relative to the baseline condition (Reclamation 2004, pg 5-77). Therefore, the Proposed Action would not affect water temperature in the Sacramento River.

¹ The EWA program and 2010-2011 Water Transfer Program include similar transfer actions; therefore, model results for the EWA are assumed to be adequate for this analysis. Although existing conditions and Project operations have changed since the 2004 Final EWA EIS/EIR, water quality impacts for the EWA program were found to be small, as described. It is unlikely that the magnitude of these impacts would change under different baseline conditions for the 2010-2011 Water Transfer Program.

Groundwater substitution transfers would change lower American River flow relative to the No Action Alternative. Under the Proposed Action, Reclamation may store water from these transfers in Folsom Reservoir during April, May, and June for buyers that require water to move through Banks PP or Jones PP during July-September. Storing water would decrease flows in the lower American River downstream of Nimbus Dam to the typical point of diversion. The decrease in flow would be small compared to the overall river flows. If Reclamation can store water, it would be released from July through August. The increased flows in the lower American River would allow dilution of water quality constituents, including pesticides and fertilizers present in agricultural run-off.

If the buyers do not require water to be moved through Banks PP or Jones PP, the transfers may be able to occur on the same schedule that releases would have been made in the No Action Alternative. This flow pattern would result in no change between Nimbus Dam and the point of diversion, and a small increase downstream of the point of diversion.

All differences in flow would be small compared to the overall river flow. The Proposed Action includes only 3,000 acre feet of transfer water from the City of Sacramento in the American River area of analysis over the three month transfer period, which would not result in substantial flow changes in the lower American River relative to the No Action Alternative. The changes would not be of sufficient frequency and magnitude to affect water quality.

Groundwater substitution transfers would not substantially increase American River water temperature relative to the No Action Alternative. The Proposed Action includes only 3,000 acre feet of transfer water from the City of Sacramento in the American River area of analysis over the three month transfer period, which would not substantially change existing water temperatures in the lower American River. Any differences in water temperature under the Proposed Action would not be of sufficient frequency and magnitude to affect water quality.

Water transfers via cropland idling would increase erosion and sediment deposition in water bodies, which would affect water quality. Idling would result in an increased number of bare fields, which may result in increased potential for sediment transport via wind erosion and deposition of transported sediment onto surface water bodies.

Crop management practices and soil textures are key factors in determination of erosion potential. The rice crop cycle reduces the potential for wind erosion. The process of rice cultivation, further described in Section 3.4.2, would leave a hard, crust-like surface after harvesting and flooding practices. If left undisturbed, this surface texture would remain intact throughout the summer, when wind erosion would be expected to occur, until winter rains begin.

Because of the clay soils, there would be little to no sediment transport from winds. During the winter rains, the hard, crust-like surface would remain intact and the amount of sediment transported through winter water runoff would not be expected to increase. The effects of soil erosion on water quality would be minimal.

The Proposed Action includes additional crops that could be idled under water transfers, which could be planted on soils more susceptible to erosion. Because the soils within the potential crop idling areas have slight erosion potential and farmers would manage idled land to reduce erosion, there would not be substantial effects to water quality.

Water transfers via cropland idling would alter the quantity of water applied to the land, which could reduce soil leaching. Under the Proposed Action, willing sellers would not apply irrigation water to participating fields during the growing season, which could reduce the potential for leaching of salts and trace elements. Additionally, growers would not apply fertilizers and pesticides associated with growing crops, which could result in decreased nutrient concentrations in surface water runoff as compared to the No Action Alternative. Reduced leaching and nutrient concentrations in runoff could be a potential benefit to water quality.

Water transfers via groundwater substitution would result in substitution of groundwater for surface water typically applied to agricultural fields. Groundwater would be applied to fields in lieu of surface water and would mix with surface water in agricultural drainages prior to irrigation return flow reaching the mainstem rivers.

The increase in the amount of groundwater substituted for surface water under the Proposed Action, as compared to the No Action Alternative, would be so small in comparison to the amount of surface water currently used to irrigate agricultural fields in the Sacramento Valley that the quality of the surface water, even after mixing with groundwater, would not substantially change.

Additionally, any groundwater substitution transfers must comply with groundwater minimization measures. The seller must recognize, assess and mitigate any adverse effects resulting from the transfer. These measures would minimize potential effects to water quality for downstream users.

Receiving Areas

Increased irrigation in drainage-impaired lands in the buyers' service areas could affect water quality. The Proposed Action would increase surface water supplies in the San Joaquin Valley. Some of this water may be used to irrigate drainage-impaired lands. Increased irrigation can cause water to accumulate in the shallow root zone and can leach salts, selenium, and other trace elements from the soil to the groundwater. Because the Proposed Action is 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.

However, as described above, some transfer water could increase drainwater. 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 drainwater 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 the area. Therefore, the Proposed Action would not result in impacts to water quality in the buyers' service areas.

3.4 Geology and Soils

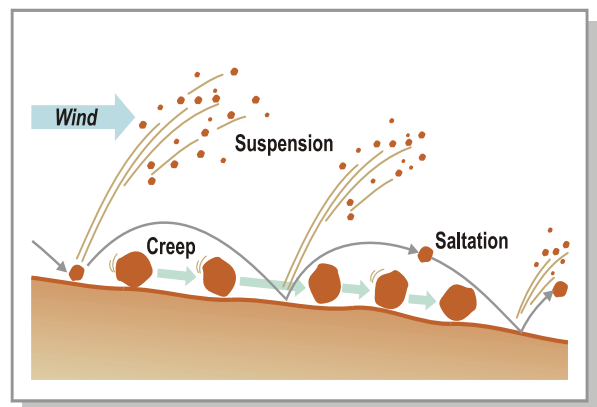
This section presents the potential impacts to geology and soils resulting from the Proposed Action. Factors such as surface soil texture, precipitation, and wind velocity and duration can affect soils. The focus of this section is on the chemical processes, properties, and erodibility of soils due to cropland idling. Section 3.2, Groundwater Resources, addresses the issues of geomorphology and land subsidence.

3.4.1 Affected Environment/Existing Conditions

3.4.1.1 Wind Erosion

Wind erosion is affected by soil erodibility, climatic factors, soil surface roughness, width of field, and quantity of vegetative coverage. Wind erosion reduces soil depth and can remove organic matter and needed plant nutrients by dispersing the nutrients contained in the surface soils.

Wind transports soil particles in three ways: saltation, surface creep, and suspension (Figure 3.4-1).



Source: NRCS 1998

Figure 3.4-1. Wind Erosion Processes

Saltation occurs when particles ranging in size from 0.1 to 0.5 millimeters (mm) in diameter are lifted from the ground, follow distinct paths influenced by air resistance and gravity, fall back to the ground, and cause the movement of additional particles. Generally, saltation occurs within one foot of the soil surface (based on velocity and other factors) and particles typically travel a distance of about 10 times their heights. Fifty to 80 percent of total soil transport is by saltation.

Surface creep moves sand-sized particles set in motion by the effect of saltating particles. During high winds, the soil particles roll across the ground surface as the particles are pushed by the flow. Surface creep can account for 7 to 25 percent of the total soil transport.

Suspension is defined as the wind moving finer particles, less than 0.1 mm in diameter, upward by diffusion. These particles can remain in the air mass for lengthened periods of time. Suspension accounts for 20 to 60 percent of the total soil transport, depending on soil texture and wind velocity.

3.4.1.2 Expansive Soils

Expansive soils are soils with the potential to experience considerable changes in volume, either shrinking or swelling, with changes in moisture content. The shrink-swell capacity of the soil refers to the potential of soil to shrink when desiccated and swell or expand when rehydrated.

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 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. Soils are classified as having low, moderate, high, and very high potential for volume changes (or shrink/swell potential) based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity [USDA, Natural Resources Conservation Service 2006]) as follows.

Low – These soils include sands and silts with relatively low amounts of clay minerals. These soils experience a change of less than 3 percent (USDA, Natural Resources Conservation Service 2006).

Moderate – These soils include silty clay and clay textured. These soils experience a change of between 3 and 6 percent (USDA, Natural Resources Conservation Service 2006).

High - These soils include clays. These soils experience a change of between 6 and 9 percent (USDA, Natural Resources Conservation Service 2006).

Very High – These soils experience a change greater than 9 percent (Natural Resources Conservation Service 2006).

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures (USDA, Natural Resources Conservation Service 2006). Figure 3.4-2 shows expansive soils in the Butte, Colusa, Glenn, Sutter, and Yolo counties.

3.4.1.3 Geology and Soil Properties

This section describes geology and soil properties in Butte, Colusa, Glenn, Sutter, and Yolo Counties. Figure 3.4-3 shows soil types within the counties.

Butte County Butte County includes valley, foothill, and mountain zones. There is little irrigated agriculture in the foothill and mountain zones because soils are generally unsuited for cultivation, but do support forestry and grazing. The region supports some orchard and grain crops in the foothill areas.

The soils associated with the valley area and alluvial fans of Butte County are deep, nearly level, very fertile, and support agricultural practices. Figure 3.4-3 shows soil types in the Sacramento Valley region. The Butte Basin was, prior to the implementation of flood control on the Feather and Sacramento Rivers, an area of extensive seasonal flooding. Early reports depict a slow-moving body of water covering from 30 to nearly 150 square miles. This slow-moving floodwater deposited the fine clay that now provides the rich agricultural soil utilized primarily for rice production.

Soils in eastern Butte County have a low to moderate shrink swell potential. The edge of western Butte County contains soils that are highly expansive.

Colusa County The eastern third of Colusa County is virtually flat with a gently increasing elevation gradient towards the northwest. The central portion of Colusa is characterized by level to gently rolling valley lands. The high, steep ridges of the Coast Ranges make up the western third of Colusa County. Deep alluvial valleys, such as Bear Valley, Indian Valley, and Antelope Valley, cut horizontally across the north-south Coast Range.

The region consists of low alluvial plains and alluvial fans. These alluvial deposits are divided into several different sub-basins based on geologic composition. These include the Stony Creek Fan, Cache Creek Floodplain, Arbuckle and Dunnigan Plains, and the Willows-to-Williams Plain.

Figure 3.4-3 shows soils in Colusa County, which largely consist of gravelly loam and silty clay soil textures. The majority of Colusa County has expansive soils with a high shrink-swell potential; a portion of southern Colusa contains soils with a low shrink-swell potential.

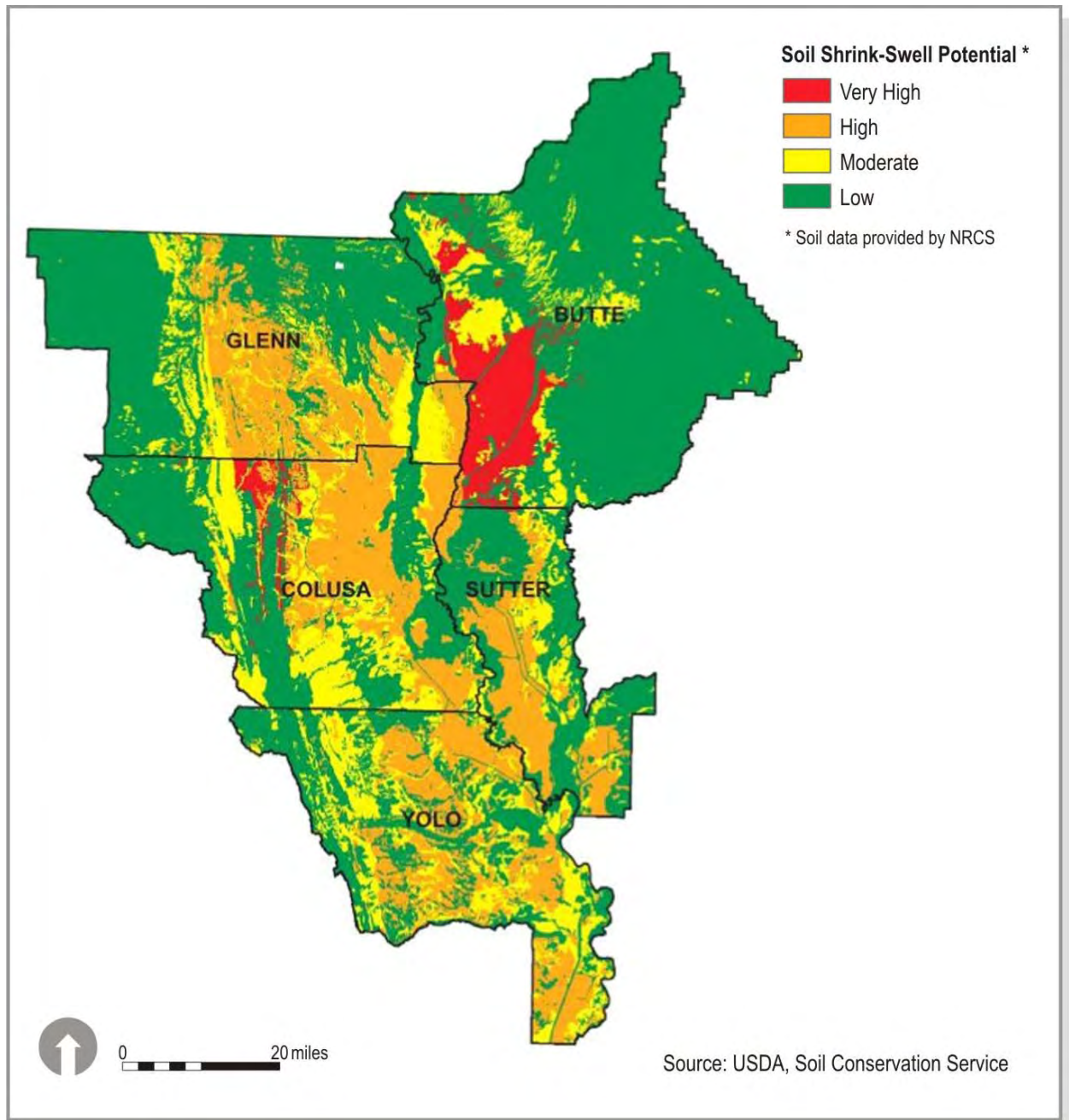


Figure 3.4.2: Soil Shrink Swell Potential

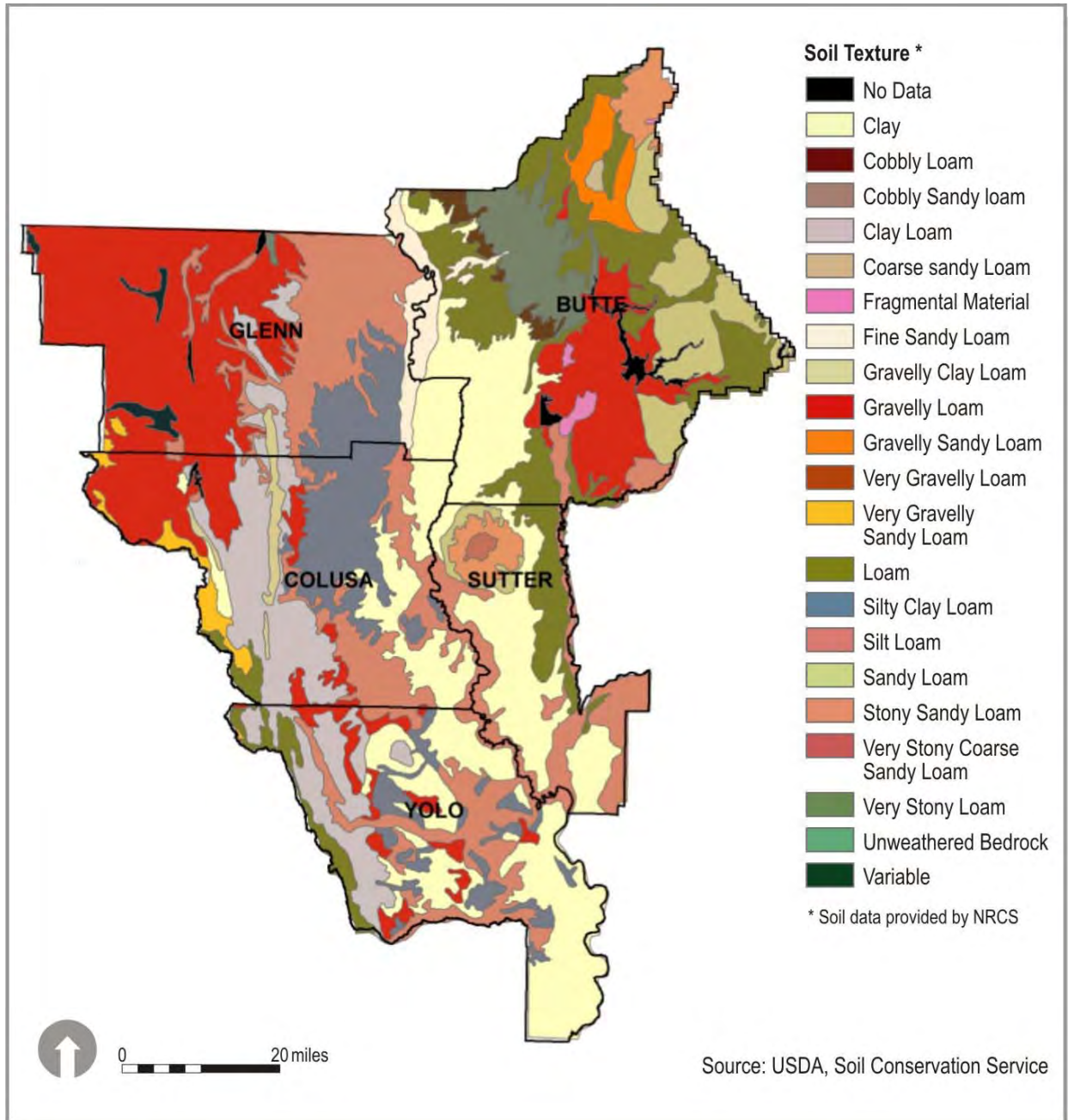


Figure 3.4-3. Soil Surface Texture

Glenn County The terrain in the western portion of Glenn County is steeper than in the eastern portion. Two major geologic provinces within the county define the overall topography of the area, the Sacramento Valley and the Coast Range. Soil types in Glenn County can be divided into five general land categories defined by physiographic position, soil texture, soil profile, and slope. These land categories are:

- **Mountain soils** - These soils are shallow to deep, well drained to excessively drained, and mostly steep to very steep.
- **Soils of the foothills** - In the foothills, the soils are formed mainly from hard, unaltered sedimentary rock of the Knoxville formation and other formations of the Cretaceous period and from poorly consolidated siltstone of the Tehama formation.
- **Soils of Older Alluvial Fans and Low Terraces** - Soils of older and low terraces are well drained to somewhat poorly drained and are mostly moderately permeable to very slowly permeable.
- **Basin Soils** - The soils of the basins are in the southwestern part of the County. Soils of the basins are characteristically fine textured and poorly drained. Slopes are nearly level, and runoff is very slow.
- **Soils of the More Recent Alluvial Fans and Flood Plains** - Most of the soils on the more recent alluvial fans and flood plains of the county are along Stony Creek and the Sacramento River. The soils generally consist of shallow to deep, well-drained to excessively-drained gravelly and non-gravelly stratified material.

Western soils are designated as cobbly-loam. The southeastern area includes silty clay soils. The central portion of the county contains clay loam soils. Weathered bedrock is found specifically in the northern central part of the county.

Glenn County contains soils with low, medium, and high shrink-swell potential. Western Glenn County has soils with predominantly low to medium shrink-swell potential, while the southeastern portion of the County contains soils with higher expansive potential.

Sutter County The topography of Sutter County mimics the gradual slopes of the Sacramento River Valley. The only prominent topographic feature within the County is the Sutter Buttes, a Pliocene volcanic plug that rises 2,000 feet above the surrounding valley floor (Sutter County 1996). In Sutter County, the sedimentary rocks are of both marine and continental origin frequently imbedded within tuff-breccias. Beneath 125 feet of recent alluvial fan, floodplain, and stream channel deposits are as much as 100 feet of Pleistocene sands and gravels which together make up the continental sediments of the Pleistocene and Recent ages (Sutter County 1996).

The western and southern portion of Sutter County contain silty clay soils, stratified soils of silty clay loam, and fine sandy loam. The eastern portion of the county contains loam soils. Approximately 83 percent of Sutter County soil types have been identified in the Soil Survey for Sutter County as having slight erodibility and generally consist of those soil types with slopes of 0 to 9 percent (Sutter County 1996). About 10 percent of Sutter County soils have moderate erodibility. These soil types usually have slopes of 9 to 30 percent. About 6 percent of Sutter County soil types have high to very high erodibility and generally consist of those soils types with slopes of 30 to 75 percent. The moderate and high erodibility groups contain soil types found in the Sutter Buttes (Sutter County 1996).

Expansive soils within Sutter County are most likely in basins and on basin rims. Soils with no or low expansion potential occur along the rivers and river valleys and on steep mountain slopes (Sutter County 1996).

Yolo County Yolo County lies within the California Coast Range and the Sacramento Valley. The western part of the county is in the Coast Range and is characterized by hilly to steep, mountainous uplands. The soils vary from moderately deep to very shallow, though much of the area is bare. The soils in this part of the county are used principally for range; the less productive areas are used as wildlife habitat (USDA Soil Conservation Service 1972).

The gradient becomes more gradual moving east across the county from the Coast Range. Rounded hills and broad slopes become the dominant feature. The soils are moderately deep to softly consolidated material, or are shallow to a claypan. They are used for dryland small grains and pasture (USDA Soil Conservation Service 1972). Most of the county, approximately two-thirds, lies within the Sacramento Valley. The topography is nearly level and soils are used for irrigated and dryland crops as well as orchards.

The soils of western Yolo County are predominantly loams to silty clay loams. Northern and eastern Yolo soils are silt loams to silty clay loams. Clay soils are present in northeastern Yolo County.

Central and western Yolo County contains soils with low to moderate shrink swell potential. Southeastern Yolo County soils are classified as containing high shrink swell potential.

3.4.2 Environmental Consequences

3.4.2.1 No Action

Under the No Action Alternative, the 2010-2011 Water Transfer Program would not occur. Non-CVP transfers would likely occur that could include some crop idling. Some CVP transfers could also occur if the proponents complete environmental documents and obtain Reclamation approval. Under

normal farming practices, farmers would continue to idle some fields because of economic factors or as part of a crop rotation. Normal farming practices would involve loosening of soils during land preparation and harvesting, which could increase potential effects from soil erosion. Crop idling under water transfers and as normal crop rotations would also leave some soils susceptible to erosion. Most of the soils in the Sacramento Valley have some clay content in them, which reduces erosion potential. For other soils, farmers often manage potential soil erosion impacts to maintain crop yields. Therefore, there would not be substantial impacts from wind erosion.

3.4.2.2 Proposed Action

Cropland idling water transfers could potentially cause expansive soils to shrink due to the reduction in applied irrigation water. Expansive soils shrink and swell depending on moisture. Under existing conditions, agricultural soils in the counties where cropland idling is proposed swell and shrink in response to winter rains and irrigation cycles (soils are irrigated, then left to dry out, then irrigated again). The Proposed Action may increase the extent of soil shrinkage due to lack of irrigation. However, because the proposed idling lands are agricultural and subject to normal swelling and shrinkage, structures or roads in the vicinity of the cropland are also subject to the same changes. The shrinking and swelling of soils due to cropland idling would not have adverse effects on these structures or roads. Therefore, potential impacts from soil instability under the Proposed Action would not be substantial.

Cropland idling water transfers that temporary convert cropland to bare fields could increase soil loss from wind erosion. In the case of rice crops, the crop cycle and soil texture reduces the potential for erosion. The process of rice cultivation includes incorporating the leftover 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, there would be little to no soil loss from wind erosion off the idled rice fields.

The Proposed Action includes additional crops that could be idled under a water transfer, which could be planted on soils more susceptible to erosion. Figure 3.4-3 shows soil texture within the Sacramento Valley. In general, soils that contain some percentage of clay content are less susceptible to erosion. Soils with a high sand content are generally more erodible; soils classified as sand, sandy loam, or loam can be considered more erodible than other soils. As shown in Figure 3.4-3, major soil types in the Sacramento Valley are clay, clay loam, gravelly loam, and silt loam. Clay and gravelly soils have a slight potential for erosion and would not be affected by wind erosion.

Silt loam soils, present in northern Glenn County, along the Sacramento River, and in portions of Yolo County, have a potential for erosion. The northern valley portion of Glenn County typically grows citrus and subtropical crops, such as olives, which would not be idled under a water transfer. Therefore, erodible soils in this area would not be affected. In other areas with silt loam soils, farmers would likely manage the land during the idling season to reduce potential soil erosion impacts. Soil erosion could affect crop yields in subsequent seasons, which would affect farm production and revenue. Farmers would take measures to avoid this as part of normal farming practices. As a result, there would not be substantial impacts from wind erosion on silt loam soils.

There are some loam and sandy loam soils in the mountain and foothill zones in eastern Butte County that are also susceptible to erosion; however, these areas would not participate in crop idling transfers.

Cropland idling water transfers would reduce the amount of water applied to the fields and could reduce the potential leaching of salts and other trace elements. Cropland idling would also reduce applied water to agricultural fields, thereby reducing the potential for salts and other trace elements to leach into the groundwater or be mobilized as runoff and enter nearby water bodies. This would be a beneficial impact. Trace elements bound to soil particles could, however, be mobilized by wind; and these soil particles could travel to adjacent lands as a result of wind erosion of idled fields. Mobilized soil particles would move by saltation, surface creep, or suspension from one field and could replace the soil lost on an adjacent field. Because the soil particles would be blown randomly, it would be unlikely that these particles would concentrate in a single area. The potential for trace elements bound to soil particles to collect at a particular site and affect the soil quality at that site would not be a substantial impact.

3.5 Agricultural Land Use

Water transfers including cropland idling and crop shifting could affect land use in agricultural areas. This section describes existing land use conditions in the counties proposed for cropland idling and crop shifting and analyzes the Proposed Action's potential impacts on agricultural land.

3.5.1 Affected Environment

Established in 1982, the Farmland Mapping and Monitoring Program (FMMP) produces maps and statistical data used for analyzing effects on California's

agricultural resources. FMMP characterizes land use into the following categories:

- **Prime Farmland** – 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 cycles² prior to the mapping date.
- **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.
- **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. Includes environmental restoration, confined animal facilities, and low density residential.
- **Water** – Water areas with an extent of at least 40 acres.
- **Interim Farmland Mapping Categories** - For farmed areas lacking modern soil survey information and for which there is expressed local concern regarding the status of farmland, Irrigated and Nonirrigated Farmland substitute for the categories of important farmland. Only Butte and Kern counties have Interim Farmland data. The FMMP defines Irrigated and Nonirrigated Farmland as follows:

² An update cycle is 2 years.

- **Irrigated Farmland** - Cropped land with a developed irrigation water supply that is dependable and of adequate quality. Land must have been used for irrigated agricultural production at some time during the 4 years prior to the mapping date.
- **Nonirrigated Farmland** - Land on which agricultural commodities are produced on a continuing or cyclic basis using stored soil moisture.

The most recent Farmland Conversion Report states that steady urbanization resulted in accelerated losses of irrigated farmland during the 2004-2006 period compared with the 2002-2004 period (Department of Conservation [DOC] 2008). During the 2004-2006 period, California's total farm and grazing lands decreased by 275 square miles (176,014 acres, as documented by the FMMP). The highest quality farmland, Prime Farmland, comprised 46 percent of the loss (81,247 acres). The following sub-sections describe agricultural land use in Butte, Colusa, Glenn, Sutter, and Yolo counties.

Butte In 2006, of the 1,073,254 acres mapped in Butte County, 649,736 acres were in agricultural use, 44,803 acres were urbanized, 22,819 acres were water and 355,896 acres were "other" (DOC 2008a). Of the acres classified as agricultural land in 2006:

- 196,219 acres were Prime Farmland;
- 21,604 were Farmland of Statewide Importance; and
- 24,235 were Unique Farmland (DOC 2008a).

Colusa In 2006, of the 740,392 acres mapped in Colusa County, 567,621 were in agricultural use, 4,877 acres were urbanized, 1,911 acres were water, and 165,983 acres were "other" (DOC 2008a). Of the total agricultural acres inventoried in 2006:

- 200,182 were Prime Farmland;
- 2,170 were Farmland of Statewide Importance;
- 123,318 were Unique Farmland; and
- 232,921 were Farmland of Local Importance (DOC 2008a).

Glenn In 2006, a total of 576,502 acres of agricultural land was inventoried. Of this:

- 161,685 acres were Prime Farmland;
- 87,867 acres were Farmland of Statewide Importance;
- 17,469 acres were Unique Farmland; and
- 80,290 acres were Farmland of Local Importance (DOC 2008a).

Sutter The 2006 inventory of land use categories and land use changes included 389,439 acres in Sutter County. Of this, 343,772 acres were agricultural land. Within the agricultural land subgroup:

- 165,817 acres were Prime Farmland;
- 107,194 acres were Farmland of Statewide Importance; and
- 19,245 acres were Unique Farmland (DOC 2008a).

Yolo The California Department of Conservation, Division of Land Resource Protection inventoried a total of 653,453 acres in Yolo County in 2008. Of these: 540,591 acres were agricultural land; 29,343 acres were urban; 7,815 acres were water; and 74,356 acres were “other” (DOC 2008a). The agricultural land was further divided into:

- 257,893 acres of Prime Farmland;
- 16,989 acres of Farmland of Statewide Importance;
- 50,197 acres of Unique Farmland; and
- 65,173 acres of Farmland of Local Importance (DOC 2008a).

Since 1992, the acreage of planted rice in the Sacramento Valley has varied from a low of approximately 370,000 acres in 1992 to a high of over 562,000 acres in 2004. Planted acreage varies as a result of a number of factors, including economic and environmental changes, and regular crop rotations. Crop rotation and fallowing are a standard rice farming practice that can reduce disease and increase water quality.

The maximum annual decline of rice acreage was 72,000 acres from 2000 to 2001. Rice acreage increased by 81,300 acres in the 2004 season from 2003. Rice acreage in all counties, except Sacramento County, has increased since 1992; the largest increase was in Colusa County.

3.5.2 Environmental Consequences

3.5.2.1 No Action

Under the No Action Alternative, water transfers for the 2010-2011 Water Transfer Program would not occur. Cropland idling or crop substitution would occur for non-CVP transfers, CVP transfers (covered under individual NEPA documentation and with Reclamation approval), or under normal farming practices. As part of crop rotations, farmers frequently remove some lands temporarily from farm production for improvements such as land leveling and weed abatement. Farmers also rotate land to reduce pest problems and build soils. Farmers would continue to place back into production other previously idled land. These continued farming practices would continue to cause some fluctuation in agricultural land use; however, in the long-term, agricultural land

uses would remain largely the same as existing conditions. Short-term water transfers would also not affect long-term agricultural land use because the farmers would presumably put the land back into production after the transfer year.

Under the No Action Alternative, some farmers may need to idle crops in the San Joaquin Valley because of water shortages. Farmers would likely look to alternative water supplies, such as groundwater, if transfers were not available under the No Action Alternative. With alternate water supplies, there would be no permanent changes to land uses. If supplies are not available, some farmers may take land out of production for either the short-term or the long-term. Depending on the severity of the shortage under the No Action Alternative, effects to land use may be temporary or long-term.

Under the No Action Alternative, the trend of land conversion from agricultural uses to urbanization and non-agricultural uses would likely continue and could possibly accelerate. Population growth is a major factor resulting in the reduction of agricultural lands. Urban water supply reductions and growing populations have increased urban water demand, and lower agricultural prices have increased farmers' willingness to sell.

Statewide and Federal programs to preserve open space and agricultural lands would continue to be implemented under the No Action Alternative. Several programs would also take agricultural land out of production. This would neither interfere with other land protection programs nor bring enrolled lands to an incompatible use.

3.5.2.2 Proposed Action

Water transfers via cropland idling could alter agricultural land use conditions. The Proposed Action includes idling transfers up to 109,469 acre feet, which would be up to a maximum of about 33,172 acres of rice land in a transfer year. If farmers choose to idle or shift field crops other than rice, the maximum acreage idled would increase because of the lower water requirements of other crops. The maximum amount of crop acreage proposed for idling under the 2010-2011 Water Transfer Program would be within normal annual variations of farmed land in the region. Table 3.5-1 shows that rice acreage has varied over 80,000 acres in subsequent years, which is more than the proposed maximum rice idling acreage. Annual variations in other field crops can be even greater because many are rotated in multi-crop sequences.

Table 3.5-1. Estimated Sacramento Valley Rice Production (acres) from 1992-2008 by County.

Year	Butte	Colusa	Glenn	Sacramento	Sutter	Yolo	Yuba	Total	Total Annual Change
1992	76,300	94,800	65,800	8,900	73,100	19,000	31,700	369,600	--
1993	79,300	112,000	74,500	10,400	81,000	21,400	31,300	409,900	40,300
1994	88,000	123,000	81,000	11,500	90,000	26,700	34,000	454,200	44,300
1995	83,000	122,000	79,000	10,300	82,000	27,000	32,000	435,300	-18,900
1996	97,000	136,000	87,000	8,800	86,000	21,600	34,000	470,400	35,100
1997	97,000	137,000	89,000	9,400	90,000	24,000	35,000	481,400	11,000
1998	88,000	121,000	83,000	9,100	91,000	20,400	37,300	449,800	-31,600
1999	102,500	135,000	88,000	9,700	104,500	30,000	39,200	508,900	59,100
2000	98,000	145,000	87,500	9,000	108,000	35,500	39,000	522,000	13,100
2001	86,800	126,300	78,300	7,800	87,700	26,000	37,100	450,000	-72,000
2002	100,000	138,500	87,500	8,200	101,700	31,500	36,000	503,400	53,400
2003	87,800	138,000	82,500	8,100	96,900	32,300	35,400	481,000	-22,400
2004	105,800	156,400	90,300	9,600	124,000	41,900	34,300	562,300	81,300
2005	96,800	145,600	87,100	7,900	101,800	29,200	33,300	501,700	-60,600
2006	99,100	145,900	87,500	3,700	106,600	28,900	33,200	504,900	3,200
2007	102,000	155,000	86,500	3,700	106,000	23,800	33,700	510,700	5,800
2008 ¹	105,300	150,200	77,800	2,500	92,300	30,000	35,300	493,400	-17,300
Average	94,000	134,000	83,000	8,000	95,000	28,000	35,000	477,000	--

Source: Reclamation 2009, CAC 2008

¹CAC 2009

One-year water transfers under the Proposed Action temporarily take land out of production, but would not affect the long-term agricultural uses of the land. One-year transfers would be similar to fallowing a field under a normal crop rotation. Farmers would resume planting on the idled field in the following year. There would be no permanent changes to the land. Cropland idling transfers would not affect the long-term designations of Prime Farmland or other FMMP classifications.

Because cropland idling would be temporary and farmers would continue agricultural uses of the land in subsequent years, the land use effects would not be substantial.

Crop shifting actions would not affect land uses because the farmers would continue to produce a crop on the fields included in the water transfer.

Water transfers could increase agricultural production on lands in the buyers' service area. Water deliveries to agricultural users in the San Joaquin Valley could bring lands back into agricultural production that were previously fallow due to reductions in available water supply. Based on the amount of water available relative to the agricultural water needs in the valley, lands returned to production would not be substantial as a result of the Proposed Action. Therefore, impacts would be beneficial, but minor.

3.6 Vegetation and Wildlife

This section describes the affected environment related to vegetation and wildlife, including habitat types for special status species. This section examines the impacts to general vegetation and wildlife species; Section 3.8 discusses special status species in more detail.

3.6.1 Affected Environment

The following sections contain information on the habitat types potentially affected by the Proposed Action. The 2004 Final EWA EIS/EIR contains detailed information on the vegetation and habitat types found in the study area (Reclamation 2004, pgs 10-6 through 10-29). Figure 3.6-1 shows Federal and State wildlife refuges and wildlife areas in the potential transfer area.

Nontidal freshwater permanent emergent habitat can be found scattered along the Sacramento River, typically in areas with slow moving backwaters. Substantial portions of these habitats occur at the Colusa, Sutter, and Tisdale Bypasses, the Butte Sink, and at the Fremont Weir. The dominant vegetation for nontidal freshwater permanent emergent includes thingrass, spikerush, big leaf sedge, bulrush, redroot nutgrass, tules, cattails, common reed, and water grass. Examples of amphibians include bullfrogs, western toads, and Pacific tree frogs. Birds include herons, egrets, bitterns, merganser, wood duck, and yellow warbler.

Natural seasonal wetland habitat can be found scattered along the Sacramento River typically in areas with slow-moving backwaters. Substantial portions of these habitats occur at the Colusa, Sutter, and Tisdale Bypasses, the Butte Sink, and at the Fremont Weir. Natural seasonal wetland habitat is also found in slow-moving backwater areas along the American River.

Dominant natural seasonal wetland vegetation includes big leaf sedge, bulrush, and redroot nutgrass. Wildlife associated with natural seasonal wetlands are predominantly special status species. Common species can include ducks, geese, heron, and other waterfowl, as well as wading birds, and shorebirds. Special-status animal species associated with natural seasonal wetlands include American peregrine falcon, California gull, greater sandhill crane, long-billed curlew, northern harrier, short-eared owl, Swainson's hawk, merlin, tricolored blackbird, white-tailed kite, GGS, California red-legged frog, California tiger salamander, western spadefoot toad, conservancy fairy shrimp, Delta green ground beetle, longhorn fairy shrimp, mid-valley fairy shrimp, California linderiella, vernal pool fairy shrimp, and vernal pool tadpole shrimp. Special-status plant species associated with natural seasonal wetland include Henderson's bentgrass, Ferris' milkvetch, alkali milk vetch, Jepson's milkvetch,

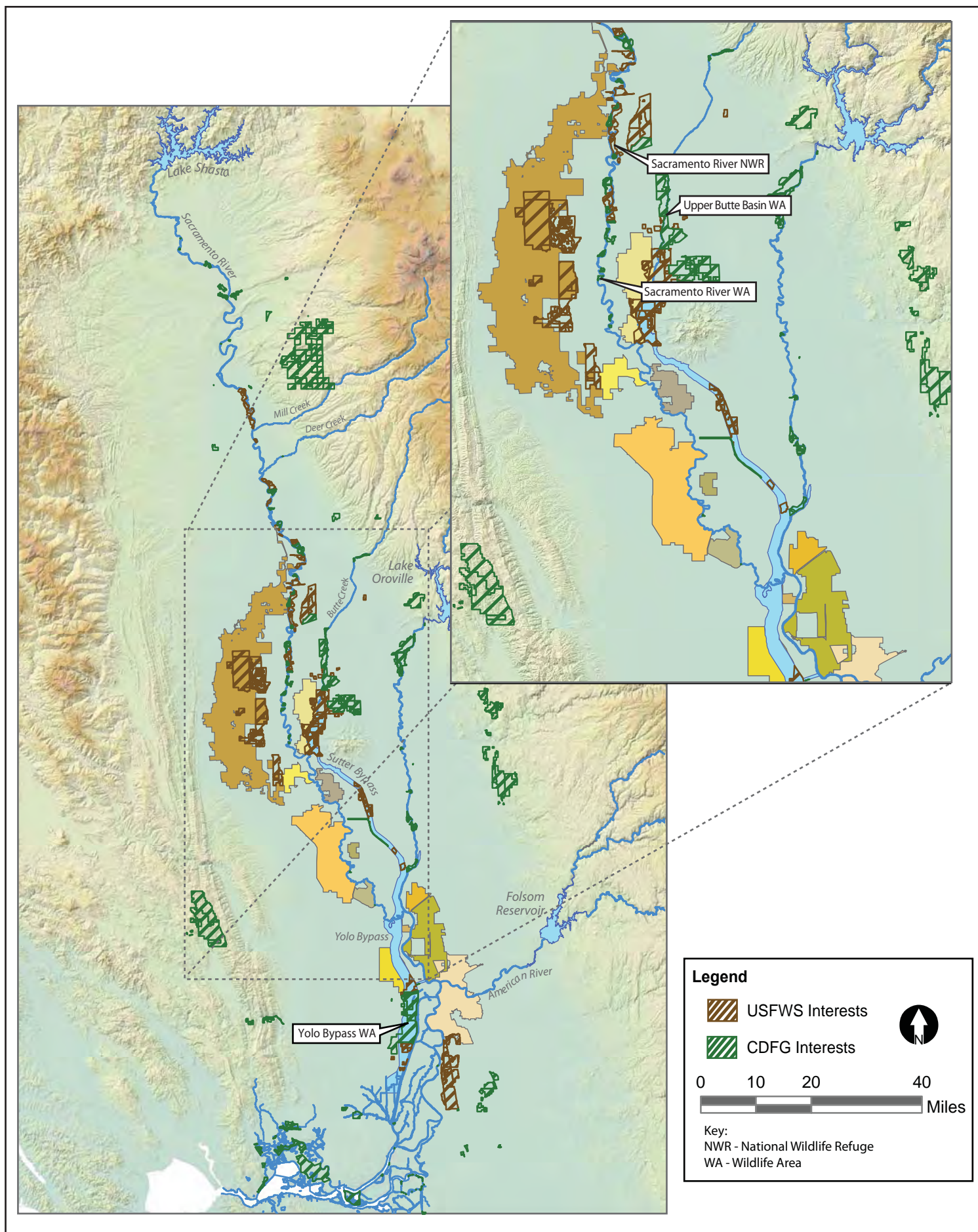


Figure 3.6-1. Federal and State Wildlife Refuges and Wildlife Areas

heartscale, brittlescale, San Joaquin spearscale, lesser saltscale, succulent owl's clover, Hoover's spurge, Hispid bird's beak, palmate-bracted bird's beak, recurved larkspur, Boggs Lake hedge-hyssop, Ahart's dwarf rush, Contra Costa goldfields, Legenere, Heckard's peppergrass, Butte County meadowfoam, pincushion navarretia, Colusa grass, San Joaquin Valley orcutt grass, hairy orcutt grass, slender orcutt grass, Sacramento orcutt grass, Ahart's paronychia, and Greene's tuctoria.

Managed seasonal wetlands on the west side of the Sacramento River generally occur between Willows and Dunnigan along the Colusa Basin Drain. Substantial portions of these habitats 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 National Wildlife Refuge Complex (six refuges totaling 35,000 acres). Managed seasonal wetland habitat between the Sacramento River generally occur along Butte Creek in the Butte Basin (Upper Butte Basin and Gray Lodge Wildlife Areas), around the Thermalito Afterbay, and along Angel Slough north of Butte City (Llano Seco Rancho Wildlife Area).

Dominant managed seasonal wetland habitats can include the same vegetation as for natural seasonal wetlands. Managed seasonal wetland habitats are often managed for waterfowl such as mallards, pintails, American widgeon, and Canada and other geese. Managed seasonal wetland habitats also support a variety of wading birds and shorebirds, such as herons, egrets, terns, and gulls. Special-status animal species associated with managed seasonal wetlands include Aleutian Canada goose, American peregrine falcon, bald eagle, black tern, California gull, greater sandhill crane, long-billed curlew, northern harrier, short-eared owl, Swainson's hawk, tricolored blackbird, western snowy plover, white-faced ibis, white-tailed kite, GGS, western pond turtle, California red-legged frog, and vernal pool tadpole shrimp. Special-status plant species associated with managed seasonal wetlands are often the same as those species found in natural seasonal wetlands.

South of Red Bluff, the Sacramento River enters the Sacramento Valley and transitions into Valley Riverine Aquatic and Valley Foothill Riparian habitat. Along most of the Sacramento River and its tributaries, remnants of riparian communities are all that remain of once very productive and extensive riparian areas. Between Red Bluff and Chico, the river is mostly unleveed and contains substantial remnants of the Sacramento Valley's riparian forests. One of the most important factors, other than agriculture, affecting riparian habitat downstream of Chico Landing is the Sacramento River Flood Control Project constructed by the Corps (Sacramento River Advisory Council 2001). This project protects the levee system owned and maintained by the State of California. The flood control project has confined riparian vegetation to a narrow band between the river and the riverside of the levees. Natural areas within this reach include the Redding Arboretum and Kutrass River Access; the

largely riparian, Anderson River Park owned by CDFG; the Woodson Bridge State Recreation Area; the Bidwell-Sacramento River State Park; the Colusa-Sacramento River State Recreation Area; and the Sacramento River Wildlife Area. Riparian forest systems include riparian forest successional stages, 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). Plant communities found in conjunction with riparian forests include valley oak woodland, wetland, and non-native grassland.

River regulation in California's Central Valley has created artificially stable inter- and intra-annual hydrological conditions that have impaired recruitment and altered the age structure of native riparian tree populations that have evolved with pre-regulation cycles of flooding and summer drought (Stella et al. 2003). Changes in hydrology have caused an overall decline in bank erosion rates and an accompanying decrease in point bar formation. Fewer suitable sites for cottonwood and willow forest regeneration are now available, changing the pattern of riparian forest succession. For example, in the absence of river processes on the lower American River such as new gravel and sand bar formation, and in combination with increased summer flows, cottonwood recruitment has been virtually eliminated and existing stands appear to be aging without opportunities for replacement. Instead alders have increased in abundance by taking advantage of the more consistent summer flows and increased bank stability (USFWS 1991). On the Sacramento River, controlled flows have resulted in a higher percentage survival through lack of scouring and a continual provision of moisture reducing losses from desiccation (Strahan 1985).

The river inundation frequency is also affected by changes in hydrology. The frequency of overbank flooding required for natural establishment, maturation, and regeneration of the later stage successional forests continually affects smaller and smaller land areas. According to the Sacramento River Advisory Council (2001), another factor in reduced riparian forests along rivers is conversion of the land to agricultural practices.

More than 60 percent of all vertebrates spend some portion of their life cycle in riparian habitat (Reclamation and SJRG 1999). In California, over 225 species of birds, mammals, reptiles, and amphibians depend on riparian habitats, and 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 areas also serve as a corridor for wildlife movement, providing access to additional seasonal food sources and new territories for dispersing young, and allowing for the movement of individuals into and out of areas, thus ensuring a good mix of genetic material into a population (Sacramento River Advisory Council 2001).

Some of the riparian habitat has a lush canopy with associated shade and cover, which provides habitat for a myriad of insects. Rough ever-sloughing bark of common riparian trees attracts wood-boring larvae and provides forage for bark-gleaning and trunk-scaling birds. Woodpeckers, warblers, flycatchers, and owls are common inhabitants of this habitat. The tall trees also attract wintering and breeding raptors (Reclamation and SJRG 1999). Other wildlife that use riparian habitats include California towhee, Bewick's wren, belted kingfisher, scrub jay, rufous-sided towhee, blue grosbeak, tree swallow, yellow-rumped warbler, lazuli bunting, western tanager, northern oriole, western fence lizard, Pacific tree frog, western toad, bullfrog, western skink, western whiptail, southern alligator lizard, racer, gopher snake, king snake, garter snake, rattlesnake, opossum, black-tailed hair, western gray squirrel, ringtail, river otter, striped skunk, raccoon, beaver, mule deer, and a number of bat species. Special-status animal species associated with valley foothill riparian habitat include greater western mastiff bat, ringtail, riparian brush rabbit, San Joaquin Valley woodrat, western yellow-billed cuckoo, California black rail, bank swallow, bald eagle, black-crowned night heron, California yellow warbler, Cooper's hawk, double-crested cormorant, golden eagle, great blue heron, great egret, least bell's vireo, little willow flycatcher, long-eared owl, osprey, snowy egret, Swainson's hawk, white-tailed kite, yellow-breasted chat, GGS, western pond turtle, California red-legged frog, foothill yellow-legged frog, and valley elderberry longhorn beetle. Special-status plant species include silky cryptantha, Delta coyote-thistle (button-celery), marsh checkerbloom, lone buckwheat, Indian valley brodiaea, Milo Baker's lupine, Keck's checkerbloom, soft bird's beak, fox sedge, rose-mallow, northern California black walnut, and Sanford's arrowhead.

Montane Riparian habitat occurs along the Sacramento River between Red Bluff and Shasta Reservoir. Montane riparian habitat vegetation is dominated by cottonwood (black and Fremont [at lower altitudes]), white alder, big leaf maple, dogwood, box elder, quaking aspen, wild azalea, water birch, and buttonwillow trees. As with valley foothill riparian, a wide variety of wildlife is supported by riparian habitats. Special status species associated with montane riparian habitat include California wolverine, Sierra Nevada red fox, great grey owl, greater western mastiff bat, ringtail cat, bald eagle, black-crowned night heron, California yellow warbler, Cooper's hawk, double-crested cormorant, great blue heron, great egret, least bell's vireo, little willow flycatcher, long-eared owl, osprey, snowy egret, yellow-breasted chat, California red-legged frog, foothill yellow-legged frog, silky cryptantha, valley elderberry longhorn beetle, red mountain catchfly, and saw-toothed lewisia.

Seasonally flooded agriculture is found throughout the Sacramento Valley. Rice fields provide important foraging habitat for a variety of wildlife species. Many species forage on post-harvest waste grain (on average 300-350 pounds produced per acre depending upon harvest method) and other food found within the fields (more than 250 pounds per acre), such as duckweed, fish, and crayfish and other invertebrates (Brouder and Hill 1995). Typically, various birds and

rodents consume rice waste grain and then raptors feed on the birds and rodents. Duckweed and other moist soil plants can provide high-quality food for waterfowl. Water level manipulations are necessary for moist soil plant germination and maturity. 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. Simply continuing to pump water through the canals will ensure some level of fish and crayfish abundance for wildlife such as herons, cranes, and egrets. Other invertebrates and their larvae can 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.

Rice also provides resting, nesting, and breeding habitat similar to natural wetlands. Irrigation ditches can contain wetland vegetation such as cattails, which provide cover habitat for rails, egrets, herons, bitterns, marsh wrens, sparrows, and common yellowthroats. Rice fields provide pair, brood, and nesting habitat for species such as the mallard, northern pintail, and black tern.

Certain special status species rely on, to varying degrees, seasonally flooded agricultural lands, in particular rice fields and their associated uplands, drainage ditches, irrigation canals, and dikes. Appendices A and B further describe special status species with the potential to occur in the area of analysis.

Upland cropland habitat includes agricultural lands farmed for profit that are not seasonally flooded. Upland cropland areas are found throughout the Sacramento Valley. For this analysis upland crops include alfalfa, milo, rye grass, sudan grass, sunflower, wild rice, tomatoes, melons, onions, vine seed, sugar beets, corn, beans, cotton, wheat, and safflower. Upland cropland vegetation throughout the Sacramento Valley is dominated by cereal rye, barley, wheat, milo, corn, dry beans, safflower, sunflower, alfalfa, cotton, tomatoes, lettuce, Bermuda grass, ryegrass, tall fescue, almonds, walnuts, peaches, plums, and grapes 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 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 then raptors feed on the birds and rodents. 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. Upland cropland special status species includes Aleutian Canada goose, California gull, greater sandhill crane,

long-billed curlew, mountain plover, northern harrier, Swainson's hawk, tricolored blackbird, western burrowing owl, white-faced ibis, and white-tailed kite.

3.6.2 Environmental Consequences

3.6.2.1 No Action

Under the No Action Alternative, water transfers for the 2010-2011 Water Transfer Program would not occur. Some cropland idling and groundwater substitution would occur upstream from the Delta under non-CVP or other water transfers. These transfers could affect wildlife habitat provided by croplands. Some habitat may be reduced because of agricultural to urban land conversion that would occur under the No Action Alternative. Reservoirs and river flows would be similar to existing conditions; therefore, available riparian habitat would not substantially change under the No Action Alternative.

In the export service area, water shortages could occur. Some water transfers would likely occur absent the Proposed Action; however, they would not likely cover the total water shortage. Some cropland would likely be taken out of production, which may affect some species that depend on cropland for foraging.

3.6.2.2 Proposed Action

The Proposed Action includes Environmental Commitments incorporated into the project description to reduce potential impacts to vegetation and wildlife resources. Section 2.3 lists the Environmental Commitments. The following analysis considers the implementation of the Environmental Commitments in evaluating impacts to vegetation and wildlife.

Groundwater substitution transfers would alter ground water levels and potentially affect natural and managed seasonal wetlands and riparian communities, upland habitats and wildlife species depending on these habitats.

As a part of groundwater substitution transfers, the willing sellers would use groundwater to irrigate crops and decrease use of surface water. Pumping additional groundwater would decrease groundwater levels in the vicinity of the sellers' pumps. Natural and managed seasonal wetlands and riparian communities often depend on surface water/groundwater interactions for part or all of their water supply. Under the Proposed Action, subsurface drawdown related to groundwater substitution transfers could result in hydrologic changes to nearby streams and marshes, potentially affecting these habitats. Reduced groundwater elevations could also affect trees that access groundwater as a source of water through taproots in addition to extensive horizontal roots that use soil moisture as a water source. Decreasing groundwater levels could reduce part of the water base for species within these habitats.

The Draft Technical Information for Groundwater Substitution Water Transfers in 2010 (Reclamation and DWR 2009) discusses how groundwater substitution transfers could affect groundwater levels and surrounding beneficial uses, including the environment. Reclamation identifies groundwater minimization measures to avoid and reduce potential adverse effects from groundwater substitution transfers, including monitoring and mitigation plans to implement before, during, and after the groundwater substitution transfer. Reclamation requires sellers to implement mitigation and monitoring for approval of the transfer. Mitigating for adverse effects to groundwater levels and accounting for surface water/groundwater interaction in the available transfer water would avoid substantial impacts to species and their habitats. Therefore, 2010 and 2011 groundwater substitution transfers would not have substantial adverse effects on habitats or wildlife species.

Cropland idling transfers may decrease flows to downstream natural and managed wetlands and riparian communities dependent on agricultural return flows. Landowners with managed seasonal wetland communities often depend upon agricultural return flows for part or all of their water supply. To avoid this potential impact, sellers will be required to maintain flows at the downstream end of their distribution system to minimize potential water supply effects to neighboring and downstream water users (see Section 2.3 Environmental Commitments). As part of the monitoring program to ensure compliance with the contractual requirements, Reclamation will periodically verify that the seller is adhering to the agreement and that no effects are occurring. As a result of this commitment, downstream managed seasonal wetland communities that depend on agricultural return flows would not be adversely affected by 2010 and 2011 cropland idling transfers.

Rice land idling transfers would reduce habitat and forage for resident and migratory wildlife populations. The Proposed Action includes cropland idling transfers that would provide up to 109,469 acre feet of water. If all the water came from rice idling, approximately 33,172 acres of rice would be idled in Butte, Colusa, Glenn, Sutter, and Yolo counties, which harvested about 493,400 acres of rice in 2008 (CAC 2009). It is likely that fewer rice acres would be idled than the maximum because some farmers would choose to idle or shift additional crops. Rice fields provide resting, nesting, and breeding habitat similar to natural wetlands. Irrigation ditches can contain wetland vegetation such as cattails, which provide cover habitat for rails, egrets, herons, bitterns, marsh wrens, sparrows, and common yellowthroats. Rice fields provide pair, brood, and nesting habitat for species such as the mallard, northern pintail, and black tern. Due to the high concentration of wildlife and vegetation that inhabit seasonal wetlands and seasonally flooded agricultural wetlands, loss of suitable habitat for species is likely under the Proposed Action.

For successful breeding, “pair”, upland nesting areas, and “brood water” habitats are needed. “Pair” water consists of shallow water (4-12 inches deep)

in wetlands, ditches, or small ponds that are adjacent to upland nesting fields. These areas have good invertebrate populations that are believed to be the primary food source of pre-laying hens. Once the young have fledged, “brood water” is needed to support the hen and ducklings. Spring and summer wetlands can serve as suitable brood water providing these wetlands have a sufficient quantity of invertebrate foods, contain vegetative cover for protection from predators, and are located near upland nesting sites. Spring/summer wetlands that are flooded for part of the year (such as rice fields/duck hunting sites) can provide good duck brood habitat. Cropland idling of a of rice fields in the Sacramento Valley would have the following effects:

- Elimination of “pair” habitat of permanent residents who use winter flooded rice fields during the months in early spring. This will also eliminate “brood” water habitat that would normally be available during the spring and summer when rice is grown.
- Elimination of shallow flooded winter rice fields that wintering waterfowl use for night roosting and for food (vegetation and invertebrates). Flooded rice fields are frequented more than the natural wetlands by invertebrates as the winter progresses. Rice fields are also relied upon more heavily than natural wetlands as the winter progresses for dense cover at night since natural wetlands vegetation becomes prostrate and trampled, thus lacking needed protective cover.

With idling transfers under the Proposed Action, there is still a large amount of forage and other habitat available to waterfowl within the Sacramento Valley. Minimization measures limit cropland idling to 20 percent of irrigated crop acreage in a county, which would limit effects to habitat. Although some waterfowl habitat may be affected, the overall effect would not be substantial.

Loss of habitat as a result of water transfers would also affect special status species. Appendix B summarizes occurrence and potential effects to special status wildlife species. Section 3.8 discusses potential impacts to GGS, black tern, greater sandhill crane, and western pond turtle, which are the species likely to be affected by rice land idling under the Proposed Action.

Idling/shifting of upland crops could alter habitat for some upland species.

Upland cropland provides forage, resting, and nesting habitat for a variety of wildlife. Many species, including waterfowl, rely heavily on agroecosystems to meet lifecycle requirements. Cropland idling/crop shifting transfers could result in either bare land, affording little wildlife habitat, or a substitute crop with varying wildlife value. The value of crop to wildlife as habitat varies greatly from corn and wheat, with significant wildlife benefits, to cotton, with little or no benefit. Standard farming practices throughout the Sacramento Valley are to rotate fields between crops that often offer different wildlife benefits. Cropland idling/shifting actions involving upland crops would be similar to normal crop

rotation practices that vary wildlife habitat value; however, there would likely be additional idle fields relative to the No Action Alternative.

Grain crops (including corn, beans, milo, and sunflower) primarily provide mostly crop forage for birds and mammals both pre and post-harvest. Waste grain per acre typically ranges from 106-320 pounds per acre for wheat, sorghum, and corn (Ringleman 1990). Reduction in the availability of waste grain as forage to wildlife would result in an adverse effects to those species dependent upon waste grain for a large portion of their forage. The species that would be potentially affected by idling of upland crops are generally birds capable of quickly dispersing to other areas. There is still a large amount of forage and other habitat available to wildlife species within the Sacramento Valley. Because less than 20 percent of the crop acreage would be affected by transfers, idling of upland crops would not adversely impact wildlife species.

3.7 Fisheries

This section describes the affected environment related to fisheries, including special status species. This section examines the impacts to general fish species; Section 3.8 discusses special status species in more detail.

3.7.1 Affected Environment

This section describes the existing conditions related to fisheries and aquatic ecosystems in all water bodies that may be influenced by implementation of the Proposed Action. This includes the Sacramento and American River systems, the Sacramento-San Joaquin Delta, San Luis Reservoir, Anderson Reservoir, and DWR and Metropolitan WD reservoirs in southern California.

Species of primary management concern were selected to be analyzed for project effects based upon their ecological, commercial, and recreational significance (Table 3.7-1). Fish species listed under the Federal or California Endangered Species Acts are both ecologically and institutionally important; some listed species are also recreationally and commercially important. The Federal-and/or state-listed species within the area of analysis are winter-run Evolutionarily Significant Unit (ESU) and spring-run ESU Chinook salmon (*Oncorhynchus tshawytscha*), Central Valley Distinct Population Segment (DPS) steelhead (*O. mykiss*), delta smelt (*Hypomesus transpacificus*) southern DPS green sturgeon (*Acipenser medirostris*), and longfin smelt (*Spirinchus thaleichthys*). Recreationally or commercially important species include American shad (*Alosa sapidissima*), striped bass (*Morone saxatilis*) and fall and late-fall run Chinook salmon. Several species were also identified due to their ecological significance and sensitivity to flow and temperature: Pacific lamprey

(*Lampetra tridentata*), white sturgeon (*Acipenser transmontanus*), Sacramento splittail (*Pogonichthys macrolepidotus*), and hardhead (*Mylopharodon conocephalus*)). Additional species of management concern are found in the Southern California Export Service Area south of the Transverse Ranges and include Southern California Coastal DPS steelhead (*O. mykiss*), tidewater goby (*Eucyclogobius newberryi*), Santa Ana sucker (*Catostomus santaanae*), and unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*).

Table 3-7.1. Fish Species of Special Management Concern

Status	Species	Location (Area of analysis)	Primary Management Consideration ⁽¹⁾
Listed	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
	Southern California Steelhead	Export Area	FE, Recreation
	Delta smelt	Upstream and Delta areas	SE,FE
	Santa Ana sucker	Export Area	FT
	Tidewater goby	Export Area	FE
	Stickleback	Export Area	SE,FE
	Green sturgeon	Upstream and Delta areas	FT, Recreation
	Longfin smelt	Upstream and Delta areas	ST
Commercial	Fall/late-fall Chinook Salmon	Upstream and Delta areas	Commercial, Recreation.
Recreational	Striped bass	Upstream and Delta areas	Recreation
	American shad	Upstream and Delta areas	Recreation
Ecological	Hardhead	Upstream and Delta areas	Ecological
	Splittail ⁽²⁾	Upstream and Delta areas	Ecological
	Pacific Lamprey	Upstream and Delta areas	Ecological
	White sturgeon	Upstream and Delta areas	Ecological, Recreation

⁽¹⁾ FE-Federal endangered, FT-Federal threatened, SE-state endangered, ST-state threatened, FC-Federal candidate

⁽²⁾ Under a Federal District Court ruling, the splittail rule has been remanded to USFWS. Splittail continue to be treated as a listed species.

3.7.1.1 Upstream from the Delta

The Sacramento River area of analysis includes Shasta Reservoir, the Sacramento River from Keswick Dam (the upstream extent of anadromous fish migration and spawning) to the Delta (at approximately Chipps Island near Pittsburg), and Butte Creek from Centerville Head Dam to the confluence with the Sacramento River.

The American River area of analysis includes Folsom Reservoir, Lake Natomas, and the Nimbus Fish Hatchery; and the lower American River, extending from Nimbus Dam to the confluence with the Sacramento River.

Fish species of primary management concern from the Sacramento River area of analysis include winter-run Chinook salmon, spring-run Chinook salmon, fall-run Chinook salmon, late fall-run Chinook salmon, steelhead, Sacramento splittail, American shad, striped bass, white sturgeon, and green sturgeon.

3.7.1.2 Delta

Reclamation operates CVP facilities in the Delta, including the Jones PP, Tracy Fish Collection Facility, and Delta Cross Channel. SWP facilities in the south Delta include Clifton Court Forebay, Skinner Fish Facility, Banks PP, and the intake channel to the pumping plant and in the western Delta including the Barker Slough PP. Delta water enters the SWP at Clifton Court Forebay. The forebay stores water until the off-peak use period when most pumping at the Banks PP occurs.

Migratory (e.g., anadromous) fish species which inhabit the Bay-Delta system and its tributaries include, but are not limited to, white sturgeon, green sturgeon, Chinook salmon (including fall-run, spring-run, winter-run, and late-fall-run Chinook salmon), steelhead, delta smelt, longfin smelt, Pacific and river lamprey, striped bass, and American shad (Moyle 2002). The Bay-Delta estuary and tributaries also support a diverse community of resident fish which includes, but is not limited to, Sacramento sucker, prickly and ruffle sculpin, California roach, hardhead, hitch, Sacramento blackfish, Sacramento pikeminnow, speckled dace, Sacramento splittail, tule perch, inland silverside, black crappie, bluegill, green sunfish, largemouth bass, smallmouth bass, white crappie, threadfin shad, carp, golden shiner, black and brown bullhead, channel catfish, white catfish, and a variety of other species which inhabit the more estuarine and freshwater portions of the Bay-Delta system (Moyle 2002).

3.7.1.3 Export Service Area

The Export Service Area includes San Luis Reservoir, Anderson Reservoir, Castaic Lake, Lake Perris, Diamond Valley Lake, and Lake Mathews. Some fish from the Delta may enter these water bodies, especially San Luis Reservoir, via the CVP and SWP pumps. These fish, including striped bass and freshwater species, may rear in the canals and downstream reservoirs. These fish support recreational fisheries along the aqueduct and in downstream reservoirs.

Species of management concern in the Southern California area south of the Transverse Ranges include Southern California Coastal DPS steelhead (*O. mykiss*), tidewater goby (*Eucyclogobius newberryi*), Santa Ana sucker (*Catostomus santaanae*), and unarmored, threespine stickleback (*Gasterosteus aculeatus williamsoni*)

3.7.2 Environmental Consequences

3.7.2.1 No Action

Under the No Action Alternative, water transfers for the 2010-2011 Water Transfer Program would not occur. Other water transfers could occur from upstream from the Delta to the Export Service Area. Water transfers involving conveyance through the Delta under the No Action Alternative would be implemented within the operational parameters of the Biological Opinions on

the Continued Long-term Operations of the CVP/SWP and all other regulatory restrictions in place at the time of implementation of the water transfers including D1641. The Endangered Species Act Section 7 consultation and Essential Fish Habitat consultation for special status fish species completed for those projects covers water transfers. Therefore, there would be no additional effects from water transfers under the No Action Alternative.

3.7.2.2 Proposed Action

Water transfers could affect fisheries and aquatic ecosystems in water bodies, including Sacramento and American River systems, the Sacramento-San Joaquin Delta, San Luis Reservoir, and DWR and Metropolitan WD reservoirs in southern California. Water transfers involving conveyance through the Delta under the Proposed Action would be implemented within the operational parameters of the Biological Opinions on the Continued Long-term Operations of the CVP/SWP and all other regulatory restrictions in place at the time of implementation of the water transfers including D1641. The Endangered Species Act Section 7 consultation and Essential Fish Habitat consultation for special status fish species completed for those projects covers water transfers.

Under the Proposed Action, water transfers would be conducted to meet Environmental Commitments in Section 2.3 of this document. These Environmental Commitments would reduce the effects of the Proposed Action on fisheries resources throughout the project area. These commitments include meeting flow and temperature requirements in the North of Delta rivers, minimizing the effects of groundwater pumping on streamflow, making release water flows similar to what would occur without cropland idling, making water transfers through the Delta in July through September, when most the most sensitive lifestages of the management species and particularly listed species are absent. Additionally, reservoir levels in Shasta Reservoir and other project reservoirs would not be changed substantially to affect fish habitat. Because of the Environmental Commitments, 2010 and 2011 water transfers would not adversely affect fish species of special management concern.

The Proposed Action could also result in increased flow in the Sacramento River during some portions of some years. Moving the maximum amount of water available from the Proposed Action (219,878 acre feet) during the period from July 1 through September 30 could result in an average flow increase in the Sacramento River of approximately 1,215 cfs. Average flow in the Sacramento River at Freeport in dry and critical years ranges from approximately 12,500 cfs in September to approximately 16,700 cfs in July (DWR 2009b). The induced increase in flow under the Proposed Action would be about 7 to 10 percent. These flow changes would generally be considered to improve habitat conditions for salmonids. Sudden changes in flows could induce young salmon to move downstream prematurely. To avoid this potential effect, large flow changes would be ramped slowly. The reasonable and prudent alternatives specified in the Biological Opinion for the Continued Long-term

Operations of the CVP/SWP for anadromous fish and critical habitat require Reclamation to consult with NMFS monthly about flow releases from Keswick Dam. Any changes in flow releases needed in conjunction with water transfers under the Proposed Action would be included in those consultations and any potentially adverse changes in flows would be addressed through those discussions.

There would be no adverse impacts to fishery resources in reservoirs in the Export Service Area.

3.8 Special Status Species

3.8.1 Affected Environment

Section 3.6 and Section 3.7 contain information on special status species that have the potential to occur in the project area. However, not all of these species have the potential to be affected by the Proposed Action. Terrestrial species potentially affected by the Proposed Action include GGS (*Thamnopphus gigas*), San Joaquin Kit Fox (kit fox) (*Vulpes macrotis mutica*), greater sandhill crane (*Grus canadensis tabida*), black tern (*Chlidonias niger*), and western pond turtle (*Actinemys marmorata*). The following listings apply to the above species under the Federal and California Endangered Species Acts (ESA).

- Giant Garter Snake – listed as threatened under the Federal and California ESAs
- San Joaquin Kit Fox – listed as endangered under the Federal ESA and threatened under the California ESA
- Greater Sandhill Crane – listed as threatened under the California ESA and is fully protected under the California Fish and Game Code
- Black Tern – listed as a State Species of Concern
- Western Pond Turtle – status is under review under the Federal ESA and listed as a State Species of Concern

Appendix B and Appendix C summarize occurrence and potential effects to special status wildlife and plant species. Further information on the affected environment for greater sandhill crane, black tern and western pond turtle is provided in the 2004 Final EWA EIS/EIR in the Action Specific Implementation Plan (Reclamation 2004, pgs 3-42 through 3-52 and 3-63 through 3-67). The 2009 Drought Water Bank Biological Opinion includes further information on life stages and habitat of the GGS (USFWS 2009).

3.8.2 Environmental Consequences

3.8.2.1 No Action

Under the No Action Alternative, water transfers for the 2010-2011 Water Transfer Program would not occur. Other water transfers could occur from upstream from the Delta to the Export Service Area. Water transfers involving conveyance through the Delta under the No Action Alternative would be implemented within the operational parameters of the Biological Opinions on the Continued Long-term Operations of the CVP/SWP and all other regulatory restrictions in place at the time of implementation of the water transfers including D1641. The Endangered Species Act Section 7 consultation and Essential Fish Habitat consultation for special status fish species completed for those projects covers water transfers. Therefore, there would be no additional effects to special status fish from water transfers under the No Action Alternative.

Cropland idling transfers under the No Action Alternative could affect special status species habitat provided by croplands.

3.8.2.2 Proposed Action

Water transfers could change reservoir releases and river flows and potentially affect special status fish species and essential fish habitat. Special-status fish species within the Proposed Action's area of analysis include winter- and spring-run Chinook salmon, steelhead, delta smelt, longfin smelt and green sturgeon. Based on the Environmental Commitments described in Section 2.3, water transfers would not adversely impact these species.

Because the Proposed Action would involve water transfers conveyed using existing facilities within the existing operational parameters addressed in the Biological Opinions on the Continued Long-term Operations of the CVP/SWP (USFWS 2008, NMFS 2009) and all other regulatory restrictions in place at the time of implementation of the water transfers including D1641, the Endangered Species Act Section 7 consultation and Essential Fish Habitat consultation for special status fish species completed for those projects covers 2010 and 2011 water transfers as well, and no further consultation is required.

Water transfers via rice land idling could potentially affect special status wildlife species and habitat. Certain special status species, such as the giant garter snake, rely on, to varying degrees, seasonally flooded agricultural lands, in particular rice fields and their associated uplands, drainage ditches, irrigation canals, and dikes. Rice land idling actions could reduce the amount of suitable habitat for special status species.

Giant Garter Snake The 2010-2011 Water Transfer Program would result in loss of habitat for GGS from rice fields that are idled or converted to other crops. Rice idling or shifting actions could affect the GGS that use flooded rice

fields for foraging and protective cover habitat during the summer months. The GGS displaced from these areas would need to find other areas to live and may face increased predation risk, competition, and reduced food supplies. This may lead to increased mortality, reduced reproductive success, and reduced condition prior to the start of the overwintering period.

The 2009 Drought Water Bank Biological Opinion (USFWS 2009) identified conservation measures to reduce the potential effects of water transfers on listed species, particularly GGS. These conservation measures, with some modifications, are included as Environmental Commitments for the 2010-2011 Water Transfer Program (Section 2.3). The primary conservation measures applicable to seasonally flooded agricultural lands (i.e. rice fields) include: limiting the size of idled land blocks to less than 320 acres with no more than 20 percent of rice fields being idled in any one county, maintaining ditch habitat and ditch water flows, maintaining a depth of at least two feet of water in all major irrigation and drainage canals to provide movement corridors, not idling parcels of land between refuges that serve as corridors, and not idling the same field consecutively. Sellers will continue to implement voluntary best management practices, including educating all district personnel to recognize and avoid contact with giant garter snakes, cleaning only one side of a conveyance channel per year, providing rock-basking habitat in the system's water prisms, and raising flail mower blades to at least 6 inches above the canal operation and maintenance road surfaces. Additionally, research and monitoring for GGS would be implemented under the Environmental Commitments. A GGS Monitoring and Research Strategy for the Sacramento Valley has been developed to implement parts of the Draft Recovery Plan for this species. Monitoring and research studies will include both long- and short-term studies to identify GGS distribution and abundance, obtain population information for GGS in the Sacramento Valley by conducting baseline surveys, and determine rice land habitat relationships for GGS. Research goals and monitoring strategies can be referenced in the 2009 Drought Water Bank Biological Opinion.

By implementation of the Environmental Commitments, some GGS would successfully relocate to find alternate forage, cover, and breeding areas. A proportion of the displaced individuals would be lost due to lack of habitat and predation. Because of the lack of available data on the population of GGS inhabiting rice fields, it is unknown how many individuals would be lost or survive. In the 2009 Drought Water Bank Biological Opinion, which incorporated the Environmental Commitments described in Section 2.3, the USFWS concluded that the 2009 Drought Water Bank was unlikely to jeopardize the GGS population. As these measures are incorporated in the 2010-2011 Water Transfer Program, the Proposed Action would not result in substantial adverse impacts to GGS.

Kit Fox Under the Proposed Action, transfer water would not lead to the conversion of annual crops to permanent (woody) crops since water transferred for agricultural demand would only be applied to currently cultivated lands. This objective would be achieved by using transferred water to irrigate lands that were previously irrigated within the last four years (2006-2009). Kit foxes prefer open annual grassland habitats with abundant small prey item food sources. By ensuring that the conservation measures will not allow the conversion of these annual agricultural grasslands to woody crops, kit fox habitat will be maintained and habitat loss will be minimized. The Proposed Action would not likely adversely affect the kit fox.

Greater Sandhill Crane Cropland idling of seasonally flooded agricultural land could reduce the amount of over-winter forage for migratory birds (Reclamation 2004). In order to limit reduction in the amount of over-winter forage for migratory birds, Reclamation will avoid or minimize actions near known wintering areas in the Butte Sink (from Chico in the north to the Sutter Buttes and from Sacramento River in the west to Highway 99) that could adversely affect foraging and roosting habitat. Based on these measures, 2010 and 2011 cropland idling transfers would not adversely affect the greater sandhill crane.

Black Tern Cropland idling of seasonally flooded agricultural land could reduce the amount of nesting and forage habitat during the summer rearing season, which could adversely affect the species (Reclamation 2004). As part of the review process for the identification of areas acceptable for cropland idling, Reclamation will review current species distribution/occurrence information from the Natural Diversity Database and other sources that include rookeries, breeding colonies, and concentration areas. Reclamation and DWR will avoid cropland idling actions that could result in the substantial loss or degradation of suitable habitat in areas that support core populations of evaluated species, and are essential to maintaining the viability and distribution of evaluated species. Environmental Commitments proposed for GGS would also benefit the black tern. Based on these measures, 2010 and 2011 cropland idling transfers would not adversely affect the black tern.

Western Pond Turtle Ditches and drains associated with rice fields provide suitable habitat for the western pond turtle. To ensure that effects of cropland idling actions on western pond turtle habitat are avoided or minimized, water levels in drainage canals will be maintained to within 6 inches of existing conditions and canals will not be allowed to dry out completely. Environmental Commitments identified for GGS would also benefit the western pond turtle. Based on these measures, cropland idling transfers would not likely to adversely impact the western pond turtle.

Water transfers via upland crop idling could potentially affect special status wildlife species and habitat. Upland cropland idling has the potential to affect a

number of special status species includes Aleutian Canada goose, California gull, long-billed curlew, mountain plover, northern harrier, Swainson's hawk, tricolored blackbird, western burrowing owl, white-faced ibis, and white-tailed kite. Idling would reduce forage areas, but some species would respond by looking for forage in other habitats. The special status species that would be potentially affected by idling of upland crops are mostly capable of quickly dispersing to other areas. There would continue to be a large amount of forage and other habitat available within the Sacramento Valley. Other species, such as the white face ibis, are well adapted to changes in environmental conditions such as drought and flooding; therefore, use of specific areas can vary greatly from year to year depending on habitat conditions.

The Environmental Commitments described for the GGS such as minimizing the block size and avoiding cropland idling actions that could result in the substantial loss or degradation of suitable habitat would also reduce potential effects to special status species. Appendix B summarizes potential impacts to special status wildlife species that could occur in the project area.

3.9 Air Quality

3.9.1 Affected Environment

Air quality effects are assessed in Glenn, Colusa, Yolo, Sutter, and Sacramento counties, where cropland idling and groundwater substitution transfers would originate. Air quality in California is regulated by the United States Environmental Protection Agency (USEPA) and the California Air Resources Board (CARB), and locally by Air Pollution Control or Air Quality Management Districts (APCD and AQMD respectively). The following APCD/AQMDs regulate air quality within the area of analysis:

- Butte County AQMD
- Colusa County APCD
- Feather River AQMD
- Glenn County APCD
- Sacramento Metro AQMD
- Yolo-Solano AQMD

Figure 3.9-1 shows the jurisdictions of the local APCD/AQMDs in relation to water districts and counties.

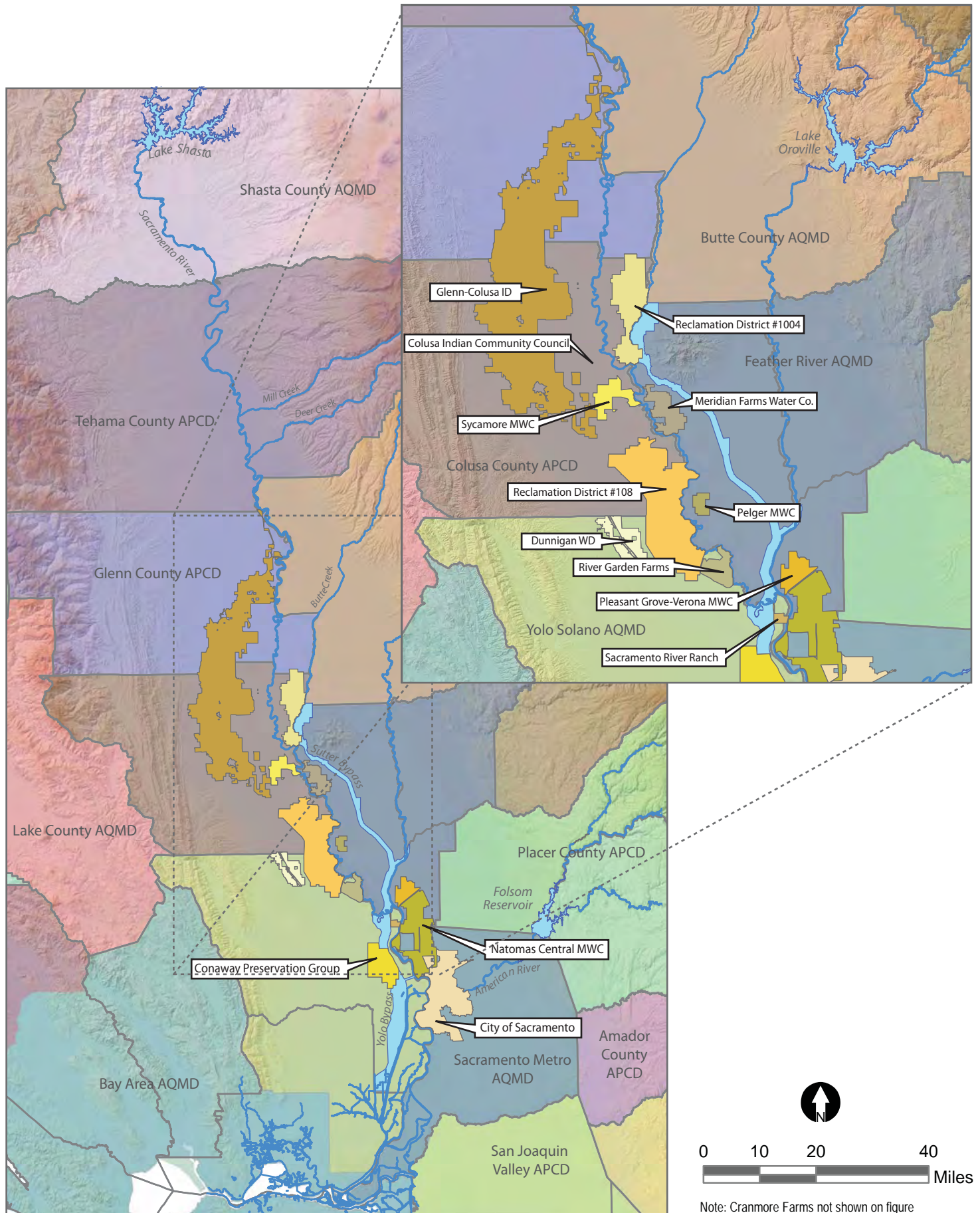


Figure 3.9-1. Air Districts

The Upstream from the Delta Region includes portions of the Sacramento Valley Air Basin. During the summer in the Sacramento Valley Air Basin, the Pacific high-pressure system can create low-elevation inversion layers that prevent the vertical dispersion of air. As a result, air pollutants can become concentrated during summer, lowering air quality. During winter, when the Pacific high-pressure system moves south, stormy, rainy weather dominates the region intermittently. Prevailing winter winds from the southeast disperse pollutants, often resulting in clear, sunny weather and good air quality over most of this portion of the region. In the Sacramento Valley Air Basin, ozone (O_3), respirable particulate matter (PM_{10}), and fine particulate matter ($PM_{2.5}$) are pollutants of concern because concentrations of these pollutants have been found to exceed standards; O_3 is a seasonal problem from approximately May through October. Seasonal conditions, such as agricultural harvesting and summer forest fires, affect peak PM_{10} and $PM_{2.5}$ concentrations, which are much higher than the annual average.

On a State level, all counties are designated as nonattainment areas for O_3 . Colusa and Glenn counties are designated as nonattainment/transitional areas, meaning that during a single calendar year, the State standards were not exceeded more than three times at any monitoring location within the district.

The areas can be reclassified as attainment areas if the state standards are not violated at any site during a three-year period. Butte, Colusa, Glenn, and the northern portion of Sutter counties³ are classified as moderate nonattainment areas under the State's 1-hour O_3 standard, whereas Sacramento, Yolo, and the southern portion of Sutter^{4,5} counties are classified as serious nonattainment areas. According to the Federal standards, Colusa, Glenn, and the northern portion of Sutter counties are designated as attainment areas for O_3 . Sacramento, Yolo, and the southern portion of Sutter counties are designated as serious nonattainment areas for the Federal O_3 standard. Butte County and the Sutter Buttes portion of Sutter County⁶ are listed as Former Subpart 1 areas.

On June 15, 2005, the 1-hour O_3 standard was revoked for most parts of the country and replaced with the 8-hour standard (69 FR 23951). On April 30, 2004, the USEPA issued a rule identifying how it planned to transition from the 1-hour National Ambient Air Quality Standard (NAAQS) to the implementation of the 8-hour NAAQS ("Phase 1 Implementation Rule"). Rules associated with the issues of implementation were divided into two phases with Phase 1

³ The northern portion of Sutter County is under the jurisdiction of the Feather River Air Quality Management District (FRAQMD).

⁴ Defined as the "[p]ortion south of a line connecting the northern border of Yolo County to the SW tip of Yuba County and continuing along the southern Yuba County border to Placer County" (69 FR 23858).

⁵ Although the northern portion of Sutter County is under the jurisdiction of the FRAQMD, it is a part of the Sacramento Federal Ozone Nonattainment Area (SFNA).

⁶ Defined as "[t]hat portion of the Sutter Buttes mountain range at or above 2,000 feet in elevation" (69 FR 23858).

addressing the area designations and classifications, revocation of the 1-hour standard, and anti-backsliding principles; and Phase 2, effective January 30, 2006, dealing with any remaining issues associated with the implementation (70 FR 71612).

Subpart 1 of the Clean Air Act (CAA) contains two sets of requirements regarding the implementation of the O₃ NAAQS; subpart 1 contains general requirements that are applicable to nonattainment areas for all pollutants, whereas subpart 2 contains additional requirements for O₃ nonattainment areas. When designing the 8-hour implementation rule, the USEPA had to cover a “gap” for areas that were in attainment for the 1-hour standard, but in nonattainment for the 8-hour standard. The USEPA concluded that areas that fell within this gap, such as Butte County and the Sutter Buttes portion of Sutter County, would only be subject to subpart 1 of the CAA and were therefore classified as such in the area designations.

The United States Court of Appeals vacated the Subpart 1 portion of the Phase 1 Implementation Rule on June 8, 2007, thereby reclassifying these areas as “Former Subpart 1” until the reclassification of the areas is finalized (*South Coast Air Quality Management Dist. v. EPA*, 489 F.3d 1295 (DC Cir. 2007)). The USEPA has subsequently proposed to classify Butte County and the Sutter Buttes Portion of Sutter County as marginal nonattainment areas for the 8-hour O₃ standard (74 FR 2936).

Table 3.9-1 summarizes the attainment status of the various counties and areas.

Agricultural engines are subject to CARB’s Airborne Toxic Control Measure (ATCM) for Stationary Compression Ignition Engines (17 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 fuel⁷ or an alternative fuel like biodiesel, the ATCM also requires further reductions in emissions from the current standards starting in 2010. 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:

⁷ “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.

Table 3.9-1. State and Federal Attainment Status

County	Attainment Status					
	CAAQS			NAAQS		
	O ₃	PM ₁₀	PM _{2.5}	O ₃	PM ₁₀	PM _{2.5}
Butte	N ¹	N	N	N ³	A	N
Colusa	N-T ¹	N	A	A	A	A
Glenn	N-T ¹	N	A	A	A	A
Sacramento	N ²	N	N	N ⁴	N ⁵	N
Sutter						
FRAQMD	N ¹	N	A	A	A	N
SFNA	N ^{2,6}	N	A	N ⁴	A	N
Sutter Buttes	N ¹	N	A	N ³	A	N
Yolo	N ²	N	A	N ⁴	A	N

Source: CARB 2009; USEPA 2009.

Notes:

¹ O₃ nonattainment classification (1-hour standard) = moderate

² O₃ nonattainment classification (1-hour standard) = serious

³ O₃ nonattainment classification (8-hour standard) = marginal (proposed)

⁴ O₃ nonattainment classification (8-hour standard) = serious

⁵ PM₁₀ nonattainment classification (24-hour standard) = moderate

⁶ On August 27, 2009, the USEPA proposed to reclassify the Sacramento Metro Ozone non-attainment area from serious to severe-15 (74 FR 43654). The current designation and classification is based on the 1997 8-hour standard of 0.080 parts per million by volume (ppmv).

Key:

A = attainment

CAAQS = California Ambient Air Quality Standard

FRAQMD = Feather River Air Quality Management District

N = nonattainment

NAAQS = National Ambient Air Quality Standard

N-T = nonattainment-transitional

O₃ = ozone

PM₁₀ = inhalable particulate matter

PM_{2.5} = fine particulate matter

SFNA = Sacramento Federal Ozone Nonattainment Area

Butte County AQMD

- Rule 441 – Registration Requirements for Stationary Compression Ignition Engines Used in Agricultural Operations
- Rule 513 – Registration Fees for Stationary Compression Ignition Engines Used in Agricultural Operations
- Rule 1001 – Airborne Toxic Control Measure 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

Sacramento Metro AQMD

- Rule 215 – Agricultural Permit Requirements and New Agricultural Permit Review
- Rule 311 – Registration Fees for Agricultural Compression Ignition Engines

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 the PM and O₃ 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 or Glenn counties would not be subject to the ATCM.

For other counties, the emission rates specified in Table 3.9-2 for Noncertified (“Tier 0”) Engines and in Table 3.9-3 for Tier 1- and 2-Certified Engines⁸ 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. Any engines manufactured prior to 1996 (Tier “0” or noncertified engines) must be replaced with Tier 3 engines beginning in 2010. Tier 1 or Tier 2 certified engines must be replaced with Tier 4 engines starting in 2014 or by 12 years after the installation of the engine, whichever is later.

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.

⁸ 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.”

Table 3.9-2. Emission Standards for Noncertified CI Agricultural Engines > 50 BHP

Horsepower Range (hp)	Compliance Date	Diesel PM Not to Exceed (g/bhp-hr) ¹	HC, NOx, NMHC+NOx, and CO Not to Exceed (g/bhp-hr)
50<hp<75	2011	0.30	Off-Road CI Engine Certification Standards for an off-road engine of the model year and maximum rated power of the engine installed to meet the applicable PM standard. ²
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 (17 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 3.9-3. Emission Standards for Tier 1- and 2-Certified CI Agricultural Engines > 50 BHP

Horsepower Range (hp)	Compliance Date	Diesel PM Not to Exceed (g/bhp-hr) ¹	HC, NOx, NMHC+NOx, and CO Not to Exceed (g/hp-hr)
50<hp<75	2015 ²	0.02	Off-Road CI Engine Certification Standards for an off-road engine of the model year and maximum rated power of the engine installed to meet the applicable PM standard. ³
75≤hp<175	2015 ²	0.01	
175≤hp<750	2014 ²	0.01	
hp>750	2014 ²	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 (17 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

3.9.2 Environmental Consequences

3.9.2.1 No Action

Baseline trends in air quality can reasonably be expected to continue if no action is taken. Total air emissions are expected to increase, even assuming that emissions allowable from individual and mobile sources would be regulated

more strictly. Increased population and associated increases in the need for more vehicles would be a contributor to the rise in pollutant emissions. Given the two year duration of the transfers, however, increases (or decreases) beyond current trends would likely be unnoticeable. Therefore, the No Action Alternative would have minimal effects on air quality.

3.9.2.2 Proposed Action

Groundwater substitution would require use of groundwater pumps to retrieve groundwater. Groundwater substitution would take place in Glenn, Colusa, Yolo, Sutter, and Sacramento counties. Agricultural users would use groundwater instead of surface water for their water supply. The use of groundwater would require pumps to lift the groundwater to the surface.

Increased groundwater pumping for groundwater substitution transfers would increase emissions of air pollutants. Electric pumps do not emit pollutants at the pump; the source of pollutants can be traced to emissions from the power plant. Power plants are given permits based on their maximum operating potential. Although the electricity required to power the groundwater pumps would not be needed under the No Action Alternative, the additional electricity used under the Proposed Action would not cause any power plant to exceed operating capacity. Although the power plants will be emitting various criteria pollutants from the combustion of fossil fuels, since the emissions do not occur at the pump, they are not considered in the emission calculations.

Diesel pump engines emit air pollutants through the exhaust. The primary pollutants from the pumps are nitrogen oxides (NO_x), total organic compounds (TOC), carbon monoxide (CO), and particulates (including visible and non-visible emissions). Pumps that run on propane burn much cleaner than diesel, but still contribute NO_x, carbon dioxide (CO₂), volatile organic compounds (VOCs), and trace amounts of sulfur dioxide (SO₂) and particulate matter. Ozone is not emitted directly in the atmosphere, but is formed by photochemical reactions by O₃ precursors (NO_x and VOC); therefore, NO_x and VOC are regulated to control emissions of O₃.

The pumps that would be used for groundwater substitution are existing pumps; however, they will need to be replaced as necessary following the requirements of CARB's ATCM. Since the ATCM will require more stringent emission limits than the existing pumps, emissions are expected to decrease in the future assuming that the replacement pumps have the same operational schedule as the existing pumps. Groundwater substitution activities would result in use of the pumps at times when they would otherwise not be used. It is therefore necessary to quantify the emissions related to the Proposed Action to determine effects.

The following sections compare Proposed Action-related emissions to several standards to determine if emissions would be substantial. The first set of

standards is related to local air districts. Each air district has its own criteria for determining significance with the California Environmental Quality Act (CEQA). The various methods and thresholds of significance for CEQA are based on compliance with the CAAQS, which are least as stringent as the NAAQS, if not more stringent. It is therefore assumed that following requirements of CEQA will be sufficient for compliance with NEPA.

The second set of standards is related to the Federal Clean Air Act. The “project” is defined in this case as the total water transfers in nonattainment or maintenance areas. In accordance with CAA, General Conformity was also evaluated. The General Conformity regulations contain certain de minimis thresholds for evaluating emissions; if the total of direct and indirect emissions is below these thresholds, then the project is assumed to conform to the State Implementation Plan and no further action is required for General Conformity.

Emission Calculations Emissions from the operation of diesel engines were estimated to evaluate compliance with the emissions thresholds for each air district and for General Conformity. Based on permits to operate obtained for several of the engines, the geometric mean power rating for a typical engine in the area is 200 hp; the geometric mean for the pumping capacity was estimated at 3,550 gallons per minute.

The maximum volume of water sold by each of the agencies involved in the 2010-2011 Water Transfers Program is identified in Table 2-1. Using the estimated size of the engines and the pumping rate, the total hours of operation for each agency were estimated; the engines were assumed to only operate from April to October of each year, or 213 days.⁹ Most diesel engines used by the agencies will be subject to the ATCM and must be at least Tier 3 certified in 2010; therefore, the emission limits in the ATCM were used to estimate the project emissions. Diesel engines that meet the “remotely located” criteria in Glenn or Colusa counties are not subject to the ATCM; therefore, these engines were not assumed to be Tier 3 certified.

Applicable standards require calculation of annual and daily emissions associated with the transfers. Table 3.9-4 includes annual emissions for each potential seller. These emissions are totaled for nonattainment areas (Yolo, Sutter, and Sacramento Counties) to provide information for the General Conformity analysis. Table 3.9-5 includes daily emissions by county.

⁹ Groundwater substitution may not start until June or July if the Projects are unable to store transferred supplies in upstream reservoirs. These calculations provide an upper limit for emissions based on the total transferred volume.

Table 3.9-4. Annual Emissions for Diesel-Fueled Agricultural Engines

Water Agency	County	Annual Emissions (tons per year)		
		Diesel PM	NMHC + NOx	CO
Colusa Indian Community Council/Cachil Dehe Band of Wintun Indians	Colusa	0.05	0.49	0.44
Conaway Preservation Group	Yolo ^{2,3}	0.68	13.60	11.78
Cranmore Farms (Pinnacle Land Ventures, LLC or Broomieside Farms)	Sutter ^{2,3}	0.51	10.12	8.77
Dunnigan WD	Yolo ^{2,3}	0.08	1.52	1.32
Glenn-Colusa Irrigation District	Glenn and Colusa	1.81	19.46	17.54
Meridian Farms	Sutter	0.18	1.95	1.75
Natomas Central MWC	Sutter and Sacramento ^{1,2,3}	0.51	10.12	8.77
Pelger MWC	Sutter	0.34	3.65	3.29
Pleasant Grove-Verona MWC	Sutter ^{2,3}	0.51	10.12	8.77
Reclamation District 108	Colusa and Yolo ^{2,3}	0.25	5.06	4.38
Reclamation District 1004	Glenn and Colusa	0.90	9.73	8.77
River Garden Farms	Yolo ^{2,3}	0.40	8.09	7.01
Sacramento River Ranch	Yolo ^{2,3}	0.16	3.26	2.82
Sycamore MWC	Colusa	0.90	9.73	8.77
City of Sacramento	Sacramento ^{1,2,3}	0.15	3.04	2.63
Total Emissions by Nonattainment Area	Yolo County	1.58	31.52	27.32
	Sutter County	1.52	30.35	26.30
	Sacramento County	0.66	13.15	11.40
Total Emissions in Attainment Area	Attainment⁵	4.17	45.00	96.81

Notes:

¹ Area designated as moderate nonattainment status for PM₁₀ (General Conformity de minimis threshold = 100 tons per year).

² Area designated as nonattainment for PM_{2.5} (General Conformity de minimis threshold = 100 tons per year).

³ Area designated as serious nonattainment for Federal ozone standards (General Conformity de minimis threshold = 50 tons per year) for NOx and VOC (precursors to O₃).

⁴ "Nonattainment" total describes the total emissions from counties that are in nonattainment of the respective air quality standard/pollutant (e.g., Yolo County, southern Sutter County, and Sacramento County).

⁵ "Attainment" total describes total emissions from counties/areas that are in attainment of the respective air quality standard/pollutant (e.g., Colusa County, Glenn County, and northern Sutter County).

Key:

CO = carbon monoxide

NMHC = non-methane hydrocarbons

NOx = nitrogen oxides

PM = particulate matter

VOC = volatile organic compounds

Table 3.9-5. Daily Emission for Diesel-Fueled Agricultural Engines

County	Daily Emissions (pounds per day)		
	Diesel PM	NMHC + NOx	CO
Colusa ¹	36.70	417.47	374.60
Glenn ¹	25.42	274.06	246.99
Sacramento ¹	6.17	123.50	107.03
Sutter ¹	19.12	337.52	294.33
Yolo ¹	14.80	296.00	256.53

Note:

¹ Several of the water agencies have territory that stretches over multiple counties. Since it is not known at this time where the pumps were located, the worst-case emissions were estimated. If a water agency has territory in two counties, then daily emissions were applied to each county; therefore, the total emissions shown in the table is greater than the total of all of the pumps operating simultaneously.

Key:

CO = carbon monoxide

NMHC = non-methane hydrocarbons

NOx = nitrogen oxides

PM = particulate matter

Local District Standards

Colusa and Glenn Counties Colusa and Glenn counties do not have individual CEQA Guidelines and are located in attainment areas for O₃ and PM. Assuming that any diesel engines used to pump groundwater are remotely located, they will not be subject to the ATCM emission limits; however, they will still be required to be registered. Since the counties are not located in nonattainment or maintenance areas, they are also not subject to General Conformity requirements. A project may be considered significant for these counties if it causes a violation of any air quality standard. Based on a review of each county's New Source Review requirements for permitting stationary sources (Colusa County APCD Rule 3.6; Glenn County APCD Rule 51), a source is required to install Best Available Control Technology (BACT) to continue attainment of the ambient air quality standards when emissions of VOC or NO_x are greater than 25 pounds per day or emissions of PM₁₀ are greater than 80 pounds per day. An exemption from permitting requirements in Glenn and Colusa counties include piston-type internal combustion engines used exclusively for agricultural irrigation. As a result, any engines located in Glenn and Colusa counties would not need to be permitted.

Although the emissions in Table 3.9-5 are higher than these thresholds, the emissions represent cumulative emissions from all engines. Since an individual engine would be required to meet the emission limits discussed above to be approved and permitted, then emissions from individual engines would be less than the thresholds and emissions would not be substantial under NEPA.

Feather River Air Quality Management District The FRAQMD has significant impact thresholds that are similar to those established in Colusa and Glenn Counties: 25 pounds per day for NO_x and VOC and 80 pounds per day for PM₁₀ (FRAQMD 1998). 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.

Although the emissions in Table 3.9-5 are higher than these thresholds, the emissions represent cumulative emissions from all engines. The daily limits discussed above are consistent with those included in the FRAQMD's New Source Review Rule (Rule 10.1) for individual emission units. Since the individual engines would not exceed the daily emission limits, emissions in Sutter County would not be substantial under NEPA.

Sacramento Metropolitan Air Quality Management District The Sacramento Metropolitan Air Quality Management District (SMAQMD) states in its Draft *CEQA Guide to Air Quality Assessment* (SMAQMD 2009) that a stationary source¹⁰ project is considered to be less than significant if the daily emissions of VOC and NO_x are below the SMAQMD's CEQA thresholds of significance: 65 pounds per day for NO_x and ROG; if the project complies with the SMAQMD's BACT and emission offset requirements; or if the source emissions are low enough to be exempt from the SMAQMD's permitting program. If agricultural engines exceed the emission thresholds that would trigger permitting, then they would be required to apply for a permit to operate, which would then require compliance with BACT and any emission offset requirements. If emissions are less than the trigger levels, then the diesel engines will be exempt from permitting. Under either scenario, the operation of diesel engines for agricultural purposes would not be substantial under NEPA.

Yolo-Solano Air Quality Management District The Yolo-Solano Air Quality Management District (YSAQMD) established thresholds of significance for NO_x and VOC of 10 tons per year each and PM₁₀ of 80 pounds per day (YSAQMD 2007). Emissions of PM₁₀ are not expected to exceed 15 pounds per day as a result of the Proposed Action; however, emissions of NO_x and VOC could exceed the threshold. Emissions would be minimized through measures in Section 3.9.3 and remaining emissions would not be substantial.

General Conformity The General Conformity regulation contains specific de minimis thresholds that must be met to avoid triggering a full General Conformity Determination. For the nonattainment regions that are designated serious nonattainment for O₃, the threshold is 50 tons per year; for the nonattainment regions that are designated serious nonattainment for PM₁₀, the threshold is 100 tons per year; and all nonattainment regions for PM_{2.5} have a threshold of 100 tons per year.

For the purposes of general conformity, the nonattainment area is defined as an area designated as nonattainment under section 107 of the Clean Air Act and described in 40 CFR 81. The nonattainment areas in 40 CFR 81 are defined by counties within each air basin; therefore, the general conformity threshold applies to the total program-related emissions in each county, rather than by the individual water agency or by the larger nonattainment area (i.e., the Sacramento Federal Ozone Nonattainment area, which includes multiple counties).

¹⁰ A stationary source is typically defined as a single emission unit; however, if a facility has multiple emission points, then the facility as a whole can be referred to as a "stationary source." As a result, when evaluating significance, all emission points (e.g., diesel engines) associated with a party should be evaluated for compliance.

The highest diesel particulate matter emissions in a nonattainment area are estimated to be approximately two tons per year (Sutter County); therefore, the Proposed Action is in compliance with General Conformity requirements for PM₁₀ and PM_{2.5}. Non-methane hydrocarbons (NMHC), which are also O₃ precursors, and NO_x emissions are estimated to be approximately 36 tons per year in the worst nonattainment area (Sutter County). Since the engines are subject to a combined standard, it is not possible to estimate the portion of emissions that are NO_x versus NMHC; therefore, it is conservatively assumed that the emissions would be all one pollutant. Even with this conservative assumption, the emissions associated with the Proposed Action are expected to be less than the General Conformity de minimis threshold for O₃.

Regional Emissions The transfer-related emissions, NO_x, PM₁₀, and PM_{2.5}, in Sacramento, Yolo, Sutter, Glenn, and Colusa Counties have been accounted for within CARB's inventory as is demonstrated by the fact that the average project emissions produced from groundwater pumping would fall below the diesel-fueled groundwater pump emission inventory.

Water transfers via cropland idling would increase PM₁₀ emissions. Acquisition of water via cropland idling in the Sacramento Valley would result in temporary conversion of lands from rice crops to bare fields. The overall effects on air quality are based on the effects of the reduction of air emissions due to declining use of farming equipment and pesticide applications and the effects, if any, of leaving crop fields idled.

The most frequently idled crop would be rice. During a typical calendar year of operation for rice production, farm equipment is required for preparing seedbeds, plowing and disking in March and April, harvesting in late September and October, and disposing of residue and disking in late October through November. Rice farmers apply fertilizers and pesticides during the spring. The equipment required for these activities produces both dust from disturbed soils and combustion emissions, which contribute to poor air quality. Idling rice fields would reduce the use of farm equipment and associated pollutant emissions, resulting in a beneficial impact on air quality.

The only potential adverse effect on air quality from idled rice fields would be PM₁₀ from potential erosion of barren fields (caused by wind or vehicles driving on the fields). The soil texture in the Sacramento Valley reduces the potential for erosion. Increased soil erosion creates a larger amount of soil particulates entrained into the air; a percentage of which are particles small enough to be considered PM₁₀. Soil types in the Sacramento Valley are generally not considered highly wind erodible.

The rice crop cycle also reduces the potential for erosion. The process of rice cultivation includes incorporating the leftover rice straw into the soil after harvest. Farmers flood the rice fields during the winter to aid in decomposition

of the straw. If no additional irrigation water were applied to the fields after this point (because the farmers would sell water for transfer), 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 type, in contrast to sandy topsoil, would not be conducive to soil loss from wind erosion (Mutters 2002). Therefore, there would be little to no fugitive dust from wind erosion off the idled rice fields. Effects on sensitive receptors, such as nearby residents, would also be minimal.

The Proposed Action includes additional crops that could be idled under a water transfer, which could be planted on soils more susceptible to erosion. Because the soils within the potential crop idling areas have slight erosion potential, there would not be substantial effects to water quality. Section 3.4.2 provides further detail on soils in these areas.

3.9.2.3 Minimization Measures

Minimization measures may not be required if the operation of the diesel pumps meet the thresholds of significance discussed in the previous paragraphs. If the operation of the pumps will result in emissions higher than the various thresholds, then the minimization measures will be used as appropriate to reduce emissions. Based on Reclamation's experience with one-year transfers in the past decade, it is highly unlikely that any of the maximum groundwater substitution acre feet thresholds would be exceeded in 2010 or 2011.

Groundwater Substitution If water is obtained from groundwater substitution, increased groundwater pumping may increase NOx emissions, although the diesel pumps will be required to meet reduced NOx emission limits in future years to meet compliance with the ATCM. Emissions calculations in this section assumed that all groundwater substitution transfers in Table 2-1 occur during the same year; however, these figures represent upper limits and may not all occur. Table 3.9-6 shows the maximum amount that could be transferred from Yolo County that would allow the Proposed Action to stay below the YSAQMD thresholds. If all proposed transfers in Yolo County stay below the thresholds, then no additional minimization measures would be necessary.

Table 3.9-6. Maximum Groundwater Substitution Allowed

County	Maximum Groundwater Substitution (acre feet)¹	Proposed Groundwater Substitution (acre feet)	Difference (acre feet)
Yolo	9,091	28,659	(19,568)

¹ Several water agencies cover multiple counties; therefore, emissions were split equally between each county in these cases.

Cropland idling would reduce emissions from engines associated with farming a crop, such as planting and harvesting equipment. If crop idling occurs in Yolo County, the reduced emissions would reduce the overall emissions from the Proposed Action within the area. For each 4.25 acre feet of water obtained through idling rice, an additional 1 acre-foot of water could be obtained through groundwater substitution without increasing the NOx emissions (Byron Buck 2009).

If transfer quantities are greater than those shown in Table 3.9-6, then Reclamation and willing sellers will work together to implement one, or a combination, of the following minimization measures that is appropriate. The minimization measures will be implemented within the willing seller's air district.

1. Reclamation will require willing sellers to use only electric pumps. For each groundwater pump that is not electric that is used for groundwater substitution for the Proposed Action, the willing seller will retrofit non-program pumps in amounts necessary to offset the maximum increases in project-related air pollutant emissions.
2. Reclamation will require willing sellers to purchase offsets to compensate for producing project-related emissions. Offsets can incorporate a variety of emission reduction options including converting diesel pumps to electric or propane (as stated above), reduced fossil fuel consumption because of cropland idling transfers (approximately 15 percent reduction), an accelerated pump repair schedule (approximately 20 percent reduction), or conversion to solar pumps (complete reduction in emissions). The willing seller can also include additional emission reduction options; however, the willing seller must include quantitative data indicating how those options lower the emissions to acceptable levels.

3.10 Power Generation

3.10.1 Affected Environment

Hydroelectric facilities are a part of the SWP and CVP facilities at dams and reservoirs. As water is released from Project reservoirs, the generation facilities produce power that is both used by the Projects and marketed to electric utilities, government and public installations, and commercial customers. Both Projects rely on their hydropower resources to reduce the cost of operations and maintenance and to repay the cost of Project facilities. Hydropower from the Reclamation and DWR power plants is an important renewable energy source and, as of September 2009, comprises approximately 26 percent of the online

capacity of California hydroelectric facilities. Overall, DWR/Reclamation hydroelectric facilities are nearly five percent of the total online capacity of California power plants (California Energy Commission 2009).

The area of analysis for the evaluation of potential effects upon hydropower generation due to implementation of the Proposed Action includes the power plants, pumping plants, and associated facilities located along the SWP and CVP of the Sacramento and American River systems, as well as those of the Delta Region and downstream of Delta area. Also in the area of analysis are reservoirs, power plants, and pumping plants not owned or operated as part of the SWP or CVP. The specific hydroelectric facilities are described in the 2004 Final EWA EIS/EIR (Reclamation 2004, pgs 16-7 and 16-11).

Other hydroelectric generation facilities in the area of analysis are owned by investor-owned utility companies such as Pacific Gas & Electric Company and Southern California Edison, by municipal agencies such as the Sacramento Municipal Utility District, and by several other agencies.

Western Area Power Administration (Western) is the marketing agency for power generated at Reclamation's CVP facilities. Created in 1977 under the Department of Energy Organization Act, Western markets and transmits electric power throughout 15 western states. In 2005, the total energy resources from the CVP, one of Western's water resource projects, was 8.2 billion kilowatt-hours (kWh), which includes CVP facility generation of 4.3 billion kWh and 3.9 billion kWh of other power purchases (to support CVP generation). The total energy delivered by the CVP area in 2005 was 8.2 billion kWh, including CVP facilities energy use (Western Area Power Administration 2005).

3.10.2 Environmental Consequences

3.10.2.1 No Action Alternative

Under the No Action Alternative, 2010-2011 Water Transfer Program would not occur. Some non-CVP transfers would likely occur. CVP transfers would also occur if proponents complete their own environmental documentation and obtain Reclamation approval. Water transfers under the No Action Alternative would not change the amount of water that is released from the reservoirs, but could alter the release pattern. Under the No Action Alternative, there would be no substantial changes in CVP/SWP power production or usage, no new power facilities would be constructed or operated, and no facilities would be taken off-line.

3.10.2.2 Proposed Action

Water transfers via groundwater substitution or cropland idling/crop shifting may cause changes in the release pattern from reservoirs in July through September. The Proposed Action would not change the amount of water that is

released from the reservoirs, but could alter the release pattern. Reclamation would attempt to retain surface water made available in upstream storage facilities until the Delta export pumps have the capacity available to convey water south. If water is held in Shasta Reservoir for cropland idling/crop shifting and groundwater substitution transfers, power generation could increase in July through September when the water is conveyed from Shasta Reservoir at greater levels than under the No Action Alternative. However, if water is not held in the reservoir, power generation would be the same as the No Action Alternative.

The value of power fluctuates throughout the year. Typically, prices are higher in late summer and fall and lower in the spring. However, in an open market, seasonal price fluctuations may not always reflect the norm. Buyers would be responsible for covering any additional costs during times when transfer water would result in the value of power generated later in the summer being less than under the existing condition. This would minimize the potential for adverse effects on power production and energy.

The energy use and related pumping costs at Banks and Tracy Pumping Plants would be higher on an average annual basis compared to the No Action Alternative. As water acquired through transfers is released downstream in July through September, Delta pumping may increase. However, the pumping increase would not be directly proportional to the increase in reservoir releases. Any water transfers that must move through the Delta would be assumed to lose an estimated 20 percent of the water obtained from the Sacramento River and its tributaries to carriage losses in the Delta. The value of power fluctuates throughout the year. Typically, prices are higher in late summer and fall and lower in the spring. However, in an open market, seasonal price fluctuations may not always reflect the norm. Altering water release patterns (power production) could produce positive or negative effects. Reclamation would incorporate provisions for potential increases in pumping costs into the requirements for approval of transfers.

The Proposed Action could affect the regional electricity market; although it is not anticipated to have a major effect on generation from CVP or SWP hydroelectric power plants. The Proposed Action would result in an average electricity increase at the Project pumps during July, August, and September, depending on the amount of water actually transferred under the Proposed Action. In addition, groundwater wells in the Sacramento Valley would increase their use of electricity for water supply replacement. However, this increase in electricity use would represent less than 2 percent of the projected statewide electrical surplus during these months.

3.11 Cultural Resources

3.11.1 Affected Environment

Cultural resources may include prehistoric and historic districts, sites, buildings, structures, or objects. Some cultural resources are locations depicting evidence of past human use of the landscape and the built environment, which is represented in structures such as dams, roadways, and buildings. Cultural resources may also be Traditional Cultural Properties or sites of religious and cultural significance that are important to Native American individuals and communities.

Under NEPA (42 USC Sections 4321-4327), Reclamation is required to consider potential environmental impacts and appropriate minimization measures for projects with Federal involvement. A complete list pertinent Federal laws, regulations, and guidance that direct Reclamation cultural resources policies and responsibilities is found in Reclamation's Directives and Standards Manual LND 02-01 for Cultural Resource Management.

3.11.1.1 Archaeological Background

Due to the alternating periods of erosion and deposition that characterize California's Central Valley, many of the Pleistocene landscapes that might hold evidence relating to the earliest human occupations of the area have been eroded away or are under more recent alluvial deposits. Archaeological information about the earliest periods in the region has come in the form of isolated finds on remnant landforms, including artifacts thought to date to the Paleo-Indian Period (11,550–8550 B.C.) found in the southernmost extent of San Joaquin Valley. Evidence for the Lower Archaic Period (8850–5550 B.C.) in the Central Valley 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 on in prehistory (Rosenthal et al. 2007:151–152).

Archaeological sites dating to the Middle Archaic Period (5550 to 550 B.C.) provide some of the oldest evidence for well-defined cultural traditions in the area. Evidence exists for increased residential stability, logistical organization, riverine adaptations, and far ranging regional exchange during the Middle Archaic (Rosenthal et al. 2007:153-155). The Windmill Pattern (1850 to 750 B.C.), which shows a widespread uniformity of burial practices, is characteristic of the period. The Upper Archaic (550 B.C. to A.D. 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 (A.D. 1100 to historic times), native peoples living in the valley 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 in the much of the region. The population of the Central Valley, which had been growing steadily since the Middle Archaic, continued to climb in the Emergent Period, and this growth correlates with an intensification of hunting, gathering, and fishing, as well as increased socio-political complexity (Rosenthal et al. 2007:257-259).

3.11.1.2 Ethnographic Background

At the onset of European colonization of California, the Central Valley was home to an estimated 100,000 people who spoke at least eight different indigenous languages: Wintu, Yana, Nomlaki, Konkow, River Patwin, and Nisenan in the Sacramento Valley, and Miwok and Yokuts in the San Joaquin Valley. 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 exploit diverse ecological zones and only came together during the winter when they shared their surpluses and performed important ceremonies (Lightfoot et al. 2009: 303).

California Indians 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 principle 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 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 the

valley's many rivers and sloughs also comprised waterfowl and fishes (Lightfoot et al. 2009: 303-338).

3.11.1.3 Historic Background

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 explored 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 the inhabitants to gain new converts and punish native raiding parties. After winning its independence from Spain, the Mexican government divided much of its territory in California into individual land grants. While these ranchos, as they came to be known, were 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 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; although most were men, they initially came from many occupations and ethnicities. Over time, however, 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. 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. With the completion of the transcontinental railway in 1869, farmers in the Central Valley began to export their crops, including many different types of fruits, nuts, and vegetables, 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. 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 (Beck and Haase 1974).

3.11.1.4 Summary of Potential Cultural Resource Types

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-era 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-era cultural resources in the Central Valley may include those associated with early Spanish expeditions 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 sites include those pertaining to cattle ranches and early transportation routes. Many sites related to ethnic minorities, such as Overseas Chinese communities, are also known to exist in the Delta and in the Central Valley.

Because water transfers would not affect cultural resources in the Delta, no further description of Delta cultural resources or historic properties is included here.

3.11.2 Environmental Consequences

3.11.2.1 No Action

Under the No Action Alternative, surface water facilities would continue to operate in the same manner as under current operations. Individual agencies would continue to manage cultural resources in a manner consistent with State and Federal laws.

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 Alternative would reflect the system as it is presently operating.

Under the No Action Alternative, water transfers outside the Proposed Action could occur. Individual water transfers would be assessed on a case-by-case basis. Without a water transfer assessment and subsequent approval, there would be no "undertaking," as defined by Section 301(7) of the National Historic Preservation Act (NHPA), and consequently, no initiation of the Section 106 process.

3.11.2.2 Proposed Action

Water transfers could change reservoir storage levels potentially exposing cultural resources. The Proposed Action would result in water being transferred through existing facilities and would not result in the construction of new facilities or the modification of existing facilities. The water transferred under the Proposed Action would be used to meet critical needs, and in a manner

consistent with existing water usage. The water would not be used to bring new lands into agricultural production or to supplement any specific development.

If reservoir operations associated with implementing water transfers remain within historic levels, then the Proposed Action will result in identical effects to cultural resources as previous conditions. This would have no additional impacts to cultural resources. If the Proposed Action would draw water below historic operation levels, this effect could result in additional impacts to cultural resources not previously affected by reservoir operations. It is not expected that transfers would draw down Project reservoirs beyond historic operational levels. The 2010-2011 Water Transfer Program does not include transfers from local stored reservoir water; therefore, there would be no changes in water levels in locally-owned reservoirs. There would be no impacts to cultural resources. Individual transfers that may result in effects to cultural resources may be subject to the considerations pursuant to Section 106 of the NHPA (16 U.S.C. 470) and its implementing regulations at 36 CFR Part 800.

3.12 Socioeconomics

3.12.1 Affected Environment

Agriculture is a primary industry in the counties upstream from the Delta. In 2008, rice was largest commodity in terms of value of agricultural production and acreage in Butte, Colusa, Glenn, and Sutter counties. In 2008, Butte, Colusa, Glenn and Sutter counties produced 85 percent of the state's total rice income. Rice ranked third value of production in Yolo County behind processing tomatoes and alfalfa hay (County Agricultural Commissioner [CAC] 2009). In the five counties, total value of production for rice in 2008 was over \$1.0 billion (CAC 2009). Total field crop production was valued about \$1.4 billion in 2008. Average county rice acreage has remained relatively stable from 2001 to 2008 relative to 1995 to 1999 averages. Table 3.12-1 shows rice acreages in Sacramento Valley counties from 2006 through 2008.

**Table 3.12-1. 2006-2008 Harvested Rice Acreages in
Upstream from the Delta Region Counties**

	2006	2007	2008
Butte	98,500	101,800	105,301
Colusa	145,000	154,700	150,200
Glenn	87,000	86,300	77,770
Sutter	106,000	105,800	92,344
Yolo	28,700	23,800	30,057
Total	465,200	472,400	455,672

Source: CAC 2008, CAC 2009

Field crops with relatively high acreages within the Upstream from the Delta Region counties include corn for grain and silage, wheat, and dry beans. In 2008, Yolo County had 37,571 acres of tomatoes for processing and Colusa County had 13,940 acres, but other counties had much fewer acres (CAC 2009). There was limited acreage of sorghum for grain, oats, and barley. Most other agriculture within the counties included fruit and nut trees, including almonds, walnuts, peaches and olives.

Regional economies are typically measured by several economic indicators, including median family income, per capita income, poverty rates and unemployment rates. The indicators are described below and Table 3.12-2 summarizes economic indicators for Butte, Colusa, Glenn, Sutter, and Yolo counties.

Table 3.12-2. 2008 Economic Indicators in Upstream from the Delta Region Counties

	Annual Median Family Income	Annual Per Capita Income	Poverty Rate (Individuals)	Unemployment Rate
Butte	\$48,328	\$22,428	21.5%	11.9%
Colusa ¹	\$52,645	\$21,561	13.4%	13.9%
Glenn ¹	\$47,292	\$18,754	19.0%	6.9%
Sutter	\$55,353	\$21,732	17.1%	11.9%
Yolo	\$72,132	\$27,530	15.2%	7.6%

Source: American Community Survey 2009a, 2009b, 2009c, 2009d, 2009e

1 – Colusa and Glenn County data represent 3-year average data from 2006 to 2008 from the American Community Survey. 2008 single year data had not been published as of December 2009.

Median family income measures the annual income received by an average family living within a household. The larger the median family income of the county, the more income tax revenue is generated, which can be used to provide community services for the unemployed.

Per capita income is the total of all wages, interest, rents, and other incomes divided by the number of people in the county. In Yolo County, people earn high per capita incomes, relative to Butte, Colusa, Glenn, and Sutter counties because of employment at the University of California and proximate access to employment opportunities in urban Sacramento. Taxes on higher incomes provide relatively more compensatory social services to offset unemployment effects and contribute to social stability.

The percentage of people living below poverty level is also a measure of community stability. Counties experiencing high poverty rates earn less revenue per capita than those with lower poverty rates. These counties must provide more services for the economically disadvantaged and have fewer resources.

Another economic indicator that influences community stability is unemployment rate. A high unemployment rate increases the demand for more social services, which the county is expected to supply.

California has an infrastructure in place that buffers the needs of the unemployed. Programs offering services include, but are not limited to, Experience Works that provides training for mature workers, as well as public programs that include MediCal, CalWORKS, food stamps, regional occupational training programs, and others. These programs would likely offer services to individuals displaced by cropland idling. Interviews with individuals involved with farm labor indicate that the services offered do not include affordable medical insurance coverage, and generally displaced farmworkers find it difficult to meet the most basic financial obligations of rent and utilities. Therefore, displaced farmworkers would most likely require financial supplements to cover fixed expenses and medical insurance (Quiroga-Valvodos 2003 and Clayton 2003 as cited in Reclamation 2009).

Factors affecting social well-being of the unemployed also include steady employment and job guarantees. Job guarantees are influenced by seasonal and economic changes. Natural conditions can lengthen or shorten employment (e.g., water shortages can reduce the number of acres farmed). The effect of natural occurrences on farm labor in the past is a component of the assessment.

In general, stable communities are typically areas that collect sizable tax revenues and have large urban centers with broad-based economies more capable of providing an assortment of public services, including unemployment compensation. The large and diverse industries of urban centers provide job opportunities, income, and tax revenues that serve to stabilize the communities. These more stable communities are identified by sizeable median incomes, low unemployment, and the number of re-employment opportunities. Conversely, a less stable community would be a smaller county, city, or local government with smaller economic base, higher unemployment, fewer re-employment opportunities, limited social services, and fewer revenues. Unemployment has a larger effect on these communities. The 2008 Final Supplemental EWA EIS/EIR includes further socioeconomic data (Reclamation 2008, pgs 3-7 to 3-11).

3.12.2 Environmental Consequences

3.12.2.1 No Action

The regional agricultural economy would remain similar to existing conditions, which fluctuates with market conditions and farm practices. Farmers would continue to temporarily fallow some land due to land practices and other issues, while other farmers would place previously fallowed land back into production. The continued rotation of these farming practices would cause some

fluctuations in agricultural employment, but those changes would likely reflect those that occur under the existing condition.

In the Export Service Area, some farmers would need to idle cropland because of water shortages. Idling could last for one year or multiple years depending on the length of the shortage. Farm income and employment would decrease as a result of cropland idling. This would be an adverse effect to regional economics under the No Action Alternative.

3.12.2.2 Proposed Action

Cropland idling/crop shifting transfers would affect output and employment in the Upstream from the Delta counties. The maximum amount of water made available by cropland idling/crop shifting would be 109,469 acre feet in Colusa, Glenn, Sutter, and Yolo counties. It is assumed that the majority of cropland idled would be rice fields. If only rice fields were idled, the maximum acreage from idling from CVP sellers would be about 33,172 acres. The acreage would increase if farmers choose to idle other field crops because they offer less water available for transfer than rice. Table 2-3 in Section 2 summarizes water available for transfer from each crop eligible for idling/shifting transfers. It is likely that the actual amount of water that is transferred via cropland idling/crop shifting in 2010 and 2011 would be less than the maximum amount proposed in Table 2-1.

Cropland idling transfers have the potential to affect the local economy if they are taken to an extreme. Businesses and individuals that depend on farming related activities would experience some decrease in business if land idling becomes extensive. Crop shifting transfers would have less of an effect because farmers would continue to purchase inputs and hire labor to grow a crop. Limiting cropland idling to 20 percent of total irrigated crop acreage in the county would not result in substantial effects to the regional economy. Because transfers would last for one year, farmers would likely put the land back into agricultural production in the subsequent year. Economic impacts would be temporary. The economic analysis in the 2004 Final EWA EIS/EIR indicated that idling 20 percent of rice acreage in the upstream of the Delta counties would result in a less than 1 percent change in output, employment, value added and wages and salaries (Reclamation 2004, pg 11-35). At the regional level, this effect would not be substantial. Effects may be more adverse in local communities. Rural communities have a much smaller economic base, and any changes to economic levels would be more adverse relative to a large regional economy. Because of the two-year duration of the 2010-2011 Water Transfer Program and Environmental Commitments to limit cropland idling, economic impacts would not likely be substantial.

Water districts and individuals that receive funds from the sale of water related to these programs would likely continue to spend a portion of their revenues within the local economy. These reinvestments may not benefit those possibly

affected by the cropland idling transfers, but can help offset overall economic impacts in the county.

Water transfers to the Export Service Area would reduce potential water supply shortages. Water transfers under the Proposed Action would provide water to agricultural and urban areas in the Export Service Area. Increased water supply in agricultural areas would allow farmers to increase irrigation and possibly put previously idled land back into production. Increased irrigation could increase yields and farmer revenues. Farm employment could also increase as farmers produce more crops. This would be a beneficial effect to the regional economy. Water delivered to urban areas would increase urban agencies supplies and reduce potential drought measures or more expensive water supply alternatives. This would be a beneficial effect to urban water customers.

3.13 Indian Trust Assets (ITAs)

3.13.1 Affected Environment

Indian Trust Assets (ITAs) are legal interests in property held in trust by the U.S. for Federally-recognized Indian tribes or individual Indians. 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 instream flows associated with trust land. 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 interprets Congressional acts, executive orders, and historic treaty provisions.

Consistent with President William J. Clinton's 1994 memorandum, "Government-to-Government Relations with Native American Tribal Governments," Reclamation assesses the effect of its programs on tribal trust resources and Federally-recognized tribal governments. Reclamation is tasked to actively engage Federally-recognized tribal governments and consult with such tribes on a government-to-government level (59 Federal Register 1994) when its actions affect ITAs. The U.S. Department of the Interior (DOI) Departmental Manual Part 512.2 ascribes the responsibility for ensuring protection of ITAs to the heads of bureaus and offices (DOI 1995). Part 512, Chapter 2 of the Departmental Manual states that it is the policy of the Department of the Interior to recognize and fulfill its legal obligations to identify, protect, and conserve the trust resources of Federally recognized Indian tribes and tribal members. All bureaus are responsible for, among other things,

identifying any impact of their plans, projects, programs or activities on ITAs; ensuring that potential impacts are explicitly addressed in planning, decision, and operational documents; and consulting with recognized tribes who may be affected by proposed activities. Consistent with this, Reclamation's Indian trust policy states that Reclamation will carry out its activities in a manner which protects ITAs and avoids adverse impacts when possible, or provides appropriate minimization measures or compensation when it does not. To carry out this policy, Reclamation incorporated procedures into its NEPA compliance procedures to require evaluation of the potential effects of its proposed actions on trust assets. Reclamation is responsible for assessing whether the implementation the 2010-2011 Water Transfer Program has the potential to affect ITAs. Reclamation will comply with procedures contained in Departmental Manual Part 512.2, guidelines, which protect ITAs from adverse effects of water transfers.

Figure 3.13-1 shows the areas that could implement groundwater substitution transfers. Maidu and Wintun people once inhabited the downstream Colusa Basin section of the Sacramento River (CDM 1995; Glenn Colusa ID, CDFG CDFG, Reclamation, Corps 1998). The Wintun Tribe comprises three divisions: Patwin, Nomlaki, and Wintu. Present-day descendants of the Wintun live on the Colusa (Cachil Dehe) and Cortina Rancherias in Colusa County and 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 large tract of trust land in Tehama County, just northwest of Orland, near I-5.

The Konkow, the northwestern branch of the Maidu nation, inhabited portions of the Central Valley and western slopes of the Sierra Nevada to the north and northeast of Sutter Buttes. The Konkow were bordered on the west by the Nomlaki (Wintun) and on the north by the Yana and Northeastern Maidu. The southernmost group of the Yana was the Yahi (City of Oroville 1995; Butte County 1998). The southernmost Maidu called themselves the Nisenan people, and occupied the drainages of the Yuba, Bear, and American Rivers and the lower drainages of the Feather River (Sutter County 2001). Major political Nisenan sites were along the mouths of the Feather, American, and Yuba Rivers. Abundant game, waterfowl, fish, and plant resources supported the entire region (Wilson and Towne 1978).

Descendants of the Maidu live on the Mooretown, Berry Creek, and Enterprise Rancherias in Butte County. The Mechoopda Indian Tribe of the Chico Rancheria (a Federally-recognized Tribe) acquired 50 acres in fee status in Butte County. Fee land by definition is not held in trust by the United States.

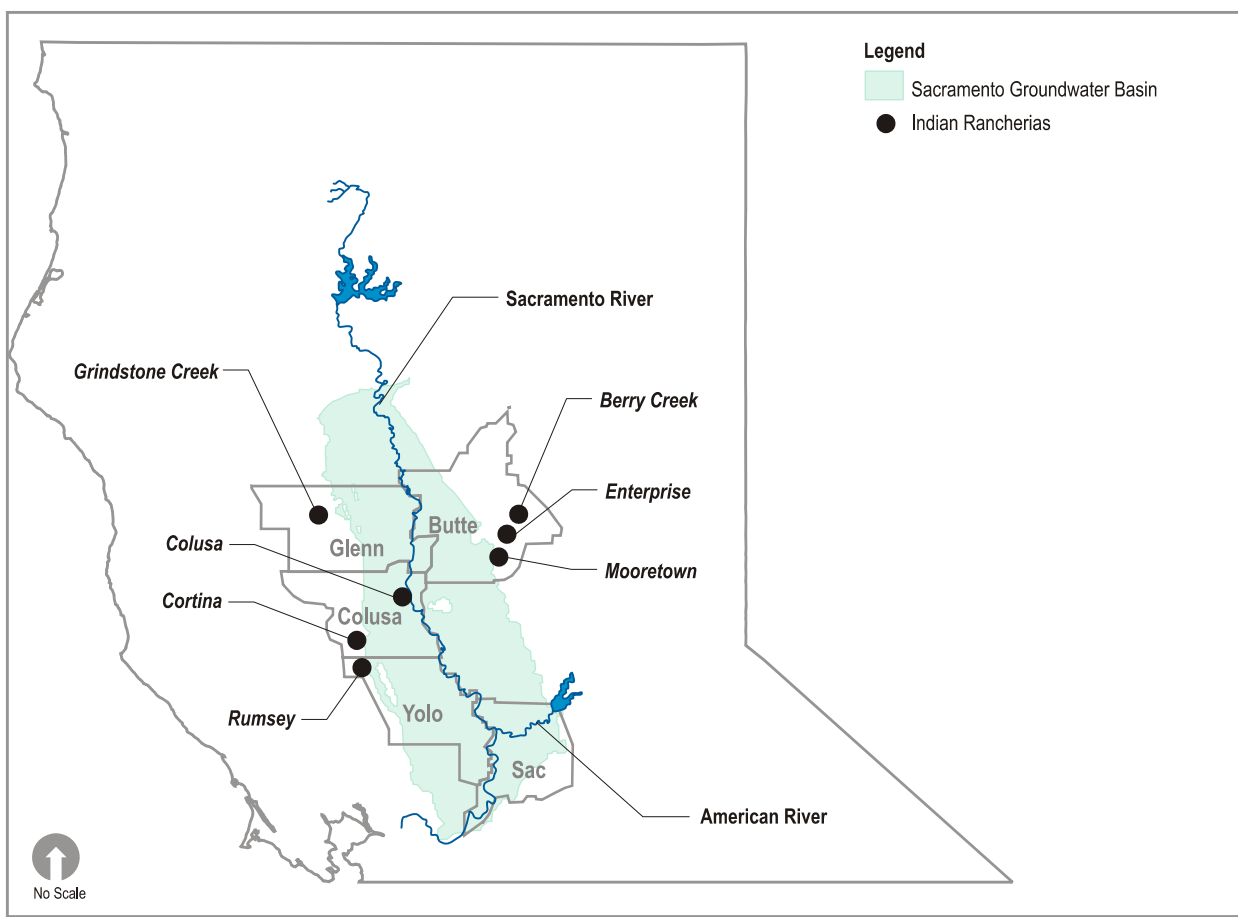


Figure 3.13-1. Indian Lands Affected by Groundwater Substitution

3.13.2 Environmental Consequences

3.13.2.1 No Action

Under the No Action Alternative, the 2010-2011 Water Transfer Program would not occur; therefore, there would be no effects on ITAs. Other water transfers would occur that would need to evaluate impacts to ITAs and consult with Bureau of Indian Affairs, if necessary. Water transfers from existing groundwater storage basins would continue to respect the integrity of Federally-protected lands, minerals, hunting and fishing rights, water rights, and in-streamflows associated with Indian lands. Under the No Action Alternative, farmers might pump more groundwater in years of reduced water supply reliability than they otherwise would. Increased pumping could affect groundwater levels and ITAs; however, ITAs would remain protected and intact through current legislation.

3.13.2.2 Proposed Action

Potential effects on ITAs consider if the Proposed Action would affect Indian trust lands and Federally-reserved hunting, fishing, gathering, water, or other rights. Cropland idling could produce fugitive dust that may affect adjacent land uses. Rainfall, crop production practices, environmental commitments, and minimization measures outlined in previous sections would reduce potential effects to ITAs from cropland idling/crop shifting transfers. Groundwater substitution could result in increased depth to groundwater in neighboring vicinities and/or increasing costs of groundwater pumping.

Groundwater substitution transfers could interfere with Federally-reserved water rights and potentially affect ITAs.

The first step of the impact analysis was to identify likely locations for groundwater substitution transfers and their relationship to ITAs through the following process:

- 1) The Bureau of Indian Affairs (BIA) 2000 Indian Trust Lands map was used to identify reservations and rancherias throughout California. (U.S. Department of the Interior, Bureau of Indian Affairs 2000)
- 2) The map was overlaid with county borders and the boundaries of groundwater substitution basins.

Figure 3.13-1 shows Indian lands falling within the boundaries of groundwater substitution basins, and therefore potentially affected by potential groundwater substitution actions. These include:

- Colusa Rancheria
- Cortina Rancheria
- Rumsey Rancheria

The exact amounts of groundwater to be pumped and locations of associated groundwater wells for each potential sellers involved in groundwater substitution are unknown. It is possible that fewer tribes and Indian lands than shown in the figure could be affected by groundwater substitution. Tribes in the vicinity of a groundwater substitution transfer could experience well drawdown relative to the No Action Alternative, which could increase costs of pumping water or potentially dry out wells, resulting in a potentially adverse effect.

In order for Reclamation to execute Federal trust responsibilities, Reclamation would evaluate each groundwater substitution well proposed by a seller, regardless of its distance from Indian trust land, for its potential to adversely affect ITAs. Reclamation's policy is to protect and avoid adverse impacts whenever possible (Reclamation 2000).

Sellers would provide the Reclamation with groundwater well and transfer information as discussed the Technical Information for Water Transfers in 2010 (Reclamation and DWR 2009). In general, the transfer proposal would include the location and characteristics of the wells that will be pumped, the volume and schedule of transfer-related groundwater pumping, and a monitoring plan designed to assess the effects of the transfer.

Transfers should:

- Assure that use of extraction wells minimizes risks to surface and groundwater quality;
- Incorporate an adequate monitoring program; and
- Proceed only after appropriate tribal consultation, as needed.

If Reclamation identifies potential impacts to ITAs, tribal consultation will then precede any groundwater transfer in the vicinity of the identified tribes. Government-to-government consultation shall take place to determine interests, concerns, effects, and appropriate minimization measures. Consultation may involve the Reclamation, BIA, and the Regional Solicitor's Office. The agencies will discuss appropriate avoidance and/or minimization strategies on a government-to-government basis. Separate minimization measures may be required for different types of trust assets, including Federally-reserved water, land, minerals, hunting, fishing, and gathering rights.

Consultation could identify any of the following measures as appropriate for reducing effects:

- More frequent groundwater monitoring;
- More detailed pre-purchase groundwater evaluation;
- Estimates of potential interference with Indian wells; and
- Discontinuation of water transfer-related groundwater pumping if groundwater levels are drawn down to a level of concern.

Measures necessary to reduce effects to 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 potential adverse effects to ITAs.

3.14 Environmental Justice

3.14.1 Affected Environment

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 program actions. The 1994 Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, 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 concept of environmental justice as applied here is that minority and low-income people should not be disproportionately affected by economic and quality of life effects from the 2010-2011 Water Transfer Program. Cropland idling and crop shifting could affect farm labor employment by temporarily reducing the amount of agricultural land in production or the number of farm workers needed to work existing land. The area of analysis for environmental justice effects is the counties in which cropland idling and crop shifting could take place.

3.14.1.1 Demographics

Table 3.14-1 presents ethnic composition in Butte, Colusa, Glenn, Sutter, and Yolo counties.

Table 3.14-1. Ethnicities in Counties Potentially Affected by Cropland idling/Shifting (2009) ⁽¹⁾

County	Hispanic	White	Asian	Pacific Islander	African American	American Indian	Multirace
Butte	13%	78%	3%	0%	1%	2%	2%
Colusa	51%	44%	1%	0%	0%	2%	1%
Glenn	33%	59%	3%	0%	0%	2%	2%
Sutter	30%	53%	13%	0%	2%	1%	2%
Yolo	30%	53%	11%	0%	2%	1%	3%

Source: California Department of Finance 2007

Notes: ⁽¹⁾ Data is from Baseline 2006 population projections for each county in the year 2009

Table 3.14-2 presents the most recent data on population, employment and poverty in the counties potentially affected by cropland idling and crop shifting.

Table 3.14-2. Demographic Characteristics of Counties Potentially Affected by Cropland Idling/Shifting

County	Population ⁽¹⁾	Farm Employment ^{(2),a}	Number of Farm workers ^(b)	Unemployment Rate ^{(3), (c)}	Persons Below Poverty ⁽⁴⁾
Butte	226,819	3,436	2,859	12.2	17.1%
Colusa	23,305	2,123	1,766	14.5	12.7%
Glenn	30,411	2,186	1,819	13.8	15.8%
Sutter	100,044	3,232	2,689	15.1	12.2%
Yolo	202,673	2,584	2,150	10.9	14.5%
California	38,688,293	239,255	199,060	12.0	13.3%⁵

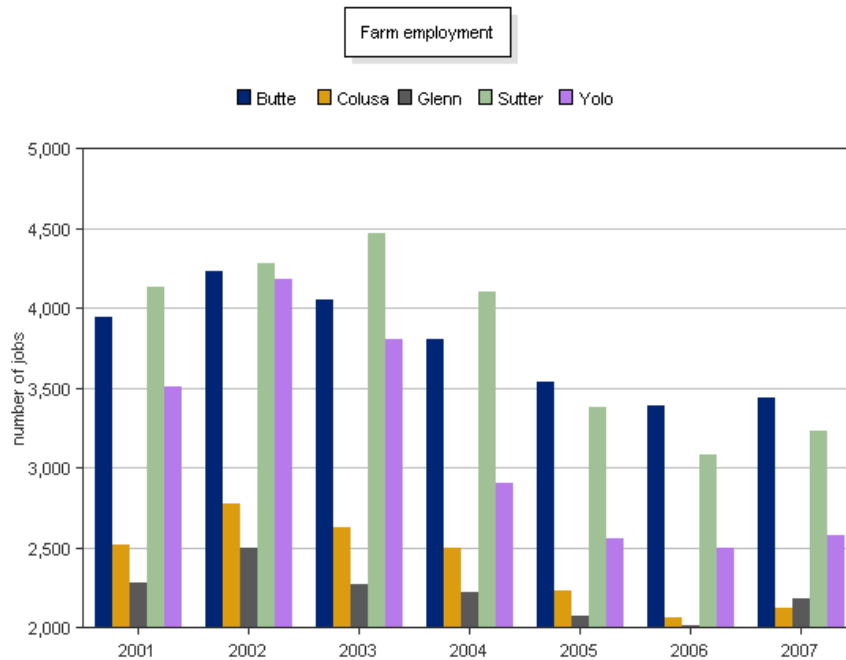
Sources:

- (1) California Department of Finance 2007.
- (2) U.S. Bureau of Economic Analysis 2007a.
- (3) California Employment Development Department 2009.
- (4) U.S. Census Bureau 2007.
- (5) U.S. Census Bureau 2008.

Notes:

- (a) The U.S. Bureau of Economic Analysis defines Farm Employment as: the number of workers engaged in the direct production of agricultural commodities, either livestock or crops; whether as a sole proprietor, partner, or hired laborer.
- (b) Farm worker employment shown is 83.2 percent of reported total farm employment.
- (c) Unemployment rate numbers are not seasonally adjusted.

Figure 3.14-1 depicts total farm employment in potentially affected counties measured over seven years by the U.S. Bureau of Economic Analysis (2007b). Farm worker employment is about 83.2 percent of reported total farm employment. During 2001 to 2007, farm worker employment has fluctuated. These changes are likely because farmers idle land temporarily under existing conditions, while other farmers place previously idled land back into production.



Source: U.S. Bureau of Economic Analysis 2007b.

Figure 3.14-1: Farm Employment – Potentially Affected Counties

The California Employment Development Department makes projections of employment by industry throughout the state. The most recent farm employment projections were made in 2006 and projections go up to 2016 (California Employment Development Department 2006). Table 3.14-3 summarizes this data.

Table 3.14-3. Total Farm Employment Projections

County	Total Farm Employment 2006	Total Farm Employment 2016	Percent Employment Change
Butte	2,500	2,200	-12%
Colusa and Glenn ¹	5,160	5,000	-3.1%
Sutter	4,500	4,500	0.0%
Yolo ³	7,500	8,200	9.3%

Source: California Employment Development Department 2006.

Notes: ¹ Glenn and Colusa are reported as part of the North Valley Region.

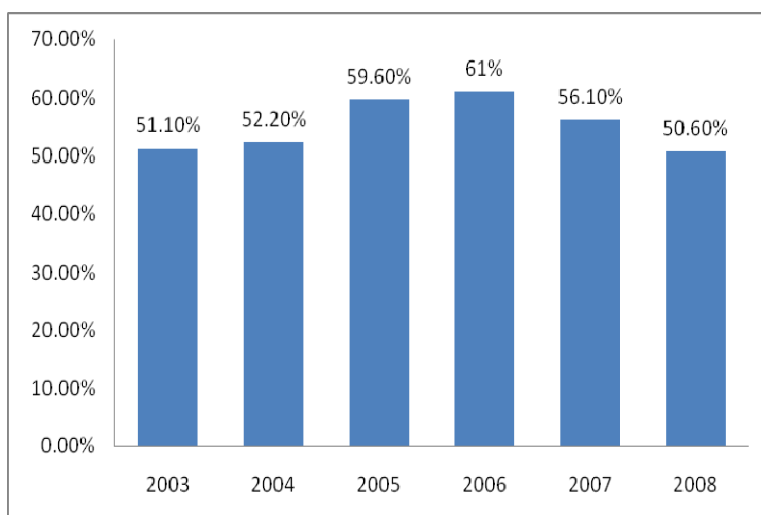
² Sutter County data is grouped with Yuba into the Yuba City Metropolitan Statistical Area.

³ Yolo County is reported as part of the Sacramento-Arden Arcade-Roseville MSA

3.14.1.2 Farm Worker Profiles

The 2008 Agricultural Employment Report (California Employment Development Department 2008a) states that Hispanics made up more than two-third (67.9 percent) of the state's agricultural labor force that year. Other races,

including African Americans and Asians, made up much smaller percentages with only 1.3 percent and 1.0 percent, respectively. Additionally, over half (52.1 percent) of the agricultural labor force in the state in 2008 was classified as “foreign-born, not a U.S. citizen,” in contrast to the less than one-fifth (18.6 percent) of the non-agricultural labor force that was identified as “foreign-born, not a U.S. citizen.” Figure 3.14-2 summarizes the percentage of foreign-born noncitizens in the agricultural workforce 2003–2008.



Source: California Employment Development Department 2008a.

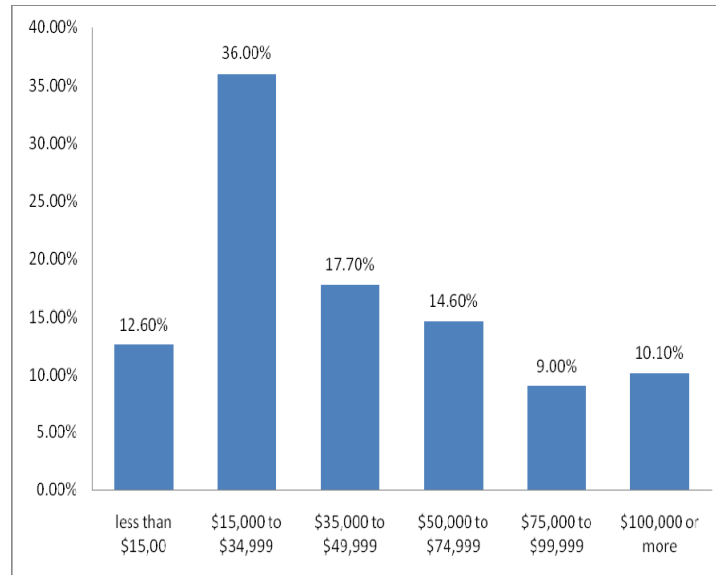
Figure 3.14-2: Percentage of Foreign-Born Noncitizen Agricultural Workers, 2003–2008

The average farm worker hourly income¹¹ in the Sacramento Valley (including potentially affected counties) in 2008 was \$10.99. In comparison, the average farm worker hourly income in the San Joaquin Valley in 2008 was \$10.48 and \$10.90 in the Central Coast Region (California Employment Development Department 2008b).

The unemployment rate among agricultural workers in California in 2008 was 14 percent. This is an increase from 8.5 percent in 2007 (10.9 percent in 2006). The agricultural worker unemployment rate is also higher than the unemployment rates for nonagricultural workers throughout the state, which was 6.4 percent in 2008, 4.7 percent in 2007, and 4.3 percent in 2006 (California Employment Development Department 2008a). In 2008, close to half of the state’s agricultural workers reported an annual family income of less than \$35,000. One out of every eight agricultural workers reported an annual

¹¹ Annual Earnings are computed by the California Employment Development Department for Total Agriculture, Total Production, and Total Crop Production. The averages listed here are for Total Crop Production only.

family income of less than \$15,000. Figure 3.14-3 shows the annual family income distribution of agricultural workers in the state in 2008.



Source: California Employment Development Department 2008a.

Figure 3.14-3: Family Income Distribution for Agricultural Workers in 2008

3.14.2 Environmental Consequences

3.14.2.1 No Action

Under the No Action Alternative, Reclamation would not approve the proposed transfers of water to buyers in 2010 and 2011. Because other transfers might occur under the No Action Alternative, cropland idling could still happen in counties upstream from the Delta in response to potential water shortages. In addition, farmers would continue to fallow some land temporarily under normal farm practices. At the same time, other farmers would place previously fallowed land back into production. As described in Section 3.5.1, several government-sponsored programs would also likely retire land for restoration and habitat purposes. These actions would take agricultural land out of production permanently. This would be a permanent, but likely small, effect to environmental justice.

In the Export Service Area, some agricultural land would be taken out of production due to water shortages. Other transfers would provide some water, but would not likely relieve the total water shortage. Agricultural uses are often the first to be cut in a water shortage, which would reduce farm labor opportunities. The size of employment reductions would depend on the length and severity of the shortage. If long-term, there would be an adverse impact to

environmental justice populations under the No Action Alternative as low income and minority populations would lose job opportunities.

3.14.2.2 Proposed Action

Cropland idling/crop shifting transfers could result in disproportionate effects to low-income and minority populations. The maximum amount of water made available by cropland idling/crop shifting would be 109,469 acre feet in Colusa, Glenn, Sutter, and Yolo counties. It is assumed that the majority of cropland idled would be rice fields. If only rice fields were idled, the maximum acreage from idling from CVP sellers would be about 33,172 acres. The acreage would increase if farmers choose to idle other field crops because they offer less water available for transfer than rice. Because of the farm worker profile, cropland idling could have disproportionate effects on low income and minority farm workers.

The farm labor effects of cropland idling actions would be similar to the effects described in the 2004 Final EWA EIS/EIR; however, cropland idling transfers included in the Proposed Action are less than those analyzed for the EWA. The 2004 Final EWA EIS/EIR calculated that cropland idling would decrease farm worker jobs; however, the majority of job losses due to cropland idling would affect other labor categories, such as administrative jobs and jobs related to agriculture related businesses (Reclamation 2004, pg. 19-10). The analysis indicated that less than 3 percent of total county farm labor would be affected by water transfers. As part of the water transfer approval process, Reclamation will follow the Environmental Commitment that would limit cropland idling to no more than 20 percent of the eligible crops in any county in one year. Therefore, cropland idling would not result in a disproportionate effect on minority and low-income employment.

In general, crop shifting would have smaller labor effects than cropland idling because farmers would continue to produce a crop and would still hire farm labor. Crop shifting would result in no disproportionate effect on minority and low-income employment.

Water transfers to agricultural areas in the Export Service Area could affect environmental justice. Water transfers under the Proposed Action would provide water to agricultural users in the Export Service Area. Increased water supply in agricultural areas would allow farmers increase irrigation and possibly put previously idled land back into production. Increased irrigation could increase farm employment as farmers produce more crops. This would be a beneficial effect to environmental justice populations.

3.15 Climate Change

3.15.1 Affected Environment

The United Nations Intergovernmental Panel on Climate Change 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 2007). 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 2005 update of the California Water Plan (Bulletin 160-05) as a key consideration in planning for the State's future water management (DWR 2005a). The 2005 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 quantitatively evaluate climate change effects for the next Water Plan update.

Sea level rise would conceptually affect Project operations by increasing the need for operations to repulse salt water intruding into the Delta. Such effects have not been examined because of the lack of existing tools for analysis. Climate change is unlikely to make a noticeable difference in operations during the two year period of this EA; therefore, this EA does not try to analyze those changes.

The CARB finalized the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions (17 CCR 95100) for major sources of greenhouse gases (GHG). The regulation requires any facility with stationary combustion sources to report if emissions are greater than or equal to 25,000 metric tons per year of CO₂.

3.15.2 Environmental Consequences

3.15.2.1 No Action

The No Action Alternative would have no effect on climate change.

3.15.2.2 Proposed Action

Use of diesel-fueled engines for groundwater pumping for groundwater substitution transfers could increase greenhouse gas emissions. The Proposed Action would have no construction element and would use existing facilities within the range of normal operations; however, emissions of GHG could increase through the use of diesel-fueled engines for groundwater pumping.

A quantitative analysis was completed to evaluate the impacts of GHG emissions. Emissions of GHG that form as a result of combustion, carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O), were estimated based on the maximum volume of water used for groundwater substitution. Emissions of carbon dioxide equivalent (CO₂e) were estimated using the global warming potential, or the heat-trapping ability of a gas, used by CARB in its Regulation for the Mandatory Reporting of Greenhouse Gases (17 CCR 95100). Table 3.15-1 provides a summary of GHG emissions.

Since emissions of CO₂ are less than 25,000 metric tons per year, the threshold used by CARB in its mandatory reporting rule, the Proposed Action would not result in substantial adverse effects to climate change.

Table 3.15-1. Emissions Inventory for Greenhouse Gases

Water Agency	County	CO2e Emissions (metric tons per year)			
		CO2	CH4	N2O	Total
Sacramento River Area of Analysis					
Colusa Indian Community Council/Cachil Dehe Band of Wintun Indians	Colusa	76	0	1	78
Conaway Preservation Group	Yolo	2,056	13	38	2,107
Cranmore Farms (Pinnacle Land Ventures, LLC or Broomieside Farms)	Sutter	1,530	10	28	1,567
Dunnigan WD	Yolo	229	1	4	235
Glenn-Colusa Irrigation District	Glenn and Colusa	3,060	19	56	3,135
Meridian Farms	Sutter	306	2	6	313
Natomas Central MWC	Sutter and Sacramento	1,530	10	28	1,567
Pelger MWC	Sutter	574	4	11	588
Pleasant Grove-Verona MWC	Sutter	1,530	10	28	1,567
Reclamation District 108	Colusa and Yolo	765	5	14	784
Reclamation District 1004	Glenn and Colusa	1,530	10	28	1,567
River Garden Farms	Yolo	1,224	8	22	1,254
Sacramento River Ranch	Yolo	492	3	9	505
Sycamore MWC	Colusa	1,530	10	28	1,567
American River Area of Analysis					
City of Sacramento	Sacramento	459	3	8	470
Total		16,891	105	310	17,306

3.16 Visual Resources

3.16.1 Affected Environment

The affected environment for visual resources includes Colusa, Glenn, Sutter, Sacramento, and Yolo counties where cropland idling and groundwater substitution transfers could occur. The general area is bordered on the east by the Sierra Nevada, on the northwest by the Coast Ranges, and on the south by the northern extent of the San Joaquin River watershed. The northern border for this region is the border of Glenn County in the Central Valley. Agriculture in the Central 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. Scenic stream corridors in the foothills include the American River and its smaller tributaries.

Because the nature of landscape analysis is very subjective, visual resource analyses are generally qualitative. Assessment methods are guided by the Scenery Management System developed by the United States Department of Agriculture, Forest Service in 1995. Visual resources are characterized as Class A, B, or C, as described below (United States Department of Agriculture, Forest Service 1995).

- 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, pattern, and balance.
- Class B - “typical”: Areas where features combine to provide ordinary or common scenic quality. These landscapes generally have positive, yet common, attributes of variety, unity, vividness, mystery, intactness, order, harmony, uniqueness, pattern, and balance.
- Class C – “indistinctive”: Areas where land use has low scenic quality. Often forms of any consequence are missing in Class C landscapes, which have weak or missing attributes of variety, unity, vividness, mystery, intactness, order, harmony, uniqueness, pattern, and balance.

Class A and B 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.

Historical changes from grasslands, floodplains, and extensive riparian areas to cropland, rice fields, and orchards have altered the visual variety in the Sacramento Valley. The valley floor is primarily irrigated agriculture that is

Class C – the least visually distinctive category. Important (Class A or B) visual resources on the valley floor include the Sacramento National Wildlife Refuge (NWR) Complex, which contains the Sacramento NWR, Colusa NWR, Delevan NWR, Sacramento River NWR, Sutter NWR, and Butte Sink NWR.

Reservoirs in the region have the greatest level of scenic attractiveness when at their maximum operating levels. Reservoirs are generally Class A or B visual resources when their water surface elevations are near to or at their maximum. As drawdown occurs during the summer and fall, an increasing area of shoreline devoid of vegetation, commonly referred to as a “bathtub ring,” 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. As a consequence of reservoir operations, the level of scenic attractiveness tends to decline in July and August with increasing drawdown.

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 flow regulations in place. Flow requirements for the various rivers and streams may be found in SWRCB water right permits or licenses, Federal Energy Regulatory Commission hydropower licenses, and interagency agreements. Because there are minimum flow requirements and the flows are managed, riparian vegetation along the rivers reflects the results of current management practices. These practices include levees for flood control, managed floodplains and overflow bypasses, and controlled releases from reservoirs, and result in a narrow riparian corridor. 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. In addition, riparian areas are popular wildlife habitat as they offer food, water, and protection from both the sun and from large-scale human disturbance.

Highways with high viewer sensitivity in the area of analysis include: Interstate 5, Highway 99, and State Routes 70 and 20. Agricultural areas along these highways and other roads in the Central Valley are generally Class C. The only upland elevations in the northern Central Valley upstream from the Delta are 32,000 acres in the Sutter Buttes. Rising from the valley floor, the Sutter Buttes, generally a Class A visual resource, provide visual drama from a wide viewing area.

3.16.2 Environmental Consequences

3.16.2.1 No Action Alternative

Under the No Action Alternative, reservoirs would be operated similar to historic conditions and water levels would increase and decrease according to normal operations. River flows would also remain similar to existing conditions. Farming practices would not change from existing conditions, as farmers would

continue to temporarily take land out of production and place other land back into production. The No Action Alternative would have no effects on visual resources.

3.16.2.2 Proposed Action

The Proposed Action does not involve construction, introduction of new scenic features, or activities that would visually change the landscape for more than one season. Therefore, there would be no permanent visual effects associated with transfers under the Proposed Action. The Proposed Action could, however, result in temporary or seasonal changes in the visual landscape.

Cropland idling water transfers would result in temporary conversion of lands from planted crops to dry fields during the summer growing season, which could change the visual landscape. As discussed in Section 2.2.3.2, rice provides the highest water yield per acre and is the mostly likely crop that would be idled. A portion of this area's rice acreage, near Interstate 5 and Highway 99, is visible to large numbers of viewers. The specific locations where rice farmland idling would occur are unknown, so it is also unknown whether the idled land would be visible to the general public. Rice acreage is generally considered a Class C visual resource. Each year, some portions of the existing rice acres are idled, creating a patchwork of flooded and dry fields. The Proposed Action would not affect the Class C rating of rice acreage because idling only changes the mosaic pattern of farmland practices and does not add a new visual feature to the landscape. Therefore, there would be no effect on the character of the landscape or visual attractiveness in the area.

Waterfowl use flooded agricultural land during the summer for brood, cover, and rearing habitat, and during migratory periods and winter for cover and forage. During the winter, large numbers of waterfowl can occasionally be observed in rice fields, increasing the visual attractiveness of the area, when the fields are flooded for rice decomposition. In the summer, the dry fields can create upland habitats suitable for raptors and their prey, increasing a potential for viewing different types of wildlife. Cropland idling is not a permanent practice, and any visual effects of reduce wildlife viewing would be temporary. Wildlife viewing opportunities at refuges would not change under the Proposed Action.

Groundwater substitution and cropland idling/shifting water transfers could change Sacramento River flows. Transfer of water via groundwater substitution and cropland idling/shifting could decrease flows in the Sacramento River if water is retained in Shasta Reservoir until Delta pumping availability in the July through September transfer period. The reduction would represent a minimal decrease in flow and would not result in a visual effect. The Sacramento River is generally considered a Class B visual resource. The decreases in flow would be insufficient to reduce the riparian vegetation corridor along the river. The minimal percent reduction of flow and the temporary nature of the decrease

would not change the character of the landscape or detract from the overall scenic attractiveness of the Sacramento River.

Sacramento River flows downstream from Shasta Reservoir or the point of diversion would increase July through September relative to the No Action Alternative. Flow increases would not change the character of the landscape; therefore, there would be no adverse effect on visual resources.

Groundwater substitution and cropland idling/shifting water transfers could change the timing of releases from Shasta Reservoir. Reclamation would strive to retain surface water made available in upstream storage facilities until the Delta export pumps have the capacity to convey water south. If water is retained in the reservoir, water levels would be higher during those months. The water level would then decline faster in July and August, and September as water for transfers is released; however, levels at the end of the pumping period would be the same as under the No Action Alternative. The same total amount of surface water would be released with water transfer actions as without the water transfers. Differences in water levels from the Proposed Action would not change the character of the landscape or scenic attractiveness (Class A or B) of Shasta Reservoir. The existing “bathtub” ring would be large enough that an additional minor drop would not result in any major visible effects. Reduction of surface water elevation also would have minimal effect on the visual features of riparian vegetation along the banks.

If water is not retained in Shasta Reservoir, there would be no change to visual resources under the Proposed Action because water would be released under the same pattern as the No Action Alternative.

Groundwater substitution water transfers would increase flows in the lower American River downstream from Folsom Reservoir from July through September. Releases would increase relative to the No Action Alternative as transferred water is released for pumping through the Delta. Given the limited amount of water available for transfer through groundwater substitution on the American River (up to 3,000 acre feet), flow increases would not change the character of the landscape; therefore, there would be no adverse effect.

Groundwater substitution water transfers would change surface water elevations in Folsom Reservoir. During July and August, the surface water elevation at Folsom Reservoir would be lower than under the No Action Alternative as water is released for Delta pumping. Water levels at the end of September would be the same as under the No Action Alternative because the same total amount of surface water would be released by the end of September with water transfer actions as without the water transfers. The small changes in surface water elevation from releases of transfer water (up to 3,000 acre feet under the Proposed Action) would have little effect on Class A or B visual resources of Folsom Reservoir; therefore, any visual effect would be minor.

3.17 Growth Inducing Impacts

Sections 1502.16(b) and 1508.8(b) of the CEQ NEPA Regulations require analysis of direct and indirect impacts of growth-inducing effects. Growth-inducing effects under NEPA are a subset of indirect effects, which are defined as effects “which are caused by the action and occur later in time or are farther removed in distance, but are still reasonably foreseeable” (40 Code of Federal Regulations 1508.8(b)).

Direct growth-inducing impacts generally stem from the construction of new housing, businesses, or infrastructure. Indirect growth inducement could result if a project establishes substantial new permanent employment opportunities or if it would remove obstacles hindering population growth such as the expansion or the provision of urban services and infrastructure in an undeveloped area. Induced growth is generally considered to be a substantial impact only if it directly (or indirectly) affects the ability of agencies to provide needed public services, or if it can be demonstrated that the potential growth substantially affects the environment.

The Proposed Action would only be implemented for two years and would not be a permanent water supply. Water transfers would not directly alter or induce growth within the agencies jurisdictions beyond what has already been planned. Buyers would use the water transferred under the Proposed Action for existing demand subject to certain needs criteria. Water transfers would not induce agricultural growth because transfer water must be used on fields that have been irrigated the past three years. The Proposed Action would have no growth inducing impacts.

3.18 Cumulative Effects

This section describes cumulative effects of the 2010-2011 Water Transfer Program for each resource area. The Council on Environmental Quality (CEQ) NEPA regulations require an analysis of direct and indirect 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 [Code of Federal Regulations] 1508.8). NEPA defines a cumulative effect as “ the impact of 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 CFR 1508.7).

3.18.1 Projects in the Cumulative Analysis

The cumulative analysis considers other potential water transfers that could occur in the 2010 and 2011 transfer season, including non-CVP water transfers and other existing water transfer programs. Table 3.18-1 lists entities who have indicated interest in providing non-CVP water for transfer, which are also shown on Figure 3.18-1. With CVP sellers, the cumulative total amount potentially transferred from all sources would be up to about 415,788 acre feet. As previously described for potential CVP sellers, the numbers presented in Table 3.18-1 are estimates and do not necessarily reflect the amount of water that would be available. These estimates reflect the potential upper limit of available water in order to include the maximum extent of potential transfers in the environmental analysis.

Reservoir re-operation is an available transfer method that is not proposed for CVP sellers in 2010 and 2011, but may be used by other non-CVP sellers. Under this transfer, sellers would sell water available from local storage reservoirs. Programs that allow stored reservoir transfers typically require sellers to demonstrate that stored water released for transfer would be in addition to the quantity of water normally released under historical and projected reservoir operations. Conservation is another potential water transfer method included in the cumulative analysis. Sellers would reduce consumptive water use and sell conserved water to buyers. For conservation to be approved, sellers must provide evidence of a measurable quantity of consumptive use savings. The Browns Valley ID transfer via conservation has been documented in the Analysis of Water Conserved under the Upper Main Water Conservation Project (2002) and was approved in past transfer programs in 2004 and 2007 through 2009.

As previously mentioned, other transfers may occur in 2010 and 2011, including water transferred under the Lower Yuba River Accord. Local projects involving groundwater may be implemented, such as the Stony Creek Fan Aquifer Performance Testing Plan and further investigations of the Lower Tuscan Aquifer.

The Sacramento Valley Water Management Program (SVWMP) has identified short-term and long-term projects to protect Northern California water rights, including groundwater planning and monitoring projects, providing for unmet demands in the Sacramento Valley, system improvement and water use efficiency measures, conjunctive management and surface water re-operation projects. The SVWMP will not be implemented until after the Proposed Action is complete; therefore, it is not considered in the cumulative analysis. The Proposed Action would not have any residual effects to the SVWMP, when it is implemented.

Table 3.18-1 Potential Non-CVP Sellers (Upper Limits)

(Acre feet)				
Water Agency	Stored Reservoir Water	Groundwater Substitution	Cropland idling/ Substitution	Other
Sacramento River Area of Analysis				
Tule Basin Farms, LLC (Sutter)		6,400	6,400	
Feather River Area of Analysis				
Brown's Valley ID (Yuba)	7,000			3,100 conserved water
Butte WD (Butte and Sutter)		5,000	10,000	
Garden Highway MWC (Sutter)		7,500		
Goose Club Farms (Sutter)			6,000	
Richvale ID (Butte)			12,000	
South Sutter WD (Sutter and Placer)	10,000			
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	
American River Area of Analysis				
City of Folsom (Sacramento)	2,000			
Placer County WA (Placer)	20,000			
Sacramento County WA (Sacramento)		10,000		
Sacramento Suburban WD (Sacramento)		12,000		
Merced/San Joaquin River Area of Analysis				
Merced ID (Merced)	15,000			
Delta Area of Analysis				
Reclamation District 2068 (Solano)		1,000	7,000	
Samra Family Trust (Sacramento)			2,000	
Smith Farms (Yolo)			3,960	
Subtotal	54,000	48,700	90,110	3,100
Total				195,910

Abbreviations:

GW: Groundwater

ID: Irrigation District

MWC: Mutual Water Company

WA: Water Agency

WD: Water District

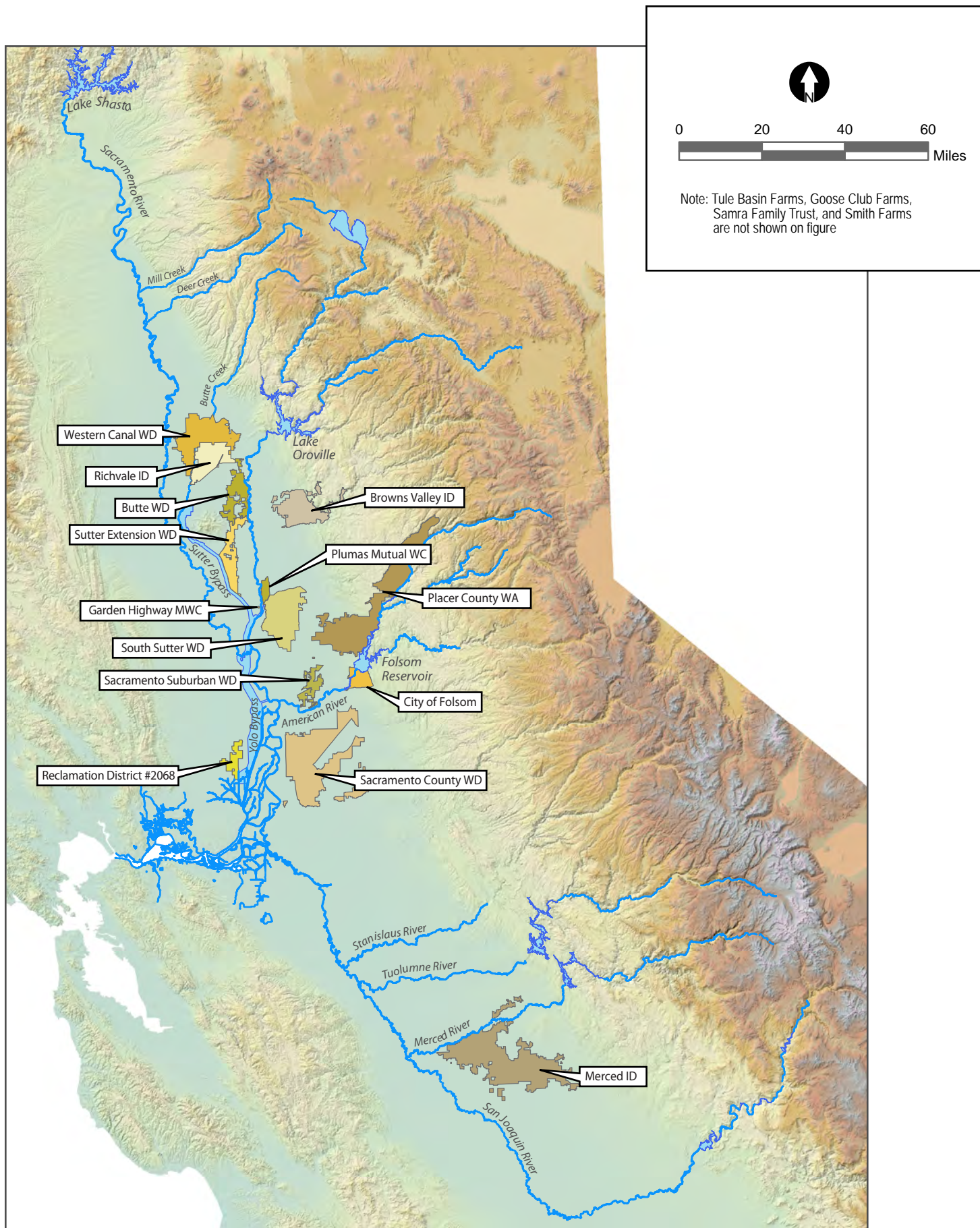


Figure 3.18-1. Cumulative Sellers

It is anticipated that groundwater use may increase in 2010 and 2011, given the current hydrologic forecast and anticipated shortages in surface water supplies. Cropland idling actions would also likely continue as part of routine crop rotation practices and in response to hydrologic conditions. Farmers may also continue to use groundwater to supplement surface water supplies.

3.18.2 Surface Water

Other water transfer programs in the cumulative condition would create additional changes in the timing and quantity of water released from reservoirs, altering river flows.

Cropland idling would reduce the water supply for users who rely on return flows from fields that would be idled under the water transfer. Cropland idling under the Proposed Action and other cumulative programs could reduce return flows and result in a cumulative impact. However, under the Proposed Action, sellers will be required to maintain flows at the downstream end of their distribution system to minimize potential water supply effects to neighboring and downstream water users. Downstream users' water use would not be affected by implementation of water transfers. The Proposed Action would not contribute to a cumulative impact to water supply.

The Proposed Action does not include stored reservoir water transfers and would not result in cumulative effects to surface water from stored reservoir transfers.

3.18.3 Groundwater

The reduction in recharge due to the decrease in precipitation and runoff in the past years in addition to the increase in groundwater transfers would lower groundwater levels. Multi-year groundwater acquisition under cumulative programs operating in similar areas of the Sacramento Valley could further reduce groundwater levels. Groundwater levels may not fully recover following a transfer and may experience a substantial net decline in groundwater levels over several years. This would be a substantial cumulative effect.

Reclamation requires well review, monitoring, and mitigation to reduce effects to third party groundwater users for approval of transfers. Requirements are detailed in the Technical Information for Water Transfers in 2010. Only wells that meet the well acceptance criteria will be allowed to participate in a transfer. Reclamation will not approve transfers if appropriate monitoring and mitigation does not occur. Monitoring and mitigation programs would reduce cumulative groundwater effects. Reclamation will perform field checks to ensure that monitoring and mitigation are appropriately implemented and groundwater effects do not occur. Coordination of groundwater programs in the Sacramento

Valley would also minimize and avoid the potential for cumulative effects to groundwater resources. DWR is involved in multiple groundwater programs in the Sacramento Valley, including monitoring programs. Reclamation will work with DWR to track program activities, collect and combine data, and assess potential groundwater effects. Because of the required groundwater monitoring and mitigation for transfer approval and agency coordination, the Proposed Action would not contribute to cumulative effects to groundwater.

3.18.4 Water Quality

Water transfers could decrease water surface elevations and storage levels in reservoirs, resulting in adverse effects to water quality, such as an increase in concentrations of constituents. All water transfers that use CVP reservoirs require Reclamation approval. Cumulative transfer would not likely be of sufficient size to alter reservoir water quality or temperature. If the potential exists, Reclamation would not approve transfers that would adversely affect reservoir quality that would affect downstream users. There would be no cumulative effects to reservoir water quality.

Cumulative programs could further reduce river flow during the summer and further increase flow in the fall. Overall, flow rates will be governed by established regulatory requirements for anadromous and riverine fish, through existing biological opinions and Delta water quality standards, which would prevent flow rates from increasing or decreasing in a manner that would be cumulatively harmful to resources.

3.18.5 Geology and Soils

Although erodible soils exist in the counties upstream from the Delta, conditions (both existing management practices and weather conditions) are not favorable for erosion of soils in this region. Therefore, soil loss from the Proposed Action in combination with other programs would not likely produce a cumulative impact.

3.18.6 Agricultural Land Use

Cropland idling by other foreseeable water acquisition programs would be on a voluntary, year-by-year basis. Farmers can choose to offer their water for sale to any operating water transfer, subject to Project conditions. The farmers can then decide to resume planting in the subsequent season. Therefore, cropland idling would be a temporary effect and would not permanently alter any land use patterns. Water transfers also would not result in any land being converted to incompatible uses. Land classifications could change under the cumulative condition if parcels are repeatedly idled under other programs. The Proposed

Action would only be implemented for two years and would not contribute to any long-term changes in land classifications. The Proposed Action would not contribute to any potential cumulative effects to land use.

3.18.7 Vegetation and Wildlife

The Proposed Action would be cumulative with other water transfer affecting the project area. Water transfers would be operated in a coordinated fashion to minimize impacts to the environment as Reclamation and DWR must approve all transfers that relate to CVP/SWP supplies and facilities. Water transfer sellers must monitor rice idling transfers under the cumulative condition to ensure that a maximum of 20 percent of rice acreage would be idled in each county. In addition, crop idling patterns and other minimization measures would be required for approval of transfers by Reclamation and DWR. Through these commitments, the cumulative effects of transfers on vegetation and wildlife would not be substantial.

3.18.8 Fishery Resources

The 2010-2011 Water Transfer Program will be operated under the environmental commitments listed in Section 2. Environmental Commitments include meeting flow and temperature requirements in the North of Delta Area rivers, minimizing the effects of groundwater pumping on streamflow, making release water flows similar to what would occur without cropland idling, making water transfers through the Delta in July through September, when most the most sensitive lifestages of the management species and particularly listed species are absent. Through these environmental commitments, the Proposed Action would not adversely affect fish species of special management concern. Other water transfer programs would need to operate under similar commitments. There would be no cumulative impacts to fishery resources.

3.18.9 Special Status Species

The 2010-2011 Water Transfer Program includes environmental commitments to reduce potential effects to special status species. Other water transfer using Federal and State facilities would be required to have similar conservation measures to protect special status species. Approval of these transfers would be coordinated to make sure that the cumulative transfers would not result in the idling of more than 20 percent of the rice fields in any county.

The frequency and magnitude of rice land idling would likely increase through implementation of water transfer programs in the future. Increased rice idling transfers could result in chronic adverse effects to GGS and their habitats and may result in long-term degradation to snake populations in the lower

Sacramento Valley. The 2009 Biological Opinion for the 2009 Drought Water Bank included Reasonable and Prudent Measures (RPMs), which are incorporated in the Environmental Commitments described in Section 2.3, to protect GGS habitat. The USFWS concluded that the 2009 Drought Water Bank was unlikely to jeopardize the GGS population. As these measures are incorporated in the 2010-2011 Water Transfer Program, the Program would not contribute to cumulative impacts to the GGS. Conservation measures proposed for GGS would also benefit the black tern and western pond turtle. Based on these measures, water transfers under the 2010-2011 Water Transfer Program would not contribute to cumulative impacts to the black tern.

It is likely that most cropland idling water transfers would involve rice crops. If other upland crops are idled, rather than shifted, there could be some cumulative effects to other species. The Environmental Commitments described for the black tern and GGS such as minimizing the block size and avoiding cropland idling actions that could result in the substantial loss or degradation of suitable habitat could also be applied to upland cropland. This would reduce effects Aleutian Canada goose, California gull, greater sandhill crane, long-billed curlew, mountain plover, northern harrier, Swainson's hawk, tricolored blackbird, western burrowing owl, white-faced ibis, and white-tailed kite.

As a result of these measures, there would be no cumulative impacts to special status species. The 2010-2011 Water Transfer Program would not contribute to potential cumulative effects to special status species.

3.18.10 Air Quality

In the areas upstream from the Delta, other sources would contribute to NO_x emissions from groundwater pumping, including increased groundwater use due to decreased surface water supplies, and potential water transfers outside of the 2010-2011 Water Transfer Program. A review of cumulative groundwater substitution transfers indicates that NO_x emissions would not exceed 50 tons per year for all non-attainment areas from the operation of the engines. Cumulative emissions would not exceed regulatory thresholds.

3.18.11 Power Generation

Cumulative water transfer programs would have similar impacts to power generation as the Proposed Action. Power generation would increase when stored reservoir water would be released between July and September. Power generation would decrease by the same amount during refill (December through April). It is unknown whether this shift in timing would affect the value of the hydropower generation. Altering water release patterns (power production) could produce positive or negative effects. Reclamation and DWR would likely incorporate provisions for potential decreases in revenue from power production

when approving transfers. There would be no cumulative effects to power generation.

3.18.12 Cultural Resources

Cumulative effects analysis for cultural resources focuses on programs that potentially acquire water through stored reservoir water purchase and cropland idling. All transfers that lower reservoirs could incrementally increase the drawdown zone to beyond the historic operational levels. Reclamation would operate reservoirs so that transfers do not draw water levels below historic operating conditions; therefore, there would be no cumulative impacts to cultural resources. The Proposed Action does not include stored reservoir purchases from local reservoirs and would not contribute to any cumulative effects to cultural resources in local reservoirs.

3.18.13 Socioeconomics

Reclamation requires sellers to monitor other cropland idling transfers in the region, including amount of water transfers and amount of crop acres idled (Reclamation and DWR 2009). Reclamation limits the purchase of water via cropland idling to 20 percent of the irrigated acreage of a particular crop. Historic variations in crop acreage, employment and personal income in a county support the 20 percent limitation. The agricultural industry experiences normal variation in crop acreage and agricultural economies adapt to it. The economic analysis in the 2004 Final EWA EIS/EIR supports the 20 percent criteria to avoid substantial adverse effects to county economies (Reclamation 2004, pg 11-35). If cumulative cropland idling transfers exceed the 20 percent limit, Reclamation would not approve the transfer. This would limit cumulative economic effects of cropland idling in the Sacramento Valley.

3.18.14 Indian Trust Assets

The ITA cumulative analysis focuses only on those programs that potentially pose incrementally detrimental effects through groundwater substitution in all areas of the State. Groundwater substitution is a component of the 2010-2011 Water Transfer Program, potential water transfers outside of the Program, and agricultural practice. It is reasonable to assume that other groundwater usage programs could evolve in the foreseeable future. Increased groundwater substitution could affect ITAs if wells dry out on tribal lands or pumping costs substantially increase. All groundwater substitution acquisitions in the Sacramento Valley require notification of the Reclamation and DWR before such acquisitions are finalized in order for the agencies to fully execute their Indian Trust responsibilities. If needed, Reclamation will deliberate with subject

matter experts and consult with appropriate tribal and BIA officials to determine appropriate minimization measures to avoid impacts to ITAs.

3.18.15 Environmental Justice

Cropland idling transfers under multiple water transfer programs could adversely affect farm worker employment and result in potential environmental justice impacts to minority or low-income populations. As described above, Reclamation requires monitoring of cumulative cropland idling programs and limits cropland idling to 20 percent of the crop acreage in a county. In addition, cropland idling transfers are temporary. Farmers would presumably resume planting the next season and would hire farm laborers. The Proposed Action would not contribute substantially to cumulative effects.

3.18.16 Climate Change

The threshold contained in CARB's Regulation for the Mandatory Reporting of Greenhouse Gas Emissions (17 CCR 95100) for general stationary combustion sources (i.e., 25,000 metric tons CO₂ per year) was used to evaluate significance. Cumulative emissions from the diesel-fueled engines are expected to be 24,940 metric tons per year CO₂, which is less than regulatory thresholds.

3.18.17 Visual Resources

Other water transfer programs would also increase cropland idling and change the visual landscape of agricultural fields to barren fields. Agriculture is considered a Class C visual resource that does not contribute substantially to the overall visual character of the area. Changes to barren fields under crop idling transfers would not be a substantial visual effect. As a result, there would be minimal cumulative impacts to visual resources.

Chapter 4

Consultation and Coordination

An administrative draft of this Final EA has been circulated for review to staff at Reclamation and DWR.

4.1 Stakeholder Involvement

DWR and Reclamation held “roundtable discussion” meetings for all buyers and sellers interested in 2010 water transfers. The meetings were held on July 2, 2009. Discussions involved review of the 2009 Drought Water Bank and planning for water transfers in 2010 and 2011.

DWR and Reclamation also developed “Issue Papers” for cropland idling and groundwater substitution transfers. The issue papers discussed various challenges and improvements to implementing cropland idling and groundwater substitution transfers and proposed temporary solutions for the 2010-2011 Water Transfer Program. The issue papers were released for public review and comment. DWR and Reclamation held a meeting on October 9, 2009 to receive public comment on the issue papers. Written comments were also accepted. DWR and Reclamation incorporated comments into the Draft Technical Information for Water Transfers in 2010, which was released to the public on November 6, 2009. The document can be found on DWR’s website at <http://www.water.ca.gov/drought/transfers/#>.

Reclamation and DWR continue to work with interested buyers and sellers to implement water transfers in 2010 and 2011. Reclamation and DWR have contacted sellers to indicate if they are interested in selling water and through what transfer mechanism. Tables 2-1, 2-2, and 3.18-1 are the result of coordination with potential sellers and buyers.

Reclamation is also participating in development of the GGS Conservation Strategy with DWR, USFWS, and CDFG.

4.2 Endangered Species Act Section 7 Consultation

Reclamation has determined that the Proposed Action would not affect listed fish species beyond the effects that are being consulted on for the Long-term Operation of the SWP/CVP, and therefore the Proposed Action will be implemented subject to operational parameters of those Opinions. Reclamation has evaluated the effects of the Proposed Action on listed terrestrial species and critical habitats in the project area and has determined that the Proposed Action

is not likely to adversely affect the San Joaquin kit fox; and may adversely affect GGS. Reclamation is conducting Endangered Species Act Section 7 formal consultation with USFWS. Reclamation will complete formal consultation with USFWS prior to finalizing this EA.

Critical habitat for GGS and San Joaquin kit fox has not been designated and so would not be affected. Critical habitat occurs within the project area for Winter-run and Spring-run Chinook salmon (*Oncorhynchus tshawytscha*) and Central Valley steelhead (*O. mykiss*), but would not be affected because of environmental commitments to operate under regulatory requirements for operation of the CVP to meet flow and temperature targets.

4.3 Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) (1976, amended in 1996) governs marine fisheries management in U.S. federal waters through Fishery Management Plans. Essential Fish Habitat (EFH) was established under the 1996 amendments to the Magnuson-Stevens Act to identify and protect commercially valuable marine and anadromous fish habitat. All Federal Action agencies which fund, permit, or carry out activities which may adversely affect EFH are required to consult with NMFS regarding the potential effect of their actions on EFH. In addition, NMFS is required to give input on any state agency activities that might impact EFH. For any Federal action that may adversely affect EFH, the Federal agency must provide NMFS with a written assessment of the effects of that action on EFH (50 CFR 600.920 (e)(1)). NMFS then provides EFH Conservation Recommendations (305 (b)(4)(A) of Magnuson-Stevenson Act) and the Federal agency responds in writing to these recommendations.

EFH is defined in the Magnuson-Stevens Act as “...those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” The following important components of EFH must be adequate for spawning, rearing, and migration:

- Substrate composition
- Water quality
- Water quantity, depth, and velocity
- Channel gradient and stability
- Food
- Cover and habitat complexity
- Space

- Access and passage
- Habitat connectivity

NMFS issued a final rule on October 15, 2008 (73 FR 60987) to implement EFH identifications and descriptions for Pacific salmon included in Amendment 14 to the Pacific Salmon FMP (including Chinook, coho, and pink salmon). The Pacific Coast salmon fishery EFH extends along the Pacific coast from Washington to Point Conception in California. Freshwater EFH includes all habitats currently and historically accessible to salmon, and which provides suitable habitat for Chinook salmon. The area of analysis includes habitat that has been designated as EFH for fall-run/late fall-run Chinook salmon, a major contributor to Pacific Coast salmon fisheries. Under the Proposed Action, all regulatory requirements to provide flow and temperature for the Sacramento River and its tributaries would continue to be met. In addition, participants would be required to continue to provide flows to meet the needs of downstream water users, including refuges, which may support salmonids rearing during some portions of the year. Therefore, the Proposed Action would not substantially affect Essential Fish Habitat and therefore, consultation with NMFS is not required.

4.4 California Environmental Quality Act

Sellers will complete CEQA analysis or the SWRCB Water Code Section 1725 process for proposed water transfers in 2010 and 2011. Project proponents will also comply with California ESA under California Fish and Game Code Section 2080.1 or 2081.

4.5 Public Review

The Draft EA and Finding of No Significant Impact (FONSI) were released for a 15-day public review period beginning January 5, 2010 and ending January 19, 2010. The documents were posted on Reclamation's website. A press release was issued on January 4, 2010 by the Bureau of Reclamation's Mid-Pacific Regional Public Affairs Office. Reclamation received comments on the Draft EA. The Final EA reflects edits based on comments received. Appendix D includes responses to comments and copies of the comment letters are in Appendix E.

Chapter 5

List of Preparers

This chapter lists the authors of this document and those who contributed to the development of this document.

Table 5.1. List of Preparers

Tim Rust Bureau of Reclamation Program Manager	28 years experience in water resources in the public and private sectors	Program Manager
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John Wondolleck CDM Associate	33 years of experience in resource development, toxic substance releases, and environmental planning	Technical Direction, Document Review
Anthony Skidmore CDM Vice President	30 years experience in NEPA/CEQA compliance	Technical Direction, Document Review
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2010-2011 Water Transfer Program
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Chris Park CDM Environmental Planner	4 years of experience in water resources planning and environmental compliance	Water Quality, Graphics
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Larry Wise Entrix Biologist	20 years of experience in fisheries and terrestrial biology	Vegetation and Wildlife, Fishery Resources, Special Status Species
John Holson Pacific Legacy Cultural Specialist	30 years of experience in cultural resources management	Cultural Resources
Julie Hinchcliff CDM Administrative Assistant	30 years of word processing and production experience	Word Processing and Production
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