Section 3.4 Geology and Soils

This section presents the existing conditions of geology and soils within the area of analysis and discusses potential effects on geology and soils from the proposed alternatives.

Because long-term water transfers would not involve the construction or modification of infrastructure that could be adversely affected by seismic events, seismicity is not discussed in this section. Further, the alternatives do not require construction activities; therefore, people and/or structures would not be exposed to geologic hazards such as ground failure or liquefaction. The focus of this section is on the chemical processes, properties, and potential erodibility of soils due to cropland idling transfers. This analysis considers how factors such as surface soil texture, wind velocity and duration, and shrink-swell potential may affect soils. Crop shifting, groundwater substitution, conservation, and stored reservoir release transfers are not expected to affect geology and soils, and thus are not further discussed in this section. Section 3.3, Groundwater Resources, evaluates groundwater substitution transfers in detail and discusses geomorphology and land subsidence. Section 3.2, Water Quality, discusses the potential for salts and other toxic substances to be transported by water or wind to adjacent fields.

3.4.1 Affected Environment/ Environmental Setting

3.4.1.1 Area of Analysis

Figure 3.4-1 shows the area of analysis for geology and soils. The area of analysis for geology and soils is composed of counties in the Seller Service Area in which cropland idling transfers could originate and counties in the Buyer Service Area where transferred water would be used for agricultural purposes. Counties in the Seller Service Area include Glenn, Colusa, Butte, Sutter, Yolo, and Solano counties and counties in the Buyer Service Area include San Joaquin, Stanislaus, Merced, San Benito, Fresno, and Kings counties.

Figure 3.4-1. Geology and Soils Area of Analysis

3.4.1.2 Existing Conditions

Potential geologic and soil effects associated with cropland idling water transfers are related to soil erosion and soil expansiveness.

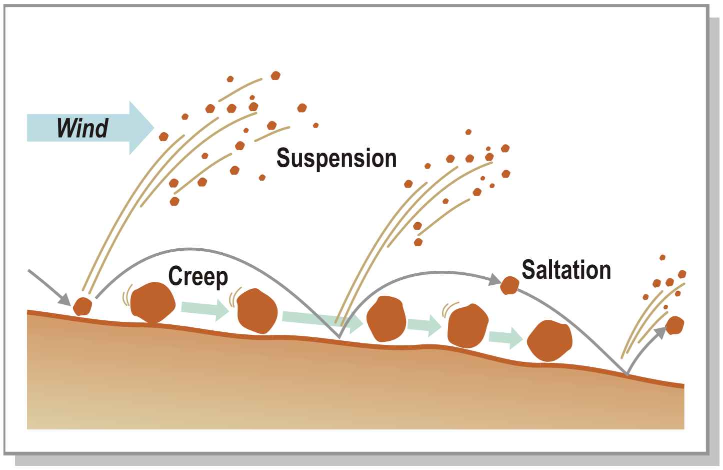
3.4.1.2.1 Soil Erosion by Wind

Soil erosion by wind is a complex process involving detachment, transport, sorting, abrasion, avalanching, and deposition of soil particles. Winds above a threshold velocity (13 miles per hour at one foot above ground) blowing over erodible soils can cause erosion in three ways (James et al. 2009, U.S. Department of Agriculture [USDA] Natural Resources Conservation Service [NRCS] 2009a):

- **Saltation:** Individual particles are lifted off the soil surface by wind; then they return and the impact dislodges other particles. Fifty to 80 percent of total transport is by saltation.
- **Suspension:** Dislodged particles, small enough to remain airborne for an extended period of time (less than 0.1 mm in diameter), are moved upward by diffusion. Suspension

accounts for 20 to 60 percent of the total soil transport, depending on soil texture and wind velocity.

- **Surface creep**: Sand-sized particles are set in motion by the effect of saltating particles. During high winds, these sand sized particles creep slowly along the surface. Up to 25 percent of total transport may be from surface creep.



Source: James et al. 2009

Figure 3.4-2. Wind Erosion Processes

Figure 3.4-2 shows the wind erosion processes described above. Wind erosion and the release of windblown dust are influenced by soil erodibility, climatic factors, soil surface roughness, width of field, and the quantity of vegetative coverage. Soils most vulnerable to windblown erosion are coarser textured soils like sandy loams, loamy sands, and sands (USDA NRCS 2009a). Specifically, soils are vulnerable to wind erosion when (USDA NRCS 2009a):

- The soil is dry, loose, and finely granulated;
- The soil surface is smooth with little or no vegetation present;
- Fields are sufficiently large, and therefore, susceptible to erosion; and,
- There is sufficient wind velocity to move soil.

Wind erosion can also be a concern because it reduces soil depth and can remove organic matter and needed plant nutrients by dispersing the nutrients contained in the surface soils. Fields continually subjected to erosion can result in land that is incapable of returning to cropping (USDA NRCS 2009a). Increases in erosion from wind blowing across exposed nonpasture agricultural land results in particulate matter emissions. Section 3.5, Air Quality, discusses effects of fugitive dust emissions as a result of cropland idling.

3.4.1.2.2 Soil Erosion from Farming Practices

In addition to natural properties predisposing soils to erosion, land preparation activities, such as discing, and harvesting can cause soil particles to be broken down and can increase the potential for erosion. Much of the farm equipment used during the cropping season disturbs the soil and produces dust that contributes to soil loss. The following paragraphs describe common cropping practices for rice, processing tomatoes, field corn, and alfalfa, which are representative of crops that could be idled in water transfers.

Rice

During a typical calendar year of operation for rice production, farm equipment is required for preparing seedbeds, plowing and discing in March through May. Water seeding is the primary seeding method in California and most planting is done from April 20 to May 20, but can continue into June (University of California Cooperative Extension [UCCE] 2007).

Rice farmers apply herbicides and pesticides during May and June to control weeds and in May to control insects, algae, and shrimp. One pesticide application in the spring controls diseases from July through August that can attack the crop. The rice crop is harvested using a combine with a cutter-bar header (UCCE 2007).

Equipment used to grow rice includes tractors, bankout wagons, discs, mowers, pickup trucks, a triplane, and a V-ditcher (UCCE 2007).

Processing Tomatoes

Primary tillage of processing tomatoes, including laser leveling, discing, subsoiling, land planning, and listing beds is done from August through early November in the year preceding planting (UCCE 2008a).

Farmers spread planting over a three-month period from late March through early June. Beginning in January, weed spray is applied on the fallow beds to control emerged weeds. This process is repeated later to help control weeds. Before planting, the beds are cultivated twice to control weeds and to prepare the seedbed. A combination of hand weeding and mechanical cultivation is also used for weed control. During the cropping season, growers apply pesticides to combat various pests. Tomato harvest begins in early July and continues through mid-to-late October.

Equipment used to grow processing tomatoes includes tractors, crawlers, all-terrain vehicles (ATVs), bait applicators, bed shapers, cultivators, cultivators (sled), ditchers, incorporators, listers, mulchers, plows, rear blades, saddle tanks, spray booms, subsoilers, triplanes, vine diverters, and vine trainers.

Field Corn

Primary tillage for field corn includes laser leveling, discing, rolling, subsoiling, land leveling, and listing beds. Land preparation occurs in October of the year preceding planting. Farmers generally plant corn from late March through April (UCCE 2008b).

Fertilizers are applied throughout the growing season and irrigation is applied biweekly in April through July for a total of six post-plant irrigations. Herbicides are applied by airplane and tractor in February and May to control weeds. Insects are controlled by pesticide application using a tractor-mounted application in May. Mites, another common corn pest, can be a problem late in the season, and may be controlled by air application of pesticides in June.

The corn is harvested in August. Equipment used to grow field corn includes tractors, crawlers, ATVs, bait applicators, bankout wagons, combines with no header, corn headers, cultivators, ditchers, listers, planters, saddle tanks, scrapers, sprayer systems, subsoilers, and triplanes (UCCE 2008b).

Alfalfa

Stand establishment begins with laser leveling (when necessary) and then discing the fields to reduce the residue from the previous crop (UCCE 2008c). Alfalfa seed is planted in September and the stand life is four years. The field is harrowed and ring rolled after planting.

Fertilizer application occurs in September and can be sufficient for three years (UCCE 2008c). Water for seed germination is sprinkled immediately after planting and then again two weeks later. Herbicides are applied in December or January for weed control.

Alfalfa can be harvested seven times for hay: April, May, June, July (twice), August, and September. Equipment used to grow alfalfa includes ATVs, a tractor, a crawler, a seeder, a chisel, a cultipacker, discs, a pickup truck, and a triplane (UCCE 2008c).

3.4.1.2.3 Expansive Soils

In addition to soil erosion, expansive properties, or linear extensibility, represent another soil attribute that could be affected by water transfers.

Expansive soils are soils with the potential to experience considerable changes in volume, either shrinking or swelling, with changes in moisture content. Therefore, the expansive nature of soils is characterized by their shrink-swell capacity. Changes in soil volume are often expressed as a percent, and in soil surveys the percent represents the overall change for the whole soil.

Soils composed primarily of sand and gravel are not considered expansive (i.e., the soil volume does not change with a change in moisture content). Soils containing silts and clays may possess expansive characteristics. The magnitude of shrink-swell capacity in expansive soils is influenced by:

- Amount of expansive silt or clay in the soil;
- Thickness of the expansive soil zone;
- Thickness of the active zone (depth at which the soils are not affected by dry or wet conditions); and
- Climate (variations in soil moisture content as attributed to climatic or man-induced changes).

Soils are classified as having low, moderate, high, and very high potential for volume changes. The linear extensibility is expressed by percentages; the range of valid values is from 0 to 30 percent (USDA NRCS no date). Table 3.4-1 summarizes shrink-swell classes and the associated linear extensibility percentage. If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures (USDA NRCS no date).

Table 3.4-1. Shrink-Swell Class and Linear Extensibility

Shrink-Swell Class	Linear Extensibility (%)
Low	< 3
Moderate	3-6
High	6-9
Very High	≥ 9

Source: USDA NRCS no date.

3.4.1.2.4 Seller Service Area

This section describes the general soils, including soil erosion and shrink-swell properties, within the Seller Service Area that could be affected by cropland idling transfers. Data on expansive soils was obtained at the county level from the USDA NRCS's web soil survey soil reports.

Generalized soil textures for the counties in the Sellers Service Area are shown in Figure 3.4-3. Figure 3.4-4 shows the shrink-swell potentials of soils in these counties.

Glenn County

Soils in the western part of the Glenn County are largely gravelly loam, gravelly sandy clay loam, and gravelly sandy loam (USDA NRCS 2011a). These soil textures are also dominant in the northeastern part of the county. These soils generally have low erodibility and low shrink-swell potentials (USDA NRCS 2011b and 2011c).

The eastern part of the county is mainly composed of unweathered bedrock, clays, and silty clay loam (USDA NRCS 2011a). These soils have mid-range erodibility and low to high shrink-swell potentials (USDA NRCS 2011b and 2011c). Smaller portions of very gravelly sandy loam and loam border these dominant eastern soils. These soils have mid-range erodibility and low shrink-swell potential. The center of the county is defined by areas of loam, gravelly clay, gravelly clay loam, clay loam, and unweathered bedrock. These soils have mid-range erodibility and high shrink-swell potentials.

Colusa County

The western part of Colusa County is a mixture of areas of moderately decomposed plant material, silt loam, gravelly sandy loam, very gravelly loam, sandy loam, and gravelly loam (USDA NRCS 2009b). These soils have low to mid-range erodibility and low to moderate shrink-swell potentials (USDA NRCS 2009c and 2009d). The central part of the county is composed of clay loam and loam with some areas in the south central part of the county which are sandy clay loam. These soils have low erodibility and low shrink-swell potentials. In the eastern part of the county, there are two areas of land that have a combination of clay loam and sandy loam, one in the south of the county and one in the north. These soils have low to mid-range erodibility and low to moderate shrink-swell potentials. The remainder of the eastern part of the county is silty clay, silt loam, clay, and clay loam (USDA NRCS 2009b). The silty clay and clay soils have mid-range erodibility and high shrink-swell potentials. The clay loam soils have low erodibility and low shrink-swell potentials.

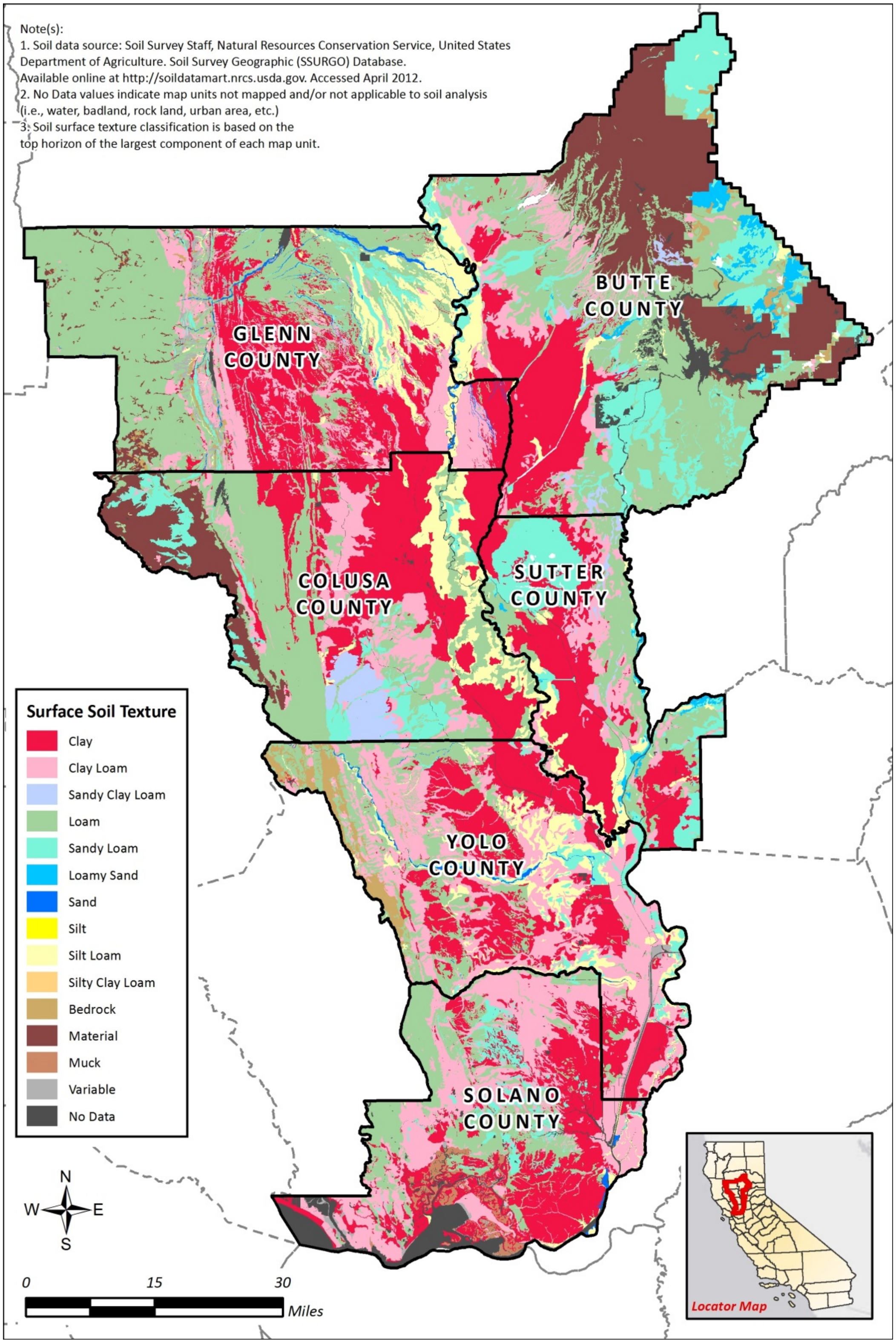


Figure 3.4-3. Surface Soil Texture – Seller Service Area

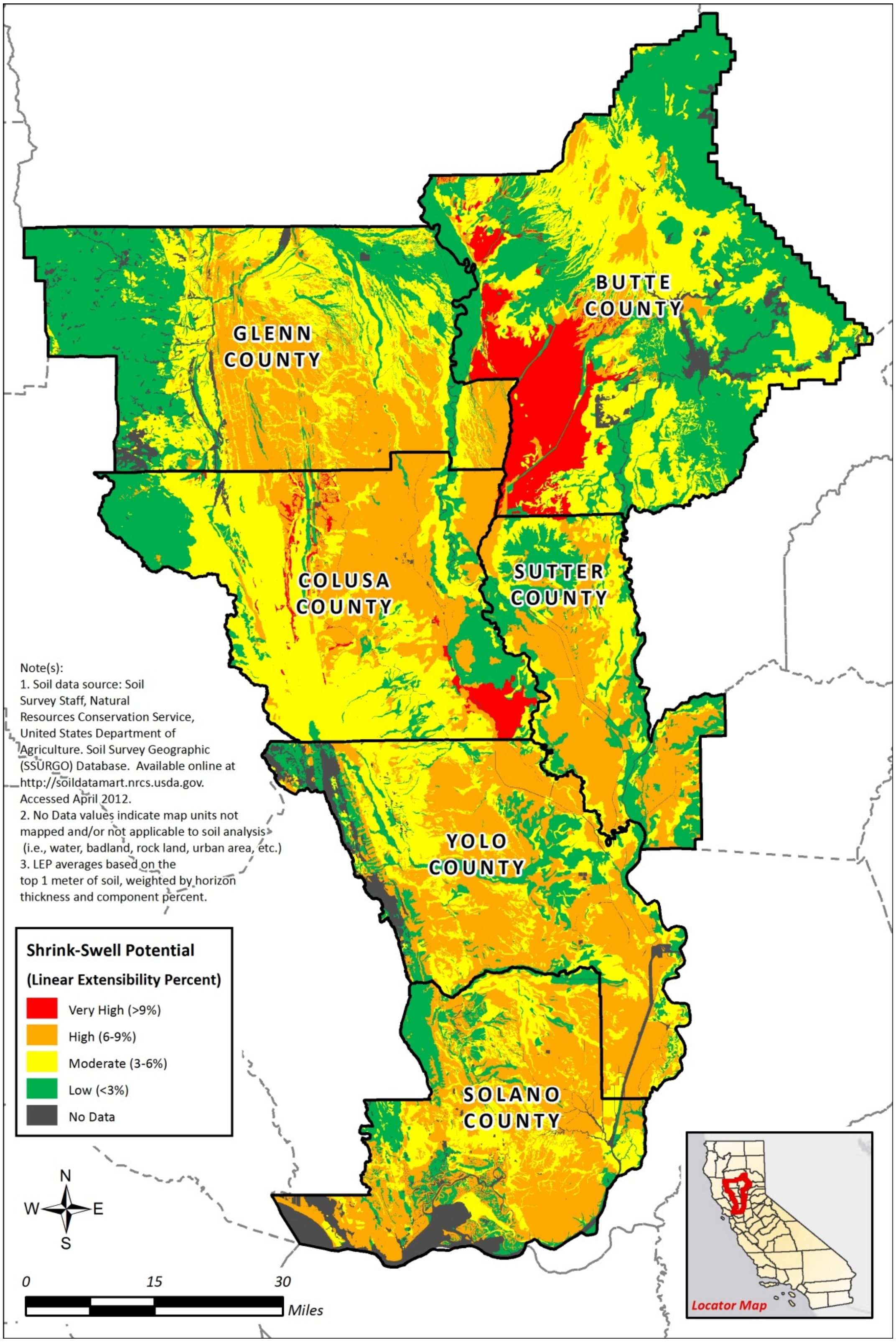


Figure 3.4-4. Shrink-Swell Potential – Seller Service Area

Butte County

The southwestern part of the county (where transfers could occur) is a mixture of loams, clay loam, sandy loam, and clay. These soils have low to mid-range erodibility and low to high shrink-swell potentials (USDA NRCS 2013a, 2013b, 2013c).

Sutter County

The eastern part of the county is a mixture of loams, clay loam, sandy loam, and an area of silty clay in the southeastern corner of the county. These soils have low to mid-range erodibility and low to high shrink-swell potentials. The western part of the county is largely comprised of clay, with a band of clay soils running down the mid-western area of the county. The western boundary of the county is defined by loam, silty clay, and silty clay loam. Clays in this area have mid-range erodibility and high shrink-swell potentials. Soils along the western boundary of the county have high to low erodibility and low shrink-swell potentials, with one area of high shrink-swell potential in the northwestern corner of the county (USDA NRCS 2009e, 2009f, 2009g).

Yolo County

The soils along the western boundary of Yolo County are a mixture of cobbly clay, clay, and silt loam (USDA NRCS 2012a). These soils have low erodibility and low shrink-swell potentials. The central part of the county is a diverse mixture of sandy loams, gravelly loams, gravelly sandy loam, silt loam, silty clay loam, and silty clay. Soils throughout the western part of the county have low erodibility and low to high shrink-swell potentials (USDA NRCS 2012b and 2012c). The eastern part of the county is mainly composed of silt loam, loam, and silty clay loam. These soils are also defined by low erodibility and low to high shrink-swell potentials. There are two areas of very fine sandy loam in the northeast and southeast parts of the county (USDA NRCS 2012a). These soil types have mid-range erodibility and high erosion potentials.

Solano County

Soils throughout the county are mainly clays and clay loams with some areas of sandy loam in the middle of the county. Clays have low erodibility and high shrink-swell potentials. Clay loams also have low erodibility, but have moderate shrink-swell potentials. Sandy loams in the central-north part of the county have high erodibility and low shrink-swell potentials (USDA NRCS 2007a, 2007b, 2007c). The eastern part of the county is largely made up of clays, clay loam, and silty clay loam (USDA NRCS 2007a). In addition to sandy loam, the middle portion of the county also contains gravelly loam and loam soils (USDA NRCS 2007a). These soils have low erodibility and low shrink-swell potentials. The western part of the county is a mixture of silty clay loam, clay loam, loam, and clay.

3.4.1.2.5 Buyer Service Area

This section describes the general topography, geology, and soils in the counties within the Buyer Service Area. Generalized soil textures for counties in the Buyer Service Area are shown in Figure 3.4-5. Figure 3.4-6 illustrates the shrink-swell potentials of soils in these counties.

San Joaquin County

Soil textures in the southwestern corner of the county consist mainly of loam and sandy loam (USDA NRCS 2013d). These soils have low to mid-range erodibilities and low shrink-swell potentials (USDA NRCS 2013e). To the east of this area, the soil texture transitions to clay and clay loam. These soils have low erodibility and moderate-to-high shrink-swell potentials (USDA NRCS 2013e). Soil textures in the other portions of the county also include bedrock, sandy clay loam, and loamy sand, but these areas do not include transfer buyers and do not have the potential to be affected.

Stanislaus County

Soil textures on the western side of the county consist mainly of loam, sandy loam, and sandy clay loam (USDA NRCS 2013f). These soils have low to mid-range erodibilities and low shrink-swell potentials (USDA NRCS 2013g). These soils transition to clay and clay loam to the east of this area, but transfer buyers are only on the west side of the San Joaquin River and would not affect these soil types.

Merced County

Soil textures in the western portion of the county consist mainly of fine sandy loam, fine sand, and loamy sand (USDA NRCS 2008a). These soils have high erosion potentials and low shrink-swell potentials (USDA NRCS 2008b and 2008c). Soils in the south of the county are dominated by loam, silt loam, and silt clay loam. These soils have low to mid-range erodibility and low shrink-swell potentials. The north-central area of the county is mainly fine sand and the south-central portion of the county contains clay loam. These soils generally have low erodibility and low to high shrink-swell potentials (USDA NRCS 2008a; 2008b; 2008c). Soils in the eastern part of the county are generally comprised of silt loam and gravelly loam. These soils have low erosion potentials and low shrink-swell ratings.

Fresno County

Soil textures in the eastern part of the county are dominated by gravelly loam, gravelly sandy loam, and sandy loam (USDA NRCS 2008d). These soils have low to mid-range erodibilities and low shrink-swell potentials (USDA NRCS 2008e and 2008f). In areas along the San Joaquin River and the Fresno Slough, the soil texture is sandy loam (USDA NRCS 2008a). Sandy loam has mid-range erodibility and high to very high shrink-swell potential. The western edge of the county is

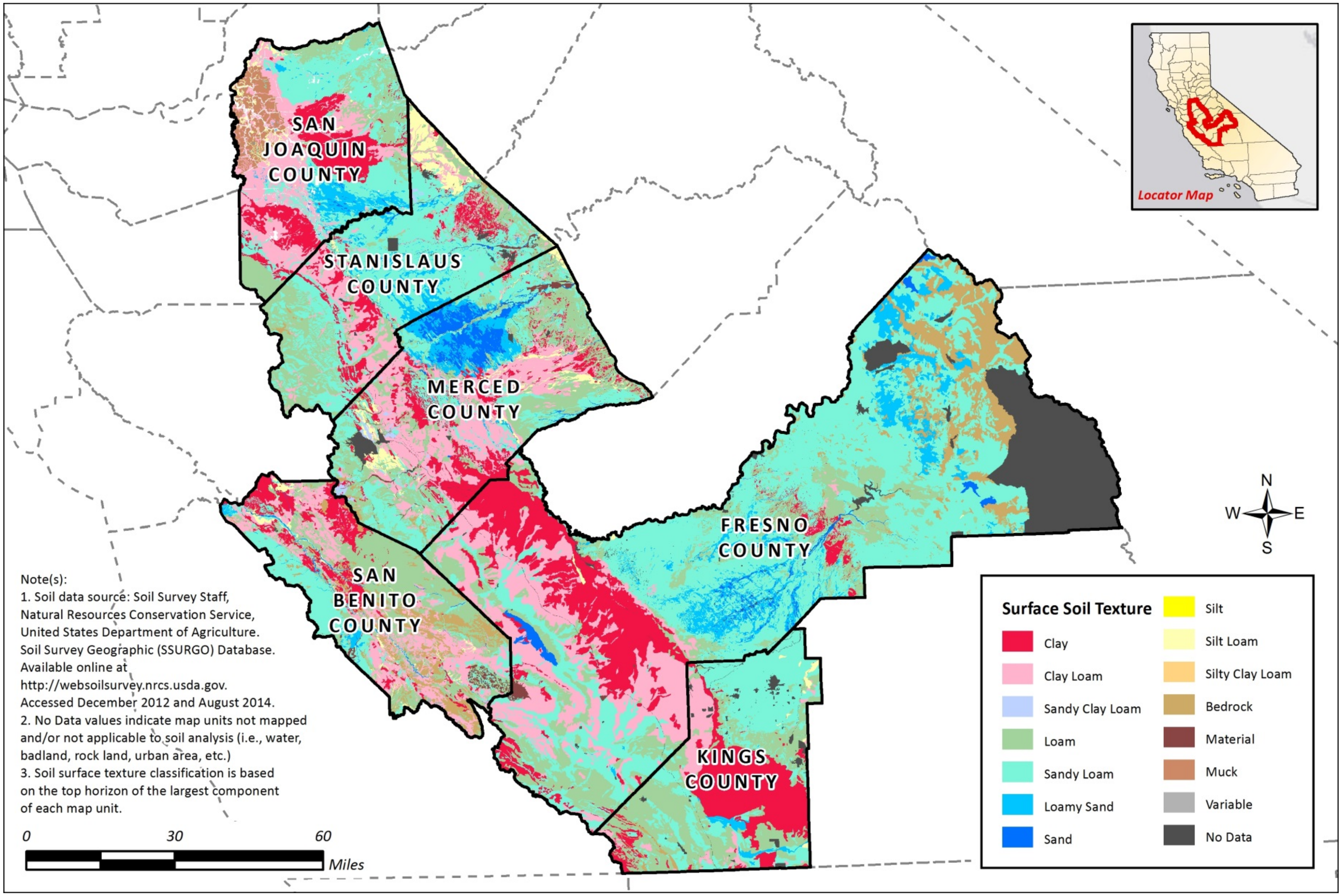


Figure 3.4-5. Soil Surface Texture – Buyer Service Area

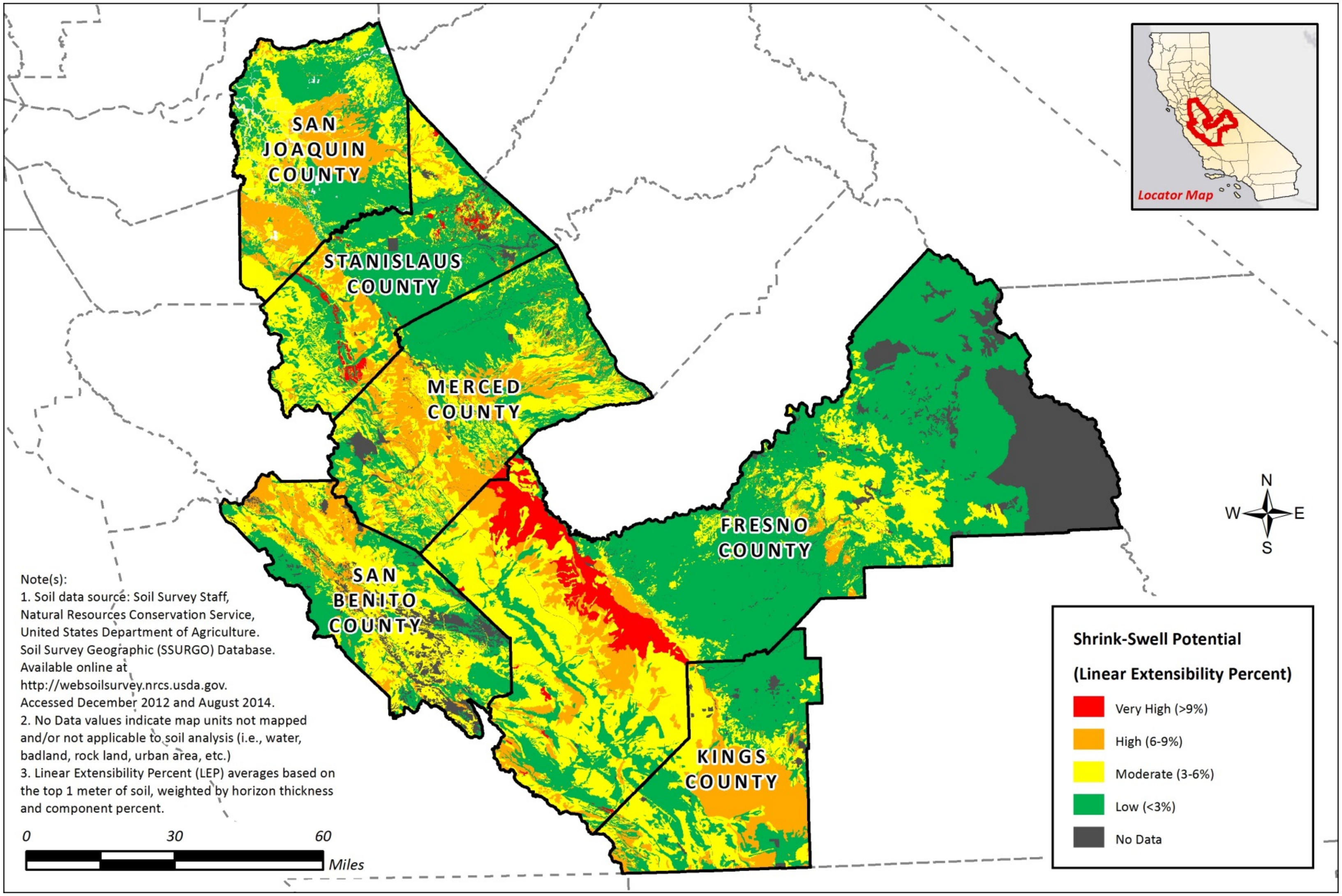


Figure 3.4-6. Shrink-Swell Potential – Buyer Service Area

defined by the Coast Ranges and consists mainly of clay loam, gravelly clay loam, loam, sandy loam, and silty clay loam (USDA NRCS 2006). The alluvial fans extending eastward into the valley are comprised of clay, clay loam, and sandy loam soils. Lands adjacent to the San Joaquin River include soils with clay and clay loam textures (USDA NRCS 2006).

San Benito County

Soils in the eastern part of the county are mainly comprised of clay, silty clay, and gravelly loam. These soils have low erodibility and low to moderate shrink-swell potentials. Soils in the northeastern part of the county have moderate to high shrink-swell potentials. In the central part of the county, the dominant soil textures are clay, clay loam, and bedrock. These soils have low erodibility and moderate shrink-swell potentials. The western part of the county is characterized by sandy clay loam and sandy loam soils. These soils have mid-range erodibility and low to high shrink-swell potentials.

Kings County

The northeastern part of the county is characterized by fine sandy loam, clay loam, and very fine sandy loam soils. These soils have high erosion potentials and low shrink-swell potential (USDA NRCS 2009h; 2009i; 2009j). Moving south, there is a band of loam soils that border the clay area of the Tulare Lake bed. These soils have low erodibility and low to high shrink-swell potentials. The northwestern edge of the county is predominantly comprised of clay loam soils with low erosion potential and moderate shrink-swell potential. The southwestern area of the county is largely loam with some areas of gravelly sandy loam, sandy loam, and coarse sandy loam. The areas of sandy loam and loam are characterized by mid-range erodibility and low shrink-swell potential. The loam, gravelly sandy loam, and coarse sandy loam areas in the southwestern corner of the county have low erodibility and low to high shrink-swell potential (USDA NRCS 2009h; 2009i; 2009j).

3.4.2 Environmental Consequences/Environmental Impacts

The following sections present the assessment methods to evaluate geology and soils effects and describe the environmental consequences/environmental impacts associated with the No Action/No Project Alternative and action alternatives.

3.4.2.1 Assessment Methods

Cropland idling is the only water transfer method with the potential to affect geology and soils. Cropland idling would create bare fields that could result in the following effects:

- Erosion of soils from wind blowing over fields with no vegetative cover.
- Changes in soil moisture and resulting shrinking and swelling from different irrigation patterns.

The potential for erosion and expansion are assessed qualitatively based on the general distribution of soil textures and the corresponding erosion and expansion properties related to the various soil textures. As described in more detail above in Section 3.4.1.2.1, soils become more erosive as their content of fine sand increases. Soils that contain greater percentages of larger diameter particles are less susceptible to erosion. This trend is somewhat reversed when it comes to the expansiveness of soils. Soils with more sands and gravel components are less affected by changes in moisture content, and therefore, do not expand as greatly as soils with higher silt and clay content.

3.4.2.2 Significance Criteria

Impacts related to geology and soils would be considered potentially significant if implementation of the alternative would:

- Result in substantial soil erosion.
- Result in a substantial risk to life or property due to location on an expansive soil.

This project does not involve construction of new structures; therefore, it does not include geology and soils significance criteria related to that type of construction (such as criteria related to seismic risk, landslides, or unstable soil).

3.4.2.3 Alternative 1: No Action/No Project

There would be no changes to soil erosion under the No Action/No Project Alternative. There would be no cropland idling transfers originating in the Seller Service Area; therefore, potential for soil erosion in the Seller Service Area would be the same as existing conditions.

Under the No Action/No Project Alternative, agricultural water users in the Buyer Service Area may increase the amount of land idled during the crop season in response to Central Valley Project (CVP) shortages, which would leave soils susceptible to erosion. Figure 3.4-5 shows surface soil textures in the counties in the Buyer Service Area. Agricultural lands in these counties are largely composed of clays and clay loam soils, which have low erodibility. Smaller areas also consist of loams, sandy loam, and loamy sand. These soils are slightly more erodible than clays.

Under normal farming practices, farmers leave fields idle during some cropping cycles and manage potential soil erosion impacts to avoid substantial loss of soils and to protect soil quality. Some examples include surface roughening tillage to produce clods, ridges, and depressions to reduce wind velocity and trap drifting soil; establishment of barriers at intervals perpendicular to wind direction; or, application of mulch (USDA NRCS 2009). Farmers would likely apply these same approaches to any increased crop acreage idled under the No Action/No Project Alternative to protect the soil quality and reduce erosion for future planting.

There would be no changes to shrinking or swelling of soils under the No Action/No Project Alternative. There would be no cropland idling transfers originating in the Seller Service Area; therefore, potential risks of soils shrinking and swelling in the Seller Service Area would be the same as existing conditions.

Under the No Action/No Project Alternative, there is a possibility for increased land idling in the Buyer Service Area as a result of CVP shortages. Figure 3.4-6 shows the shrink-swell potentials of soils in San Joaquin, Stanislaus, Merced, San Benito, Fresno, and Kings counties. Shrink-swell potential in these counties ranges from low to very high; however, the majority of soils have moderate shrink-swell potential.

Soil movement through shrinking and swelling can cause damage to structures and/or roads built on or near the expansive soils. Under existing conditions, agricultural soils shrink and swell in response to winter rains and irrigation cycles (soils are irrigated, then left to dry out, then irrigated again). Therefore, agricultural lands are subject to normal swelling and shrinkage during growing and harvesting cycles and structures and roads in the vicinity of the cropland are also subject to these changes. Thus, the shrinking and swelling of soils as a result of increased idling under the No Action/No Project Alternative would not damage structures or pose a risk to life or property.

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

Cropland idling transfers in the Seller Service Area could result in temporary conversion of lands from cropland to bare fields, which could increase soil erosion. Table 3.4-2 shows potential maximum annual acreage for cropland idling in the Sellers Service Area.

Table 3.4-2. Maximum Annual Cropland Idling under the Proposed Action (Acres)

Region	Rice	Alfalfa[1]/ Sudan Grass	Corn	Tomatoes	Total
Sacramento River Region	40,704	1,400	400	400	42,904
Feather River Region	10,769	600	800	400	12,569
Delta Region	-	3,000	1,500	-	4,500
Total	**51,473**	**5,000**	**2,700**	**800**	**59,973**

[1] Alfalfa cannot be idled within the legal boundaries of the Delta

Rice fields are proposed for idling in Colusa, Glenn, Butte, Yolo, and Sutter counties. Rice is typically grown on clay soils that are less susceptible to erosion than sandy soils. The rice crop cycle also reduces the potential for erosion. The process of rice cultivation includes incorporating the residual rice straw into the soils after harvest. The fields are then flooded during the winter to aid in decomposition of the straw. If no irrigation water is applied to the fields after this point, the soils would remain moist until approximately mid-May. Once dried, the combination of the decomposed straw and clay soils produces a hard, crust-like surface. This surface texture would remain until the following winter rains if not disturbed. In contrast to sandy topsoil, this surface type would not be conducive to soil loss from wind erosion. Therefore, idled rice fields would not be conducive to soil loss from wind erosion.

Transfers could also include crops other than rice (Table 3.4-2) that have different cropping practices and can be planted on different soil types than clay. For purposes of this analysis, it is assumed that alfalfa, tomatoes, and corn are representative of the non-rice crops that could be idled for long-term water transfers.

As shown in Figure 3.4-3, the soils in Central Valley agricultural areas in Glenn, Colusa, Butte, Sutter, Solano, and Yolo counties are primarily clay and clay loam with minor portions of silt loam, loam, sandy loam, and sandy clay loam. In general, soils that contain some percentage of clay content, such as the predominant soils in counties in the Sellers Service Area, are less susceptible to erosion.

In the Sacramento River Region (Glenn, Colusa, and Yolo counties), there could be a combined maximum of 2,200 acres of alfalfa, corn, or tomato cropland idled. The sellers that expressed interest in participating in cropland idling transfers in these counties are located mainly on clay and clay loam soils that have low erodibility. The northeastern part of Glenn County has silt loam, loam, and sandy loam soils (Figure 3.4-3). Areas of loam and silt loam also exist along the eastern edge of Colusa County. The majority of the southeastern corner of Colusa County and the northeastern corner of Yolo County are composed of clay with small patches of loam, silt loam, and sand soils

(Figure 3.4-3). It is possible that some idling could occur on the more erodible soil textures. While these soils are more susceptible to wind erosion, the amount of potential acres idled is small, with a maximum of 2,200 acres of alfalfa, corn, and tomatoes in the three counties. Idling of this amount of crop acreage on sandy soils would not likely result in substantial soil erosion.

In the Feather River Region (Butte and Sutter counties), there is also potential for idling to occur on some of the loam or loamy sand soils located in south-central areas (Figure 3.4-3). Idling in the Feather River Region is proposed for a maximum of 1,800 acres of non-rice crops. Because of the predominance of clay soils, it is likely that some of these crops included in a cropland idling transfer would be planted on clay soils. Idling of additional crops up to the maximum acreage on sandy soils would not likely result in substantial soil erosion.

Under the Proposed Action, idling of corn and sudan grass could occur on up to 4,500 acres in the Delta Region (northeastern Solano County). Soils in this area are mostly clay and clay loam; therefore, they are not susceptible to wind erosion.

Due to the primary clay soil textures in counties in the Seller Service Area as well as relatively small acreages of non-rice crops proposed for idling, substantial soil erosion as a result of idling non-rice crops is not expected. The acreages of corn, tomato, and alfalfa crops identified for idling in Table 3.4-3 represent maximum areas that would be idled; it is not likely that all of these fields would be idled at the same time or in each year.

Under normal farming practices, farmers leave fields fallow during some cropping cycles in order to make improvements such as land leveling and weed abatement or to reduce pest problems and build soils. As described under the No Action/No Project Alternative, farmers manage potential soil erosion impacts to avoid substantial loss of soils and to protect soil quality (USDA NRCS 2009). While farmers would not be able to engage in management practices that result in a consumptive use of water on an idled field, they could continue such erosion control techniques as surface roughening tillage to produce clods, ridges, and depressions to reduce wind velocity and trap drifting soil; establishment of barriers at intervals perpendicular to wind direction; or, application of mulch (USDA NRCS 2009). Therefore, cropland idling under the Proposed Action would not result in substantial soil erosion. Impacts would be less than significant.

Cropland idling water transfers could cause expansive soils to shrink due to the reduction in applied irrigation water. Under the Proposed Action, cropland idling transfers could occur in Glenn, Colusa, Butte, Yolo, Solano, and Sutter counties. As shown in Figure 3.4-4, these counties are largely characterized by moderate to high shrink-swell potentials with some smaller areas of low and very high shrink-swell potentials. Cropland idling may increase the extent of soil shrinkage due to lack of irrigation. As described under the No Action/No Project Alternative, because the proposed lands that could be idled are agricultural, they are subject to swelling and shrinkage under normal agricultural growing cycles. Thus, structures and roads in the vicinity of irrigated fields are subject to these changes in soils on a regular basis. The shrinking and swelling of soils due to cropland idling would not result in adverse effects on these structures or roads and would not pose a substantial risk to life or property. Therefore, potential impacts from soil instability under the Proposed Action would be less than significant.

Use of water from transfers on agricultural fields in the Buyer Service Area could reduce soil erosion. Water transfers to agricultural users in San Joaquin, Stanislaus, Merced, San Benito, Fresno, and Kings counties would reduce the amount of land idled relative to the No Action/No Project Alternative. Crop plantings would reduce the potential for soil erosion that occurs from winds blowing over bare fields. This would be a benefit of the Proposed Action. Farming practices would resume, which would cause some soil loss from discing, harvesting, and movement of farm equipment. These practices are normal on agricultural lands in the Buyer Service Area and would not result in significant soil erosion.

Use of water from transfers on agricultural fields in the Buyer Service Area could affect soil movement. Irrigation of previously idled fields in San Joaquin, Stanislaus, Merced, San Benito, Fresno, and Kings counties could result in soil swelling. These fields were irrigated in the past and soils have undergone shrinkage and swelling due to normal farming practices and land fallowing. Thus, structures and roads in the vicinity of irrigated fields are subject to these changes in soils on a regular basis. Irrigation as a result of water transfers would not change soil movement relative to what the land has experienced in the past. As a result, there would be no impacts to roads and structures from soil movement.

3.4.2.5 Alternative 3: No Cropland Modifications

There would be no cropland idling under Alternative 3; therefore, there would be no geology and soils impacts in the Seller Service Area. Effects in the Buyer Service Area would be the same as the Proposed Action.

3.4.2.6 Alternative 4: No Groundwater Substitution

Effects in the Buyer Service Area would be the same as the Proposed Action.

Cropland idling transfers in the Seller Service Area could result in temporary conversion of lands from cropland to bare fields, which could increase soil erosion. Table 3.4-3 shows the acreage and types of crops proposed for idling in each county in the Seller Service Area. Cropland idling transfers under Alternative 4 could idle up to 51,473 acres of rice, 5,000 acres of alfalfa, 2,700 acres of corn, and 800 acres of tomatoes in counties in the Seller Service Area.

Table 3.4-3. Maximum Annual Cropland Idling Acreages under Alternative 4

Region	Rice	Alfalfa[1]/ Sudan Grass	Corn	Tomatoes	Total
Sacramento River Region	40,704	1,400	400	400	42,904
Feather River Region	10,769	600	800	400	12,569
Delta Region	-	3,000	1,500	-	4,500
Total	**51,473**	**5,000**	**2,700**	**800**	**59,973**

[1] Alfalfa cannot be idled within the legal boundaries of the Delta

The potential land idling in Alternative 4 would be the same as analyzed in the Proposed Action. This analysis found that the low potential for erosion and small amounts of idling would reduce the potential for erosion. Therefore, cropland idling under Alternative 4 would not result in substantial soil erosion. Impacts would be less than significant.

Cropland idling water transfers could cause expansive soils to shrink due to the reduction in applied irrigation water. Impacts related to expansive soils would be the same as those described under the Proposed Action. The shrinking and swelling of soils due to cropland idling would not have adverse effects on structures or roads in the area of analysis and would not pose a substantial risk to life or property. Therefore, potential impacts from soil instability under Alternative 4 would be less than significant.

3.4.3 Comparative Analysis of Alternatives

Table 3.4-4 summarizes the effects of each of the action alternatives. The following text supplements the table by describing the magnitude of the effects under the action alternatives and No Action/No Project Alternative.

Table 3.4-4. Comparative Analysis of Alternatives

Potential Impact	Alternatives	Significance	Proposed Mitigation	Significance after Mitigation
Cropland idling transfers in the Seller Service Area that temporarily convert cropland to bare fields could increase soil erosion.	2, 4	LTS	None	LTS
Land idling that temporarily converts cropland to bare fields in response to CVP shortages in the Buyer Service Area could increase soil loss from wind erosion.	1	LTS	None	LTS
Cropland idling water transfers could cause expansive soils in the Seller Service Area to shrink due to the reduction in applied irrigation water.	2, 4	LTS	None	LTS
Land idling in response to CVP shortages in the Buyer Service Area could cause expansive soils to shrink due to the reduction of applied irrigation water.	1	LTS	None	LTS
Use of transfer water on agricultural fields in the Buyer Service Area could increase soil erosion.	2, 3, 4	LTS	None	LTS
Use of transfer water on agricultural fields in the Buyer Service Area could increase soil movement.	2, 3, 4	LTS	None	LTS

Key:
LTS – less than significant

3.4.3.1 No Action/No Project Alternative

There would be no changes to geology and soils in the Seller Service Area relative to existing conditions. In the Buyer Service Area, increased land idling could occur in response to CVP shortages, which could affect soil erosion and soil stability. Farmers would continue to manage idled fields to control soil erosion impacts and protect the quality of soils for future plantings. Agricultural lands typically undergo shrinking and swelling with a normal planting and harvesting schedule. Thus, potential soil shrinkage under the No Action/No Project Alternative would not result in damage to nearby roads or properties.

3.4.3.2 Alternative 2: Full Range of Transfers – Proposed Action

Cropland idling transfers under the Proposed Action could increase soil erosion and affect soil stability that could damage nearby structures. Cropland idling transfers under the Proposed Action could idle up to 51,473 acres of rice, 5,000 acres of alfalfa, 2,700 acres of corn, and 800 acres of tomatoes in counties in the Seller Service Area. Soils in the area are largely composed of clays, which are less erodible soils. For rice crops, the natural crop cycle and field preparation involved in cultivation also reduces the probability of soil erosion when rice fields are idled (see Sections 3.4.2.3 and 3.4.2.4). Idling of maximum acreages of non-rice crops that may be planted on more sandy soils would not result in substantial soil erosion relative to the No Action/No Project Alternative. Further, farmers would continue to manage idled fields to control soil erosion impacts. Because agricultural lands typically undergo shrinking and swelling with a normal planting and harvesting schedule, there would not be risks to structures as a result of soil instability. Potential effects on expansive soils and soil erosion in the Seller Service Area under the Proposed Action would be greater than the No Action/No Project Alternative; however, impacts would still be less than significant. The Proposed Action would increase water supplies to agricultural users in the Buyer Service Area which would reduce potential soil erosion and effects to soil stability relative to the No Action/No Project Alternative.

3.4.3.3 Alternative 3: No Cropland Modification

The No Cropland Modification Alternative does not include cropland idling or crop shifting transfers. The potential effects on expansive soils and soil erosion from these actions as described under the Proposed Action would not occur under the No Cropland Modification Alternative.

3.4.3.4 Alternative 4: No Groundwater Substitution

As in the Proposed Action, cropland idling transfers could affect soil erosion and soil stability, but these effects would be less than significant. Effects in the Buyer Service Area would be the same as the Proposed Action.

3.4.4 Environmental Commitments/Mitigation Measures

There would be no significant impacts to geology and soils from implementation of the No Action/No Project Alternative or the action alternatives. Therefore, no environmental commitments/mitigation measures are proposed.

3.4.5 Potentially Significant Unavoidable Impacts

None of the action alternatives would result in potentially significant unavoidable impacts on geology and soils.

3.4.6 Cumulative Effects

The timeframe for the geology and soils cumulative effects analysis extends from 2015 through 2024, a ten-year period. The cumulative effects area of analysis for geology and soils is the same as shown in

Figure 3.4-1. This section analyzes cumulative effects using the project method, which is further described in Chapter 4.

The projects considered for the cumulative condition are the State Water Project (SWP) water transfers and CVP Municipal and Industrial Water Shortage Policy (WSP), which are described in more detail in Chapter 4. SWP transfers could utilize cropland idling in the area of analysis and could therefore affect soils on agricultural fields. The WSP could reduce agricultural water deliveries and increase land idling in the Buyer Service Area. Effects of the WSP in the Seller Service Area would be minor as agricultural water supplies would not substantially change relative to existing conditions.

The following sections describe potential geology and soils cumulative effects for each of the proposed alternatives.

3.4.6.1 Alternative 2: Full Range of Transfers

Cropland idling in the Seller Service Area under the Proposed Action in combination with other cumulative projects would contribute to existing soil erosion in the region. SWP transfers would include water made available through cropland idling; however, most of the transfers would originate in Butte County, where only minor actions could occur under the Proposed Action. Some SWP cropland idling transfers could also occur in Sutter County. SWP cropland idling would include similar crops as the Proposed Action.

The rice crop cycle and soil texture in which rice is planted reduces the potential for erosion, and a hard crust usually develops over the surface of the field. Idled rice fields would not be conducive to soil loss from wind erosion. The Proposed Action and SWP transfers would not result in significant cumulative soil erosion effects from idling rice.

Cropland idling under the Proposed Action could also occur on corn, tomato, and alfalfa fields. SWP transfers could also involve idling of these crops. However, it is likely that the majority of SWP cropland idling transfers would be rice fields and the amounts of non-rice crops to be idled would be similar to those in the Proposed Action. Farmers participating in cropland idling would manage their fields to reduce erosion and protect soil quality. Given the soil textures in the Sacramento Valley and their low to mid-range erodibility, soil erosion as a result of idling non-rice crops would be low, and would be minimized further by implementing normal soil erosion measures. Potential reductions in agricultural deliveries under the WSP would have minor effects on soil erosion in the Seller Service Area. Therefore, the Proposed Action in combination with other cumulative projects would not result in a cumulative significant impact on soil erosion.

Cropland idling in the Seller Service Area under the Proposed Action could cause expansive soils to shrink. Similar to the cropland idling under the Proposed Action, cropland idling as a result of SWP transfers would also occur on agricultural lands. As these agricultural lands undergo shrinking and swelling as part of the normal cropping cycle, shrinkage as a result of cropland idling would not result in substantial risk to life or property. The combination of idling under the Proposed Action with cropland idling under the SWP transfers would not increase the potential for damage to life or property from expansive soils. Therefore, the Proposed Action in combination with other cumulative projects would not result in a cumulative significant impact associated with the shrinkage of expansive soils.

Use of water from transfers on agricultural fields in the Buyer Service Area could reduce soil erosion. SWP transfers would increase water supply in the Buyer Service Area and reduce soil erosion. The WSP could reduce agricultural water supplies in dry and critical years, which could increase cropland idling and soil erosion. However, CVP water transfers would offset some of these effects. The Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact related to soil erosion in the Buyer Service Area.

Use of water from transfers on agricultural fields in the Buyer Service Area could affect soil movement. SWP transfers would increase water supply in the Buyer Service Area. The WSP and Proposed Action would change agricultural water supplies and potentially affect soil movement. However, agricultural lands are typically subject to shrinking and swelling under normal farming practices. Roads and structures in the vicinity are also subject to this effect. The Proposed Action and WSP would not substantially change soil movement in the Buyer Service Area relative to normal farming practices. Therefore, the Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact related to soil movement in the Buyer Service Area.

3.4.6.3 Alternative 3: No Cropland Modification

Since there would be no cropland idling under Alternative 3, there would be no cumulative impacts to expansive soils or soil erosion in the Seller Service Area. Cumulative effects in the Buyer Service Area would be the same as the Proposed Action.

3.4.6.4 Alternative 4: No Groundwater Substitution

Cumulative impacts under Alternative 4 would be the same as those described under the Proposed Action.

3.4.7 References

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Section 3.5 Air Quality

This section presents the existing setting in relation to air quality within the area of analysis and discusses potential effects on air quality from the proposed alternatives. Appendix F, Air Quality Emission Calculations, provides detailed emission calculations.

Groundwater substitution and cropland idling transfers would affect air quality in the area of analysis. Implementation of conservation or stored reservoir purchase transfers would not affect air quality and are not further discussed in this section. Although some crops may be more energy intensive than others, crop shifting is a regular practice in the Seller and Buyer Service Areas and a quantitative analysis was not conducted for this transfer method.

3.5.1 Affected Environment/ Environmental Setting

The following paragraphs provide a brief explanation of the regulatory setting for air quality. Sections 3.5.1.1 through 3.5.1.3 describe the factors that influence pollutant levels on a regional level, including geographical location, weather patterns, and pollutant sources.

3.5.1.1 Area of Analysis

The area of analysis for air quality includes counties where cropland idling could occur in the Seller Service Area, counties overlying groundwater basins where groundwater substitution transfers could occur, and counties where transferred water would be used for agricultural purposes in the Buyer Service Area. Figure 3.5-1 shows the air quality area of analysis.

Figure 3.5-1. Air Quality Area of Analysis

3.5.1.2 Regulatory Setting

Air quality management and protection responsibilities exist in federal, state, and local levels of government. The federal Clean Air Act (CAA) and California Clean Air Act (CCAA) are the primary statutes that establish ambient air quality standards and establish regulatory authorities to enforce regulations designed to attain those standards.

3.5.1.2.1 Federal

The U.S. Environmental Protection Agency (USEPA) is responsible for implementation of the CAA. The CAA was enacted in 1955 and was amended in 1963, 1965, 1967, 1970, 1977, 1990, and 1997. Under authority of the CAA, USEPA established National Ambient Air Quality Standards (NAAQS) for the following criteria pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), inhalable particulate matter with an aerodynamic diameter less than or equal to 10 microns (PM_{10}), fine particulate matter with an aerodynamic diameter less than or equal to 2.5 microns ($PM_{2.5}$), and sulfur dioxide (SO_2).

Table 3.5-1 presents the current NAAQS for the criteria pollutants. Ozone is a secondary pollutant, meaning that it is formed in the atmosphere from reactions of precursor compounds under certain conditions. Primary precursor compounds that lead to formation of O_3 include volatile organic compounds (VOC) and nitrogen oxides (NOx). $PM_{2.5}$ can be emitted directly from sources (e.g., engines) or can form in the atmosphere from precursor compounds. $PM_{2.5}$ precursor compounds in the area of analysis include sulfur oxides (SOx), NOx, VOC, and ammonia.

The Federal CAA requires states to classify air basins (or portions thereof) as either “attainment” or “nonattainment” with respect to criteria air pollutants, based on whether the NAAQS have been achieved, and to prepare State Implementation Plans (SIPs) containing emission reduction strategies to maintain the NAAQS for those areas designated as attainment and to attain the NAAQS for those areas designated as nonattainment. Table 3.5-2 summarizes the air basins and counties included in the area of analysis. Figure 3.5-2 identifies the air basins that would be affected by the alternatives.

Table 3.5-1. National Ambient Air Quality Standards

Pollutant	Averaging Time	NAAQS Primary	NAAQS Secondary
O_3	8 Hour	0.075 ppm (147 µg/m^3)	Same as Primary Standard
PM_{10}	24 Hour	150 µg/m^3	Same as Primary Standard
$PM_{2.5}$	24 Hour	35 µg/m^3	Same as Primary Standard
$PM_{2.5}$	Annual	12 µg/m^3	15 µg/m^3
CO	1 Hour	35 ppm (40 mg/m^3)	N/A
CO	8 Hour	9 ppm (10 mg/m^3)	N/A
NO_2	1 Hour	100 ppb[1] (188 µg/m^3)	N/A
NO_2	Annual	53 ppb (100 µg/m^3)	Same as Primary Standard
SO_2	1 Hour	75 ppb[2] (196 µg/m^3)	N/A
SO_2	3 Hour	N/A	0.5 ppm (1,300 µg/m^3)
SO_2	24 Hour	0.14 ppm (366 µg/m^3)[3]	N/A
SO_2	Annual	0.030 ppm (79 µg/m^3)[3]	N/A
Pb	Rolling 3-Month Average	0.15 µg/m^3	Same as Primary Standard

Source: California Air Resources Board (CARB) 2013a.

Notes:

[1] To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 100 parts per billion (ppb).

[2] To attain this standard, the 3-year average of the annual 99th percentile of 1-hour daily maximum concentrations must not exceed 75 ppb.

[3] On June 22, 2010, the 24-hour and annual primary SO_2 NAAQS were revoked (75 Federal Register [FR] 35520). The 1971 SO_2 NAAQS (0.14 parts per million [ppm] and 0.030 ppm for 24-hour and annual averaging periods) remain in effect until one year after an area is designated for the 2010 1-hour primary standard. CARB recommended that all of California be designated attainment for the 1-hour SO_2 NAAQS (CARB 2011a). Although the USEPA designated as nonattainment most areas in locations where existing monitoring data from 2009-2011 indicated violations of the 1-hour SO_2 NAAQS, they deferred action on all other areas. As a result, the USEPA has not yet finalized area designations for California (78 FR 47191).

Key:

µg/m^3 = micrograms per cubic meter; CAAQS = California Ambient Air Quality Standard; mg/m^3 = milligrams per cubic meter; N/A = not applicable; NAAQS = National Ambient Air Quality Standard; ppb = parts per billion; ppm = parts per million

Table 3.5-2. Area of Analysis – Air Basins

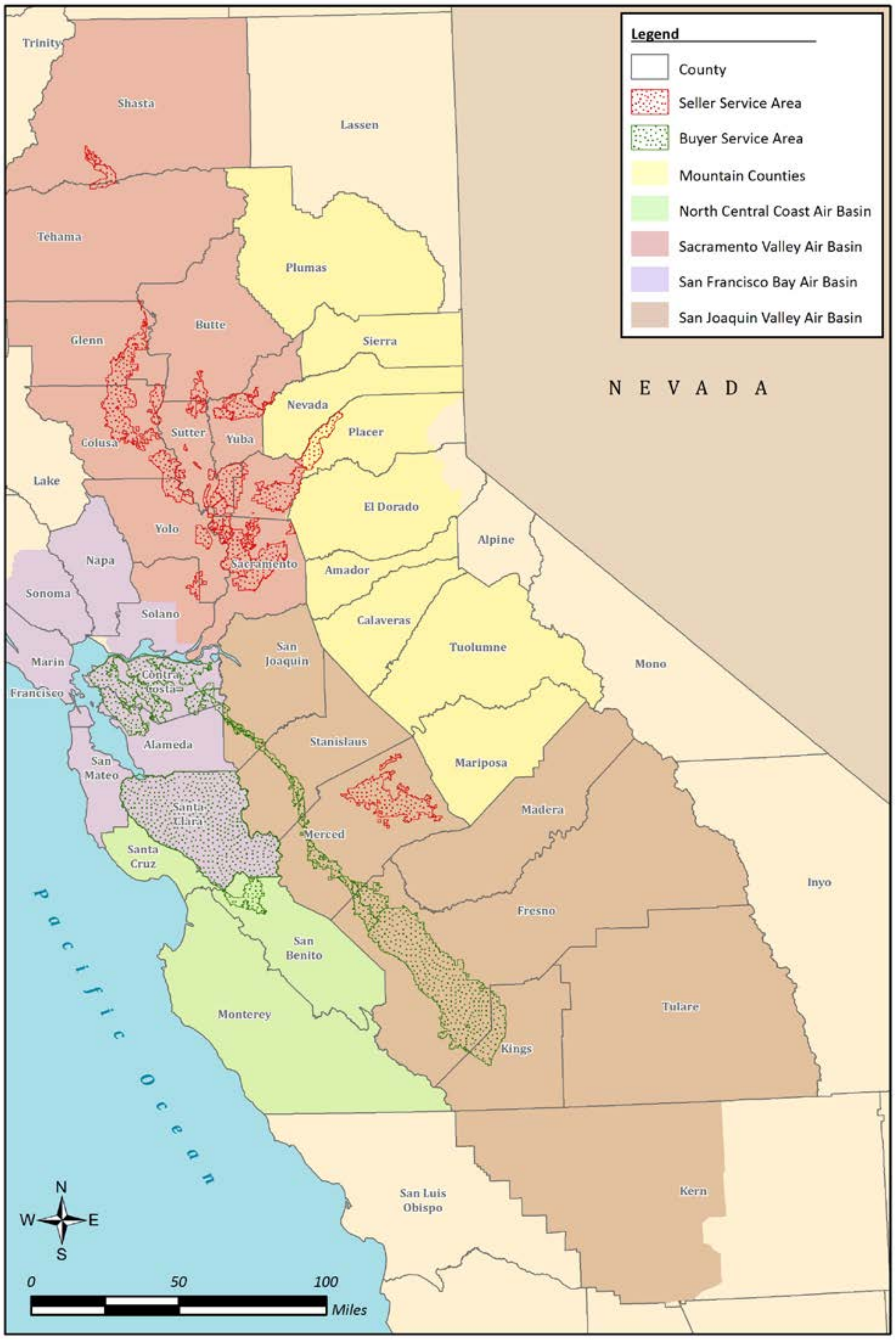
Agency Type	Air Basin	County
Sellers	Mountain Counties	Placer[1]
Sellers	Sacramento Valley	Butte
Sellers	Sacramento Valley	Colusa
Sellers	Sacramento Valley	Glenn
Sellers	Sacramento Valley	Placer[2]
Sellers	Sacramento Valley	Sacramento
Sellers	Sacramento Valley	Shasta
Sellers	Sacramento Valley	Solano[3]
Sellers	Sacramento Valley	Sutter
Sellers	Sacramento Valley	Tehama
Sellers	Sacramento Valley	Yolo
Sellers	Sacramento Valley	Yuba
Sellers	San Joaquin Valley	Merced
Buyers	North Central Coast	San Benito
Buyers	San Francisco Bay	Alameda
Buyers	San Francisco Bay	Contra Costa
Buyers	San Francisco Bay	Santa Clara
Buyers	San Joaquin Valley	Fresno
Buyers	San Joaquin Valley	Kings
Buyers	San Joaquin Valley	Merced
Buyers	San Joaquin Valley	San Joaquin
Buyers	San Joaquin Valley	Stanislaus

Notes:

[1] The portion of Placer County included in the Mountain Counties Air Basin is defined as "all of Placer County except that portion in the Lake Tahoe Air Basin, as defined in Section 60113(b), and that portion included in the Sacramento Valley Air Basin, as defined in Section 60106(k)" (17 California Code of Regulations [CCR] 60111(i)).

[2] The portion of Placer County included in the Sacramento Valley Air Basin is defined as "that portion of Placer County which lies west of Range 9 east, M.D.B. & M" (17 CCR 60106(k)).

[3] The portion of Solano County included in the Sacramento Valley Air Basin is generally defined as the eastern portion of the county. The full description is included in 17 CCR 60106(j).



Source: CARB 2010.

Figure 3.5-2. California Air Basins

General Conformity Section 176 (c) of the CAA (42 U.S. Code [USC] 7506(c)) requires any entity of the federal government that engages in, supports, or in any way provides financial support for, licenses or permits, or approves any activity to demonstrate that the action conforms to the applicable SIP required under Section 110 (a) of the Federal CAA (42 USC 7410(a)) before the action is otherwise approved. In this context, conformity means that such federal actions must be consistent with a SIP's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of those standards. Each federal agency must determine that any action proposed that is subject to the regulations implementing the conformity requirements will, in fact, conform to the applicable SIP before the action is taken. Long-term water transfers are subject to the general conformity rule because a federal agency, the Bureau of Reclamation, is approving Central Valley Project (CVP)-related transfers.

On April 5, 2010, the USEPA revised the general conformity regulations at 40 Code of Federal Regulations (CFR) 93 Subpart B for all federal activities except those covered under transportation conformity (75 Federal Register [FR] 17254). The revisions were intended to clarify, streamline, and improve conformity determination and review processes, and to provide transition tools for making conformity determinations for new NAAQS. The revisions also allowed federal facilities to negotiate a facility-wide emission budget with the applicable air pollution control agencies, and to allow the emissions of one precursor pollutant to be offset by the emissions of another precursor pollutant. The revised rules became effective on July 6, 2010.

The general conformity regulations apply to a proposed federal action in a nonattainment or maintenance area if the total of direct and indirect[1] emissions of the relevant criteria pollutants and precursor pollutants caused by the proposed action equal or exceed certain de minimis amounts, thus requiring the federal agency to make a determination of general conformity. A Federal agency can indirectly control emissions by placing conditions on Federal approval or Federal funding.

Table 3.5-3 presents the de minimis amounts for the area of analysis.

[1] Direct emissions are those that are caused or initiated by the Federal action, and occur at the same time and place as the Federal action. Indirect emissions are reasonably foreseeable emissions that are further removed from the Federal action in time and/or distance, and can be practicably controlled by the Federal agency on a continuing basis (40 CFR 93.152).

Table 3.5-3. General Conformity De Minimis Thresholds

Pollutant	Area	Federal Status	De Minimis (tpy)
VOC (as O_3 precursor)[1]	San Joaquin Valley Air Basin	Nonattainment (Extreme)	10
VOC (as O_3 precursor)[1]	Sacramento Valley Air Basin	Nonattainment (Severe)	25
VOC (as O_3 precursor)[1]	San Francisco Bay Air Basin	Nonattainment (Marginal)	100
NOx (as O_3 precursor)[2]	San Joaquin Valley Air Basin	Nonattainment (Extreme)	10
NOx (as O_3 precursor)[2]	Sacramento Valley Air Basin	Nonattainment (Severe)	25
NOx (as O_3 precursor)[2]	San Francisco Bay Air Basin	Nonattainment (Marginal)	100
CO	San Joaquin Valley Air Basin	Maintenance[3]	100
CO	Sacramento Valley Air Basin	Maintenance[4]	100
CO	San Francisco Bay Air Basin	Maintenance[5]	100
PM_{10}	San Joaquin Valley Air Basin	Maintenance	100
PM_{10}	Sacramento County	Maintenance	100
$PM_{2.5}$	San Joaquin Valley Air Basin	Nonattainment	100
$PM_{2.5}$	Sacramento Valley Air Basin[6]	Nonattainment	100
$PM_{2.5}$	San Francisco Bay Air Basin	Nonattainment	100
SO_2 (as $PM_{2.5}$ precursor)	See Footnote[7]	Attainment	100

Source: CARB 2011b; USEPA 2013a; 40 CFR 93.153.

Notes:

[1] As a precursor to $PM_{2.5}$, VOC also has a threshold of 100 tons per year (tpy). Because the thresholds for VOC as an O_3 precursor are more conservative, those values are used in the analysis.

[2] As a precursor to both NO_2 and $PM_{2.5}$, NOx also has a threshold of 100 tpy. Because the thresholds for NOx as an O_3 precursor are more conservative, those values are used in the analysis.

[3] Includes the urbanized portions of Fresno (Fresno County), Modesto (Stanislaus County), and Stockton (San Joaquin Valley); however, no water agencies are located in these areas.

[4] Includes the Chico Urbanized Area (Butte County) and the Sacramento area (portions of Placer, Sacramento, and Yolo County). No water agencies are located in the Chico Urbanized Area or the urbanized area of Yolo County, near the City of Davis.

[5] Includes the San Francisco-Oakland-San Jose urbanized area, which includes San Francisco County and portions of Alameda, Contra Costa, Marin, Napa, San Mateo, Santa Clara, Solano, and Sonoma Counties.

[6] Includes the Sacramento area (Sacramento County and portions of El Dorado, Placer, Solano, and Yolo Counties), the Yuba City-Marysville area (Sutter County and a portion of Yuba County), and the Chico Urbanized Area (Butte County). No water agencies are located in the Chico Urbanized Area.

[7] Although the area of analysis is an attainment area for SO_2, any precursors to nonattainment pollutants are also subject to de minimis thresholds; therefore, since SO_2 is a precursor to $PM_{2.5}$, which is in nonattainment for certain regions, it is subject to the given emissions threshold.

Key:

CO = carbon monoxide; NOx = nitrogen oxides; O_3 = ozone; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; SO_2 = sulfur dioxide; tpy = tons per year; VOC = volatile organic compounds

The general conformity regulations incorporate a stepwise process, beginning with an applicability analysis. According to USEPA guidance (USEPA 1994), before any approval is given for a proposed action to go forward, the regulating federal agency must apply the applicability requirements found at 40 CFR 93.153(b) to the proposed action. The guidance states that the applicability analysis can be (but is not required to be) completed concurrently with any analysis required under the National Environmental Policy Act (NEPA). If the regulating federal agency determines that the general conformity regulations do not apply to the proposed action (meaning the project emissions do not exceed the de minimum thresholds), no further analysis or documentation is required.

If the general conformity regulations apply to the proposed action, the regulating federal agency must next conduct a conformity evaluation in accord with the criteria and procedures in the implementing regulations, publish a draft determination of general conformity for public review, and then publish the final determination of general conformity. For a required action to meet the conformity determination emissions criteria, the total of direct and indirect emissions from the action must be in compliance or consistent with all relevant requirements and milestones contained in the applicable SIP (40 CFR 93.158(c)), and in addition must meet other specified requirements, such as:

- For any criteria pollutant or precursor, the total of direct and indirect emissions from the action is specifically identified and accounted for in the applicable SIP's attainment or maintenance demonstration (40 CFR 93.158(a)(1)); or

- For precursors of O_3, NO_2, or particulate matter, the total of direct and indirect emissions from the action is fully offset within the same nonattainment (or maintenance) area through a revision to the applicable SIP or a similarly enforceable measure that effects emission reductions so that there is no net increase in emissions of that pollutant (40 CFR 93.158(a)(2)); or

- For O_3 or NO_2, the total of direct and indirect emissions from the action is determined and documented by the State agency primarily responsible for the applicable SIP to result in a level of emissions which, together with all other emissions in the nonattainment (or maintenance) area, would not exceed the emissions inventory specified in the applicable SIP (40 CFR 93.158(a)(5)(i)(A)); or

- For O_3 or NO_2, the total of direct and indirect emissions from the action (or portion thereof) is determined by the State agency responsible for the applicable SIP to result in a level of emissions which, together with all other emissions in the nonattainment (or maintenance) area, would exceed the emissions inventory specified in the applicable SIP and the State Governor or the Governor's designee for SIP actions makes a written commitment to USEPA for specific SIP revision measures reducing emissions to not exceed the emissions inventory (40 CFR 93.158(a)(5)(i)(B)).

3.5.1.2.2 State

The CCAA substantially added to the authority and responsibilities of the State's air pollution control districts (APCDs). The CCAA establishes an air quality management process that generally parallels the Federal process. The CCAA, however, focuses on attainment of the California Ambient Air Quality Standards (CAAQS) that, for certain pollutants and averaging periods, are typically more stringent than the comparable NAAQS. The CAAQS are included in Table 3.5-4.

Table 3.5-4. California Ambient Air Quality Standards

Pollutant	Averaging Time	CAAQS
O_3	1 Hour	0.09 ppm (180 µg/m^3)
O_3	8 Hour	0.070 ppm (137 µg/m^3)
PM_{10}	24 Hour	50 µg/m^3
PM_{10}	Annual	20 µg/m^3
$PM_{2.5}$	Annual	12 µg/m^3
CO	1 Hour	20 ppm (23 mg/m^3)
CO	8 Hour	9.0 ppm (10 mg/m^3)
NO_2	1 Hour	0.18 ppm (339 µg/m^3)
NO_2	Annual	0.030 ppm (57 µg/m^3)
SO_2	1 Hour	0.25 ppm (655 µg/m^3)
SO_2	24 Hour	0.04 ppm (105 µg/m^3)
Pb	30-Day Average	1.5 µg/m^3

Source: CARB 2013a.
Key:
µg/m^3 = micrograms per cubic meter; CAAQS = California Ambient Air Quality Standard; mg/m^3 = milligrams per cubic meter; ppm = parts per million

The CCAA requires that the CAAQS be met as expeditiously as practicable, but does not set precise attainment deadlines. Instead, the act established increasingly stringent requirements for areas that will require more time to achieve the standards.

The air quality attainment plan requirements established by the CCAA are based on the severity of air pollution problems caused by locally generated emissions. Upwind APCDs are required to establish and implement emission control programs commensurate with the extent of pollutant transport to downwind districts.

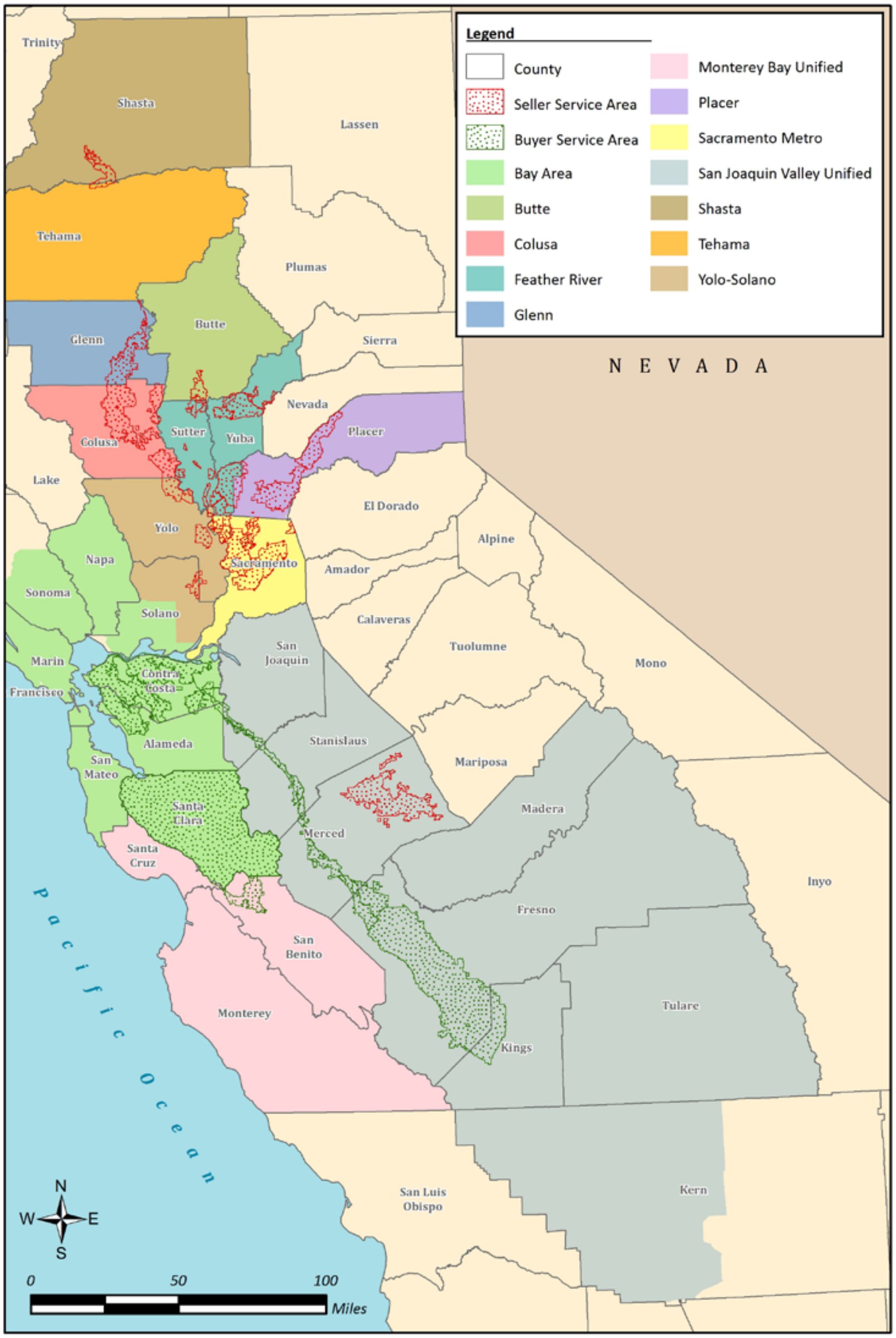
The California Air Resources Board (CARB) is responsible for developing emission standards for on-road motor vehicles and some off-road equipment in the state. In addition, CARB develops guidelines for the local districts to use in establishing air quality permit and emission control requirements for stationary sources subject to the local air district regulations.

3.5.1.2.3 Regional/Local

Multiple air quality management districts (AQMDs) and APCDs have jurisdiction over the O_3, PM_{10}, and $PM_{2.5}$ nonattainment areas. The following APCDs/AQMDs regulate air quality within the area of analysis:

- Bay Area AQMD
- Butte County AQMD
- Colusa County APCD
- Feather River AQMD
- Glenn County APCD
- Monterey Bay Unified APCD
- Placer County APCD
- Sacramento Metropolitan AQMD
- San Joaquin Valley APCD
- Shasta County AQMD
- Tehama County APCD
- Yolo-Solano APCD

Figure 3.5-3 depicts the location of each air district in relation to the Seller and Buyer Service Areas.



Source: CARB 2010.

Figure 3.5-3. Locations of APCDs and AQMDs

Air Toxic Control Measure Agricultural engines are subject to CARB's Airborne Toxic Control Measure (ATCM) for Stationary Compression Ignition Engines (17 California Code of Regulations [CCR] 93115). The ATCM contains emissions limits on diesel engines greater than 50 brake-horsepower (bhp), particularly for diesel particulate matter (DPM), based on the size and use of the engine. In addition to requiring the use of CARB diesel fuel[2] or an alternative fuel like biodiesel, the ATCM also contains schedules of required emission reductions that phase-in depending on engine use (e.g., agriculture, emergency, etc.) size (horsepower [hp]), and calendar year. In addition, the individual air districts may have their own rules and regulations governing implementation of the ATCM that must be followed. Rules adopted by the various APCDs and AQMDs related to the ATCM and permitting of stationary agricultural diesel engines are summarized below.[3]

Butte County AQMD

- Rule 441 – Registration Requirements for Stationary Compression Ignition Engines Used in Agricultural Operations
- Rule 1001 – ATCM for Stationary Compression Ignition Engines Used in Agricultural Operations

Colusa County APCD

- No additional rules

Feather River AQMD

- Rule 4.16 – Registration Permits for Compression Ignition Engines Used in Agricultural Operations
- Rule 7.14 – Registration Fees for Compression Ignition Engines Used in Agricultural Operations

Glenn County APCD

- No additional rules

Placer County APCD

- No additional rules

Sacramento Metropolitan AQMD

- No additional rules

San Joaquin Valley APCD

- No additional rules

[2] "CARB diesel fuel" is defined as diesel fuel that meets the specifications of vehicular diesel fuel, namely meeting a 15 parts per million (ppm) sulfur standard.

[3] Because only buyers are under the jurisdiction of the Bay Area AQMD and the Monterey Bay Unified APCD, the rules and regulations associated with these two air districts are not discussed further in this section because they do not participate in groundwater substitutions associated with the Proposed Action and alternatives.

Shasta County AQMD

- No additional rules

Tehama County APCD

- No additional rules

Yolo-Solano AQMD

- Rule 11.3 – Agricultural Engine Registrations

The ATCM requires new stationary diesel-fueled engines to meet certain specific emission standards unless they are remotely located. An engine is defined as a remotely located engine if it is in a Federal ambient air quality area that is designated as attainment for any of the particulate matter and O_3 NAAQS and is more than one-half mile from any residential area, school, or hospital. Assuming that the latter requirement is met (i.e., proximity to sensitive receptors), engines in Colusa, Glenn, Shasta, and Tehama counties are not subject to the ATCM.

For other counties, the emission rates specified in Table 3.5-5 for Noncertified ("Tier 0") Engines and in Table 3.5-6 for Tier 1- and 2-Certified Engines[4] are applicable. The different tables reflect the certification status of existing engines and the emission standard that must be met by the respective compliance dates. The ATCM generally requires that any new engines used for agricultural operations meet the current Tier 3 standard, which must then be subsequently replaced with Tier 4 engines at certain compliance dates.[5] As of 2010, any engines manufactured prior to 1996 (Tier 0 or noncertified engines) cannot continue to be operated unless they meet the emission standards summarized in Table 3.5-5 (equivalent to Tier 3 engines). Tier 1 or Tier 2 certified engines must meet the emission standards required for Tier 4 engines (see Table 3.5-6) starting in 2014 or by 12 years after the installation of the engine, whichever is later. Engines may either be retrofit or replaced to meet the applicable emission standards.

The ATCM does not expressly prohibit the use of diesel engines for agricultural purposes; therefore, diesel engines may be used for groundwater pumping associated with groundwater substitution transfers as long as they are replaced when required by the compliance schedule.

[4] A certified engine is defined as "a CI engine that is certified to meet the Tier 1, Tier 2, Tier 3, or Tier 4 Off-Road CI Certification Standards as specified in title 13, California Code of Regulations, section 2423." New engines must be certified by CARB for emission compliance before they are legal for sale, use, or registration in California. Certification is granted annually to individual engine families and is good for one model year.

[5] Existing engines may also retrofit with a Verified Diesel Emission Control Strategy to meet the applicable emission limits.

Table 3.5-5. Emission Standards for Noncertified Compression Ignition Agricultural Engines > 50 BHP

BHP Range	Compliance Date	DPM Not to Exceed (g/bhp-hr)[1,2]
50<hp<75	2011	0.30
75≤hp<100	2011	0.30
100≤hp<175	2010	0.22
175≤hp<750	2010	0.15
hp>750	2014	0.075

Source: 17 CCR 93115

Notes:

[1] The diesel PM standard indicates the emission limit that existing noncertified engines must meet by the given compliance date. The emission rates in the table reflect Tier 3 emission limits (13 CCR 2423). In other words, existing noncertified engines must be replaced with Tier 3 engines (or retrofit, if feasible) by the compliance date.

[2] If no limits have been established for an off-road engine of the same model year and maximum rated power, then the in-use stationary diesel-fueled engine used in an agricultural operation shall not exceed Tier 1 standards in title 13, CCR, section 2423 for an off-road engine of the same maximum rated power irrespective of model year.

Key:

CI = compression ignition
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
HC = hydrocarbons
NMHC = non-methane hydrocarbons
hp = horsepower

Table 3.5-6. Emission Standards for Tier 1- and 2-Certified Compression Ignition Engines > 50 BHP

BHP Range	Compliance Date	DPM Not to Exceed (g/bhp-hr)[1,2]
50<hp<75	2015 [3]	0.02
75≤hp<175	2015 [3]	0.01
175≤hp<750	2014 [3]	0.01
hp>750	2014 [3]	0.075

Source: 17 CCR 93115.

Notes:

[1] The diesel PM standard indicates the emission limit that existing Tier 1- or 2-certified engines must meet by the given compliance date. The emission rates in the table reflect Tier 4 emission limits (13 CCR 2423). In other words, existing Tier 1- or 2-certified engines must be replaced with Tier 4 engines (or retrofit, if feasible) by the compliance date.

[2] Or 12 years after the date of initial installation, whichever is later

[3] If no limits have been established for an off-road engine of the same model year and maximum rated power, then the in-use stationary diesel-fueled engine used in an agricultural operation shall not exceed Tier 1 standards in title 13, CCR, section 2423 for an off-road engine of the same maximum rated power irrespective of model year.

Key:

CI = compression ignition
CO = carbon monoxide
g/bhp-hr = grams per brake-horsepower hour
HC = hydrocarbons
NMHC = non-methane hydrocarbons
hp = horsepower

3.5.1.3 Existing Conditions

The following sections describe the air basins within the Long-Term Water Transfers area of analysis, including CARB's estimated annual average daily emissions for agricultural sources. Emissions categories include farming operations (harvesting and tilling), fugitive windblown dust (non-pasture agricultural lands), agricultural burning, agricultural equipment, and irrigation pumps. Although there are other agricultural emissions categories that CARB includes in its inventories, only those categories that could be affected by the Proposed Action and alternatives were summarized. This section also summarizes existing monitoring data for the area of analysis.

The entire area of analysis is in attainment of the PM_{10}, NO_2, SO_2, CO[6], and Pb NAAQS. Table 3.5-7 summarizes the federal attainment status of counties in the area of analysis. Table 3.5-8 summarizes the attainment status for the CAAQS. The entire area of analysis has attained the CO, NO_2, SO_2, and Pb CAAQS.

Figure 3.5-4 shows the federal maintenance areas for the CO standard; Figure 3.5-5 shows the federal nonattainment areas for the 8-hour O_3 standard; Figure 3.5-6 shows the federal nonattainment areas for $PM_{2.5}$; and Figure 3.5-7 shows the federal maintenance areas for PM_{10}.

[6] Portions of the area of analysis are listed as maintenance areas of the CO NAAQS, meaning that they were previously in nonattainment, but have since been redesignated as attainment areas. The Sacramento Census Bureau Urbanized Area (portions of Placer, Sacramento, and Yolo Counties) is designated as a maintenance area for CO; however, no water agencies are located in the maintenance area in Yolo County (near the City of Davis). Additionally, the Chico Urbanized Area in Butte County is designated maintenance, but no water agencies are located in this area. The San Francisco-Oakland-San Jose Urbanized Area (portions of Alameda, Contra Costa, Marin, Napa, San Mateo, Santa Clara, Solano, and Sonoma Counties and all of San Francisco County) is also a maintenance area for CO.

Table 3.5-7. Federal Attainment Status for the Area of Analysis

Air Basin	County	O_3	PM_{10}	$PM_{2.5}$
Sacramento Valley	Butte	N[1]	A	N
	Colusa	A	A	A
	East Solano	N[2]	A	N
	Glenn	A	A	A
	Placer	N	A	N
	Sacramento	N[2]	M[5]	N
	Shasta	A	A	A
	Sutter (Sacramento Metro[3])	N[2]	A	N
	Tehama	A	A	A
	Yolo	N[3]	A	N
	Yuba	A	A	N
San Joaquin Valley	Fresno	N[4]	M	N
	Kings	N[4]	M	N
	Merced	N[4]	M	N
	San Joaquin	N[4]	M	N
	Stanislaus	N[4]	M	N
San Francisco Bay	Alameda	N[1]	A	N
	Contra Costa	N[1]	A	N
	Santa Clara	N[1]	A	N
North Central Coast	San Benito	A	A	A

Source: CARB 2011b; USEPA 2013a; 40 CFR 81.

Notes:

[1] 8-Hour O_3 classification = marginal

[2] 8-Hour O_3 classification: Severe 15

[3] The Sacramento Metro Area portion of Sutter County is defined as "portion south of a line connecting the northern border of Yolo County to the southwest tip of the Yuba County and continuing along the southern Yuba County border to Placer County." (40 CFR 81).

[4] 8-Hour O_3 classification: Extreme

[5] On October 23, 2013, the USEPA approved the *PM_{10} Implementation/Maintenance Plan and Redesignation Request for Sacramento County* (October 28, 2010) and redesignated the area as maintenance for PM_{10} (78 FR 59261).

[6] PM_{10} classification: Moderate

Key:

O_3 = ozone; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; N = nonattainment; A = attainment; M = maintenance

Table 3.5-8. State Attainment Status for the Area of Analysis

Air Basin	County	O_3	PM_{10}	$PM_{2.5}$
Sacramento Valley	Butte	N	N	N
	Colusa	A	N	A
	East Solano	N	N	A
	Glenn	A	N	A
	Placer	N	N	A
	Sacramento	N	N	A
	Shasta	N	N	A
	Sutter	N-T[1]	N	A
	Tehama	N	N	A[2]
	Yolo	N	N	A
	Yuba	N-T[1]	N	A
San Joaquin Valley	Fresno	N	N	N
	Kings	N	N	N
	Merced	N	N	N
	San Joaquin	N	N	N
	Stanislaus	N	N	N
San Francisco Bay	Alameda	N	N	N
	Contra Costa	N	N	N
	Santa Clara	N	N	N
North Central Coast	San Benito	N	N	A

Source: CARB 2014a; CARB 2011b; 17 CCR 60200-60210.

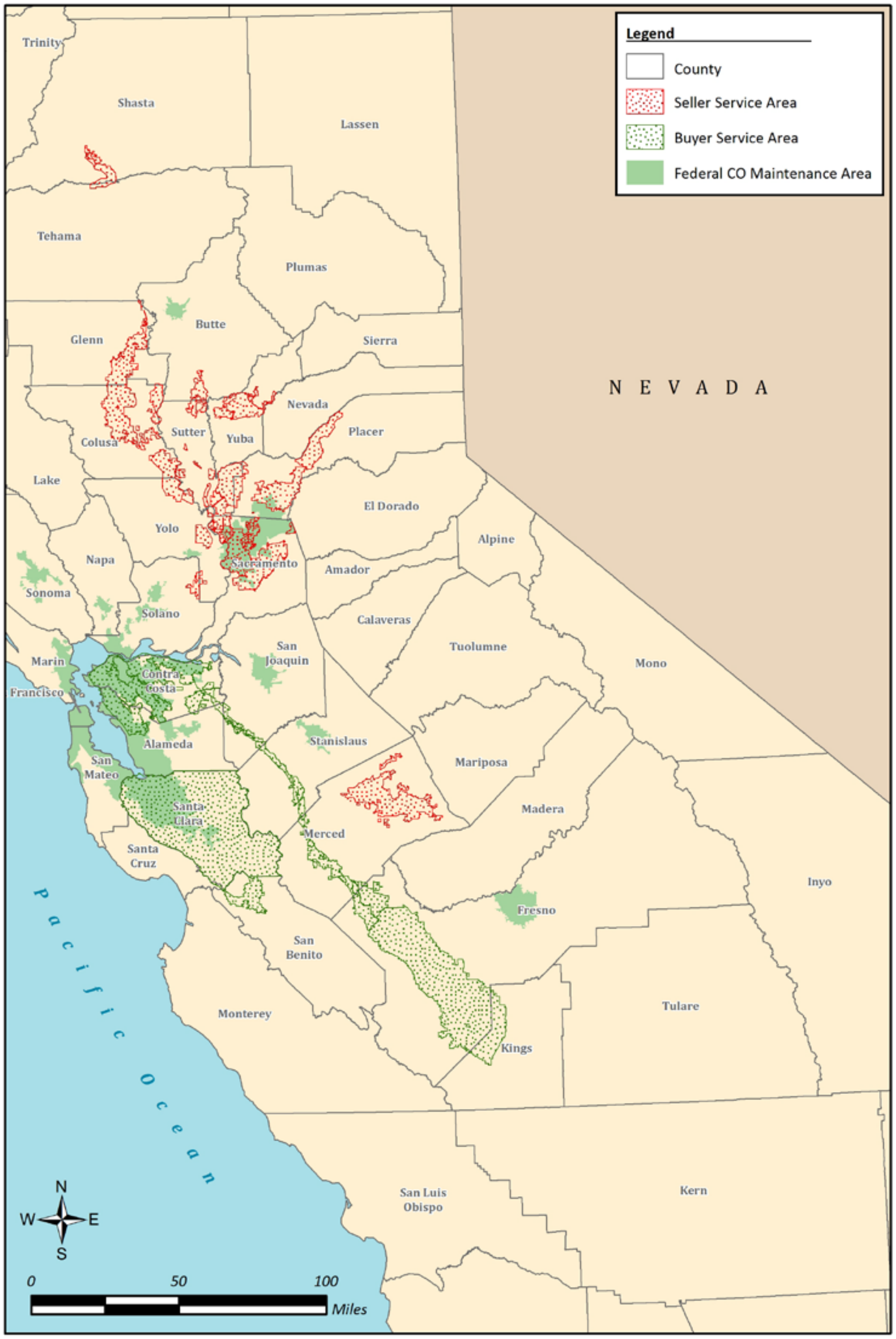
Notes:

[1] Nonattainment/transitional areas are defined as those areas that during a single calendar year, the State standards were not exceeded more than three times at any monitoring location within the district.

[2] Tehama County is "unclassified" for the $PM_{2.5}$ CAAQS, which generally means that insufficient monitoring data is available to make a designation. Such areas are typically treated as attainment areas.

Key:

O_3 = ozone; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; N = nonattainment; N-T = nonattainment-transitional; A = attainment

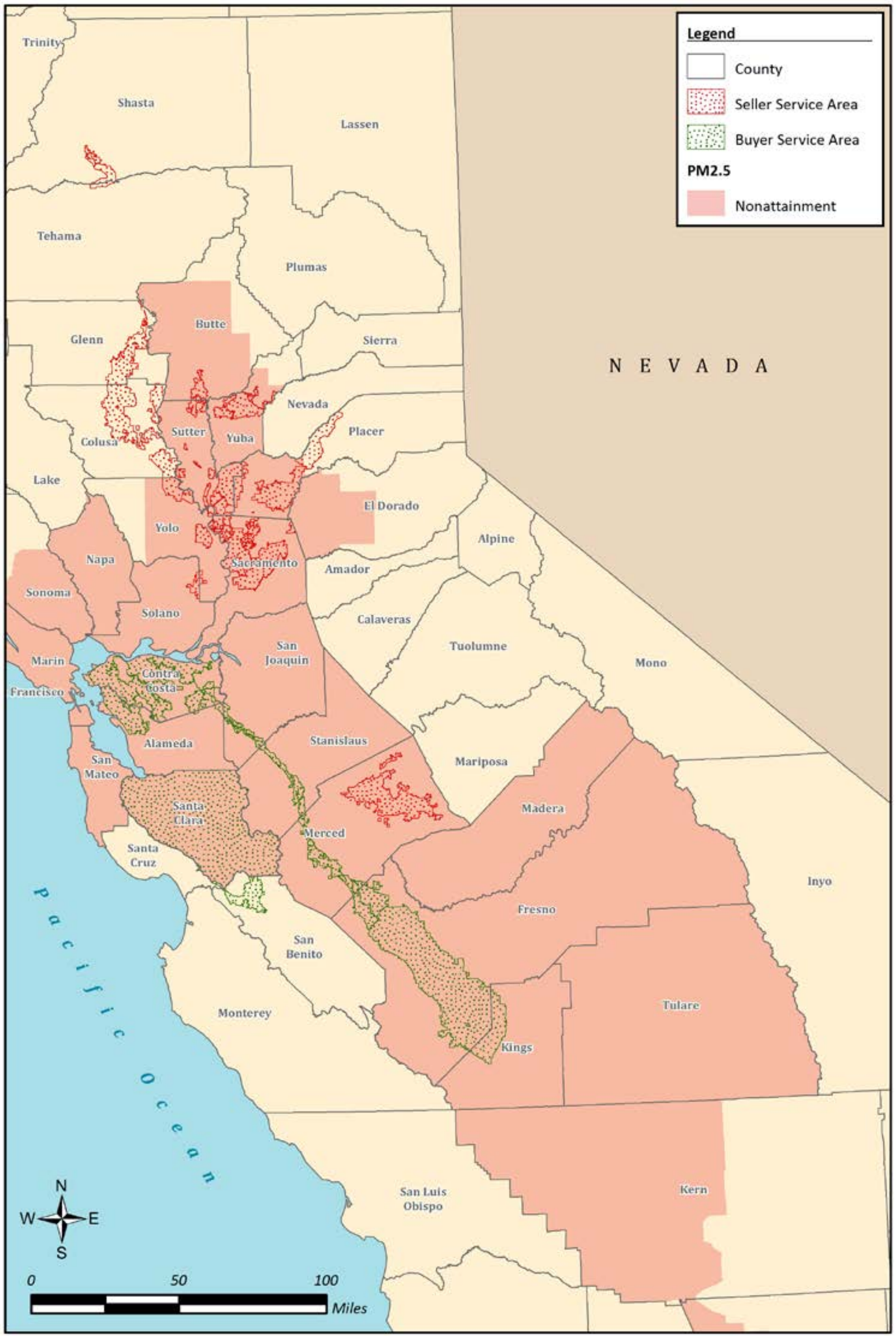


Source: USEPA 2013b.

Figure 3.5-4. Federal CO Maintenance Areas

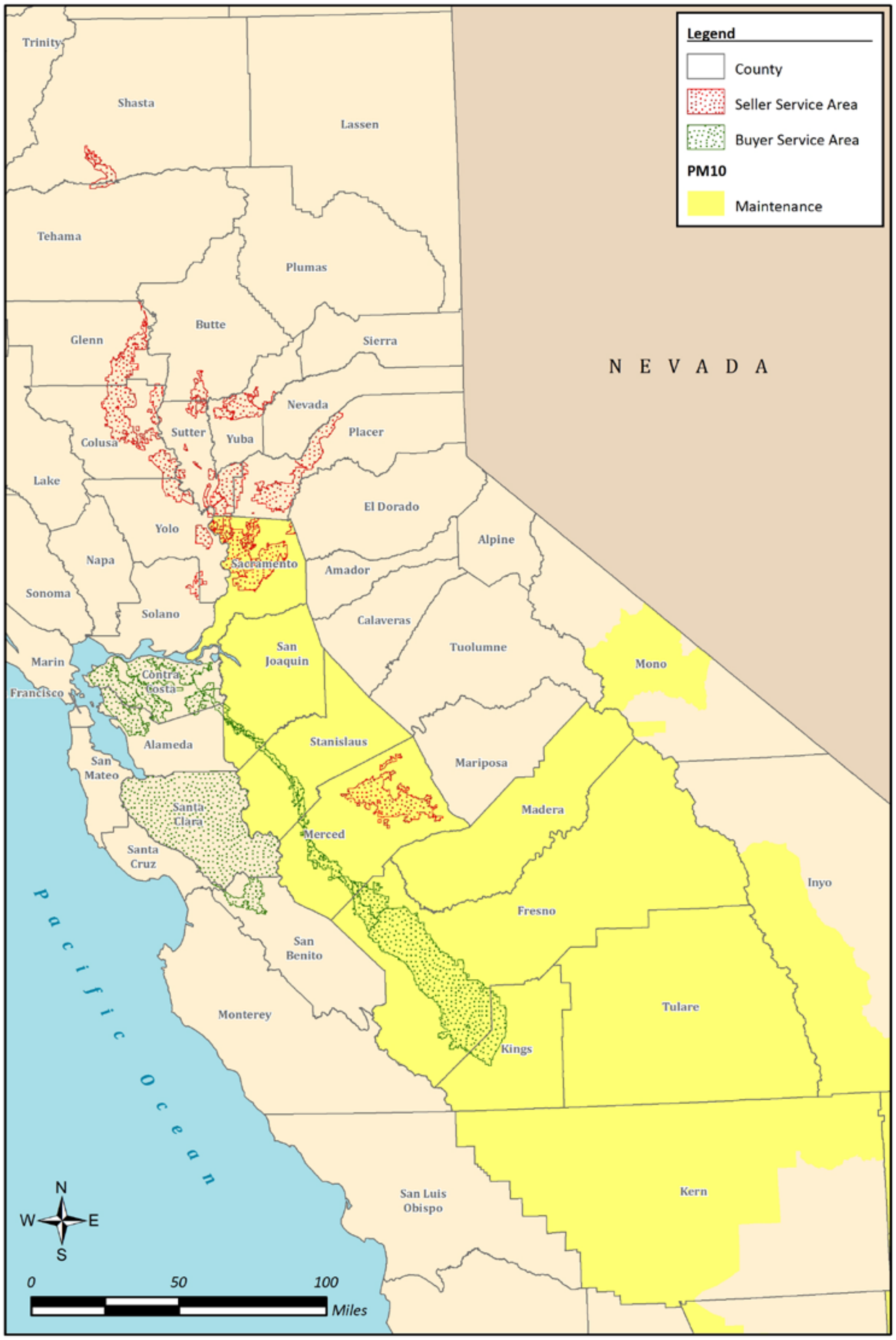
Source: USEPA 2013b.

Figure 3.5-5. Federal 8-Hour O_3 Nonattainment Areas



Source: USEPA 2013b.

Figure 3.5-6. Federal $PM_{2.5}$ Nonattainment Areas



Source: USEPA 2013b.

Figure 3.5-7. Federal PM_{10} Maintenance Areas

3.5.2 Environmental Consequences/Environmental Impacts

These sections present the assessment methods and significance criteria and describe the environmental consequences/environmental impacts associated with each alternative.

3.5.2.1 Assessment Methods

Groundwater substitution could increase air emissions in the Seller Service Area by increased exhaust emissions from groundwater pumping or by increased fugitive dust emissions by cropland idling. Cropland idling transfers could reduce vehicle exhaust emissions but increase fugitive dust emissions. This analysis estimates emissions using available emissions data and models and information on fuel type, engine size (hp), and annual transfer amounts included in the proposed alternatives. Existing emissions models used for the analysis include:

- Diesel engine emission standards established in 17 CCR 93115.8 and 13 CCR 2423
- Diesel engine emission factors from the USEPA's *Compilation of Air Pollutant Emission Factors* (AP-42), specifically from the following chapters:
  - Chapter 3.2: Natural Gas-Fired Reciprocating Engines (USEPA 2000)
  - Chapter 3.3: Gasoline and Diesel Industrial Engines (USEPA 1996)
- CARB Emission Inventory Documentation for the following categories:
  - Section 7.4: Agricultural Land Preparation (CARB 2003a)
  - Section 7.5: Agricultural Harvest Operations (CARB 2003b)
  - Section 7.12: Windblown Dust – Agricultural Lands (CARB 1997)
- CARB Size Fractions for particulate matter (CARB 2012)

To estimate reduction in vehicle exhaust as a result of cropland idling transfers, this analysis uses available information in "Comparison of Summertime Emission Credits from Land Fallowing Versus Groundwater Pumping" (Byron Buck & Associates 2009). The study compared the relative reduction in emissions due to cropland idling activities versus groundwater substitution. Byron Buck & Associates (2009) estimated the gallons of fuel consumed by farm equipment that would be reduced per acre idled and the average quantity of fuel consumed by groundwater pumping. It was assumed that an agency would need 4.25 acre-feet (AF) of water produced by idling to offset the equivalent emissions of one AF of groundwater pumped (Byron Buck & Associates 2009). Using this ratio, the expected reductions in vehicular exhaust emissions from cropland idling were estimated.

This analysis summarizes emissions by air district and county. Analyzing air quality emissions is a complex undertaking and the specific sub-region in which emissions must be analyzed and the appropriate unit varies based on the subject matter. For example, local air districts typically have significance thresholds with units in pounds per day (lbs/day). Emissions must be assessed for the entire air district, which may be a multi-county area.

For the purposes of general conformity, the nonattainment or maintenance area is defined as an area designated as nonattainment or maintenance under section 107 of the CAA and described in 40 CFR 81.305 for California. The nonattainment area varies by pollutant and the area's designation and classification. The nonattainment and maintenance areas included in this analysis for the Sellers Service Area (defined in 40 CFR 81.305) are summarized below:

- CO Maintenance Area (Sacramento Census Bureau Urbanized Area): Parts of Placer, Sacramento, and Yolo Counties.
- PM_{10} Maintenance Area
  - Sacramento County
  - San Joaquin Valley: Includes Merced County
- 8-Hour O_3 Nonattainment Area
  - Sacramento Metro (Severe-15 Classification): Sacramento and Yolo Counties and parts of El Dorado, Placer, Solano, and Sutter Counties.
  - San Joaquin Valley (Extreme Classification): Includes Merced County

- $PM_{2.5}$ Nonattainment Areas
  - San Joaquin Valley (Annual and 24-Hour Averages): Includes Merced County
  - Sacramento Area (24-Hour Average): Sacramento County and parts of El Dorado, Placer, Solano, and Yolo Counties
  - Yuba City/Marysville (24-Hour Average): Sutter County and part of Yuba County.

Detailed calculations are provided in Appendix F, Air Quality Emission Calculations.

3.5.2.2 Significance Criteria

For California Environmental Quality Act (CEQA), impacts on air quality would be considered potentially significant if the transfers would:

- Conflict with or obstruct implementation of the applicable air quality plan.
- Violate any ambient air quality standard or contribute substantially to an existing or projected violation of any ambient air quality standard.
- Result in a cumulatively considerable net increase of any criteria pollutant for which the area of analysis is nonattainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for O3 precursors).
- Expose sensitive receptors to substantial pollutant concentrations.
- Create objectionable odors affecting a substantial number of people.

Changes in air quality are determined relative to existing conditions (for CEQA) and to the No Action/No Project Alternative (for NEPA). In addition to the general criteria provided above, individual air districts may establish significance criteria that would also be applicable. Additional significance criteria by air district are provided below. Significance criteria are only provided for the sellers in the area of analysis where potential air quality impacts from groundwater substitution and cropland idling transfers could occur.

3.5.2.2.1 Butte County AQMD

The Butte County AQMD has jurisdiction over facilities in Butte County. Water agencies subject to Butte County AQMD rules and regulations include the following:

1. Butte Water District (WD)[7]

The Butte County AQMD's *CEQA Air Quality Handbook* (2008) contains a thresholds table for evaluating significance from operational or construction impacts. The table contains various thresholds depending on the type of environmental document being prepared. In the case of an Environmental Impact Report (EIR), NOx, reactive organic gases (ROG),[8] or PM_{10} would be significant if emissions exceeded 137 lbs/day for either pollutant during operations.

3.5.2.2.2 Colusa County APCD

The Colusa County APCD has jurisdiction over facilities in Colusa County. Water agencies subject to Colusa County APCD rules and regulations include the following:

1. Eastside Mutual Water Company (MWC)
2. Glenn-Colusa Irrigation District (ID)[9]
3. Reclamation District (RD) 108[10]
4. RD 1004[11]
5. Sycamore MWC

The Colusa County APCD does not have significance thresholds for CEQA. As discussed previously, a criterion for determining significance is whether a proposed action or alternative could violate any air quality standard. The threshold used to define a "major source" in the CAA (100 tons per year [tpy]) was used to evaluate significance.

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[7] A portion of Butte WD is also located in Sutter County; therefore, only the portion of the water authority located in Butte County would be subject to the rules and regulations of the Butte County AQMD.

[8] CARB uses the term "reactive organic gases," which is similar to the term "volatile organic compounds" used by the USEPA, but with different exempt compounds (CARB 2009). For this analysis, the terms are used interchangeably.

[9] A portion of the Glenn-Colusa ID is located in Glenn County; therefore, only irrigation pumps or idled croplands located in Colusa County are subject to the Colusa County APCD's significance thresholds.

[10] A portion of RD 108 is located in Yolo County; therefore, only irrigation pumps or idled croplands located in Colusa County are subject to the Colusa County APCD's significance thresholds.

[11] Portions of RD 1004 are located in Glenn and Sutter Counties; therefore, only irrigation pumps or idled croplands located in Colusa County are subject to the Colusa County APCD's significance thresholds.

3.5.2.2.3 Feather River AQMD

The Feather River AQMD has jurisdiction over facilities in Sutter and Yuba counties. Water agencies implementing cropland idling and/or groundwater substitution transfers subject to Feather River AQMD rules and regulations include the following:

1. Butte WD[12]
2. Cordua ID
3. Cranmore Farms
4. Garden Highway MWC
5. Gilsizer Slough Ranch
6. Goose Club Farms and Teichert Aggregates
7. Natomas Central MWC[13]
8. Pelger MWC
9. Pleasant Grove-Verona MWC
10. RD 1004[14]
11. Tule Basin Farms

The Feather River AQMD published *Indirect Source Review Guidelines* (2010) to assess the air quality impact of land use projects under CEQA. The Feather River AQMD has significant impact thresholds of 25 lbs/day for NOx and VOC and 80 lbs/day for PM_{10} (Feather River AQMD 2010). Although the significant impact thresholds are geared towards indirect source emissions (i.e., development projects that produce emissions from vehicular traffic to the site, rather than by direct emissions from the facility), the thresholds are assumed to be applicable to stationary source projects as well.

[12] A portion of Butte WD is also located in Butte County; therefore, only the portion of the water authority located in Sutter County would be subject to the rules and regulations of the Feather River AQMD.

[13] A portion of Natomas Central MWC is also located in Sacramento County; therefore, only the portion of the water authority located in Sutter County would be subject to the rules and regulations of the Feather River AQMD.

[14] Portions of RD 1004 are also located in Colusa and Glenn Counties; therefore, only the portion of the water authority located in Sutter County would be subject to the rules and regulations of the Feather River AQMD.

3.5.2.2.4 Glenn County APCD

The Glenn County APCD has jurisdiction over facilities in Glenn County. Water agencies subject to Glenn County APCD rules and regulations include the following:

1. Glenn-Colusa ID[15]
2. RD 1004[16]

As with the Colusa County APCD, the Glenn County APCD does not publish its own quantitative significance thresholds for air quality impacts. As a result, the major source permitting threshold of 100 tpy was also used to determine significance for each pollutant.

3.5.2.2.5 Sacramento Metropolitan AQMD

The Sacramento Metropolitan AQMD has jurisdiction over facilities in Sacramento County. Water agencies subject to Sacramento Metropolitan AQMD rules and regulations include the following:

1. City of Sacramento
2. Natomas Central MWC[17]
3. Sacramento County Water Agency
4. Sacramento Suburban WD

The Sacramento Metropolitan AQMD's *Guide to Air Quality Assessment in Sacramento County* (2009) contains a thresholds table for evaluating significance from operational or construction impacts. The thresholds table indicates that emissions of NOx and ROG would be significant if emissions exceeded 65 lbs/day for either pollutant during operations.

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[15] A portion of the Glenn-Colusa ID is located in Colusa County; therefore, only the portion of the water authority located in Glenn County would be subject to the rules and regulations of the Glenn County APCD.

[16] Portions of RD 1004 are also located in Colusa and Sutter counties; therefore, only the portion of the water authority located in Glenn County would be subject to the rules and regulations of the Glenn County APCD.

[17] A portion of Natomas Central MWC is also located in Sutter County; therefore, only the portion of the water authority located in Sacramento County would be subject to the rules and regulations of the Sacramento Metropolitan AQMD.

3.5.2.2.7 San Joaquin Valley APCD

The San Joaquin Valley APCD has jurisdiction over facilities in the San Joaquin Valley Air Basin. Water agencies subject to San Joaquin Valley APCD rules and regulations include the following:

1. Merced ID

The San Joaquin Valley APCD's *Guide for Assessing and Mitigating Air Quality Impacts* (GAMAQI) (2002) contains provisions for evaluating significance under CEQA. The GAMAQI establishes O_3 precursor (ROG and NOx) emissions thresholds for project operation of 10 tpy for each O_3 precursor pollutant.

3.5.2.2.8 Shasta County AQMD

The Shasta County AQMD has jurisdiction over facilities in Butte County. Water agencies subject to Shasta County AQMD rules and regulations include the following:

1. Anderson-Cottonwood ID[18]

The *Shasta County General Plan (As Amended Through September 2004)* contains a thresholds table for evaluating significance from operational or construction impacts. The *Shasta County General Plan* has two significance threshold levels, Level "A" thresholds and Level "B" thresholds, with the Level "B" thresholds equal to 137 lbs/day for NOx, ROG, and PM_{10}. If the Level "A" thresholds are exceeded, then Standard Mitigation Measures and Best Available Mitigation Measures (BAMM) must be applied and special BAMM must be applied if Level "B" thresholds are exceeded. The Level "A" thresholds are 25 lbs/day for NOx and ROG and 80 lbs/day for PM_{10}. Because the Level "A" thresholds are the minimum levels are which mitigation would not be required, they were used as the significance threshold in this analysis.

3.5.2.2.9 Tehama County APCD

The Tehama County APCD has jurisdiction over facilities in Tehama County. Water agencies subject to Tehama County APCD rules and regulations include the following:

1. Anderson-Cottonwood ID[19]

[18] A portion of Anderson-Cottonwood ID is also located in Tehama County; therefore, only the portion of the water authority located in Shasta County would be subject to the rules and regulations of the Shasta County AQMD.

[19] A portion of Anderson-Cottonwood ID is also located in Shasta County; therefore, only the portion of the water authority located in Tehama County would be subject to the rules and regulations of the Tehama County APCD.

The Tehama County APCD's *Planning & Permitting Air Quality Handbook* (2009) contains a thresholds table for evaluating significance from operational or construction impacts. The table contains various thresholds depending on the type of environmental document being prepared. In the case of an EIR, NOx, ROG, or PM_{10} would be significant if emissions exceeded 137 lbs/day for either pollutant during operations.

3.5.2.2.10 Yolo-Solano AQMD

The Yolo-Solano AQMD has jurisdiction over facilities in Yolo County and the eastern portion of Solano County. Water agencies subject to Yolo-Solano AQMD rules and regulations include the following:

1. Conaway Preservation Group
2. Pope Ranch
3. RD 108[20]
4. RD 2068
5. River Garden Farms
6. Te Velde Revocable Family Trust

The Yolo-Solano AQMD's *Handbook for Assessing and Mitigating Air Quality Impacts* (2007) contains thresholds for determining the significance of project operations. The thresholds for ROG and NOx are 10 tpy each and the threshold for PM_{10} is 80 lbs/day.

3.5.2.3 Alternative 1: No Action/No Project

Cropland idling and groundwater pumping in the Buyer Service Area as a result of CVP water shortages could increase emissions. Under the No Action/No Project Alternative, agricultural water users in the Buyer Service Area would continue to face CVP shortages, similar to existing conditions. In response, farmers would leave some crops idle, which would leave bare soils susceptible to fugitive dust emissions from windblown dusts. Farmers would also continue to pump groundwater for irrigation, which releases emissions if diesel pumps are used. These actions in response to CVP shortages are similar to those that occur under existing conditions; therefore, there would be no change to emissions under the No Action/No Project Alternative.

[20] A portion of RD 108 is also located in Colusa County; therefore, only the portion located in Yolo County is subject to the rules and regulations of the Yolo-Solano AQMD.

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

As described above, the Proposed Action would have three main effects to emissions:

1. Increased exhaust emissions from groundwater substitution;

2. Decreased fugitive dust and farm equipment engine exhaust emissions from reduced land preparation and harvesting activities; and

3. Increased fugitive dust emissions from wind erosion during crop idling activities.

This section evaluates each of these effects separately and combined.

3.5.2.4.1 Sellers Service Area

Increased groundwater pumping for groundwater substitution transfers would increase emissions of air pollutants in Sellers Service Area. Increased emissions from diesel- and natural gas-fired engines would occur within the area of analysis as pump activity for groundwater substitution transfers.

The only water agencies located in the Placer County APCD are the Placer County Water Agency and the South Sutter WD. Neither water agency is proposing to participate in groundwater substitution or cropland idling. There would be no air quality impacts associated with groundwater pumping and cropland idling in the Placer County APCD.

Merced ID is the only water agency located in the San Joaquin Valley APCD; additionally, Anderson-Cottonwood ID is the only water agency located in the Shasta County and Tehama County APCDs. Merced ID is only proposing stored reservoir water transfers that would not increase emissions. Anderson-Cottonwood ID exclusively operates electric engines; therefore, there would be no local criteria pollutant emissions resulting from the combustion of fossil fuels. Additionally, these water agencies are not proposing to participate in cropland idling or crop shifting. There would be no air quality impacts associated with groundwater pumping and cropland idling in the San Joaquin Valley, Shasta County, and Tehama County APCDs.

Although the Butte WD operates in Butte and Sutter Counties, the agency is only proposing to use wells located in Sutter County for groundwater pumping. As a result, because wells in Butte County would not be used, there would be no air quality impacts associated with groundwater pumping in the Butte County AQMD.

Engine exhaust emissions were estimated using AP-42 emission factors and diesel emission standards as summarized in Section 3.5.2.1, Assessment Methods. Estimated emissions from groundwater pumping that would occur in the Colusa County APCD, Feather River AQMD, Glenn County APCD, Sacramento Metropolitan AQMD, and Yolo-Solano AQMD are provided in Table 3.5-9 through Table 3.5-13. Significance was determined for individual water agencies. Detailed calculations are provided in Appendix F, Air Quality Emission Calculations.

Table 3.5-9. Annual Emissions from Groundwater Pumping for the Colusa County APCD (tpy)

Water Agency[1,2]	VOC	NOx	CO	SOx	PM_{10}	$PM_{2.5}$
Eastside MWC	<1	2	2	1	<1	<1
RD 1004	1	13	5	1	<1	<1
Significance Threshold	100	100	100	100	100	100
Significant?	No	No	No	No	No	No

Notes:

[1] Glenn-Colusa ID is not included in the table because no engines would operate in Colusa County.

[2] RD 108 and Sycamore MWC are not included on the table because only electric engines would operate in these water agencies and there would be no local criteria pollutant emissions.

Key:

CO = carbon monoxide; NOx = nitrogen oxides; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; SOx = sulfur oxides; VOC = volatile organic compounds

Table 3.5-10. Peak Daily Emissions from Groundwater Pumping for the Feather River AQMD (lbs/day)

Water Agency[1,2]	VOC	NOx	CO	SOx	PM_{10}	$PM_{2.5}$
Gilsizer Slough Ranch	10	**119**	26	8	2	2
Pelger MWC	1	17	23	6	1	1
Pleasant Grove-Verona MWC	**33**	**285**	126	31	8	8
Tule Basin Farms	4	**128**	10	<1	<1	<1
Air District Threshold	25	25	n/a	n/a	80	n/a
Significant?	**Yes**	**Yes**	n/a	n/a	No	n/a

Notes:

[1] Butte WD, Cordua ID, Cranmore Farms, Garden Highway MWC, Goose Club Farms and Teichert Aggregates, and Natomas Central MWC are not included on the table because only electric engines would operate in these water agencies and there would be no local criteria pollutant emissions.

[2] RD 1004 is not included in the table because no engines would operate in Sutter County.

Key:

CO = carbon monoxide; lbs/day = pounds per day; NOx = nitrogen oxides; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; SOx = sulfur oxides; VOC = volatile organic compounds

Table 3.5-11. Annual Emissions from Groundwater Pumping for the Glenn County APCD (tpy)

Water Agency[1]	VOC	NOx	CO	SOx	PM_{10}	$PM_{2.5}$
RD 1004	<1	2	<1	<1	<1	<1
Air District Threshold	100	100	100	100	100	100
Significant?	No	No	No	No	No	No

Notes:

[1] Glenn-Colusa ID is not included on the table because only electric engines would operate in these water agencies and there would be no local criteria pollutant emissions.

Key:

CO = carbon monoxide; NOx = nitrogen oxides; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; SOx = sulfur oxides; VOC = volatile organic compounds

Table 3.5-12. Peak Daily Emissions from Groundwater Pumping for the Sacramento Metropolitan AQMD (lbs/day)

Water Agency	VOC	NOx	CO	SOx	PM_{10}	$PM_{2.5}$
Sacramento Suburban WD	23	**788**	61	<1	2	2
Air District Threshold	65	65	n/a	n/a	n/a	n/a
Significant?	No	**Yes**	n/a	n/a	n/a	n/a

Notes:

[1] City of Sacramento, Natomas Central MWC, and Sacramento County Water Agency not included on the table because only electric engines would operate in these water agencies and there would be no local criteria pollutant emissions.

Key:

CO = carbon monoxide; lbs/day = pounds per day; NOx = nitrogen oxides; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; SOx = sulfur oxides; VOC = volatile organic compounds

Table 3.5-13. Peak Daily Emissions from Groundwater Pumping for the Yolo-Solano AQMD (lbs/day)

Water Agency[1]	VOC	NOx	CO	SOx	PM_{10}	$PM_{2.5}$
Peak Daily Emissions (lbs/day)						
Conaway Preservation Group	13	148	125	25	6	6
Air District Threshold	n/a	n/a	n/a	n/a	80	n/a
Significant?	n/a	n/a	n/a	n/a	No	n/a
Annual Project Emissions (tpy)						
Conaway Preservation Group	1	8	7	1	<1	<1
Air District Threshold	10	10	n/a	n/a	n/a	n/a
Significant?	No	No	No	No	No	No

Notes:

[1] Pope Ranch, RD 108, RD 2068, River Garden Farms, and Te Velde Revocable Family Trust are not included on the table because only electric engines would operate in these water agencies and there would be no local criteria pollutant emissions.

Key:

CO = carbon monoxide; lbs/day = pounds per day; NOx = nitrogen oxides; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; SOx = sulfur oxides; VOC = volatile organic compounds

As shown in the tables, criteria pollutant emissions would not exceed the significance criteria for the Colusa County APCD (Table 3.5-9), Glenn County APCD (Table 3.5-11), and Yolo-Solano AQMD (Table 3.5-13). Air quality impacts from groundwater pumping in these air districts would be less than significant.

As shown in Table 3.5-10, VOC emissions would exceed the significance criteria in Pleasant Grove-Verona MWC and NOx emissions would exceed the significance criteria in Gilsizer Slough Ranch, Pleasant Grove-Verona MWC, and Tule Basin Farms. As a result, groundwater pumping in the Feather River AQMD would result in a significant impact. Implementation of mitigation measure AQ-1 would reduce VOC and NOx emissions to less than significant. Table 3.5-24 summarizes mitigated emissions from groundwater pumping.

As shown in Table 3.5-12, NOx emissions exceed the significance criteria for the Sacramento Metropolitan AQMD. As a result, NOx emissions that would occur from groundwater pumping in Sacramento County would result in a significant impact under CEQA. Implementation of mitigation measures AQ-1 and AQ-2 would reduce emissions to less than significant. Table 3.5-20 summarizes mitigated emissions from groundwater pumping.

Water transfers via cropland idling could reduce vehicle exhaust emissions from reduced operations in the Sellers Service Area. Cropland idling reduces use of farm equipment that reduces criteria pollutant emissions from vehicle exhaust. Reduced vehicle exhaust emissions were estimated based on the proposed acreages of croplands that would be idled and consequently the amount of equipment that would be idled during the Proposed Action. Emissions were estimated for the upper limit of cropland that could be idled as part of the Proposed Action. It is likely that the individual water agencies would not choose to idle the upper limits proposed as part of the Proposed Action in every year; therefore, these reductions are a maximum reduction and would likely not occur in every year.

Table 3.5-14 summarizes daily emissions that would not occur from vehicle exhaust (i.e., emission reductions) in the area of analysis, while Table 3.5-15 summarizes annual emissions.

Table 3.5-14. Maximum Reduction in Daily Emissions from Vehicle Exhaust (Cropland Idling) (lbs/day)[1]

Water Agency	VOC	NOx	CO	SOx	PM_{10}	$PM_{2.5}$
Butte WD	(1)	(13)	(17)	(4)	(1)	(1)
Conaway Preservation Group	(1)	(23)	(31)	(8)	(2)	(2)
Cranmore Farms	(<1)	(3)	(4)	(1)	(<1)	(<1)
Glenn-Colusa ID	(4)	(72)	(95)	(24)	(6)	(6)
Goose Club Farms and Teichert Aggregates	(1)	(11)	(14)	(4)	(1)	(1)
Pelger MWC	(<1)	(3)	(4)	(1)	(<1)	(<1)
Pleasant Grove-Verona MWC	(1)	(10)	(13)	(3)	(1)	(1)
RD 108	(1)	(22)	(29)	(7)	(2)	(2)
RD 1004	(1)	(11)	(14)	(4)	(1)	(1)
RD 2068	(<1)	(8)	(11)	(3)	(1)	(1)
Sycamore MWC	(1)	(11)	(14)	(4)	(1)	(1)
Te Velde Revocable Family Trust	(<1)	(8)	(10)	(3)	(1)	(1)
Total	**(10)**	**(195)**	**(256)**	**(64)**	**(15)**	**(15)**

Notes:
[1] Emission reductions (beneficial impacts) are shown in parentheses.
Key:
CO = carbon monoxide; NOx = nitrogen oxides; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; SOx = sulfur oxides; VOC = volatile organic compounds

Table 3.5-15. Maximum Reduction in Annual Emissions from Vehicle Exhaust (Cropland Idling) (tpy)[1]

Water Agency	VOC	NOx	CO	SOx	PM_{10}	$PM_{2.5}$
Butte WD	(<0.1)	(0.8)	(1.1)	(0.3)	(0.1)	(0.1)
Conaway Preservation Group	(0.1)	(1.6)	(2.0)	(0.5)	(0.1)	(0.1)
Cranmore Farms	(<0.1)	(0.2)	(0.2)	(0.1)	(<0.1)	(<0.1)
Glenn-Colusa ID	(0.3)	(4.8)	(6.3)	(1.6)	(0.4)	(0.4)
Goose Club Farms and Teichert Aggregates	(<0.1)	(0.7)	(1.0)	(0.2)	(0.1)	(0.1)
Pelger MWC	(<0.1)	(0.2)	(0.2)	(0.1)	(<0.1)	(<0.1)
Pleasant Grove-Verona MWC	(<0.1)	(0.7)	(0.9)	(0.2)	(0.1)	(0.1)
RD 108	(0.1)	(1.5)	(1.9)	(0.5)	(0.1)	(0.1)
RD 1004	(<0.1)	(0.7)	(1.0)	(0.2)	(0.1)	(0.1)
RD 2068	(<0.1)	(0.5)	(0.7)	(0.2)	(<0.1)	(<0.1)
Sycamore MWC	(<0.1)	(0.7)	(1.0)	(0.2)	(0.1)	(0.1)
Te Velde Revocable Family Trust	(<0.1)	(0.5)	(0.7)	(0.2)	(<0.1)	(<0.1)
Total	**(0.7)**	**(12.9)**	**(17.0)**	**(4.2)**	**(1.0)**	**(1.0)**

Notes:
[1] Emission reductions (beneficial impacts) are shown in parentheses.
Key:
CO = carbon monoxide; NOx = nitrogen oxides; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; SOx = sulfur oxides; VOC = volatile organic compounds

As shown in the tables, cropland idling would result in reduced vehicle exhaust emissions for all pollutants, although the actual reduction would likely be less than indicated in the tables because the full amount of cropland idling would not occur every year. Air quality impacts from vehicle exhaust that would not occur during cropland idling in the area of analysis would be beneficial.

Water transfers via cropland idling would decrease fugitive dust emissions associated with land preparation and harvesting, but also increase fugitive dust emissions from wind erosion of bare fields in the Sellers Service Area. Cropland idling could result in reduced fugitive dust (PM_{10} and $PM_{2.5}$) emissions from land preparation and harvesting activities. Barren land, on the other hand, could consequently result in an increase in particulate matter emissions.

CARB has published emission inventory documentation that specifies the expected particulate matter emissions for land preparation and harvesting activities that would occur for various crops (CARB 2003a; CARB 2003b). Under cropland idling transfers, land preparation and harvesting activities would not occur; therefore, fugitive dust emissions would not be released. CARB also provides emission inventory documentation for windblown dust for agricultural lands (CARB 1997). These emissions would occur if the fields are left barren and subject to causing windblown dust. $PM_{2.5}$ emissions were estimated from PM_{10} emissions using CARB's published PM size fractions for agricultural tilling dust (profile no. 417) and agricultural windblown dust (profile no. 411) (CARB 2012). Table 3.5-16 summarizes daily fugitive dust emissions that would occur from cropland idling in the area of analysis while Table 3.5-17 summarizes annual fugitive dust emissions.

As shown in the tables, the combined effect of reduced dust emissions from absence of land preparation and harvesting with increased dust emissions from windblown dust would cause net PM_{10} and $PM_{2.5}$ emissions to be negative for all crops. As a result, fugitive dust emissions occurring from cropland idling in the area of analysis would be beneficial.

Table 3.5-16. Daily Fugitive Dust Emissions from Cropland Idling (lbs/day)[1]

Water Agency	PM_{10} Land Preparation/ Harvesting	PM_{10} Erosion	PM_{10} Total	$PM_{2.5}$ Land Preparation/ Harvesting	$PM_{2.5}$ Erosion	$PM_{2.5}$ Total
Butte WD	(158)	6	(152)	(24)	1	(22)
Conaway Preservation Group	(245)	18	(227)	(37)	4	(33)
Cranmore Farms	(65)	1	(64)	(10)	<1	(9)
Glenn-Colusa ID	(1,646)	416	(1,230)	(247)	83	(164)
Goose Club Farms and Teichert Aggregates	(260)	6	(254)	(39)	1	(38)
Pelger MWC	(66)	1	(65)	(10)	<1	(10)
Pleasant Grove-Verona MWC	(234)	5	(229)	(35)	1	(34)

Water Agency	PM_{10} Land Preparation/ Harvesting	PM_{10} Erosion	PM_{10} Total	$PM_{2.5}$ Land Preparation/ Harvesting	$PM_{2.5}$ Erosion	$PM_{2.5}$ Total
RD 108	(371)	75	(296)	(56)	15	(41)
RD 1004	(253)	44	(209)	(38)	9	(29)
RD 2068	(46)	5	(41)	(7)	1	(6)
Sycamore MWC	(256)	66	(190)	(38)	13	(25)
Te Velde Revocable Family Trust	(80)	6	(74)	(12)	1	(11)
Total	**(3,680)**	**651**	**(3,029)**	**(552)**	**130**	**(421)**

Notes:
[1] Emission reductions (beneficial impacts) are shown in parentheses.
Key:
PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter

Table 3.5-17. Annual Fugitive Dust Emissions from Cropland Idling (tpy)[1]

Water Agency	PM_{10} Land Preparation/ Harvesting	PM_{10} Erosion	PM_{10} Total	$PM_{2.5}$ Land Preparation/ Harvesting	$PM_{2.5}$ Erosion	$PM_{2.5}$ Total
Butte WD	(14)	1	(14)	(2)	<1	(2)
Conaway Preservation Group	(22)	2	(20)	(3)	<1	(3)
Cranmore Farms	(6)	<1	(6)	(1)	<1	(1)
Glenn-Colusa ID	(148)	37	(111)	(22)	7	(15)
Goose Club Farms and Teichert Aggregates	(23)	1	(23)	(4)	<1	(3)
Pelger MWC	(6)	<1	(6)	(1)	<1	(1)
Pleasant Grove-Verona MWC	(21)	<1	(21)	(3)	<1	(3)
RD 108	(33)	7	(27)	(5)	1	(4)
RD 1004	(23)	4	(19)	(3)	1	(3)
RD 2068	(4)	<1	(4)	(1)	<1	(1)
Sycamore MWC	(23)	6	(17)	(3)	1	(2)
Te Velde Revocable Family Trust	(7)	1	(7)	(1)	<1	(1)
Total	**(331)**	**59**	**(273)**	**(50)**	**12**	**(38)**

Notes:
[1] Emission reductions (beneficial impacts) are shown in parentheses.
Key:
PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter

3.5.2.4.2 Buyer Service Area

Use of water from transfers on agricultural fields in the Buyer Service Area could reduce windblown dust. Water transfers to agricultural users in Merced, San Benito, Fresno, and Kings Counties would reduce the amount of land idled relative to the No Action/No Project Alternative. Crop plantings would reduce the potential for fugitive dust emissions that occurs from winds blowing over bare fields. The air quality impacts in the Buyer Service Area would be beneficial.

3.5.2.4.3 General Conformity

Water transfers via groundwater substitution and cropland idling could exceed the general conformity de minimis thresholds. Counties located in federal nonattainment or maintenance areas must also demonstrate compliance with the general conformity provisions in 40 CFR 93 Subpart B. Glenn and Colusa counties are designated as attainment areas for all NAAQS and are therefore not considered further in terms of general conformity. Furthermore, several water agencies are not within the federal 8-hour O_3 attainment area of Sutter County and their emissions are excluded from the general conformity applicability analysis. The excluded water agencies are summarized below:

- Cranmore Farms
- Garden Highway MWC
- Gilsizer Slough Ranch
- Pelger MWC
- Pleasant Grove-Verona MWC
- Tule Basin Farms

Because the CEQA-related mitigation measures are fully enforceable under Cal. Pub. Res. Code §21081.6 and would be a requirement of project implementation, mitigated emissions for the Proposed Action were compared to the general conformity de minimis thresholds. Although sellers may be initially proposing to use both groundwater substitution and cropland idling, it is possible that they could opt to use only one method in the future. Because cropland idling would reduce criteria pollutant emissions, only emissions from groundwater substitution were compared to general conformity de minimis thresholds to provide a worst-case estimate of impacts. Table 3.5-18 summarizes the general conformity applicability analysis.

Mitigated emissions would be less than the general conformity de minimis thresholds; therefore, no further action would be required under general conformity. Detailed calculations are provided in Appendix F.

Table 3.5-18. General Conformity Applicability Evaluation for the Proposed Action (Annual Emissions, tons per year)

County/ Nonattainment Area	**Sacramento Metro[1,5]**	**Sacramento Metro[1,5]**	**Sacramento Area[2]**	**Sacramento[3,4]**	**Yuba City-Marysville[6]**	**Sacramento Co.**	**Sacramento[4]**	**Yuba City-Marysville[6]**
Pollutant	VOC	NOx	CO	SOx	SOx	PM_{10}	$PM_{2.5}$	$PM_{2.5}$
Classification	Severe	Severe	Maintenance	$PM_{2.5}$ Precursor	$PM_{2.5}$ Precursor	Maintenance	Nonattainment	Nonattainment
Sacramento	0.1	4.9	0.4	0.001	--	0.01	0.01	--
Solano[7]	0	0	--	--	--	--	--	--
Sutter	0.3	3.6	--	--	3.1	--	--	0.5
Yolo	0.7	7.9	--	--	--	--	--	--
Yuba[7]	--	--	--	--	0.0	--	--	0.0
Total	1.2	16.3	0.4	0.001	3.1	0.01	0.01	0.5
De Minimis Threshold (tpy)	25	25	100	100	100	100	100	100
Exceed Threshold?	No	No	No	No	No	No	No	No

Notes:

1 The Sacramento Metro 8-hour O_3 nonattainment area consists of Sacramento and Yolo Counties and parts of El Dorado, Placer, Solano, and Sutter Counties. Emissions occurring within the attainment area of these counties are excluded from the total emissions.

2 The Sacramento Area CO maintenance area is based on the Census Bureau Urbanized Area and consists of parts of Placer, Sacramento, and Yolo Counties. The general conformity applicability evaluation is based on emissions that would occur within the entire county to be conservative.

3 All counties are designated as attainment areas for SO_2; however, because SO_2 is a precursor to $PM_{2.5}$, its emissions must be evaluated under general conformity.

4 The 24-hour $PM_{2.5}$ nonattainment area for Sacramento includes Sacramento County and parts of El Dorado, Placer, Solano, and Yolo Counties. The general conformity applicability analysis assumes that all emissions that could occur within each county would occur within the Sacramento nonattainment area to be conservative.

5 VOC and NOx emissions are excluded from Sutter County for Cranmore Farms, Garden Highway MWC, Gilsizer Slough Ranch, Pelger MWC, RD 1004, and Tule Basins Farms because they are located in areas designated as attainment for the federal 8-hour O_3 NAAQS.

6 The Yuba City-Marysville $PM_{2.5}$ nonattainment area consists of all of Sutter County and part of Yuba County.

7 Only electric-powered engines are proposed to operate in this county for groundwater substitution; therefore, emissions are equal to zero.

Key:

CO = carbon monoxide; n/a = not applicable; NOx = nitrogen oxides; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; SO_2 = sulfur dioxide; VOC = volatile organic compounds

3.5.2.5 Alternative 3: No Cropland Modifications

Alternative 3 would include transfers through groundwater substitution, but would not include any cropland idling or crop shifting transfers.

Increased groundwater pumping for groundwater substitution transfers would increase emissions of air pollutants. Groundwater substitution transfers that would occur under Alternative 3 would be identical to those that would occur under the Proposed Action. As a result, air quality impacts in the Colusa County APCD, Glenn County APCD, and Yolo-Solano AQMD and the would be less than significant (see Table 3.5-9, Table 3.5-11, and Table 3.5-13). Air quality impacts in the Feather River AQMD would be less than significant for NOx and VOC after implementation of mitigation measure AQ-1 (see Table 3.5-10). Air quality impacts in the Sacramento Metropolitan AQMD would be less than significant with implementation of mitigation measures AQ-1 and AQ-2 (see Table 3.5-12). There would be no air quality impacts in Placer County APCD, San Joaquin Valley APCD, Shasta County AQMD, and Tehama County APCD because groundwater pumping would use electric engines or would not occur in these areas.

Water transfers via groundwater substitution could exceed the general conformity de minimis thresholds. The general conformity evaluation was completed as described in Section 3.5.2.4.3 General Conformity. Since cropland idling would not be completed in Alternative 3, any emission reductions that would result from reduced land preparation and harvesting activities would not occur. Because the general conformity analysis for the Proposed Action only analyzed emissions from groundwater substitution, the impacts in Alternative 3 would be the same as those analyzed in the Proposed Action. As shown in Table 3.5-18 mitigated emissions would be less than the de minimis thresholds and no further action is required under general conformity.

3.5.2.6 Alternative 4: No Groundwater Substitution

Alternative 4 would include transfers through cropland idling and crop shifting, but would not include any groundwater substitution transfers.

Water transfers via cropland idling could reduce vehicle exhaust emissions from reduced operations in the area of analysis. Cropland idling reduces use of farm equipment that reduces criteria pollutant emissions from vehicle exhaust. The proposed acreages of cropland that would be idled during Alternative 4 would be the same as that idled during the Proposed Action. As a result, impacts would be the same as those shown in Table 3.5-14 and Table 3.5-15. Air quality impacts from reduced vehicle exhaust during cropland idling would be beneficial.

Water transfers via cropland idling would increase fugitive dust emissions from wind erosion of bare fields and decrease fugitive dust emissions associated with land preparation and harvesting in the area of analysis. Cropland idling could result in reduced fugitive dust (PM_{10} and $PM_{2.5}$) emissions from land preparation and harvesting activities. Barren land, on the other hand, could consequently result in an increase in particulate matter emissions. The proposed acreages of cropland that would be idled during Alternative 4 would be the same as that idled during the Proposed Action. As a result, impacts would be the same as those shown in Table 3.5-16 and Table 3.5-17. Air quality impacts from changes in fugitive dust emissions during cropland idling would be beneficial.

3.5.3 Comparative Analysis of Alternatives

Table 3.5-19 summarizes the effects of the action alternatives. The following text supplements the table by describing the magnitude of the effects under the action alternative and No Action/No Project Alternative.

Table 3.5-19. Comparison of Alternatives

Potential Impact	Alternatives	Significance	Proposed Mitigation	Significance After Mitigation
Cropland idling that temporarily converts cropland to bare fields from inadequate water supplies could increase fugitive dust emissions	1	NCFEC	None	NCFEC
Increased groundwater pumping for groundwater substitution transfers would increase emissions of air pollutants in the Sellers Service Area.	2, 3	S	AQ-1, AQ-2	LTS
Water transfers via cropland idling could reduce vehicle exhaust emissions from reduced operations in the Sellers Service Area.	2, 4	B	None	B
Water transfers via cropland idling would increase fugitive dust emissions from wind erosion of bare fields and decrease fugitive dust emissions associated with land preparation and harvesting in the Sellers Service Area.	2, 4	B	None	B

Potential Impact	Alternatives	Significance	Proposed Mitigation	Significance After Mitigation
Use of water from transfers on agricultural fields in the Buyer Service Area could reduce windblown dust.	2, 3, 4	B	None	B
Water transfers via groundwater substitution and cropland idling could exceed the general conformity de minimis thresholds.	2, 3, 4	LTS	None	LTS

Key:
B = beneficial
LTS = less than significant
NCFEC = no change from existing conditions
S = significant

3.5.3.1 No Action/No Project Alternative

There would be no changes to the agricultural lands in the Seller Service Area relative to existing conditions. In the Buyer Service Area, increased land idling could occur in response to water shortages, which could then increase windblown dust emissions.

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

Increased groundwater pumping could increase criteria pollutant emissions from engine exhaust. Cropland idling would increase fugitive dust emissions from wind blowing on bare fields. These emission increases would then be partially offset by reduced farm equipment exhaust and fugitive dust emissions from land preparation and harvesting activities that would no longer occur under the Proposed Action. Mitigation measures would reduce significant impacts to less than significant in the Feather River AQMD and the Sacramento Metropolitan AQMD.

3.5.3.3 Alternative 3: No Cropland Modification

The No Cropland Modification Alternative does not include cropland idling or crop shifting transfers. Impacts associated with groundwater pumping would be the same as those identified for the Proposed Action.

3.5.3.4 Alternative 4: No Groundwater Substitution

The No Groundwater Substitution Alternative does not include groundwater pumping to enable water transfers. Impacts associated with cropland idling would be the same as those identified for the Proposed Action.

3.5.4 Environmental Commitments/Mitigation Measures

Implementation of the various engine control measures (AQ-1) would substantially reduce NOx emissions; however, the extent of the reduction would vary based on the size (hp) and age of the existing engine. For example, a 250 hp engine may have different NOx emission standards than a 100 hp engine. As a result, the same emission reduction between the two different engines may not occur. Table 3.5-20 summarizes the expected daily emissions after mitigation for groundwater substitution. The following mitigation measures would reduce the severity of the air quality impacts.

3.5.4.1 Mitigation Measure AQ-1: Reduce Pumping at Diesel or Natural Gas Wells to Reduce Pumping Below Significance Levels

Selling agency would reduce pumping at diesel or natural gas wells to reduce emissions to below the thresholds. If an agency is transferring water through cropland idling and groundwater substitution in the same year, the reduction in vehicle emissions can partially offset groundwater substitution pumping at a rate of 4.25 AF of water produced by idling to one acre-foot of groundwater pumped. Agencies may also decide to replace old diesel or natural gas wells to reduce emission below the thresholds.

3.5.4.2 Mitigation Measure AQ-2: Operate Dual-Fired Wells as Electric Engines

Any engines operating in the area of analysis that are capable of operating as either electric or natural gas engines would only operate with electricity during any groundwater transfers.

Table 3.5-20. Mitigated Peak Daily Emissions from Groundwater Pumping (lbs/day)

Air District	VOC	NOx	CO	SOx	PM_{10}	$PM_{2.5}$
Feather River AQMD						
Gilsizer Slough Ranch	1	24	31	8	2	2
Pleasant Grove-Verona MWC	2	23	48	14	1	1
Tule Basin Farms	4	19	10	<1	<1	<1
Significance Threshold	25	25	n/a	n/a	80	n/a
Significant?	No	No	n/a	n/a	No	n/a
Sacramento Metropolitan AQMD						
Sacramento Suburban WD	2	54	4	<1	<1	<1
Significance Threshold	65	65	n/a	n/a	n/a	n/a
Significant?	No	No	n/a	n/a	n/a	n/a

Notes:
[1] Emission reductions (beneficial impacts) are shown in parentheses.
Key:
CO = carbon monoxide; lbs/day = pounds per day; NOx = nitrogen oxides; PM_{10} = inhalable particulate matter; $PM_{2.5}$ = fine particulate matter; SOx = sulfur oxides; VOC = volatile organic compounds

Following mitigation, VOC and NOx emissions would be reduced to less than significant under CEQA.

3.5.5 Potentially Significant Unavoidable Impacts

None of the action alternatives would result in potentially significant unavoidable impacts on air quality.

3.5.6 Cumulative Effects

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

Increased groundwater pumping for groundwater substitution transfers would increase criteria pollutant emissions from engine operation in the air districts. All counties affected by the Proposed Action are located in areas designated nonattainment for the PM_{10} CAAQS. Additionally, all counties are designated nonattainment for the O_3[21] CAAQS except Butte and Glenn Counties; Butte County, the San Joaquin Valley Air Basin, and the San Francisco Bay Air Basin are also designated nonattainment for the $PM_{2.5}$ CAAQS. Nonattainment status represents a cumulatively significant impact within the area. Because no single project determines the nonattainment status of a region, individual projects would only contribute to the area's designation on a cumulative basis.

The significance thresholds developed by the air districts serve to evaluate if a proposed project could either 1) cause or contribute to a new violation of a CAAQS or NAAQS in the area of analysis or 2) increase the frequency or severity of any existing violation of any standard in the area. Air districts recognize that air quality violations are not caused by any one project, but are a cumulative effect of multiple projects. Therefore, the air districts (including the Sacramento Metropolitan AQMD) have developed guidance that indicates a proposed project would be cumulatively considerable if the air quality impacts are individually significant.

Implementation of mitigation measures would reduce the Proposed Action's individual impacts to less than significant. Therefore, the Proposed Action's contribution to air quality impacts would not be cumulatively considerable.

[21] O_3 is a secondary pollutant, meaning that it is formed in the atmosphere from reactions of precursor compounds under certain conditions. Primary precursor compounds that lead to O_3 formation include VOCs and NOx; therefore, the significance thresholds established by the air districts for VOC and NOx are intended to maintain or attain the O_3 CAAQS and NAAQS.

Water transfers via cropland idling could reduce vehicle exhaust emissions from reduced operations in the different air districts. As described previously, counties affected by the Proposed Action are located in areas designated nonattainment for the O_3, PM_{10}, and $PM_{2.5}$ CAAQS. Because no single project determines the nonattainment status of a region, the nonattainment status represents a cumulatively significant impact within the area of analysis. Based on guidance published by the air districts, a proposed project would be cumulatively considerable if the air quality impacts are individually significant.

Cropland idling activities would reduce vehicle exhaust emissions from reduced operations, which would be a beneficial impact to air quality. As a result, the Proposed Action's contribution to air quality impacts would not be cumulatively considerable.

Water transfers via cropland idling could increase fugitive dust emissions from wind erosion of bare fields and decrease fugitive dust emissions associated with land preparation and harvesting in the different air districts. As described previously, counties affected by the Proposed Action are located in areas designated nonattainment for the O_3, PM_{10}, and $PM_{2.5}$ CAAQS. Because no single project determines the nonattainment status of a region, the nonattainment status represents a cumulatively significant impact within the area of analysis. Based on guidance published by the air districts, a proposed project would be cumulatively considerable if the air quality impacts are individually significant.

Cropland idling activities would have a net reduction in fugitive dust emissions from reduced operations, which would be a beneficial impact to air quality. As a result, the Proposed Action's contribution to air quality impacts would not be cumulatively considerable.

3.5.6.2 Alternative 3: No Cropland Modification

Cumulative effects under Alternative 3 would be the same as the groundwater pumping impacts described in the Proposed Action.

3.5.6.3 Alternative 4: No Groundwater Substitution

Cumulative effects under Alternative 4 would be the same as the cropland idling impacts described in the Proposed Action.

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Section 3.6 Climate Change

This section presents the existing setting in relation to greenhouse gas (GHG) emissions within the area of analysis and discusses potential effects in relation to climate change from the proposed alternatives. Appendix G, Climate Change Analysis Emission Calculations, provides detailed emission calculations.

GHG emissions associated with groundwater substitution and cropland idling transfers are evaluated in relation to climate change in the area of analysis. The effects of climate change on the alternatives were also analyzed. Implementation of conservation or stored reservoir purchase transfers would not affect GHG emissions in relation to climate change and are not further discussed in this section. Although some crops may be more energy intensive than others, crop shifting is a regular practice in the Seller and Buyer Service Areas and a quantitative analysis was not conducted for this practice.

3.6.1 Affected Environment/Environmental Setting

The United Nations Intergovernmental Panel on Climate Change (IPCC) predicts that changes in the earth's climate will continue through the 21st century and that the rate of change may increase significantly in the future because of human activity (IPCC 2013). Many researchers studying California's climate believe that changes in the earth's climate have already affected California and will continue to do so in the future. Climate change may seriously affect the State's water resources. Temperature increases could affect water demand and aquatic ecosystems. Changes in the timing and amount of precipitation and runoff could occur. Sea level rise could adversely affect the Delta and coastal areas of the State.

Climate change is identified in the 2009 update of the California Water Plan (Bulletin 160-09) as a key consideration in planning for the State's future water management (California Department of Water Resources 2009). The 2009 Water Plan update qualitatively describes the effects that climate change may have on the State's water supply. It also describes efforts that should be taken to evaluate climate change effects quantitatively for the next Water Plan update.

3.6.1.1 Area of Analysis

The area of analysis for climate change includes counties where cropland idling could occur in the Seller Service Area, counties overlying groundwater basins where groundwater substitution transfers could occur, and counties where transferred water would be used for agricultural purposes in the Buyer Service Area. Figure 3.6-1 shows the climate change area of analysis.

Figure 3.6-1. Climate Change Area of Analysis

3.6.1.2 Regulatory Setting

GHG emissions and global climate change are governed by several federal and state laws and policies described below.

3.6.1.2.1 Federal

Department of the Interior

In 2009, the Department of Interior (DOI) issued a Secretarial Order on climate change that expands DOI bureaus' responsibilities in addressing climate change (amended on February 22, 2010). The purpose of Secretarial Order No. 3289 is to provide guidance to bureaus and offices within the DOI on how to provide leadership by developing timely responses to emerging climate change issues. This Order replaces Secretarial Order No. 3226, signed on January 19, 2001, entitled "Evaluating Climate Change Impacts in Management Planning." It reaffirms efforts within DOI that are ongoing with respect to climate change. Among the requirements of the Order is one that requires each bureau and office of DOI to "consider and analyze potential climate change impacts when undertaking long-range planning exercises, setting priorities for scientific research and investigations, and/or when making major decisions affecting DOI resources."

The Reclamation *National Environmental Policy Act (NEPA) Handbook* (2012) recommends that climate change be considered, as applicable, in every NEPA analysis. The *NEPA Handbook* acknowledges that there are two interpretations of climate change in regards to Reclamation actions: 1) Reclamation's action is a potentially significant contributor to climate change and 2) climate change could affect a Reclamation proposed action. The *NEPA Handbook* recommends considering different aspects of climate change (e.g., relevance of climate change to the proposed action, timeframe for analysis, etc.) to determine the extent to which it should be discussed under NEPA.

Additionally, DOI Department Manual 523 (effective December 20, 2012) states that it is DOI policy to use best available science in decision-making water management planning including integrating adaptation strategies. It also states that climate change be considered in developing or revising management plans. Section B further states that "the Department will promote existing processes and when necessary, institute new processes to: 1) Conduct assessments of vulnerability to anticipated or current climate impacts, 2) Develop and implement comprehensive climate change adaptation strategies based on vulnerability and other factors, and 3) Include measurable goals and performance metrics."

Prevention of Significant Deterioration (PSD) and Title V GHG Tailoring Rule

On June 3, 2010, the U.S. Environmental Protection Agency (USEPA) issued a final rule to amend the applicability criteria that determine when new and modified stationary sources are subject to PSD and Title V permitting programs for GHG[1] emissions (75 Federal Register [FR] 31514). The tailoring rule applies a threshold for obtaining these permits for GHG emissions of 75,000 to 100,000 short tons per year (tpy) of carbon dioxide equivalent (CO_2e). [2]

The key elements of the tailoring rule were phased in starting on January 2, 2011. During that phase, only stationary sources that would already be subject to PSD permitting requirements were required to permit GHG emissions. Permitting was required for new sources that would emit 75,000 tpy CO_2e or for existing major stationary sources that had an emissions increase of 75,000 tpy CO_2e. During that phase of permitting, no source was subject to PSD permitting solely because of its GHG emissions. Beginning July 1, 2011, permitting is required for new stationary sources or for modifications that would increase CO_2e emissions by 100,000 tpy. This second phase of permitting applies to both PSD and Title V permitting programs.

NEPA

While there is currently no federal regulation in place to govern the effects of climate change and GHG emissions, the Council on Environmental Quality (CEQ) provided a draft memorandum in February 2010 that outlines how Federal agencies may better consider the effects of GHG emissions and climate change in their evaluation of NEPA documents. In that draft guidance, CEQ proposes the consideration of opportunities to reduce GHG emissions and adapt the actions to climate change impacts throughout the NEPA process.

In the context of NEPA, CEQ proposes that the following climate change issues be considered:

1. The GHG emissions effects of a proposed action and alternative actions; and

2. The relationship of climate change effects to a proposed action or alternatives, including the relationship to proposal design, environmental impacts, mitigation and adaptation measures.

[1] For purposes of the tailoring rule, GHG is defined as the aggregate group of carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.
[2] CO_2e emissions are calculated by multiplying the mass amount of emissions for each pollutant (e.g., N_2O) by the gas's associated global warming potential (ratio of the time-integrated radiative forcing from the instantaneous release of one kilogram of a trace substance relative to that of one kilogram of the reference gas, CO_2 defined by 40 CFR 98 (Mandatory GHG Reporting).

For the GHG emission analysis, the CEQ draft guidance outlines when to evaluate GHG emissions and offers a protocol on how to evaluate GHG emissions. The draft NEPA guidance states that if a proposed action causes direct emissions of 25,000 metric tons or more of CO_2e emissions on an annual basis, then a quantitative and qualitative assessment should be completed in an Environmental Impact Statement (EIS). The draft CEQ guidance suggests that the following steps be taken to evaluate the effects of GHG emissions:

- Quantify cumulative emissions over the life of the project
- Discuss measures to reduce GHG emissions, including consideration of reasonable alternatives
- Qualitatively discuss the link between such GHG emissions and climate change

In the draft memorandum, CEQ recognizes that the discussion of climate change effects in NEPA documents may be discussed in varying detail depending on available data.

3.6.1.2.2 State

California Executive Order S-3-05
On June 1, 2005, former California Governor Arnold Schwarzenegger signed Executive Order S-3-05. This executive order established the following GHG emission reduction targets for California:

- By 2010, reduce GHG emissions to 2000 levels.
- By 2020, reduce GHG emissions to 1990 levels.
- By 2050, reduce GHG emissions to 80 percent below 1990 levels.

The order also requires the Secretary of the California Environmental Protection Agency (Cal/EPA) to report to the Governor and the State Legislature biannually on progress made toward meeting the GHG emission targets, commencing in January 2006. The Secretary of the Cal/EPA is also required to report about climate change impacts on water supply, public health, agriculture, the coastline, and forestry; mitigation and adaptation plans to combat these impacts must also be developed.

California GHG emissions were estimated to be 453.06 million tonnes of CO_2e in 2010, compared to 466.32 million tonnes of CO_2e in 2000 (California Air Resources Board [CARB] 2014). The GHG emissions inventory indicates that emissions decreased by over 13 million tonnes over the decade, representing a 3 percent decrease in statewide emissions. As a result, the State was successful in meeting the first milestone of S-3-05.

California Assembly Bill (AB) 32

California AB 32, the Global Warming Solutions Act of 2006, codifies the state's GHG emissions targets by requiring the state's global warming emissions to be reduced to 1990 levels by 2020 and directs the CARB to enforce the statewide cap that would begin phasing in by 2012. Former Governor Schwarzenegger signed and passed AB 32 into law on September 27, 2006. Key AB 32 milestones are as follows (CARB n.d.):

- January 1, 2009 – Scoping Plan adopted indicating how emissions will be achieved from significant sources of GHGs via regulations, market mechanisms, and other actions.
- During 2009 – CARB staff drafted rule language to implement its plan and held a series of public workshops on each measure (including market mechanisms).
- January 1, 2010 – Early action measures took effect.
- During 2010 – CARB conducted series of rulemakings, after workshops and public hearings, to adopt GHG regulations including rules governing market mechanisms.
- January 1, 2011 – Completion of major rulemakings for reducing GHGs including market mechanisms.
- January 1, 2012 – GHG rules and market mechanisms (e.g., cap-and-trade regulation) adopted by CARB took effect and are legally enforceable.
- December 31, 2020 – Deadline for achieving 2020 GHG emissions cap.

CARB has been proactive in its implementation of AB 32 and has met each of the milestones identified above that have already passed and is on track to meet the last milestone.

California Environmental Quality Act (CEQA) Guidelines

On March 18, 2010, the California Natural Resources Agency adopted amendments to CEQA Guidelines to include provisions for evaluating the significance of GHG emissions. The amended guidelines give the lead agency leeway in determining whether GHG emissions should be evaluated quantitatively or qualitatively, but requires that the following factors be considered when assessing the significance of impacts from GHG emissions (14 California Code of Regulations 15064.4):

- The extent to which the project may increase or reduce GHG emissions as compared to the existing environmental setting.
- Whether the project emissions exceed a threshold of significance that the lead agency determines applies to the project.
- The extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions.

The amended CEQA Guidelines also suggest measures to mitigate GHG emissions, including implementing project features to reduce emissions, obtaining carbon offsets to reduce, or sequestering GHG. The CEQA Guidelines also require energy use and conservation measures to be discussed, which are summarized in Section 3.16, Power.

3.6.1.2.3 Regional/Local

The following air pollution control districts (APCDs) and air quality management districts (AQMDs) regulate air quality within the area of analysis:

- Bay Area AQMD
- Butte County AQMD
- Colusa County APCD
- Feather River AQMD
- Glenn County APCD
- Monterey Bay Unified APCD
- Placer County APCD
- Sacramento Metropolitan AQMD
- San Joaquin Valley APCD
- Shasta County AQMD
- Tehama County APCD
- Yolo-Solano APCD

Section 3.5, Air Quality, depicts the location of each air district in the Seller and Buyer Service Areas. Although these air districts do not regulate GHG emissions directly, they may have GHG-specific significance criteria in their respective CEQA guidelines.

3.6.1.3 Existing Conditions

This section presents projections of the foreseeable affected environment for use as the basis against which the incremental effects of the alternatives are compared in Section 3.6.2 and to indicate the likely effect of climate change on the alternatives.

3.6.1.3.1 California Climate Trends and Associated Impacts

This discussion describes the data sources used for the analysis, the projected climate changes, and the associated impacts of those changes for the state of California and the study area.

Data Sources

Four reports were used as the main data sources for projected changes in climate for this evaluation. Each report is based on different global climate models (GCMs) and emission scenarios, as described below. Because each GCM/emission scenario pair has related uncertainty, it is important to consider results from various models to understand the possible outcomes (California Climate Change Center [CCCC] 2009a). For this analysis, the ranges of projected changes published in each report are presented.

- **"Climate Change Scenarios and Sea Level Rise Estimates for the California 2009 Climate Change Scenarios Assessment" (CCCC 2009a) –** This report provides projected climate data for California, including monthly temperature data, monthly precipitation data and snow water equivalent (the amount of water contained in snowpack). In addition to the report, the data is available through a series of interactive, web-based tools provided by the California Energy Commission (CEC). Four GCMs were used in the report; the National Center for Atmospheric Research (NCAR) Parallel Climate Model (PCM), the National Oceanic and Atmospheric Administration Geophysical Fluids Dynamics Laboratory (GFDL) model (Version 2.1), the NCAR Community Climate System Model (CCSM), and the French Centre National de Recherches Meteorologiques (CNRM) models. Two emission scenarios from the IPCC Fourth Assessment were used; a low emissions scenario involving substantial reductions in emissions after 2050 (B1) and a medium-high emissions scenario assuming continued increased in emissions (A2). Two downscaling methods were used: 1) constructed analogues and 2) bias correction and spatial downscaling.

- **"Climate Change Impacts on Water Supply and Agricultural Water Management in California's Western San Joaquin Valley, and Potential Adaptation Strategies" (CCCC 2009b) –** This report provides estimated watershed runoff and agricultural and urban water demand projections for the Sacramento River basin and the Delta export region of the San Joaquin Valley. The Water Evaluation and Planning modeling system was used in conjunction with six GCMs: CNRM, GFDL, PCM, CCSM, the Center for Climate System Research, and the Max Planck Institute. Two emissions scenarios, B1 and A2, were evaluated.

- **"Climate Change Impacts in the United States: The Third National Climate Assessment" (Melillo, Richmond, and Yohe 2014) –** This report assesses current scientific findings about observed and projected impacts of climate change in the United States. The report draws from a large body of scientific peer-reviewed research published or in press by March 1, 2012.

- **"Global Climate Change Impacts in the United States" (Karl, Melillo, and Peterson 2009) –** This report was prepared by the United States Global Change Research Program, a consortium of 13 federal departments and agencies authorized by Congress in 1989 through the Global Change Research Act of 1990 (Pub. L. 101-606, 104 Stat. 3096, codified as amended at 15 U.S. Code [USC] 2921), and serves as the basis for "The Second National Climate Assessment." The foundation for this report is a set of 21 Synthesis and Assessment Products, as well as other peer-reviewed scientific assessments, including those of the IPCC, the United States Climate Change Science Program, the United States National Assessment of the Consequences of Climate Variability and Change, the Arctic Climate Impact Assessment, the National Research Council's Transportation Research Board report on the Potential Impacts of Climate Change on United States Transportation, and a variety of regional climate impact assessments.

Projected Changes in Climate

The projected changes in climate conditions are expected to result in a wide variety of impacts in the state of California and San Joaquin River area. In general, estimated future climate conditions include changes to:

- Annual temperature
- Extreme heat
- Precipitation
- Sea level and storm surge
- Snowpack and streamflow

These projected changes are discussed in detail in the following paragraphs.

Annual Temperature. GCM data exhibit warming across California under both a low emission scenario and medium-high emission scenario (CCCC 2009a). While the data contain variability, there is a steady, linear increase over the 21st century (CCCC 2009a). Projected increases are shown in Table 3.6-1.

Table 3.6-1. Projected Changes in Temperature Compared to the Historical Average (1961 to 1990)

Region	Mid-21st Century	End of 21st Century
California	+1.8 to 5.4°F	+3.6 to 9.0°F
Sacramento Area, California	---	+3.6 to 6.3°F

Sources: CCCC 2009a, CEC 2011.
Key:
--- = no data available
°F = degrees Fahrenheit

On a seasonal basis, the models project substantial warming in the spring and greater warming in the summer than in the winter. Summer (July to September) temperature changes range from 2.7 to 10.8 °F and winter (January to March) temperature changes range from 1.8 to 7.2 °F at the end of the 21st century when compared to the historical average (1961 to 1990) (CCCC 2009a). In addition, the models suggest that, during the summer, warming of interior land surfaces will be greater than that observed along the coast (CCCC 2009a).

Extreme Heat. The climate model results consistently show increases in frequency, magnitude and duration of heat waves when compared to historical averages (1961 to 1990). Historically, extreme temperatures typically occur in July and August. With climate change, these occurrences are likely to begin in June and continue through September (CCCC 2009a). Occurrences lasting five days or longer are projected to become 20 times or more prevalent in the last 30 years of the 21st century (CCCC 2009a).

For Sacramento, the closest area to the San Joaquin River for which data is available, GCM results show a more-than-threefold increase in the frequency of extreme heat and a significant increase in the intensity of hot days (CCCC 2009a). By 2100, the data show as many as 100 days per year with temperatures greater than 95°F in Sacramento (CEC 2011).

*Precipitation***.** On average, the climate model projections show little change in total annual precipitation in California (CCCC 2009a). Specifically, the Mediterranean seasonal precipitation pattern is expected to continue, with most precipitation falling between November and March from North Pacific storms and the prevalence of hot, dry summers (CCCC 2009a). In addition, past trends show a large amount of variability from month to month, year to year, and decade to decade. This high degree of variability is expected to continue in the next century (CCCC 2009a).

For Sacramento, several model simulations indicate a drying trend when compared to the historical average (1961 – 1990). Under the low emissions scenario, the 30-year mean precipitation is projected to be more than five percent drier by mid-21st century and 10 percent drier by late-21st century (CCCC 2009a). The model results showing the drying trend indicate a decline in the frequency of precipitation events, but do not show a clear correlation in the precipitation intensity (CCCC 2009a).

In the western San Joaquin Valley, model simulations suggest that there is a generally decreasing trend in precipitation as the 21st century progresses (CCCC 2009b). In addition, model results indicate that water shortages may be felt more acutely in the western San Joaquin Valley as Delta exports become more constrained (CCCC 2009b).

Sea Level and Storm Surge. By 2050, sea level rise is projected to be between 30 and 45 centimeters (cm) (12 to 18 inches), compared to 2000 levels (CCCC 2009a). Global models indicate that California may see up to a 140 cm (55 inch) rise in sea level by the end of the 21st century (CEC 2011). Combined with high tides and winter storms, sea level rise is projected to result in an increased rate of extreme high sea level events (CCCC 2009a).

Snowpack and Streamflow. Snowpack and streamflow amounts are projected to decline because of less late winter precipitation falling as snow and earlier snowmelt (Melillo, Richmond, and Yohe 2014). In California, snow water equivalent (the amount of water held in a volume of snow) is projected to decrease by 16 percent by 2035, 34 percent by 2070, and 57 percent by 2099, as compared to measurements between 1971 and 2000 (Melillo, Richmond, and Yohe 2014). By the end of the century, late spring streamflow could decline by up to 30 percent (CEC 2011).

Associated Impacts

The combined changes in climate result in various impacts for California and the study area. Potential impacts include changes to wildfire hazards, water supply and demand, natural resources, infrastructure, agriculture and livestock, and human health. Descriptions of the associated impacts are included below.

Wildfire Hazards. Prolonged periods of higher temperatures combined with associated drought will drive larger and more frequent wildfires in California (Melillo, Richmond, and Yohe 2014). The wildfires are projected to start earlier in the summer and last longer into the fall. In

California, the risk of wildfire is projected to increase by up to 55 percent, depending on the level of emission reductions that can be achieved globally (CEC 2011). Changes to temperature and precipitation are also projected to change vegetation types and increase the spread of invasive species that are more fire-prone that, when coupled with more frequent and prolonged periods of drought, increase the risk of fires and reduce the capacity of native species to recover (CEC 2011).

Water Supply and Demand. The projected changes in climate will increase pressure on California's water resources, which are already fully utilized by the demands of a growing economy and population (CEC 2011). Although significant changes in annual precipitation are not projected, increasing temperatures, decreasing snowmelt and changes to spring streamflows will decrease the reliability of water supplies and increase the likelihood of more frequent short-term and long-term droughts and water shortages (Melillo, Richmond, and Yohe 2014). Water is also an important resource for creating hydroelectric power, which may be impacted by decreased supply (Karl, Melillo, and Peterson 2009).

Increasing temperatures will result in increased competition for water among agricultural, municipal, and environmental uses. Larger agricultural demands may lead to increased stress on the management of surface water resources and, potentially, the over exploitation of groundwater aquifers (CCCC 2009b). Agricultural areas could be significantly impacted, with California farmers losing as much as 25 percent of the water supply they need (CEC 2011).

Water supplies are also at risk from rising sea levels. An influx of saltwater would degrade California's estuaries, wetlands, and groundwater aquifers. In particular, saltwater intrusion would threaten the quality and reliability of the major state fresh water supply that is pumped from the southern edge of the Sacramento and San Joaquin River Delta (Delta) (CEC 2011). In addition, the entire Delta region is now below sea level, protected by more than a thousand miles of levees and dams, and catastrophic failure of those dams from an extreme high sea level event would greatly affect this resource (Karl, Melillo, and Peterson 2009).

Projected changes in the timing and amount of river flow, particularly in winter and spring, is estimated to more than double the risk of Delta flooding events by mid-century, and result in an eight-fold increase before the end of the century (Karl, Melillo, and Peterson 2009). Taking into account the additional risk of a major seismic event and increases in sea level due to climate change over this century, the California Bay–

Delta Authority has concluded that the Delta and Suisun Marsh are not sustainable under current practices (Karl, Melillo, and Peterson 2009).

Natural Resources. Climate change will continue to affect natural ecosystems, including changes to biodiversity, location of species and the capacity of ecosystems to moderate the consequences of climate disturbances such as droughts (Melillo, Richmond, and Yohe 2014). In particular, species and habitats that are already facing challenges will be the most impacted by climate change (Melillo, Richmond, and Yohe 2014). Other impacts to natural resources include:

- Changing water quality of natural surficial water bodies, including higher water temperatures, decreased and fluctuating dissolved oxygen content, increased cycling of detritus, more frequent algal blooms, increased turbidity, increased organic content, color changes, and alkalinity changes (Karl, Melillo, and Peterson 2009).

- Decreased tree growth and habitat change in low- and mid-elevation forests from increased temperature and drought (Karl, Melillo, and Peterson 2009).

- Increased frequency and intensity of insect attacks due to increased temperatures and shorter winters (Melillo, Richmond, and Yohe 2014).

- Disruption of the coordination between predator-prey or plant-pollinator life cycles that may lead to declining populations of many native species (Karl, Melillo, and Peterson 2009).

- Changes in the tree canopy that affect rainfall interception, evapotranspiration, and infiltration of precipitation, affecting the quantity of runoff (Karl, Melillo, and Peterson 2009).

- Reduced ability to respond to flooding and increased stress on species populations due to changes in wetland and riparian zone plant communities and hydraulic roughness (Karl, Melillo, and Peterson 2009).

- Shifting distribution of plant and animal species on land, with some species becoming more or less abundant (Karl, Melillo, and Peterson 2009).

- Rare or endangered species may become less abundant or extinct (Melillo, Richmond, and Yohe 2014).

- Decreased recreation and tourism opportunities from ecosystems degradation (Karl, Melillo, and Peterson 2009).

Infrastructure. Existing infrastructure were designed based on past, stable climate trends and may not have the capacity to respond to rapid changes in climate that are projected for the future (Melillo, Richmond, and Yohe 2014). Impacts to infrastructure include:

- Changes to soil moisture (Karl, Melillo, and Peterson 2009), which may led to soil subsidence under structures.
- Increased energy demand for cooling, refrigeration and water transport (Karl, Melillo, and Peterson 2009).
- Buckling of pavement or concrete structures (Karl, Melillo, and Peterson 2009).
- Decreased lifecycle of equipment or increased frequency of equipment failure (Karl, Melillo, and Peterson 2009).
- Accelerated erosion when stormwater infrastructure capacity is exceeded (Melillo, Richmond, and Yohe 2014).

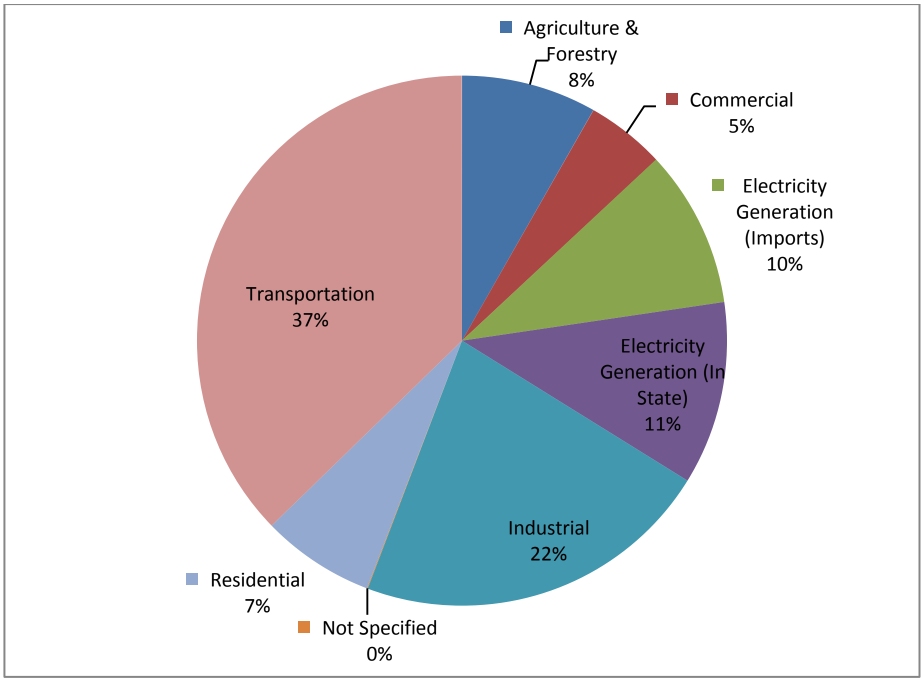
Agriculture and Livestock. Increased temperatures are projected to lengthen the growing season, although disruptions from extreme heat, drought, and changes to insects are also expected (Melillo, Richmond, and Yohe 2014). With adaptive actions, agriculture in the United States is expected to be resilient in the near-term, but yields of crops are expected to decline mid-century and late-century due to increased extremes in the climate (Melillo, Richmond, and Yohe 2014). California produces a large portion of the nation’s high-value specialty crops, which are irrigation dependent and vulnerable to extreme changes in temperature and moisture (Melillo, Richmond, and Yohe 2014). Increased frequency and duration of heat waves would also put stress on livestock.

Human Health. Extreme heat events, increased wildfires, decreased air quality caused by rising temperatures, and diseases transmitted by insects, food and water that are impacted by climate change are a threat to human health and well-being (Melillo, Richmond, and Yohe 2014).

3.6.1.3.2 GHG Emissions Sources and Inventory

California is the second highest emitter of GHG emissions in the states, only behind Texas; however, from a per capita standpoint, California has the 45th lowest GHG emissions among the states. Worldwide, California is the 20th largest emitter of carbon dioxide (CO_2) if it were a country; on a per capita basis, California would be ranked 38th in the world

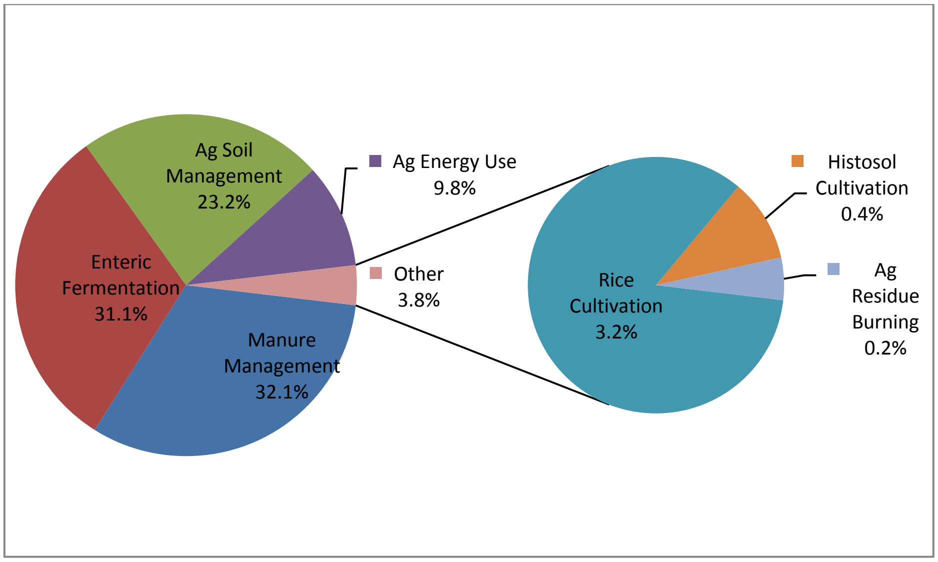
(CARB 2014a). As shown in Figure 3.6-2, transportation is responsible for 37 percent of the State's GHG emissions, followed by the industrial sector (22 percent), electricity generation (21 percent), commercial and residential (12 percent), agriculture and forestry (8 percent) and other sources (0.04 percent). Emissions of CO_2 and nitrous oxide (N_2O) are largely byproducts of fossil fuel combustion. Methane (CH_4), a highly potent GHG, results largely from off-gassing associated with agricultural practices and landfills. California gross GHG emissions in 2012 (the last year inventoried) totaled approximately 459 million metric tons CO_2e (CARB 2014b).



Source: CARB 2014b.

Figure 3.6-2. California GHG Emissions in 2012

Agricultural emissions represented approximately 8 percent of California's emissions in 2012. Agricultural emissions represent the sum of emissions from agricultural energy use (from pumping and farm equipment), agricultural residue burning, agricultural soil management (the practice of using fertilizers, soil amendments, and irrigation to optimize crop yield), enteric fermentation (fermentation that takes place in the digestive system of animals), histosols (soils that are composed mainly of organic matter) cultivation, manure management, and rice cultivation. Agricultural emissions are shown in Figure 3.6-3.



Source: CARB 2014b.

Figure 3.6-3. California Agricultural GHG Emissions in 2012

3.6.2 Environmental Consequences/Environmental Impacts

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

3.6.2.1 Assessment Methods

This analysis estimates CO_2, CH_4, and N_2O emissions that would occur from groundwater substitution transfers and cropland idling transfers. The other two pollutant groups commonly evaluated in various GHG reporting protocols, hydrofluorocarbons and perfluorocarbons, are not expected to be emitted in large quantities as a result of the alternatives and are not discussed further in this section.

This analysis estimates emissions using available emissions data and information on fuel type, engine size (horsepower [hp]), and annual transfer amounts included in the proposed alternatives. Existing emissions data used in the analysis includes:

- Diesel and natural gas fuel emission factors from The Climate Registry (TCR 2014a)
- Electric utility CO_2 emission factors from TCR (2014b)
- Emissions & Generation Resource Integrated Database (eGRID) CH_4 and N_2O emission factors from USEPA (USEPA 2014)

- “Comparison of Summertime Emission Credits from Land Fallowing Versus Groundwater Pumping” (Byron Buck & Associates 2009)

In 2009, Byron Buck & Associates completed a comparison of the relative reduction in emissions due to cropland idling activities versus groundwater substitution. Byron Buck & Associates estimated the gallons of fuel consumed by farm equipment that would be reduced per acre idled and the average quantity of fuel consumed by groundwater pumping. It was assumed that an agency would need 4.25 acre-feet (AF) of water produced by idling to offset the equivalent emissions of one AF of groundwater pumped (Byron Buck & Associates 2009). Using this ratio, the expected reductions in vehicular exhaust emissions from cropland idling were estimated.

Each GHG contributes to climate change differently, as expressed by its global warming potential (GWP). GHG emissions are discussed in terms of CO_2e emissions, which express, for a given mixture of GHG, the amount of CO_2 that would have the same GWP over a specific timescale. CO_2e is determined by multiplying the mass of each GHG by its GWP.

This analysis uses the GWP from the IPCC Fourth Assessment Report (Forster et al. 2007) for a 100-year time period to estimate CO_2e. This approach is consistent with the federal GHG Reporting Rule (40 Code of Federal Regulations [CFR] 98), as effective on January 1, 2014 (78 FR 71904) and California’s 2000-2012 GHG Inventory Report (CARB 2014a). The GWPs used in this analysis are 25 for CH_4 and 298 for N_2O.

Annual emissions were summarized by water agency. Detailed calculations are provided in Appendix G, Climate Change Analysis Emission Calculations.

3.6.2.2 Significance Criteria

The significance criteria described below were developed consistent with the CEQA Guidelines to determine the significance of potential impacts on climate change that could result from implementation of the alternatives. Individual air districts develop their own criteria for evaluating significance. Since climate change is a cumulative issue, GHG emissions were not separated by individual water agencies, counties, or air districts to evaluate significance. Rather, emissions that would occur as a result of the entire alternative were evaluated.

To determine the appropriate significance level to use, the GHG significance criteria for various air districts were evaluated. The review of the CEQA Guidelines was not restricted to only those counties that would be affected by the alternatives. Instead the CEQA Guidelines for air districts with known quantitative or qualitative guidance for GHG emissions were reviewed. Many of the air districts included in the area of analysis do not have published significance thresholds for GHG emissions and climate change. These air districts include the Butte County AQMD, Colusa County APCD, the Glenn County APCD, Shasta County AQMD, Tehama County APCD and the Yolo-Solano AQMD.

Table 3.6-2 summarizes the various emissions thresholds used by air districts throughout California.

Table 3.6-2. Air District GHG Significance Thresholds

Air District	GHG Significance Threshold
Antelope Valley AQMD and Mojave Desert AQMD	Direct and indirect emissions in excess of 100,000 tpy or 548,000 pounds per day CO_2e
Bay Area AQMD	None[1]
Sacramento Metropolitan AQMD	Thresholds of significance for GHG emissions should be related to AB 32's GHG reduction goals.[2]
San Joaquin Valley APCD	Compliance with Best Performance Standards
San Luis Obispo County APCD	Consistency with a Qualified GHG Reduction Plan OR 1,150 metric tons CO_2e/year[3] OR 4.9 CO_2e/service population[4]/year
Santa Barbara County APCD	10,000 metric tons CO_2e/year (proposed)
South Coast AQMD	10,000 metric tons CO_2e/year[5]

Sources: Antelope Valley AQMD 2011; Bay Area AQMD 2012; Mojave Desert AQMD 2011; Sacramento Metropolitan AQMD 2011; San Joaquin Valley APCD 2009; San Luis Obispo County AQMD 2012; Santa Barbara County APCD 2011; and South Coast AQMD 2008.

Notes:

1 The Bay Area AQMD previously recommended a GHG significance threshold of 10,000 metric tons CO_2e/year for industrial sources. On March 5, 2012, the Alameda County Superior Court issued a judgment finding that the Bay Area AQMD had failed to comply with CEQA when it adopted the thresholds. The Bay Area AQMD consequently struck the significance thresholds from its CEQA Guidelines (2012) and no longer recommends significance thresholds.

2 For example, a possible significance threshold could be to determine whether a project's emissions would substantially hinder the State's ability to attain the goals identified in AB 32 (i.e., reduction of statewide GHG emission to 1990 levels by 2020). Additionally, another strategy is to determine if the project is consistent with the State's strategy to achieve the 2020 GHG emissions limit as outlined in the Scoping Plan (CARB 2008).

3 Construction emissions are amortized and combined with operational emissions. The project life is assumed to be 50 years for residential projects and 25 years for commercial projects. This threshold would be most applicable to an industrial (i.e., stationary source) project.

4 The service population is defined as the sum of residents and employees.

5 Construction emissions are amortized and combined with operational emissions. Project lifetime is assumed to be 30 years if not known.

Although several air districts have a significance threshold of 10,000 metric tons per year (MT/yr), the threshold is specific to industrial, stationary source emissions. A "stationary source" is generally defined as "any building, structure, facility, or installation that emits or may emit any regulated air pollutant or any pollutant listed under section 112(b) of the [CAA]" (40 CFR 70.2). A facility can be further defined as any stationary equipment located on one or more contiguous or adjacent properties under common ownership and control (40 CFR 98.6). The stationary source threshold used by multiple air districts (i.e., 10,000 MT/yr) is not intended to cover stationary source emissions owned and operated by multiple parties; rather, it is applicable to individual pieces of equipment, or at most, an individual facility, rather than all equipment affected by the action alternatives. Because multiple facilities and owners are affected by the action alternatives, using the stationary source threshold as the significance threshold for the action alternatives would be overly onerous and is not recommended.

The significance threshold proposed by the Antelope Valley AQMD and the Mojave Desert AQMD (100,000 tons CO_2e per year) is identical to the PSD permitting threshold described previously. Because the intent of the PSD permitting program is to prevent the deterioration of air quality, the 100,000 tpy threshold is appropriate for evaluating significance for the proposed alternatives and was used for this analysis.

3.6.2.3 Alternative 1: No Action/No Project

Combined emissions from groundwater substitution and cropland idling transfers could increase emissions of GHG emissions. There would be no groundwater substitution transfers originating in the Seller Service Area; therefore, the potential for GHG emissions from engine exhaust would be the same as existing conditions.

Cropland idling and groundwater pumping in the Buyer Service Area as a result of Central Valley Project (CVP) water shortages could affect emissions. Under the No Action/No Project Alternative, agricultural water users in the Buyer Service Area would continue to face CVP shortages, similar to existing conditions. In response, farmers would leave some crops idle, which would reduce vehicle exhaust from farm equipment. Farmers would also continue to pump groundwater for irrigation, which releases emissions if diesel pumps are used. These actions in response to CVP shortages would continue under the No Action/No Project Alternative. There would be no change to emissions relative to existing conditions.

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

3.6.2.4.1 Seller Service Area

Increased groundwater pumping for groundwater substitution transfers could increase emissions of GHGs. Table 3.6-3 summarizes direct annual emissions, as CO_2e that would occur from groundwater pumping by each water agency.

Table 3.6-3. Annual GHG Emissions from Groundwater Substitution Transfers (Proposed Action), metric tons CO_2e per year

Water Agency	CO_2	CH_4	N_2O	Total
Anderson-Cottonwood Irrigation District	164	<1	1	165
Butte Water District	356	1	1	358
City of Sacramento	483	1	2	485
Conaway Preservation Group	2,360	3	8	2,371
Cordua Irrigation District	496	1	2	499
Cranmore Farms	272	<1	1	274
Eastside Mutual Water Company	392	<1	1	394
Garden Highway Mutual Water Company	452	1	2	454
Gilsizer Slough Ranch	441	1	1	443
Glenn-Colusa Irrigation District	785	1	3	789
Goose Club Farms and Teichert Aggregates	341	1	1	342
Natomas Central Mutual Water Company	376	1	1	378
Pelger Mutual Water Company	283	<1	1	285
Pleasant Grove-Verona Mutual Water Company	1,890	2	6	1,898
Pope Ranch	119	<1	<1	120
Reclamation District 108	642	1	3	646
Reclamation District 1004	900	1	2	903
Reclamation District 2068	184	<1	1	185
River Garden Farms	326	1	1	327
Sacramento County Water Agency	1,427	2	5	1,434
Sacramento Suburban Water District	4,379	4	10	4,393
Sycamore Mutual Water Company	490	1	2	493
Te Velde Revocable Family Trust	202	<1	1	203
Tule Basin Farms	374	<1	1	375
Total (MT/yr)	18,134	23	57	18,215
Total (tpy)	**19,989**	**26**	**63**	**20,078**

Key:
< = less than
CH_4 = methane
CO_2 = carbon dioxide
MT/yr = metric tons per year
MTCO_2e/yr = metric tons carbon dioxide equivalent per year
N_2O = nitrous oxide
tpy = short tons per year

As shown in Table 3.6-3, GHG emissions would not exceed the significance criterion of 100,000 tpy and emissions would be less than significant.

Water transfers via cropland idling could reduce vehicle exhaust emissions from reduced operations in the study area. Reduced vehicle exhaust emissions were estimated based on the proposed acreages of rice that would be idled during the Proposed Action, as described in Section 3.6.2.1. Table 3.6-4 summarizes annual emissions, as CO_2e that would not occur from vehicle exhaust by water agency.

Table 3.6-4. Annual GHG Emissions Reductions from Cropland Idling Transfers (Proposed Action), metric tons CO_2e per year

Water Agency[1,2]	CO_2	CH_4	N_2O	Total
Butte Water District	205	<1	1	205
Conaway Preservation Group	380	<1	1	381
Cranmore Farms	44	<1	<1	45
Glenn-Colusa Irrigation District	1,174	1	3	1,178
Goose Club Farms and Teichert Aggregates	178	<1	1	179
Pelger Mutual Water Company	45	<1	<1	45
Pleasant Grove-Verona Mutual Water Company	160	<1	<1	161
Reclamation District 108	356	<1	1	357
Reclamation District 1004	178	<1	1	179
Reclamation District 2068	133	<1	<1	134
Sycamore Mutual Water Company	178	<1	1	179
Te Velde Revocable Family Trust	124	<1	<1	125
Total (MT/yr)	3,154	4	9	3,167
Total (tpy)	**3,477**	**4**	**10**	**3,490**

Notes:

[1] The reduction in emissions due to cropland idling is shown.

[2] The actual water agencies to participate in cropland idling may not be the water agencies shown in the table; however, these agencies were selected as representative agencies in the applicable counties.

Key:

< = less than

CH_4 = methane

CO_2 = carbon dioxide

MT/yr = metric tons per year

MTCO_2e/yr = metric tons carbon dioxide equivalent per year

N_2O = nitrous oxide

tpy = tons per year

As shown in Table 3.6-4, GHG emissions, as CO_2e, would not exceed the significance criterion. Additionally, if groundwater substitution emissions and cropland idling emissions occurred in the same year, then the reduced emissions occurring from cropland idling would offset the expected increase from groundwater substitution. As a result, the Proposed Action would result in a less than significant impact.

Changes to the environment from climate change could affect the Proposed Action. As described in the Section 3.6.1.3, changes to annual temperatures, extreme heat, precipitation, sea level rise and storm surge, and snowpack and streamflow are expected to occur in the future because of climate change. Because of the short-term duration of the

Proposed Action (10 years), any effects of climate change on this alternative are expected to be minimal. Impacts to the Proposed Action from climate change would be less than significant.

3.6.2.4.2 Buyer Service Area

Use of water from transfers on agricultural fields in the Buyer Service Area could affect emissions. Water transfers to agricultural users in Alameda, Contra Costa, Fresno, Kings, Merced, San Benito, San Joaquin, and Santa Clara Counties could temporarily reduce the amount of land idled relative to the No Action/No Project Alternative. This would increase use of farm equipment, which would increase vehicle exhaust emissions. Farmers may also pump less groundwater for irrigation, which would reduce emissions from use of diesel pumps. The total amount of agricultural activity in the Buyer Service Area relative to GHG emissions would not likely change relative to existing conditions and the impact would be less than significant.

3.6.2.5 Alternative 3: No Cropland Modifications

3.6.2.5.1 Seller Service Area

Increased groundwater pumping for groundwater substitution transfers could increase emissions of GHGs. Groundwater substitution transfers that would occur under Alternative 3 would be identical to those that would occur under the Proposed Action (Table 3.6-3). As a result, GHG impacts associated with groundwater substitution would be the same as those discussed for the Proposed Action. As a result, groundwater pumping would result in a less than significant impact.

Changes to the environment from climate change could affect Alternative 3. As described in the Section 3.6.1.3, changes to annual temperatures, extreme heat, precipitation, sea level rise and storm surge, and snowpack and streamflow are expected to occur in the future because of climate change. Because of the short-term duration of Alternative 3 (10 years), any effects of climate change on this alternative are expected to be minimal. Impacts to this alternative from climate change would be less than significant.

3.6.2.5.2 Buyer Service Area

Use of water from transfers on agricultural fields in the Buyer Service Area could affect emissions. Water transfers to agricultural users in Alameda, Contra Costa, Fresno, Kings, Merced, San Benito, San Joaquin, and Santa Clara Counties could temporarily reduce the amount of land idled relative to the No Action/No Project Alternative. This would increase use of farm equipment, which would increase vehicle exhaust emissions. Farmers may also pump less groundwater for irrigation, which would reduce emissions from use of diesel pumps. The total amount of agricultural activity in the Buyer Service Area relative to

GHG emissions would not likely change relative to existing conditions and the impact would be less than significant.

3.6.2.6 Alternative 4: No Groundwater Substitution

3.6.2.6.1 Seller Service Area

Water transfers via cropland idling could reduce vehicle exhaust emissions from reduced operations in the study area. Reduced vehicle exhaust emissions were estimated based on the proposed acreages of croplands that would be idled during Alternative 4, as described in Section 3.6.2.1. The proposed acreage of land to be idled in Alternative 4 would be equal to those proposed under the Proposed Action (see Table 3.6-4). As a result, cropland idling would result in a less than significant impact.

Changes to the environment from climate change could affect Alternative 4. As described in the Section 3.6.1.3, changes to annual temperatures, extreme heat, precipitation, sea level rise and storm surge, and snowpack and streamflow are expected to occur in the future because of climate change. Because of the short-term duration of Alternative 4 (10 years), any effects of climate change on this alternative are expected to be minimal. Impacts to this alternative from climate change would be less than significant.

3.6.2.6.2 Buyer Service Area

Use of water from transfers on agricultural fields in the Buyer Service Area could affect emissions. Water transfers to agricultural users in Alameda, Contra Costa, Fresno, Kings, Merced, San Benito, San Joaquin, and Santa Clara Counties could temporarily reduce the amount of land idled relative to the No Action/No Project Alternative. This would increase use of farm equipment, which would increase vehicle exhaust emissions. Farmers may also pump less groundwater for irrigation, which would reduce emissions from use of diesel pumps. The total amount of agricultural activity in the Buyer Service Area relative to GHG emissions would not likely change relative to existing conditions and the impact would be less than significant.

3.6.3 Comparative Analysis of Alternatives

Table 3.6-5 summarizes the effects of the action alternatives. The following text supplements the table by describing the magnitude of the effects under the action alternative and No Action/No Project Alternative.

Table 3.6-5. Climate Change Comparison of Alternatives

Potential Impact	Alternatives	Significance	Proposed Mitigation	Significance After Mitigation
Combined emissions from groundwater substitution and cropland idling transfers could increase emissions of GHG emissions.	1	NCFEC	None	NCFEC
Cropland idling and groundwater pumping in the Buyer Service Area as a result of CVP water shortages could affect emissions.	1	NCFEC	None	NCFEC
Increased groundwater pumping for groundwater substitution transfers could increase emissions of GHGs.	2, 3	LTS	None	LTS
Water transfers via cropland idling could reduce vehicle exhaust emissions from reduced operations in the study area.	2, 4	LTS	None	LTS
Changes to the environment from climate change could affect the action alternatives.	2, 3, 4	LTS	None	LTS
Use of water from transfers on agricultural fields in the Buyer Service Area could affect emissions.	2, 3, 4	LTS	None	LTS

Key:
LTS = Less than Significant
NCFEC = no change from existing conditions

3.6.3.1 No Action/No Project Alternatives

There would be no changes to emissions in the Seller Service Area relative to existing conditions.

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

Increased groundwater pumping could increase GHG emissions from engine exhaust. These emission increases would then be partially offset by reduced farm equipment exhaust emissions from land preparation and harvesting activities that would no longer occur under the Proposed Action. The effects associated with groundwater pumping and cropland idling would be less than significant.

3.6.3.3 Alternative 3: No Cropland Modifications

The No Cropland Modification Alternative does not include cropland idling or crop shifting transfers. Impacts associated with groundwater pumping would be the same as those identified for the Proposed Action.

3.6.3.4 Alternative 4: No Groundwater Substitution

The No Groundwater Substitution Alternative does not include groundwater pumping to enable water transfers. Alternative 4 would include cropland idling up to the same upper limits for acreage as the

Proposed Action, but idling may occur more frequently because there are fewer other transfer types for buyers to choose from. Reductions in emissions as a result of cropland idling would be larger than reductions in emissions under the Proposed Action.

3.6.4 Environmental Commitments/Mitigation Measures

There would be no significant impacts to climate change from implementation of the No Action/No Project Alternative or the action alternatives. Therefore, no environmental commitments/mitigation measures are proposed.

3.6.5 Potentially Significant Unavoidable Impacts

None of the action alternatives would result in potentially significant unavoidable impacts on GHG emissions or energy use in relation to potential contributions to climate change.

3.6.6 Cumulative Effects

The timeframe for the Long-Term Water Transfers cumulative analysis extends from 2015 through 2024, a ten-year period.

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

Combined emissions from groundwater substitution and cropland idling transfers in combination with other cumulative projects could increase emissions of GHG emissions. By its very nature, climate change is a cumulative impact from various global sources of activities that incrementally contribute to global GHG concentrations. Individual projects provide a small addition to total concentrations, but contribute cumulatively to a global phenomenon. The goals of AB 32 require GHG emission reductions from existing conditions. As a result, cumulative GHG and climate change impacts must be analyzed from the perspective of whether they would impede the state's ability to meet its emission reduction goals. As shown in Figure 3.6-2, transportation is responsible for 37 percent of the State's GHG emissions, followed by the industrial sector (22 percent), electricity generation (21 percent), commercial and residential (12 percent), agriculture and forestry (8 percent) and other sources (0.04 percent). It is reasonable to expect that these sectors would continue to contribute to GHG emissions in the future. Climate change therefore represents a significant cumulative effect for the entire State and could have a variety of meteorological and hydrologic implications.

Under the Proposed Action, increased groundwater pumping would increase GHG emissions from engine exhaust. These emissions would be partially offset by reductions in farm equipment exhaust emissions from cropland idling activities. GHG emissions that would occur under the Proposed Action are substantially less than the threshold of significance and would not result in a cumulatively considerable impact.

3.6.6.2 Alternative 3: No Cropland Modifications

Cumulative effects under Alternative 3 would be the same as the groundwater pumping impacts described in the Proposed Action.

3.6.6.3 Alternative 4: No Groundwater Substitution

Emissions from cropland idling transfers in combination with other cumulative projects could increase emissions of GHG emissions. Cumulative effects under Alternative 4 would be similar to those described in the Proposed Action. Cropland idling transfers would result in a reduction in emissions. GHG emissions that would occur under Alternative 4 would not result in a cumulatively considerable impact.

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Section 3.7 Fisheries

This section presents a description of the fishery resources within the study area. It includes a comparison of the impacts of the alternatives; a description of environmental commitments and mitigation measures that will be implemented to avoid, minimize and mitigate any impacts identified; a description of any remaining potentially significant, unavoidable impacts; and an evaluation of the cumulative effects of the project considering other existing and reasonably foreseeable actions within the area of analysis. The types of transfers most likely to affect fisheries resources (fish and their habitat) are groundwater substitution transfers, which may affect flows on small streams, and stored reservoir water transfers that may affect the value of fish habitat in the reservoirs supplying this water and affect flows on the rivers downstream of those reservoirs. Rice fields and upland crops do not provide suitable habitat for fish species of management concern. Conservation and cropland idling transfers would not likely affect fisheries resources because neither would substantially affect flows in natural waterways; therefore, they are not further discussed in this chapter.

3.7.1 Affected Environment/Environmental Setting

This section provides an overview of the area where the action alternatives have the potential to affect fishery resources, including special-status fish species. Vegetation and terrestrial wildlife species are discussed in Section 3.8.

3.7.1.1 Area of Analysis

The area of analysis includes the Seller Service Area and Sacramento San Joaquin Delta (Figure 3.7-1). Fisheries Resources in the Buyer Service Area would not be affected as described below.

3.7.1.1.1 Seller Service Area

This region includes potential seller lands within the Sacramento River and San Joaquin watersheds and downstream areas.

The action alternatives could affect major watersheds and numerous minor watersheds within the Sacramento River Basin that include the following water bodies:

- Sacramento River from Shasta Reservoir to the Sacramento San Joaquin Delta (Delta);

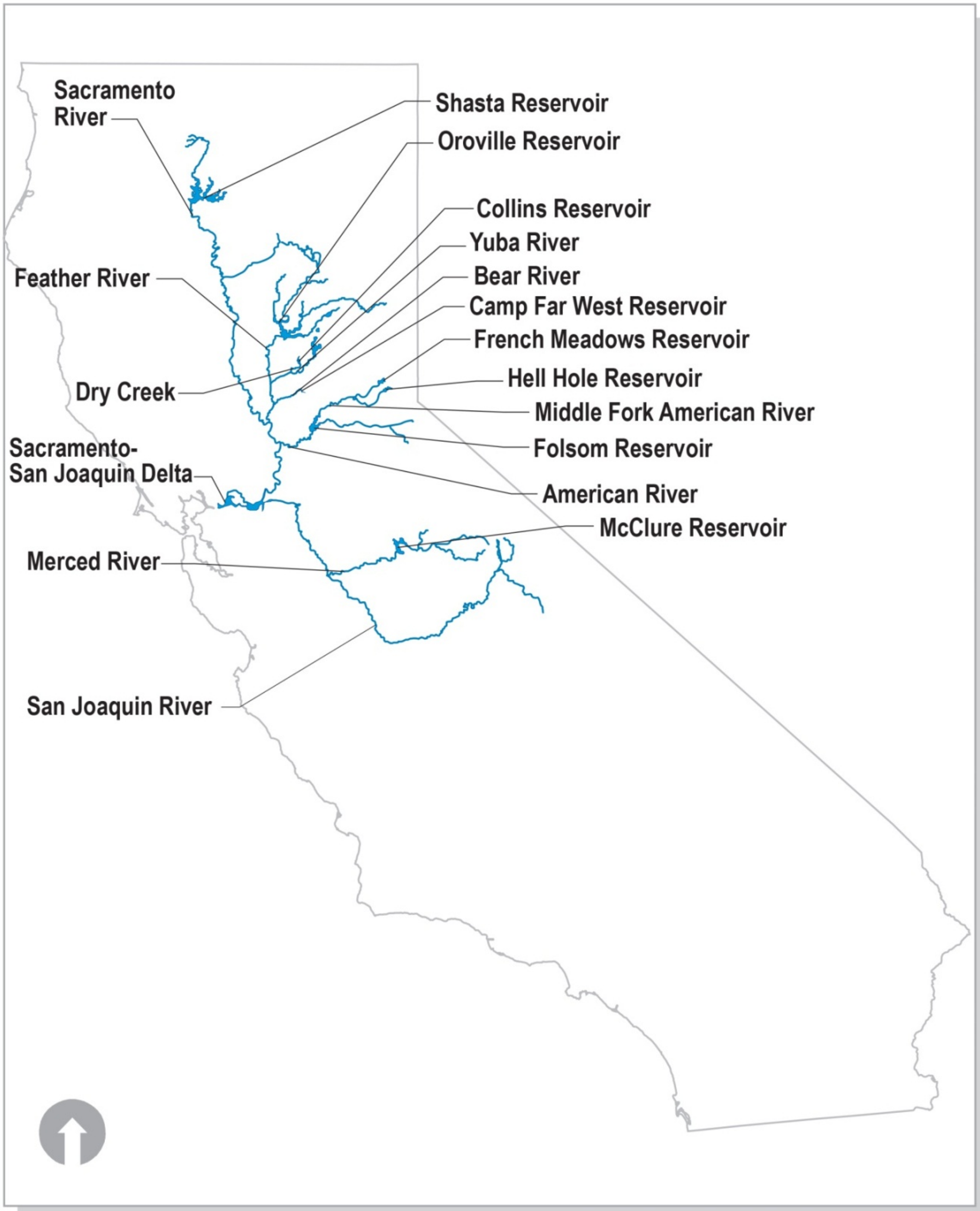


Figure 3.7-1. Major Rivers and Reservoirs in the Area of Analysis

- Feather River, including and downstream of Lake Oroville and its tributaries, the Yuba River including and downstream of New Bullards Bar Reservoir (although fish species evaluated here cannot access the river upstream of Englebright Dam), and the Bear River including and downstream of Camp Far West Reservoir;

- American River including and downstream of Folsom Reservoir and Lake Natoma (although fish species evaluated here cannot access the river upstream of Nimbus Dam);

- Middle Fork American River downstream of Hell Hole and French Meadows Reservoirs (although fish species evaluated here cannot access the river upstream of Nimbus Dam); and

- Numerous small tributaries to the Sacramento River, Feather River, Yuba River, and Bear River.

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

- San Joaquin River downstream of the Merced River; and
- Merced River including and downstream of Lake McClure.

As described below, water transfer actions would not affect other tributaries of the San Joaquin watershed in the Seller Service Area.

Water transfers made under the alternatives would move through the Sacramento-San Joaquin Delta (Delta), and so resources within the Delta could be affected.

3.7.1.1.2 Buyer Service Area

The Buyer Service Area includes portions of Contra Costa County, Northwestern Alameda County, Santa Clara County, northwestern San Benito County, a small area of San Joaquin and Stanislaus counties, a small portion of western Merced County, and extends through western Fresno County into northwest Kings County. Water diversions from the Delta through the Banks and Jones Pumping Plants would be subject to the existing biological opinions (BOs) on the long-term operations of the Central Valley Project (CVP) and State Water Project (SWP), which included transfers in excess of the size considered in the alternatives in this Environmental Impact Statement/Environmental Impact Report (EIS/EIR).

San Luis Reservoir is the only water body in the Buyer Service Area that could be affected by the water transfers. San Luis Reservoir is an artificial environment and does not support a naturally evolved aquatic community. Fish species in San Luis Reservoir have either been directly introduced or transported into the reservoir via the California Aqueduct or Delta-Mendota

Canal. It does not support primary populations of the fish species of management concern (see Section 3.7.1.3.2), nor does it support these species in downstream areas.

For Contra Costa Water District (WD) and East Bay Municipal Utility District (MUD), diversions would be subject to the BOs associated with their pumping stations and diversions. Water would be moved through existing conveyance facilities and would not affect natural water bodies.

As the project would not affect the fish species of primary management concern in the Buyer Service Area, the Buyer Service Area is not included in the area of analysis for fisheries resources.

3.7.1.2 Regulatory Setting

There are a number of federal, state and local regulations and policies that apply to fisheries resources within the area of analysis. Applicable requirements are discussed in greater detail in Appendix H, and include:

- Federal Endangered Species Act (ESA);
- Fish and Wildlife Coordination Act;
- Magnuson-Stevens Fisheries Act of 2006;
- Executive Order 11990 (Protection of Wetlands);
- California Endangered Species Act (CESA);
- California Natural Community Conservation Planning Act;
- Requirements of the 1995 Bay/Delta Plan Water Quality Control Plan and Decision 1641;
- California Water Code;
- Central Valley Project Improvement Act;
- Existing Natural Community Conservation Plans (NCCPs) and Habitat Conservation Plans (HCPs);
- Requirements stipulated in the various CVP water contracts between Reclamation and the various buyers and sellers, and their associated BOs of the United States Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries). These documents specify the amount of water each contract holder can receive from the CVP and provide the terms and conditions about the delivery and use of that water, that are intended to protect fish and wildlife resources. Transfers made under long-term water transfer actions would adhere to these requirements;
- Requirements stipulated in previous consultations, BOs of USFWS and NOAA Fisheries Service, and subsequent and ongoing legal proceedings regarding the Long-Term Operations of the CVP and the SWP. These opinions provide various operating standards for the CVP

and SWP, to which Reclamation and the California Department of Water Resources (DWR), respectively, must adhere, to minimize impacts to listed species.

3.7.1.3 Existing Conditions

The following section describes the fisheries resources, including special-status fish species, within the different regions of the area of analysis.

3.7.1.3.1 Seller Service Area

Riverine Habitats

The area of analysis lies within the Sacramento-San Joaquin Province[1], as described in Moyle (2002). Within this province, the action alternatives have the potential to affect fish assemblages occurring in the Central Valley sub-province.

In the Central Valley sub-province, the action alternatives have the potential to affect the California roach, pikeminnow-hardhead-sucker, and deep-bodied fish (e.g., tule perch [*Hysterocarpus traskii*]) assemblages. These assemblages are defined by areas at different elevations within the sub-province that are characterized by different flow, temperature and geomorphological characteristics and have a group of species that are typically located in these areas. These assemblages may overlap geographically at different times of years in response to changes in flow and temperature.

The California roach assemblage occurs in small, warm tributaries to larger streams that flow through open foothill woodlands of oak and foothill pine. These streams are usually intermittent during the summer months, and fish are often restricted to pools where temperatures may exceed 30 degrees Celsius (°C). In the winter and spring, flows in these streams can be high, resulting in high water velocities. The dominant native fish in this assemblage is California roach (*Hesperoleucus symmetricus*) due to their small size and tolerance of low oxygen levels and high temperatures. Sacramento suckers (*Catostomus occidentalis occidentalis*), Sacramento pikeminnow (*Ptychocheilus grandis*), and other native minnows may use these streams for spawning in the winter and spring (Moyle 2002). Predatory green sunfish (*Lepomis cyanellus*) have replaced California roach in some areas.

The pikeminnow-hardhead-sucker assemblage occurs in streams with average summer flows of more than ten cubic feet per second (cfs); deep, rocky pools; and wide, shallow riffles. These streams range in elevation from about 90 to over 1,500 feet in elevation. Streams within the pikeminnow-hardhead-sucker assemblage are generally characterized by high water quality (i.e., high clarity,

[1] A province, as used by Moyle (2002), is a geographic region that is geographically isolated from other geographic regions and in which an endemic assemblage of species has evolved. These provinces can be subdivided into sub-provinces, which have become isolated in the nearer term or which may have a lesser degree of isolation, and may contain one or more endemic species or sub-species.

low conductivity, high dissolved oxygen, and summer temperatures between 19 and 22°C) and high habitat complexity created by stream meanders and riparian vegetation (Moyle 2002). Some streams may become intermittent during the summer, concentrating fish in isolated pools, which may experience elevated water temperatures (greater than 25°C). Sacramento pikeminnows and Sacramento suckers tend to be the most abundant fishes in this assemblage. Hardhead (*Mylopharodon conocephalus*) are often confined to cooler waters in reaches with deep, rock-bottomed pools. However, they are abundant where they are found (Moyle 2002). Other native fishes occurring in these areas are tule perch , speckled dace (*Rhinichthys osculus*), California roach, riffle sculpin (*Cottus gulosus*), and rainbow trout (*Oncorhynchus mykiss*). The cooler upstream areas of streams within this zone may support spawning and rearing of anadromous and resident salmonids.

The deep-bodied fish assemblage historically occupied the warm waterways of the valley floor, including slow moving river channels, oxbow and floodplain lakes, swamps, and sloughs (Moyle 2002). These habitat types have been substantially modified by human activities in the last 200 years by numerous dams, diversions, channelization with levees, filling of wetlands, elimination of riparian forests, and introduction of non-native fish species. The fish species that historically resided in this zone include deep-bodied fishes such as Sacramento perch (*Archoplites interruptus*), thicktail chub (*Siphatales crassicauda*), and tule perch, which used backwater habitats, and hitch (*Lavinia exilicauda*), Sacramento blackfish (*Orthodon microlepidotus*), and Sacramento splittail (*Pogonichthys macrolepidotus*), which used the main channel habitats. Human-induced modification of the habitat types used by this assemblage and the introduction of many exotic species has resulted in extirpation or reduction of native fish populations. Consequently, dominant fishes currently occurring in these habitat types are now introduced species, including largemouth bass (*Micropterus salmoides*), white and black crappie (*Pomoxis annularis* and *P. nigromaculatus*), bluegill (*Lepomis macrochirus*), threadfin shad (*Dorosoma petenense*), striped bass (*Morone saxatilis*), bigscale logperch (*Percina macrolepida*), red shiner (*Cyprinella lutrensis*), inland silverside (*Menidia beryllina*), white catfish (*Ameiurus catus*), black and brown bullhead (*A. melas* and *A. nebulosus*), and common carp (*Cyprinus carpio*) (Moyle 2002). This area serves as a migration corridor for anadromous fish moving between the ocean and their freshwater spawning and rearing habitats.

Fish species of primary management concern in the Seller Service Area include winter-, spring-, and fall-/late fall-run Chinook salmon (*Oncorhynchus tshawytscha*), Central Valley steelhead (*O. mykiss*), Sacramento splittail, American shad (*Alosa sapidissima*), striped bass, white sturgeon (*Acipenser transmontanus*), and green sturgeon (*A. medirostris*). These species are further described in Section 3.7.1.3.2.

Central Valley Reservoirs

All of the major rivers and many of their tributaries have dams and reservoirs intended to provide for water supply, power generation, and flood control. CVP and SWP reservoirs (Shasta, Oroville, and Folsom reservoirs) may be affected by water transfers due to additional water storage, reductions in downstream supply due to streamflow depletions, changes in project operations required to meet the requirements of the various contracts, regulations, and BOs associated with the operation of the projects when transfer water is being moved from Sellers to Buyers. Under all circumstances, the CVP and SWP will be operated in accordance with these requirements. The non-CVP/SWP project reservoirs (Camp Far West, Collins, French Meadows, Hell Hole, and McClure) would provide water stored in these reservoir for transfer. The non-project reservoirs operate under their own sets of operating requirements to provide for water supply, flood control and environmental needs, including the maintenance of flow and temperature in the rivers downstream of these reservoirs, and would be operated in accordance with those requirements.

Reservoirs operate within a wide range of storage volumes and associated water surface elevations and surface areas, as water is stored in the reservoirs during the wet portion of the year and released from the reservoir during the dry portion of the year. Reservoirs are typically drawn down by tens and often more than 100 feet each year. Most of the reservoirs that will be affected by the project are in the foothills just upstream of the valley floor, within the elevations typically associated with the pikeminnow-hardhead-sucker assemblage. French Meadows and Hell Hole Reservoirs are at higher elevations than the other reservoirs, in the elevation of rainbow trout assemblage.

With the exception of Hell Hole and French Meadows reservoirs, the remaining reservoirs often support warmwater fishes in the surface waters and around the edges of the reservoirs, and coldwater fishes in the deeper, cooler portions of the reservoir. Reservoirs are generally stocked with trout to support recreational fisheries. Introduced bass, sunfish, catfish, carp, and other species that were introduced to create recreational fisheries generally dominate these reservoirs. Native species may include Sacramento sucker, Sacramento pikeminnow, hardhead, hitch, and Tui chub (*Gila bicolor*). The populations of these native species have been greatly reduced or extirpated by the non-native fish in many reservoirs. Hell Hole and French Meadows reservoirs, which are at higher elevation than the other reservoirs, support populations of rainbow trout, brown trout (*Salmo trutta*), lake trout (*Salvelinus namaycush*), kokanee salmon (*Oncorhynchus nerka*), Tui chub, and Sacramento sucker (Placer County Water Agency 2011). None of the reservoirs support listed fish species or anadromous fish, as downstream dams create impassible barriers to the migration of these species. Consequently, any impacts of long-term water transfers on conditions in the reservoirs described above would not affect listed fish species. Most of the reservoirs discussed above (again with the exception of Hell Hole and French Meadows reservoirs), are operated in part to support special-status fish species in the downstream rivers and the Sacramento – San Joaquin Delta (Delta).

Sacramento – San Joaquin Delta

The Delta is a series of interconnected channels and islands lying near and upstream of the confluence of the Sacramento and San Joaquin rivers, near Antioch. The legal Delta is a triangular area extending from Freeport in the north to Vernalis in the south, to Antioch in the west. The waterways within the Delta are highly channelized by the levees protecting farms, homes, and towns on the islands. The Delta is strongly influenced by the tides, with water elevations and current direction being determined by the interaction of inflow, exports and tides. It serves as the hub of the State's water system and flow patterns through the Delta have been highly altered from historical patterns. The Delta includes a variety of habitats for fish including the mainstem rivers, sloughs, canals, natural and managed wetlands, and flooded islands. These habitats are affected by water diversions (both by the CVP and SWP as well as thousands of smaller local diversions), introduced fish, invertebrates, and plants, and environmental toxins from urban, municipal and farms.

Dozens of fish species use the Delta during some portion of their life. Six of these species are listed under federal or state ESAs. These include winter-run and spring-run Chinook salmon, Central Valley steelhead, and green sturgeon, all of which migrate through the Delta on their way to upstream spawning and rearing habitats, and when their offspring migrate to the ocean from these upstream habitats. Most of these species may rear for some period of time in the Delta on their way to the ocean, with this duration depending on the species and conditions in the Delta. Delta smelt (*Hypomesus transpacificus*) are endemic (they are not found anywhere else) to the Delta and spend their entire lives in the Delta or Suisun Bay. The longfin smelt (*Spirinchus thaleichthys*), a state-, but not federally-, listed fish species spawns in the Delta and rears in Suisun, San Pablo and San Francisco bays and nearshore marine ecosystems. A few of the non-listed native species that use the Delta include fall-run Chinook salmon, white sturgeon, and Sacramento splittail. A large number of non-native species also live in the Delta, including striped bass, largemouth bass, various sunfish and catfish, inland silversides, and threadfin shad.

3.7.1.3.2 Fish Species of Management Concern

Species of primary management concern were analyzed for impacts based upon legal status and their commercial and recreational importance (Table 3.7-1). Two types of species were analyzed: special-status species and other species of management concern. For the purposes of this document, special-status fish species are defined as those listed under the ESA or CESA. The federally-listed species within the area of analysis include winter-run Evolutionarily Significant Unit (ESU) and spring-run ESU Chinook salmon, Central Valley Distinct Population Segment (DPS) steelhead, southern DPS green sturgeon, delta smelt, and longfin smelt. The life history information for federally listed fish species is included in Section 3.7.1.3.3. Species listed by the State of

California include: white sturgeon, Sacramento splittail, the fall/late-fall run ESU of Chinook salmon, and hardhead. Other species of management concern include non-listed recreationally or commercially important species: American shad and striped bass.

Table 3.7-1. Fish Species of Management Concern

Type	Species	Location (Area of analysis)	Primary Management Consideration[1]
Special- Status	Winter-run Chinook Salmon	Upstream and Delta areas	FE,SE
	Spring-run Chinook Salmon	Upstream and Delta areas	FT,ST
	Central Valley Steelhead	Upstream and Delta areas	FT, Recreation
	Green sturgeon	Upstream and Delta areas	FT,
	Delta smelt	Delta area	FT, SE
	Longfin smelt	Delta area	FC, ST
	Hardhead	Upstream and Delta areas	SSC
	Sacramento splittail	Upstream and Delta areas	SSC
	Fall/late-fall Chinook Salmon	Upstream and Delta areas	SSC, Commercial, Recreation
Other	Striped bass	Upstream and Delta areas	Recreation
	American shad	Upstream and Delta areas	Recreation
	White sturgeon	Upstream and Delta areas	Commercial, Recreation

[1] FE = federally endangered; SE = state endangered; FT = federally threatened; ST = state threatened; FC = federal candidate species; SSC = state species of concern

The spatial distribution of habitat use by these species in waters potentially affected by long-term water transfer actions is shown in Table 3.7-2 and discussed below. Fish species of management concern do not occur in reservoirs within the area of analysis, except as noted in Table 3.7-2. No field sampling information is available regarding the presence of special-status fish species in the following waterways: Seven Mile Creek, Elder Creek, Spring Valley Creek, North Fork Walker Creek, and Wilson Creek. Without further information, it was assumed that these streams could support special-status fish species and, therefore, further biological analyses were conducted in these waterways.

A review of field sampling data and reports in the following waterways indicates that there is no evidence of the presence of special-status fish species in the following waterways: Seven Mile Creek, Walker Creek, North Fork Walker Creek, Wilson Creek, French Creek, Willow Creek, South Fork Willow Creek, Funks Creek, Stone Corral Creek, Lurline Creek, Spring Valley Creek, Cortina Creek, Sand Creek, Sycamore Slough (Colusa County), Wilkins Slough Canal, Honcut Creek, North Honcut Creek, South Honcut Creek, and Dry Creek (tributary of Bear River). As a result, no further biological analysis was conducted in these waterways.

Table 3.7-2. Habitat Use by Fish Species of Management Concern within the Area of Analysis

Water Body	Listed Species						Other Evaluation Species					
	Winter-run Chinook Salmon	Spring-run Chinook Salmon	Central Valley Steelhead	Green Sturgeon	Delta Smelt	Longfin Smelt[1]	Fall/late-fall –run Chinook Salmon	Striped bass	American shad	Hardhead	Splittail	White sturgeon
Reservoirs												
Shasta Reservoir										S,R		R
Keswick Reservoir										S,R		
Lake Oroville										R,M		R
French Meadows Reservoir[2]												
Hell Hole Reservoir[2]												
Folsom Reservoir										R,M		
Lake Natoma[2]												
New Bullards Bar Reservoir										R,M		
Camp Far West Reservoir										R,M		
Lake McClure										R,M		
Rivers and Creeks												
Sacramento River Watershed												
Sacramento River from Keswick to Red Bluff	S,R,M	S,R,M	S,R,M	S,R,M			S,R,M	R	S,M	S,R		
Sacramento River from Red Bluff to the Delta	M	M	M	S,R,M	S,R,M	S,R,M	S,R,M	S,R,M	S,R,M	S,R	S,R	S,R,M
Deer Creek (Tehama County)		S,R,M	S,R,M				S,R,M			S,R		
Antelope Creek		S,R,M	S,R,M							S,R	S,R	
Paynes Creek										S,R	S,R	
Elder Creek[3]												
Mill Creek (Tehama County)		S,R,M	S,R,M				S,R,M			S,R	S,R	
Thomes Creek			S,R,M				R			S,R	S,R	
Mill Creek (tributary to Thomes Creek)										S,R		
Stony Creek		S,R,M	S,R,M				S,R,M			S,R		

Water Body	Listed Species						Other Evaluation Species					
	Winter-run Chinook Salmon	Spring-run Chinook Salmon	Central Valley Steelhead	Green Sturgeon	Delta Smelt	Longfin Smelt[1]	Fall/late-fall –run Chinook Salmon	Striped bass	American shad	Hardhead	Splittail	White sturgeon
Butte Creek		S,R,M	S,R,M				S,R,M			S,R		
Cache Creek							S,R,M			S,R		
Eastside/Cross Canal			R,M				R,M					
Auburn Ravine			S,R,M				S,R,M			S,R		
Coon Creek			S,R,M				S,R,M					
Colusa Basin Drain		R,M	R,M				R,M				S,R,M	
Freshwater Creek			S,R,M									
Putah Creek							S,R,M					
Little Chico Creek		S,R,M	S,R,M				R			S,R		
Salt Creek			S,R,M							S,R		
Feather River d/s of Lake Oroville		S,R,M	S,R,M	S,R,M			S,R,M	S,R,M	S,R,M	S,R		S,R,M
Yuba River		S,R,M	S,R,M				S,R,M	S,R,M	S,R,M	S,R		S,R,M
Bear River				S,R,M			S,R,M			S,R		S,R,M
American River d/s of Nimbus Dam	R	R	S,R,M	R			S,R,M	S,R,M	S,R,M		R,M	S,R,M
San Joaquin River Watershed												
Merced River			S,R,M				S,R,M	S,R,M		S,R		
San Joaquin River d/s of Merced River		M	S,R,M		S,R,M	S,R,M	R,M	S,R,M	S,R,M		S,R	S,R,M
Delta and Bays												
Delta	R,M	R,M	R,M	R,M	S,R,M	S,R,M	R,M	R,M	R,M		S,R	R,M
Suisun Bay	R,M	R,M	R,M	R,M	R	R,M	R,M	R,M	R,M		S,R	R,M
Suisun Marsh	R,M	R,M	R,M	R,M	S,R ,M	S,R,M	R,M	R,M	R,M		S,R	R,M

S = Spawning habitat; R = Rearing habitat; M = Migration corridor

[1] Longfin smelt is a federal candidate species and a state threatened species.

[2] There is no evidence that special-status fish species are found in this waterway.

[3] There is no information on the presence of special-status fish species in this stream, but critical habitat has been designated for Central Valley steelhead. Therefore, the stream was included for further analysis.

3.7.1.3.3 Federally and State Listed Fish Species Potentially Affected

Winter-Run Chinook Salmon

Winter-run Chinook salmon is federally-listed as endangered (59 Federal Register [FR] 440; 70 FR 37160) and state-listed as endangered (California Department of Fish and Game [CDFG] 2012). This ESU includes all naturally spawned populations of winter-run Chinook salmon in the Sacramento River and its tributaries in California and is represented by a single extant population (NOAA Fisheries 2008a).

Critical habitat for winter-run Chinook salmon has been designated within the Sacramento River from Keswick Dam to Chipps Island, and all waters between Chipps Island and the Golden Gate Bridge and to the north of the San Francisco and Oakland Bay Bridge (57 FR 36626). The lower reaches of the Sacramento River, the Delta, and the San Francisco Bay serve as migration corridors for both upstream migration of adults and downstream migration of juveniles (Table 3.7-2; NOAA Fisheries 2014). Juveniles may also spend some time rearing in these areas during emigration.

Adult winter-run Chinook salmon immigration occurs from December through July, peaking in March (Moyle 2002). They primarily spawn from late-April to early August, with the peak generally occurring from May through June (Moyle 2002). Spawning currently occurs on the mainstem of the Sacramento River upstream of Red Bluff Diversion Dam, although spawning historically occurred in the tributaries upstream of Shasta Reservoir. This is also the primary rearing area for fry and juveniles prior to emigration to the ocean. Emigration occurs between September and June (NOAA Fisheries 2014), with fish leaving their primary rearing areas and moving downstream. The Sacramento River downstream of Red Bluff Diversion Dam, the Delta, and the San Francisco Bay serve primarily as migration corridors for both upstream migration of adults and downstream emigration of juveniles (NOAA Fisheries 2014), although some rearing occurs in these areas during emigration. Winter-run Chinook salmon may use the lowest reaches of tributary streams for short periods as holding areas during emigration, but do not spend extensive time there.

Water transfers, which would occur from July through September, would coincide with the spawning period of winter-run Chinook salmon. However, spawning occurs upstream of the areas potentially affected by the transfers. Due in part to elevated water temperatures in these downstream areas during this period, emigration would be complete before water transfers commence in July.

Water transfers could affect the timing of releases from Shasta Reservoir throughout the year, which could positively or negatively alter instream flows in the upper Sacramento River and, therefore, affect winter-run Chinook salmon spawning and rearing habitat. These potential effects are evaluated below.

Spring-Run Chinook Salmon

The Central Valley spring-run Chinook salmon ESU is listed as threatened by both the state of California and the federal government (65 FR 42422). This species' range historically included any accessible reach in the headwaters of all major river systems in the Central Valley (Yoshiyama et al. 1996). Today, because dams block most of the upper reaches of these river systems, this ESU exists only in the Sacramento River and its tributaries (Moyle 2002). Three extant natural viable populations persist on Mill, Deer, and Butte Creeks. The listed population also includes fish from Feather River Hatchery production (NOAA Fisheries 2008b). Spawning also occurs in small numbers and intermittently in several other rivers and smaller waterways throughout the Sacramento River watershed (Table 3.7-2). Spring-run Chinook salmon do not currently spawn in the San Joaquin River or its tributaries, as this run was extirpated by development throughout the watershed (NOAA Fisheries 2008b), although the USFWS released 54,000 hatchery produced juvenile spring-run Chinook salmon into the San Joaquin River in April 2014 (San Joaquin River Restoration Program [SJRRP] 2014). In their final rule, NOAA Fisheries designated these fish as a nonessential experimental population under the ESA and established take exceptions for particular activities, including CVP/SWP exports (78 FR 79622).

Designated critical habitat for Central Valley spring-run Chinook salmon ESU includes 1,158 miles of stream habitat in the Sacramento River basin and 254 square miles of estuary habitat in the San Francisco-San Pablo-Suisun Bay complex (70 FR 52488). Tributaries used by spring-run Chinook salmon for spawning and rearing include Deer, Butte, and Mill creeks, and the Feather River, all of which are located in the Seller Service Area upstream of the Delta (Table 3.7-2).

Upstream migration of adult spring-run Chinook salmon occurs from March through September with peak migration occurring from May through June (Moyle 2002). The fish occur in the Sacramento River upstream of the valley floor during the summer and spawn in suitable habitat adjacent to these areas from late August through October, with spawn peaking in mid-September (Moyle 2002). Eggs are deposited in gravel where fry remain until they emerge between November and March to seek shallow water with low velocity (Moyle 2002). After emergence, juveniles display two very distinct emigration patterns: some remain in the stream and others emigrate immediately to the Delta and the ocean beyond. Those that remain display a classic stream-type life history pattern until they emigrate the following year, typically during November and December (Moyle 2002). Stream flow changes and/or turbidity increases in the upper Sacramento River watershed are thought to stimulate juvenile emigration (Kjelson et al. 1982; Brandes and McLain 2001).

Water transfers, which would occur from July through September, would coincide with the spawning period of spring-run Chinook salmon. However, spawning occurs upstream of the areas potentially affected by the transfers. The bulk of upstream migration (March-September, peaking May-June) and emigration (November-June) would be complete before water transfers commence in July. After their reintroduction, spring-run Chinook salmon would occur on the San Joaquin River upstream of the Merced River during their spawning period (August-October), and consequently, would not be affected by water transfers during their spawning period. They would not be present in the area downstream for the Merced during the period when water transfers would occur, as temperatures would be too warm during that time of year. As described for spring-run Chinook salmon occurring on the Sacramento River, the bulk of upstream migration and emigration of spring-run reintroduced to the San Joaquin River system would be complete before water transfers commence in July.

Water transfers could affect the timing of reservoir releases throughout the year, which could positively or negatively alter instream flows below these reservoirs and, therefore, affect spring-run Chinook salmon spawning and rearing habitat. These potential effects are evaluated below.

Central Valley Steelhead

The Central Valley steelhead DPS (Central Valley [CV] steelhead) is federally listed as threatened (71 FR 834; 76 FR 50447). The DPS includes all naturally spawned populations of steelhead below natural and manmade impassable barriers in the Sacramento and San Joaquin rivers and their tributaries, including the Sacramento-San Joaquin Delta (63 FR 13347). Steelhead from San Francisco and San Pablo Bays and their tributaries, as well as two artificial propagation programs (the Coleman National Fish Hatchery and Feather River Hatchery steelhead hatchery programs) are excluded from the listing. Critical habitat was designated for this DPS on September 2, 2005 (70 FR 52488).

CV steelhead was historically well distributed throughout the Sacramento and San Joaquin rivers (Busby et al. 1996). Steelhead occur anywhere in the Central Valley where water temperatures are suitable, and where they can physically access habitat (i.e., where rivers are not blocked by dams and other obstacles). Spawning and rearing occurs on the upper Sacramento River and its major tributaries (e.g., Putah Creek, Little Chico Creek, and Cow Creek) (McEwan and Jackson 1996). Small self-sustaining populations also occur in the Stanislaus, and other streams previously thought to be devoid of steelhead in the San Joaquin River basin (McEwan 2001). Incidental catches and observations of steelhead juveniles also have occurred on the Tuolumne and Merced rivers, indicating that steelhead are widespread, throughout accessible rivers and creeks in the Central Valley (Table 3.7-2; Good et al. 2005).

CV steelhead are considered winter-run steelhead (ocean-maturing), though summer-run steelhead may have been present in this geographic region prior to construction of large dams (Moyle 2002). Winter-run steelhead enter streams from the ocean when winter rains provide large amounts of cold water for migration and spawning (Moyle 2002). These fish enter the Delta as early as

August, with a peak in late September to October. Migration to the main channels and tributaries for spawning occurs from December through April. They may remain in the main channels of the rivers until flows are high enough in tributaries to enter for spawning (Moyle 2002). Adult immigration in the San Joaquin River generally occurs until April (Moyle 2002).

In California, most steelhead spawn from December through April (McEwan and Jackson 1996). Spawning takes place in small, cool, well-oxygenated streams where water remains year-round. Eggs are laid in gravel and hatch in three to four weeks. The fry remain in the gravels for another two to three weeks before emerging (Moyle 2002). Juvenile steelhead may remain in freshwater habitats for one or more years before emigrating to the ocean to mature. Some fish may mature in streams, adopting a resident life history. Juveniles can be found in cool, clear, fast-flowing permanent rivers and creeks where there is a predominance of riffles, overhanging vegetation or banks, and ample invertebrate prey (Moyle 2002).

Steelhead may begin emigrating in the late fall, but the primary period of emigration is from December to May (Snider and Titus 2000; NOAA Fisheries Service 2004). CV steelhead use the lower reaches of the Sacramento River and the Bay-Delta for rearing and as a migration corridor to the ocean.

Summer rearing of CV steelhead would overlap with water transfers occurring in the Seller Service Area (July-September), both in the Sacramento and San Joaquin River and their tributaries (see specific tributaries listed above). Thus water transfers have the potential to affect steelhead. The majority of rearing, however, would occur in the cooler sections of rivers and creeks above the influence for the water transfers.

Water transfers could affect the timing of reservoir releases throughout the year, which could positively or negatively alter instream flows below these reservoirs and, therefore, affect steelhead spawning and rearing habitat. These potential effects are evaluated below.

Green Sturgeon

The Southern DPS (consisting of coastal and Central Valley populations south of Eel River) of North American green sturgeon are listed as federally threatened (71 FR 17757-17766). Critical habitat was designated for this DPS on October 9, 2009 (74 FR 52300). Like other sturgeon, green sturgeon spawn in fresh water. However, they are one of only a few anadromous species of sturgeon.

Green sturgeon range from Mexico to Alaska in marine waters, and forage and migrate in estuaries and bays from the San Francisco Bay north to British Colombia (NOAA Fisheries 2012). The Southern DPS are believed to spawn regularly in the Rogue River, Klamath River Basin, and the Sacramento River

(NOAA Fisheries 2012), and they are not believed to use the San Joaquin River or its tributaries (71 FR 17757).

Adults migrate upstream between late February and late July (Moyle 2002). Spawning occurs upstream of the Delta, predominately in the upper Sacramento River and Feather River (71 FR 17757 17766), from March through July, with peak activity occurring from April to June (Moyle et al. 1995). Green sturgeon spend multiple years in freshwater prior to emigrating to the ocean (71 FR 17757 17766). During this rearing and holding period, they are found in the Sacramento, Feather, and Lower American rivers, and throughout the Delta, where they may be affected by water transfers (Table 3.7-2).

Delta Smelt

The delta smelt is a federally listed threatened species (58 FR 12854-12864); a petition to elevate the status of delta smelt from threatened to endangered under the federal ESA was warranted but precluded by other higher priority listing actions (75 FR 17667). The delta smelt is also listed as endangered by the State of California. Delta smelt are endemic to the upper San Francisco Estuary and occur from western San Pablo Bay and the Napa River landward to the freshwater reaches of the Bay-Delta (Bennett 2005). They occur in the Delta primarily below Isleton on the Sacramento River side and below Mossdale on the San Joaquin River side. A small proportion of individuals are found in the Cache slough area throughout the year (Sommer et al. 2011). They are found seasonally throughout Suisun Bay and in small numbers in larger sloughs of Suisun Marsh. Locations of the fish are dependent upon life cycle stage, salinity, and turbidity (Table 3.7-2; Feyrer et al. 2007).

Delta smelt inhabit open surface waters and shoal areas within the western Delta and Suisun Bay for the majority of their life span (59 FR 65256). They are primarily an annual species and most adult smelt die after spawning. Spawning occurs from January through June in sloughs and shallow, edge-waters of channels in the upper Delta. Larvae and juveniles are generally present in the Delta from March through June. Delta smelt have typically moved downstream towards Suisun Bay by July because elevated water temperatures and low turbidity conditions in the Delta are less suitable than those downstream (Nobriga et al. 2008). Some delta smelt reside year-round in and around Cache Slough (Sommer et al. 2011). Delta smelt in Suisun Bay and Cache Slough would be outside of the influence of the export facilities.

Longfin Smelt

The San Francisco Bay-Delta DPS of longfin smelt is a candidate species for listing under the Federal ESA (77 FR 19756) and the DPS is listed as threatened under CESA (CDFG 2009a). Environmental groups have petitioned the USFWS and the California Department of Fish and Wildlife (CDFW) to list the San Francisco Bay-Delta Population of longfin smelt as endangered citing their population decline over the last 20 years (Bay Institute, et al. 2007). The

USFWS has determined that listing is warranted but currently precluded by higher priority listing actions (77 FR 19756).

Longfin smelt are a short-lived fish species that live primarily in the San Francisco Bay and the Delta, but can sometimes be found in the nearshore ocean. Their primary habitat is open waters of estuaries, both in seawater and freshwater areas, and individuals are most abundant in San Pablo and Suisun bays (Moyle 2002).

Longfin smelt spend the early summer in San Pablo and San Francisco bays, generally moving into Suisun Bay in August. They migrate to suitable spawning habitat in estuaries between January and March and spawn in the Delta, downstream of Rio Vista (Moyle et al. 1995). Most spawning occurs from January through May (Moyle 2002) in fresh or slightly brackish water. After hatching, longfin smelt disperse widely throughout the estuary and some are swept downstream into more brackish parts of the estuary. The majority of adults die after spawning. Indices of longfin smelt abundance from the CDFW fall Midwater trawl sampling during January through June correlate positively with Delta outflow, although the mechanism(s) driving this correlation is(are) unknown (Kimmerer et al. 2009). Larvae are generally present in the Delta from February through May, while juveniles are present in March through June. Based on their life history timing, longfin smelt are unlikely to be present during water transfers.

3.7.2 Environmental Consequences/Environmental Impacts

3.7.2.1 Assessment/Evaluation Methods

This section describes the assessment methods used to identify and assess the potential environmental impacts to fisheries resources, including habitat and fish species of management concern that could potentially result from implementation of the long-term water transfer actions, including groundwater substitution and stored reservoir release. Specific species' biology and distribution, as described in Section 3.7.1 Affected Environment/Environmental Setting, are considered herein at a watershed level (i.e., the analysis assumes that if transfers affect conditions within a watershed, then transfers could affect any species that occurs within the watershed, unless the life history traits of a species indicate that the species would not be affected).

Development of the impact analysis involved literature review, review of known occurrences of special-status species based on the California Natural Diversity Database (CNDDB), USFWS regional species lists, information from NOAA Fisheries website, and results of hydrologic modeling, as detailed below.

Each alternative, including the No Action/No Project Alternative, is discussed in terms of potential impacts on sensitive resources in the Seller Service Area, including the Delta.

The assessment methods specific to each transfer type are described below, followed by the assessment process for different habitat and species.

3.7.2.1.1 Groundwater Substitution Transfers

Under the action alternatives, there would be an increased use of groundwater to irrigate crops instead of diversion of water from rivers and creeks. This would entail increased groundwater pumping compared to the No Action/No Project Alternative to substitute for water usually provided from CVP supplies. This additional use of groundwater would reduce stream flows during and after a transfer as the groundwater aquifer refills. Increased subsurface drawdown would potentially affect fish habitats, such as riverine, riparian, seasonal wetland, and managed wetland habitats, which are reliant on groundwater for all or part of their water supply. Decreased amounts of surface water in these habitats could affect fish species of management concern. This change in the availability of surface water also could result in changes in flows in the Delta and could require some minor modifications in the operation of the CVP and SWP, including Shasta, Oroville and Folsom reservoirs, to meet various regulatory requirements.

Groundwater substitution transfers were modeled using the SACFEM2013 groundwater model to assess potential changes to groundwater and surface water. Groundwater substitution pumping was simulated as an additional pumping stress on the system, above the baseline pumping volume. The annual volume of transfers was determined by comparing the supply in the seller service area to the demand in the buyer service area. The availability of supplies in the seller service area was determined based on data provided by the potential sellers. The demand was estimated using demand data provided by East Bay MUD and Contra Costa WD as well as the available capacity at the Delta export pumps to convey transfers. The available export capacity was determined from CalSim II model results. The CalSim II model currently only simulates conditions through WY 2003. The available capacity for south of delta exports was typically more limiting than the south of delta water supply demand. Because CalSim II results are only available through 2003, the SACFEM2013 model simulation was truncated at the end of WY 2003.

The analysis of supply and demand resulted in the potential to export groundwater substitution pumping transfers through the Delta during 12 of the years from 1970 through 2003 (33 years, SACFEM2013 simulation period). Each of the 12 annual transfer volumes was included in a single model simulation. Including each of the 12 years of transfer pumping in one simulation rather than 12 individual simulations allows for the potential compounding effects from pumping from prior years. Appendix D, Groundwater Model Documentation, includes more information about the use of SACFEM2013 in this analysis.

The results of the SACFEM2013 analysis estimated streamflow depletion from groundwater substitution throughout the Sacramento Valley. These estimates were included in Transfer Operations Model simulations of the action alternatives. The Transfer Operations Model results are the basis for the determination of potential effects to fish and their habitats. Appendix B, Water Operations Assessment, includes more details about the transfer operations model.

3.7.2.1.2 Reservoirs

Water would be made available for transfers from Camp Far West, Collins, Hell Hole, French Meadows, and McClure reservoirs. These reservoirs would continue to operate in accordance with their existing regulatory requirements and other commitments. Water transfers from these reservoirs would result in decreasing their storage and associated elevation and surface area, during the period when transfers would be made (July through September), and the ongoing reduction in storage until the reservoirs are refilled. Shasta, Oroville, and Folsom reservoirs would not directly provide water for transfer, but their release patterns may be affected by the project because flows may be modified at compliance points in the mainstem rivers downstream of these reservoirs or in the Delta. This may result in more or less water being released from these reservoirs at different times of year. All reservoirs would continue to function under their existing operating requirements, including reservoir drawdown to targeted storage levels, and in meeting downstream flow, temperature, and other water quality requirements.

Reservoirs do not provide the primary habitat for the fish species of management concern. The approach to evaluating impacts as the result of changes in reservoir operations on downstream habitats is described in the next section.

3.7.2.1.3 Rivers and Creeks

As discussed in the preceding sections, water transfer actions would affect flows in the rivers and creeks within the Seller Service Area adjacent to and downstream of the areas where these activities would occur.

The analysis of potential impacts to stream flow focused on the frequency and magnitude of changes in mean monthly flow rates by water year types (wet, above normal, below normal, dry, and critically dry), as compared to existing conditions, based on the modeling results. For the purposes of this analysis, it is assumed that water temperatures vary inversely with flow rates in rivers and creeks, such that, at lower flows, water temperatures would be higher. This assumption was not used for in-Delta water temperatures, for which Wagner et al. (2011) found no relationship (maximum R^2=0.07) with Sacramento River flows and a low relationship (R^2=0.14) with San Joaquin River flows.

For smaller tributaries, the impact analysis compared modeled groundwater depletion flow rates to available mean monthly flow rates for the historical period of record and identified changes in flow rates that would result from water transfer actions. As described there, not every water body could be evaluated in the groundwater model; therefore, smaller water bodies adjacent to those modeled are assumed to respond in a similar way, with similar changes in flow magnitude and timing. Potential impacts to biological resources in these adjacent water bodies would be similar to those of the modeled streams. For the Full Range of Transfers and No Cropland Idling/Shifting alternatives, a screening analysis was conducted for smaller waterways for which groundwater modeling data were available to eliminate the need for biological analyses for streams in which substantial reductions in stream flow did not occur.

Historical stream flow information from the U.S. Geological Survey or the California Data Exchange Center (2012) for these streams were gathered where available and used as the measure of baseline flow. For locations for which historical flow data were limited or unavailable, a quantitative analysis was not possible; thus a qualitative discussion of potential impacts is included for these locations. No impacts would occur to groundwater in the No Action/No Project and No Groundwater Substitution alternatives and, therefore, this screening analysis did not apply.

For rivers and their major tributaries, including the Sacramento, American, Feather, Yuba, Bear, San Joaquin, and Merced rivers, transfer operations model outputs were used to assess impacts to surface water flows.

An action alternative could have an adverse impact on fish habitat if it resulted in decreased flows to a degree that would substantially affect riverine, riparian, or wetland habitats (as described in Section 3.8) in a river or stream, or interfere with fish movement or access to or from areas where the fish spawns. This degree of decreased flow is measured as both a ten percent change in mean flow by water year type and a minimum change in flow of one cfs where quantitative flow data were available. A qualitative assessment was applied in instances where quantitative data were not available.

The ten percent threshold was used to determine measurable flow changes based on several major legally certified environmental documents in the Central Valley related to fisheries (Trinity River Mainstem Fishery Restoration Record of Decision, December 19, 2000; San Joaquin River Agreement Record of Decision in March 1999; Freeport Regional Water Project Record of Decision, January 4, 2005; Lower Yuba Accord EIR/EIS). In these documents, there is consensus that differences in modeled flows of less than ten percent would be within the noise of the model outputs and beyond the ability to measure actual changes.

The one cfs minimum flow threshold was used as a conservative measure of detectability by a fish. The threshold was applied to each month during the entire modeled period, such that, if a change of greater than one cfs occurred in any one month during the modeled period, the waterway would be examined further for biological effects.

Combined, these two thresholds were used as an initial screening evaluation to determine whether further analyses were warranted to assess biological significant impacts because these two thresholds may not always translate into a significant biological effect on fisheries resources. Therefore, these further biological analyses included consideration of other physical and biological factors in addition to absolute and relative flow changes, including presence and timing of life stages of fish species, size of the waterway, timing of flow changes, and water year type.

3.7.2.1.4 Sacramento-San Joaquin Delta

The changes described above for rivers and streams would also apply downstream into the Delta. Additionally exports would vary in timing and magnitude with implementation of water transfers. These changes were modeled using the water transfer model. To assess the potential impacts of these changes on vegetation and wildlife resources in the Delta, the difference in Delta outflow and the location of X2, defined as the distance (in kilometers) up the axis of the estuary to the daily averaged near-bottom 2-practical salinity units (psu) isohaline (Jassby et al. 1995), were considered. Changes in these parameters were used to qualitatively assess the impacts of long-term water transfers on natural communities and special-status species. Diversions would be made using the same conditions imposed upon these facilities by the various contracts, agreements and BOs for these facilities and thus would not have additional impacts to fish species. Modeled changes in Delta outflow or X2 relative to existing conditions were considered substantial and required further analysis if they were greater than ten percent.

3.7.2.1.5 Species Impacts Assessment

The species impacts analysis includes an assessment of the direct and indirect impacts of implementing the action alternatives on fish species of management concern. The assessment evaluated the permanent and temporary impacts on fish species of management concern and is based on impacts to the aquatic habitats that the species use within the area of analysis, the timing of those impacts, and the species’ geographic and temporal distribution.

For special-status fish species, species-habitat associations were developed and defined (see Appendix I) based on literature review and review of species databases, including the CNDDB and USFWS species lists. Fish use different areas for different parts of their life cycle (migration, spawning, rearing). Hydrologic impacts on fish habitat were assessed qualitatively based on extrapolation of groundwater and surface water modeling results, described above, to the species habitat requirements.

Direct and indirect impacts on fish species of management concern may include habitat degradation or removal, displacement of individuals, and habitat fragmentation leading to disruption of spawning, migrating, and/or rearing behaviors.

3.7.2.2 Significance Criteria

Consistent with the provisions of the California Environmental Quality Act (CEQA) and the CEQA Guidelines, an alternative would have a significant impact on fisheries resources if it would:

- Cause a substantial reduction in the amount or quality of habitat for target species.
  - Have a substantial adverse effect, such as a reduction in area or geographic range, on any riverine, riparian, or wetland habitats, or other sensitive aquatic natural community, or significant natural areas identified in local or regional plans, policies, regulations, or by CDFW, NOAA Fisheries, or USFWS that may affect fisheries resources;
  - Conflict with the provisions of an adopted HCP, NCCP, or other approved local, regional, or state habitat conservation plan;
- Cause a substantial adverse effect to any special-status species,
  - Have a substantial adverse effect, either directly or through habitat modifications, on any endangered, rare, or threatened species, as listed in Title 14 of the California Code of Regulations (sections 670.2 or 670.5) or in Title 50, Code of Federal Regulations. A significant impact is one that affects the population of a species as a whole, not individual members;
  - Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by CDFW, NOAA Fisheries, or USFWS, including substantially reducing the number or restricting the range of an endangered, rare, or threatened species;
  - Cause a substantial reduction in the area or habitat value of critical habitat areas designated under the federal ESA or essential fish habitat as designated under the Magnusson Stevens Fisheries Act;
  - Conflict substantially with goals set forth in an approved recovery plan for a federally listed species, or with goals set forth in an approved State Recovery Strategy (Fish & Game Code Section 2112) for a state listed species;

- Conflict with the provisions of an adopted HCP, NCCP, or other approved local, regional, or state habitat conservation plan; or

- Substantially fragment or isolate habitats or block movement corridors.

The significance criteria described above apply to fish habitats and fish species of management concern that could be affected by the alternatives. Changes in habitat quality are determined relative to existing conditions (for CEQA) and the No Action/No Project Alternative (for the National Environmental Policy Act).

3.7.2.3 Alternative 1: No Action/No Project Alternative

The assessment evaluates the effects of the No Action/No Project Alternative on fisheries resources (fish habitat and fish species of management concern) and separately for special-status fish species by including likely future conditions in the absence of the long-term water transfer and identifies a range of impacts associated with the No Action/No Project Alternative in comparison with existing conditions.

3.7.2.3.1 Fisheries Resources and Special-Status Fish Species

Reservoirs

The No Action/No Project Alternative would not affect reservoir storage and reservoir surface area. Under the No Action/No Project Alternative, storage volumes, reservoir surface area, and downstream releases from reservoirs would be the same as under existing conditions. Future climate change is not expected to alter conditions in any reservoir under the No Action/No Project Alternative because there will be limited climate change predicted over the ten year project duration (see Section 3.6, Climate Change/Greenhouse Gas).

Impacts on Fisheries Resources: The No Action/No Project Alternative would have no impact on fisheries resources in reservoirs, as reservoirs do not support primary populations of the fish species of management concern, including special-status fish species, and conditions would be the same as under existing conditions.

Impacts on Special-Status Fish Species: The No Action/No Project Alternative would have no impact on special-status fish species, as reservoirs do not support primary populations of special-status fish species, and conditions would be the same as under existing conditions.

Rivers and Creeks

The No Action/No Project Alternative would not cause flows of rivers and creeks in the Sacramento and San Joaquin river watersheds to be lower than under existing conditions. Under the No Action/No Project Alternative, the rate and timing of flows in rivers and creeks in the Sacramento and San Joaquin river watersheds would be similar to existing conditions. Future climate change is not expected to alter conditions in any river or creek under the No Action/No Project Alternative because there will be limited climate change predicted over the ten year project duration (see Section 3.6, Climate Change/Greenhouse Gas).

Impacts on Fisheries Resources: The No Action/No Project Alternative would have no impact on fisheries resources in rivers and creeks, as conditions would be the same as under existing conditions.

Impacts on Special-Status Fish Species: The No Action/No Project Alternative would have no impact on special-status fish species in rivers and creeks, as conditions would be the same as under existing conditions.

Delta

The No Action/No Project Alternative would not alter flows through the Delta compared to existing conditions. Under the No Action/No Project Alternative, flows into the Delta and diversions from the Delta would be the same as under existing conditions. All existing regulatory requirements would continue and would provide similar levels of protection to natural resources. Future climate change is not expected to alter conditions in the Delta under the No Action/No Project Alternative because there will be limited climate change predicted over the ten year project duration (see Section 3.6, Climate Change/Greenhouse Gas).

Impacts on Fisheries Resources: The No Action/No Project Alternative would have no impact on fisheries resources in the Delta, as conditions would be the same as under existing conditions.

Impacts on Special-Status Fish Species: The No Action/No Project Alternative would have no impact on special-status fish species in the Delta, as conditions would be the same as under existing conditions.

3.7.2.3.2 Special-Status Species Habitat

Under the No Action/No Project Alternative, conditions would be same as under existing conditions in terms of groundwater pumping, farming practices, reservoir operations, and river and stream flows. The No Action/No Project Alternative would not result in changes to existing water transfer practices. Special-status species habitat would not be impacted as a result of the No Action/No Project Alternative.

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

3.7.2.4.1 Fisheries Resources and Special-Status Fish Species

Under the Proposed Action, water transfers could directly affect fisheries resources by changing the timing and volume of flows within rivers and creeks, or storage volumes in reservoirs. These changes are detailed in Section 3.8.2.4. This section summarizes changes to stream flows and reservoir operations, which are evaluated in the context of impacts to fisheries resources (fish habitat and fish species of management concern) and separately for special-status fish species.

Reservoirs
The Proposed Action could impact reservoir storage and reservoir surface area. Under the Proposed Action, modeled storage volumes, reservoir elevations and surface areas would change as described in Section 3.8.2.4.1. All reservoirs would continue to be operated according to their existing requirements and within their current range of operations. These reservoirs do not support primary populations of the fish species of management concern, including special-status fish species.

Impacts on Fisheries Resources: The Proposed Action would have no impact on fisheries resources in reservoirs, as reservoirs do not support primary populations of the fish species of management concern, including special-status fish species.

Impacts on Special-Status Fish Species: Proposed Action would have no impact on special-status fish species, as reservoirs do not support primary populations of special-status fish species.

Rivers and Creeks

Sacramento River Watershed
The Proposed Action could cause flows in rivers and creeks to be lower than under the No Action/No Project Alternative. Under the Proposed Action, mean monthly modeled flows would be reduced by less than ten percent on the Sacramento, Feather, Yuba, and American rivers. Based on the screening level criteria, these flow reductions are not considered substantial. Therefore, the effects of the Proposed Action on fisheries in these rivers would be less than significant. Existing regulatory requirements protecting fisheries resources (flow magnitude and timing, temperature, and other water quality parameters) would continue to be met. Among larger rivers, only Bear River flows would be reduced by more than ten percent by the Proposed Action and, therefore is discussed in detail below.

In addition, an initial screening evaluation was conducted on flows in several smaller creeks with special-status fish species (see Section 3.7.2.1 for details). The evaluation concluded that impacts in the following waterways are less than significant: Deer Creek (in Tehama County), Antelope Creek, Paynes Creek, Elder Creek, Mill Creek (in Tehama County), Thomes Creek, Mill Creek (Thomes Creek tributary), Butte Creek, Auburn Ravine, Freshwater Creek, Colusa Basin Drain, Putah Creek, and Wilson Creek (Table 3.7-3).

Table 3.7-3. Screening Evaluation Results for Smaller Streams in the Sacramento River Watershed for Detailed Fisheries Impact Analysis for the Proposed Action.

Waterway	>1 cfs reduction?	>10% reduction?
Deer Creek (Tehama County)	N	-
Antelope Creek	N	-
Paynes Creek	N	-
Elder Creek	N	-
Mill Creek (Tehama County)	N	-
Thomes Creek	N	-
Mill Creek (tributary to Thomes Creek)	N	-
Stony Creek	Y	Y
Butte Creek	Y	N
Cache Creek	Y	Y
Eastside/Cross Canal	Y	U
Auburn Ravine	N	-
Coon Creek	Y	Y
Colusa Basin Drain	Y	N
Freshwater Creek	N	-
Putah Creek	Y	N
Little Chico Creek	Y	Y
Salt Creek	Y	U

Y = Yes; N = No; U = Unknown

Note: Darkened rows indicate that a detailed analysis was not conducted because both criteria were not met.

Flows in Cache, Stony, Coon, and Little Chico Creeks would meet both criteria (Table 3.7-3) and the effects of the Proposed Action on fisheries in these creeks therefore are discussed in detail below.

Historical flow data was limited or not available for Eastside/Cross Canal, and Salt Creek. These streams have the potential for impacts on special-status fish species due to flow reductions under the Proposed Action although no data were available to determine the proportional reduction of base flows. Generally, these waterways are not immediately adjacent to groundwater substitution transfers, and other nearby small waterways are not experiencing flow decreases that are causing significant impacts to aquatic resources. In addition, flow reductions as the result of groundwater declines would be observed at monitoring wells in the region and adverse effects on riparian vegetation would be mitigated by implementation of Mitigation Measure GW-1 (See Section 3.3, Groundwater Resources), because it requires monitoring of wells and implementing a mitigation plan if the seller's monitoring efforts indicate that the operation of the wells for groundwater substitution pumping are causing substantial adverse impacts. The mitigation plan would include curtailment of pumping until natural recharge corrects the environmental impact. Therefore, the impacts to fisheries resources would be less than significant in these streams.

Impacts on Fisheries Resources: Long-term water transfer actions under the Proposed Action would have a less than significant impact on fisheries resources in the following rivers and creeks within the Sacramento River Watershed: Sacramento River, Feather River, Yuba River, American River, Butte Creek, Putah Creek, Colusa Basin Drain, Deer Creek (in Tehama County), Antelope Creek, Paynes Creek, Elder Creek, Mill Creek (in Tehama County), Thomes Creek, Mill Creek (Thomes Creek tributary), Butte Creek, Auburn Ravine, Freshwater Creek, Colusa Basin Drain, Putah Creek, Eastside/Cross Canal, and Salt Creek. As modeled, flow changes in these streams would be small and no substantial effect on water quality would result from implementing the Proposed Action.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the Proposed Action would have a less than significant impact on special-status fish species in the following waterways within the Sacramento River Watershed: Sacramento River, Feather River, Yuba River, American River, Butte Creek, Putah Creek, Colusa Basin Drain, Deer Creek (in Tehama County), Antelope Creek, Paynes Creek, Elder Creek, Mill Creek (in Tehama County), Thomes Creek, Mill Creek (Thomes Creek tributary), Butte Creek, Auburn Ravine, Freshwater Creek, Colusa Basin Drain, Putah Creek, Eastside/Cross Canal, and Salt Creek. Flow changes would be small, and the habitat for these species would not be substantially affected by the Proposed Action, as described above.

As modeled, Cache Creek, Stony Creek, Coon Creek, Little Chico Creek, and the Bear River may experience a greater than ten percent change in mean monthly flows in at least one water year type and month of the year. Potential fisheries impacts in these waterways are discussed individually below.

Cache Creek

Groundwater substitution under the Proposed Action could cause Cache Creek flows to be lower than under the No Action/No Project Alternative. As detailed in Section 3.8.2.4, mean monthly flows in Cache Creek under the Proposed Action would not be greater than ten percent lower than the No Action/No Project Alternative when all water year types are combined in the mean calculation, but would be greater than ten percent lower in individual water year types within months between May and November. In most cases when flow reductions would exceed ten percent, reductions would be less than 20 percent (13 of 16 cases), but would be up to 31 percent (0.61 cfs) in critical water years during November. Because these flow changes exceed the ten percent screening criterion, they could affect fisheries resources.

Historical evidence indicates that Chinook salmon and steelhead spawned in Cache Creek (Shapovalov 1947 as cited in Yoshiyama et al. 1996). However, since 1947, there has been only one account of Chinook salmon, likely a fall-run individual, spawning in Cache Creek (in November 2000; Moyle and Ayers 2000) despite systematic fish surveys in the creek (e.g., Marchetti and Moyle

1998, Stillwater Sciences 2008). This is likely because of damming and agricultural diversions in the valley floor reaches over the past few decades combined with the natural porous geology of Cache Creek that has limited connection of the creek to the Sacramento River. Connectivity for migration of Chinook salmon only occurs in wet years (Stillwater Sciences 2008). In most years, Cache Creek dries out above the Cache Creek Settling Basin, precluding access by salmonids. Groundwater modeling results indicate that no substantial (greater than ten percent) changes to instream flows in Cache Creek would occur in wet years when Chinook salmon could be present. Therefore, there would be no effect of the Proposed Action on fall-run Chinook salmon.

Hardhead were reported in Cache Creek by Marchetti and Moyle (1998) but were not observed at any locations by Stillwater Sciences (2008). If hardhead are present in the creek, instream flow reductions may reduce hardhead habitat. However, because recent information indicates that hardhead are no longer present, this potential impact is unlikely. Therefore, the impacts would be less than significant.

Impacts on Fisheries Resources: Long-term water transfer actions under the Proposed Action would have a less than significant impact on fisheries resources within Cache Creek, as occurrence of fish species of management concern, including special-status fish species, is unlikely in this stream.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the Proposed Action would have a less than significant impact on special-status fish species in Cache Creek, because occurrence of special-status fish species is unlikely in this stream.

Stony Creek

Groundwater substitution under the Proposed Action could cause Stony Creek flows to be lower than under the No Action/No Project Alternative. Modeling results indicate that there would be one water year in one month (critical water years during October) in which flows would be reduced by 10.0 percent (3.3 cfs) under the Proposed Action. Spring-run and fall-/late fall-run Chinook salmon, steelhead, and hardhead reside in Stony Creek. Because spring-run and fall-/late fall-run Chinook salmon are not present in the creek during October, there would be no effects to these races. Juvenile steelhead and hardhead could be present in the river and experience this reduction in flows. However, because this reduction occurs in only one month and one water year type in one month, it is not expected to have a substantial effect on the two species present in the creek. Therefore, it is concluded that effects to steelhead and hardhead would be less than significant.

Coon Creek

Groundwater substitution under the Proposed Action could cause Coon Creek flows to be lower than under the No Action/No Project Alternative. Although existing baseline data is incomplete, the comparison of modeling results to

Coon Creek stream gage flow data from 2003 to 2005 (Bergfeld personal communication 2014) indicates that, in a worst case scenario, there would be one water year in one month (above normal water years during April) in which flows could potentially be reduced by 13.9 percent (2.8 cfs) under the Proposed Action. This calculation represents a worst case scenario because baseline flows used in this calculation are at the low end (20 cfs) of existing flow data range (20 cfs to 40 cfs) during 2003-2005. If the calculation included the high end of the range (40 cfs) for baseline flows, the reduction due to Proposed Action would be 7.0 percent. Therefore, this flow reduction would likely occur less frequently than assumed. Flows in all other months and water year types would be reduced by less than ten percent of baseline flows. As a result, it is concluded that effects of the Proposed Action to fisheries resources in Coon Creek would be less than significant.

Little Chico Creek

Groundwater substitution under the Proposed Action could cause Little Chico Creek flows to be lower than under the No Action/No Project Alternative. As modeled, flows in Little Chico Creek would be reduced by more than ten percent in multiple water year types during July through October (up to 100 percent of instream flows). It is not uncommon for Little Chico Creek flows to be very low during these months. A review of existing stream gage data from 1976 to 1995 reveals that flows would be less than 0.5 cfs during at least one month in 20 of 21 years and would be 0 cfs in 14 of 21 years. Low flows during these months would cause increases in water temperatures and reduced dissolved oxygen levels to levels intolerable for over-summering adult spring-run Chinook salmon. Therefore, spring-run Chinook salmon would not be present in the creek during this time of year. In addition, any juvenile steelhead and hardhead in the river would experience reductions in flows under the Proposed Action that would cause flows to be within the range of flows during the July through October period (generally less than 0.5 cfs). Therefore, the flow reduction of greater than ten percent would not have a substantial effect on fisheries resources in Little Chico Creek.

Bear River

The Proposed Action could cause Bear River flows to be lower than under the No Action/No Project Alternative. Under the Proposed Action, the only flow reduction greater than ten percent would occur in critical water years during February (approximately 18 percent, or 45 cfs lower). Fish species of management concern that could be present in the Bear River during February would include green and white sturgeon and hardhead.

Green and white sturgeon are not typically found in the Bear River but are thought to enter the river during spring of most wet years and some normal years (USFWS 1995). There is no evidence of species presence in the Bear River during critical water years. Because substantial flow reductions would only be in critical years, no sturgeon are expected to be in the Bear River during reduced flow conditions. Therefore, the impact of reduced flows on green and white sturgeon in the Bear River would be less than significant.

The reduction in flows under the Proposed Action during critical years in February is not expected to have a substantial effect on hardhead habitat for several reasons. First, hardhead are typically in the lower half of the water column and prefer slow moving pools (Moyle 2002). A reduction in flows would maintain the lower half of the water column and the number of slow moving pools in the river during February is not expected to decrease. Second, the frequency of the reduction would be low. Critical years would occur approximately once every five years within the period of analysis (1970-2003). Third, the timing of the reduction would be during a period that would least likely affect hardhead. Water temperatures during February are already low such that a reduction in flows would not likely increase water temperatures to a level that is stressful to hardhead. In addition, hardhead typically spawn and fry are present during April through May, possibly later in smaller streams (Moyle 2002). Therefore, only juvenile and adult hardhead, the least sensitive life stages, are present in the Bear River during February. For these reasons, the impact to hardhead in the Bear River would be less than significant.

Average monthly flows would be higher, compared to the No Action/No Project Alternative, in critical water years during July (approximately 240 percent, 58 cfs), and dry years during August and September (219 percent, 27 cfs and 127 percent, 12 cfs, respectively) when water is released from Camp Far West Reservoir for transfer. These flow increases during the summer months could be beneficial to fish species present.

Impacts on Fisheries Resources: Long-term water transfer actions under the Proposed Action would have a less than significant impact on fisheries resources within Bear River for the reasons stated above.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the Proposed Action would have a less than significant impact on special-status fish species in Bear River for the reasons stated above.

San Joaquin River Watershed

San Joaquin River

The Proposed Action could cause San Joaquin River flows to be lower than under the No Action/No Project Alternative. Under the Proposed Action, flows in the San Joaquin River would be reduced by less than two percent relative to the No Action/No Project Alternative. Based on the screening level criteria, these flow changes would not be considered substantial.

Impacts on Fisheries Resources: Long-term water transfer actions under the Proposed Action would have a less than significant impact on fisheries resources occurring in the San Joaquin River, as flow reductions would be small and would continue to meet existing requirements established to protect fish.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the Proposed Action would have a less than significant impact on special-status fish species, occurring in the San Joaquin River, as flow reductions would be small and would continue to meet existing requirements established to protect fish.

Merced River

The Proposed Action could cause Merced River flows to be lower than under the No Action/No Project Alternative. Under the Proposed Action, flows from McClure Reservoir would be released under existing agreements. Under the Proposed Action, flows would generally be similar to or greater than flows under the No Action/No Project Alternative. Flow reductions would not exceed ten percent in any water year type or month. Flows would be higher compared to the No Action/No Project Alternative during April and May. The greatest relative increase in flow under the Proposed Action would occur in dry water years during April (approximately 38 percent, 85 cfs higher than existing conditions). Increased flows during April and May could be beneficial to biological resources, particularly in dry and critically dry water years.

Impacts on Fisheries Resources: Long-term water transfer actions under the Proposed Action would have a beneficial effect on fisheries resources occurring in the Merced River, because flows would be higher than under the No Action/No Project Alternative.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the Proposed Action would have a beneficial effect on special-status fish species occurring in the Merced River, as flows would generally be higher than under the No Action/No Project Alternative.

Delta

Delta Exports

The Proposed Action could cause Delta exports to be higher than under the No Action/No Project Alternative. Changes in mean monthly Delta exports under the Proposed Action relative to the No Action/No Project Alternative would generally be very small (less than five percent), except in the summer to fall months of dry and critically dry water years. At the CVP diversion facilities (Jones Pumping Plant), changes in exports would be less than three percent, except in July through September of dry and critical water years when transfers are being pumped (ranging from a three to 38 percent increase in exports, or 9,000 to 72,000 acre-feet [AF] per month). At the SWP diversion facilities (Banks Pumping Plant), changes in exports would be less than ten percent, except in dry and critical water years during July and August (ranging from a five to 55 percent increase in exports, or 10,000 to 30,000 AF per month).

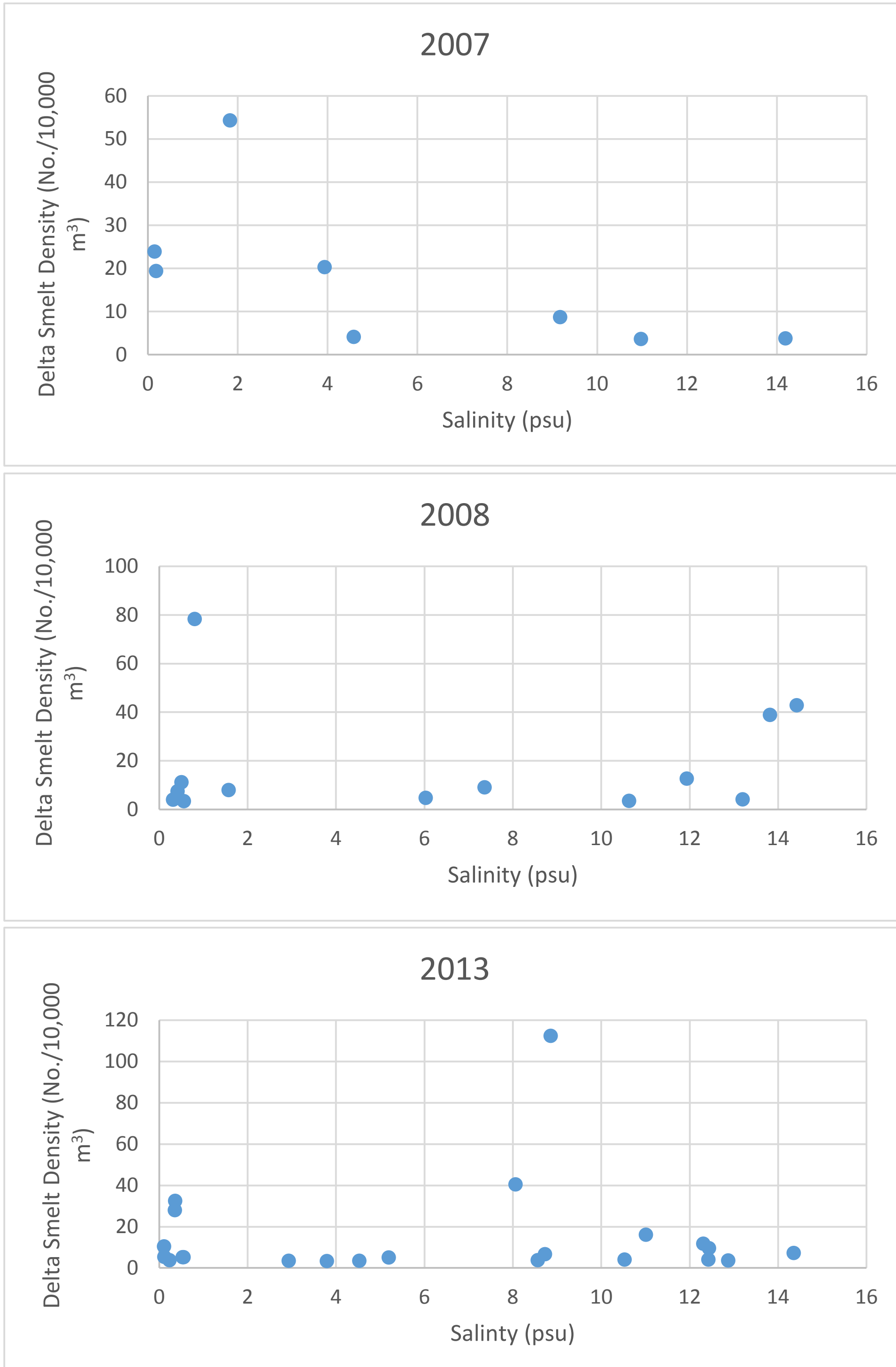
Mean monthly exports at Contra Costa WD diversions would be similar in all water year types and months except dry and critical water years during July through September (12.7 to 32.3 percent increase or 2,500 to 4,300 AF per month).

Model outputs indicate that, at the East Bay MUD diversion facilities at Freeport, fairly substantial proportional increases in mean monthly exports would occur throughout the year under the Proposed Action relative to the No Action/No Project Alternative (up to 75.3 percent increase). However, flows in the Sacramento River at Freeport would not be reduced in any month or water year type by more than 422 cfs (0.8 percent). Regardless, all of these facilities would continue to be operated in accordance with their existing or future regulatory requirements and the terms and conditions specified in their BOs. Both BOs contain a Reasonable and Prudent Alternative (RPA) that, when implemented, would avoid jeopardy of ESA listed fish species. In addition, the State Water Resources Control Board's (SWRCB's) Water Rights Decision-1641 imposes flow and water quality objectives in the 1995 Bay-Delta Plan upon the SWP and CVP operations to assure protection of beneficial uses in the Delta. The SWP and CVP must comply with these and other regulatory requirements in order to operate. Because changes in flows in Delta channels are predicted to be small and there are additional protections for fisheries and aquatic resources already in place under the ESA and D-1641, these impacts would be less than significant.

Collectively, the largest changes in Delta diversions relating to long-term water transfers would primarily occur from July through September. This is the period when through-Delta water transfers are allowed because it is the least sensitive period for fisheries resources. Longfin smelt are typically found in the bays and nearshore ocean during this time of year (Rosenfield 2010) and would be unaffected by the Proposed Action. Delta smelt have typically moved downstream towards Suisun Bay by this time of year because elevated water temperatures and low turbidity conditions in the Delta are less suitable than those downstream (Nobriga et al. 2008), although some delta smelt reside year-round in and around Cache Slough (Sommer et al. 2011) outside of the influence of the export facilities. An evaluation of CDFW summer tow net surveys in July and August of recent dry (2007, 2013) and critical (2008) water years supports the claim that delta smelt are not near the export facilities during these months[2] (CDFW 2014). There is no consistent pattern in delta smelt density relative to salinity (Figure 3.7-2), suggesting that there is no salinity range preference for the low salinity zone (~2 psu) by delta smelt juveniles during these months in these dry and critical water years. There is, however, a general lack of delta smelt caught in tows with water temperatures above ~22°C, indicating that the fish avoid areas with higher water temperatures (Figure 3.7-3). This suggests that the delta smelt, a species that is subject to the wide range of physical conditions typical of an estuary, will move to more

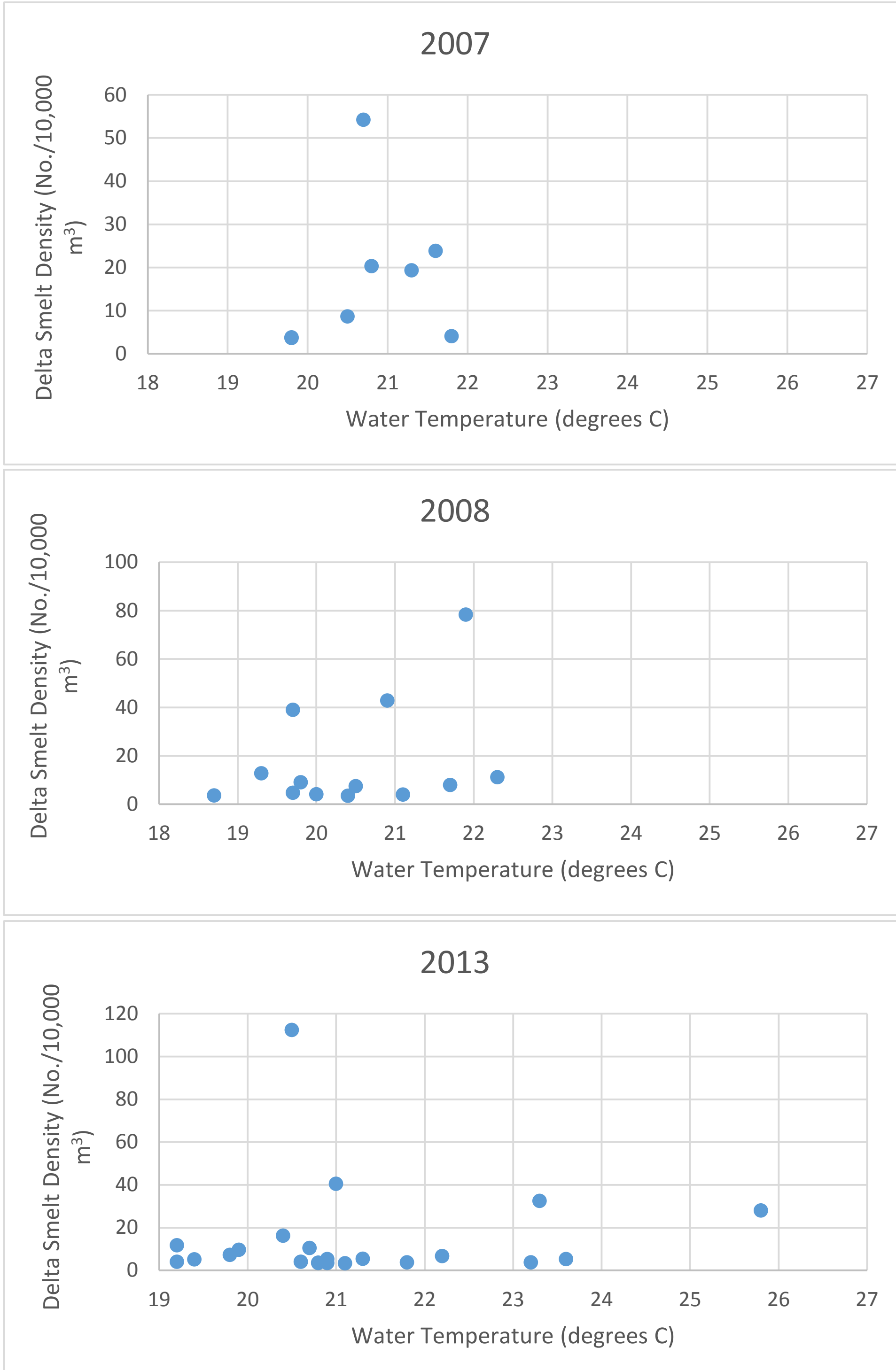
[2] Includes only tows in which fish were caught

suitable (lower) water temperature conditions despite being in a less suitable physiological habitat that is not the low salinity zone.



Source: CDFW 2014

Figure 3.7-2. Density of delta smelt as a function of salinity in recent dry and critical water years: 2007 (dry), 2008 (critical), and 2013 (dry).



Source: CDFW 2014

Figure 3.7-3. Density of delta smelt as a function of water temperature in recent dry and critical water years: 2007 (dry), 2008 (critical), and 2013 (dry).

Delta outflow would not be reduced and, therefore, X2 location would not increase, during these months under the Proposed Action (see “Delta Outflow” section below). In fact, Delta outflow would increase under the Proposed Action in dry and critical years during July through September, although X2 location would change minimally (less than 1.3 percent). Consequently, potential increases in exports during this period would have limited, if any, effects on delta smelt.

Green and white sturgeon are rarely observed (only sporadically in low numbers; DWR and Reclamation unpublished salvage data) at the diversion facilities and, therefore, are not likely to be affected by these changes. The vast majority of juvenile Chinook salmon and steelhead would have emigrated from the Delta region by the end of June (NOAA Fisheries 2014) and are, therefore, unlikely to be affected by increases in exports. In addition, fish screens and monitoring at the East Bay MUD (currently conducted December through June when sensitive fish species are present) and Contra Costa WD (currently conducted year-round) facilities, as well as year-round fish salvage monitoring at SWP and CVP facilities, would further ensure that special-status fish species or other fish species of management concern are not affected by any increases in exports at their facilities. Reclamation is consulting frequently with USFWS and NOAA Fisheries on CVP and SWP operations relative to the BOs and special-status fish species in the Delta.

Impacts on Fisheries Resources: Long-term water transfer actions under the Proposed Action would have a less than significant impact on fisheries resources that are influenced by Delta exports because occurrence of these species would be unlikely during the period of increased exports, species that are present are rarely observed at diversion facilities, and fish screens and monitoring at export facilities would further ensure that there would not be a substantial increase in the number of fish of a special-status species.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the Proposed Action would have a less than significant impact on special-status fish species that are influenced by Delta exports because occurrence of these species would be unlikely during the period of increased exports, species that are present are rarely observed at diversion facilities, and fish screens and monitoring at export facilities would further ensure that there would not be a substantial increase in the number of fish of a special-status species.

Delta Outflow

The Proposed Action could cause Delta Outflows to be lower than under the No Action/No Project Alternative. Under the Proposed Action, modeled mean Delta outflows would not be more than 1.3 percent (147 cfs) lower than flows under the No Action/No Project Alternative in any month or water year type. Outflow would be 12.2 percent (500 cfs) higher during July in critically dry water years. The maximum mean monthly upstream shift in X2 location would be 0.1 km (0.2 percent) upstream during periods of decreased flow, and 1.9 km

(1.0 percent) downstream during periods of increased flow. Average daily fluctuations in outflow, and therefore X2 position, at Chipps Island due to tides are 170,000 cfs (DWR 1995). Therefore, a change of 500 cfs in Delta outflow would be 0.3 percent of the daily tidal change experienced in this area. These changes to Delta outflow, and resultant changes in X2 position, due to the Proposed Action would not have a substantial adverse impact on biological resources because either outflow reductions would be minimal (less than 1.3 percent) or the potential outflow increase of 12.2 percent could be beneficial.

Impacts on Fisheries Resources: Long-term water transfer actions under the Proposed Action would have a less than significant impact on fisheries resources that may be influenced by Delta outflow, as reductions in Delta outflow and increases in X2 location would be small (less than1.3 percent) in all months and water year types and would therefore not cause a substantial reduction in the number of fish of a special-status species. In addition, Delta outflow would increase by 12.2 percent under the Proposed Action in critical years during July, which could benefit fisheries resources.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the Proposed Action would have a less than significant impact on special-status fish species that may be influenced by Delta outflow, as reductions in Delta outflow and increases in X2 location would be small (less than 1.3 percent) in all months and water year types and would therefore not cause a substantial reduction in the number of fish of a special-status species. In addition, Delta outflow would increase by 12.2 percent under the Proposed Action in critical years during July, which could benefit special-status fish species.

3.7.2.4.2 Special-Status Species Habitat

The impacts of long-term water management actions on special-status species (listed or candidate species under the ESA, CESA or listed as a species of concern by the State of California), including winter-, spring-, and fall-/late fall-run Chinook salmon, Central Valley steelhead, delta smelt, longfin smelt, green sturgeon, hardhead, and Sacramento splittail were evaluated based on the impacts of these actions on fisheries habitats, specifically reservoirs, mainstem rivers, small tributaries to the Sacramento River, and the Delta. The distribution of special-status fish species is within these habitat types is provided in Table 3.7-2.

As described in the preceding sections, long-term water transfer actions would be carried out such that that all facilities would be operated consistent with their existing or future regulatory requirements. The most current flow and temperature requirements established by various regulating agencies including the USFWS, NOAA Fisheries, Federal Energy Regulatory Commission (FERC), and SWRCB, for the protection of downstream resources, including fish, would be met.

Reservoirs
Special-status fish species do not occupy the reservoirs that would be affected by long-term water transfer actions. These reservoirs are operated to maintain environmental conditions on the downstream rivers, as discussed in the next section.

Mainstem Rivers
Environmental Commitments would require that facilities affected by long-term water transfer actions continue to provide the existing protections for fish dependent on the mainstem rivers including the Sacramento, Feather, American, Yuba, Bear, Merced, and San Joaquin rivers. Each of the special-status fish species use mainstem habitats for some portion of their life history, with the exception of delta and longfin smelt, which use only those portions of the mainstream rivers in the Delta. Spawning, rearing, holding and migration habitat on these rivers would be maintained. While minor changes in flows and temperatures would occur, these would be within the normal ranges that would occur under the No Action/No Project Alternative.

Impacts to Special-Status Fish Species: The Proposed Action would have a less than significant impact on special-status fish species in mainstem rivers. Flows in all mainstem rivers would remain within their normal ranges and, therefore, there would be no substantial reduction in spawning, rearing, or migration habitat of special-status species.

Small Tributaries to the Sacramento River
Small tributaries to the Sacramento River could be impacted by groundwater substitution, which could reduce flows in these streams due the hydrologic connectivity between groundwater tables and these streams. The groundwater model results indicate that the effects of groundwater substitution on stream flow would be most pronounced during July through September when special-status fish species are unlikely to occur in the streams. In addition, these flow reductions would not be frequent or large enough to have a substantial effect on special-status fish species in the small tributaries during this period.

Impacts to Special-Status Fish Species: Groundwater substitution actions under the Proposed Action would have a less than significant impact on special-status fish species that could occur in small tributaries to the Sacramento River because there would be no substantial reduction in spawning, rearing, or migration habitat of special-status species.

Delta
All of the special-status fish species use the Delta for some portion of their life history. As previously described, the transfer operations model indicates that there would be very minor reductions in Delta outflow (less than 1.3 percent) as a result of the long-term water transfer actions and Delta outflow would improve by 12.2 percent in critical water years during July. Therefore, there

would be no substantial reduction in spawning, rearing, or migration habitat of special-status species.

Impacts to Special-Status Fish Species: The Proposed Action would have a less than significant impact on special-status fish species in the Delta because there would be no substantial reduction in spawning, rearing, or migration habitat of special-status species. The transfer operations model indicates that there would be very minor reductions in Delta outflow (less than 1.3 percent) as a result of the long-term water transfer actions and Delta outflow would improve by 12.2 percent in critical water years during July.

3.7.2.5 Alternative 3: No Cropland Modifications Alternative

3.7.2.5.1 Fisheries Resources and Special-Status Fish Species

Under this alternative, water would not be made available through cropland idling or crop shifting. Water would be made available for transfer through groundwater substitution, stored reservoir releases, and conservation. The amount of water made available from each of these sources would be at the same levels as described for the Proposed Action. No additional water would be made available from these sources to offset the loss of water that would not be available from cropland idling/shifting.

Reservoirs

The No Cropland Modifications Alternative could impact reservoir storage and reservoir surface area. Under the No Cropland Modifications Alternative, modeled storage volumes, reservoir elevations and surface areas would change as described in Section 3.7.2.6.1. All reservoirs would continue to be operated according to their existing requirements and within their current range of operations. These reservoirs do not support primary populations of the fish species of management concern, including special-status fish species.

Impacts on Fisheries Resources: The No Cropland Modifications Alternative would have no impact on fisheries resources in reservoirs, as reservoirs do not support primary populations of the fish species of management concern, including special-status fish species.

Impacts on Special-Status Fish Species: The No Cropland Modifications Alternative would have no impact on special-status fish species, as reservoirs do not support primary populations of special-status fish species.

Rivers and Creeks

Sacramento River Watershed

The No Cropland Modifications Alternative could cause Sacramento River flows to be lower than under the No Action/No Project Alternative. As detailed in Section 3.7.2.6, under the No Cropland Modifications Alternative, mean monthly modeled flows would be reduced by less than ten percent on the

Sacramento, Feather, Yuba, and American rivers. Based on the screening level criteria, these flow reductions are not considered substantial. Therefore, the effects of the No Cropland Modifications Alternative on fisheries in these rivers would be less than significant. Existing regulatory requirements protecting fisheries resources (flow magnitude and timing, temperature and other water quality parameter) would continue to be met. Among larger rivers, only Bear River flows would be reduced by more than ten percent by the No Cropland Modifications Alternative and therefore is discussed in detail below.

Flows in smaller streams are only affected by an alternative through changes to groundwater. Because the effects of Alternative 3 involve transfers through groundwater substitution only, impacts of Alternative 3 to smaller streams would be the same as the Proposed Action.

Impacts on Fisheries Resources: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on fisheries resources in the following rivers and creeks within the Sacramento River Watershed: Sacramento River, Feather River, Yuba River, American River, Butte Creek, Putah Creek, Colusa Basin Drain, Deer Creek (in Tehama County), Antelope Creek, Paynes Creek, Elder Creek, Mill Creek (in Tehama County), Thomes Creek, Mill Creek (Thomes Creek tributary), Butte Creek, Cache Creek, Auburn Ravine, Freshwater Creek, Colusa Basin Drain, Putah Creek, Stony Creek, Eastside/Cross Canal, Coon Creek, Little Chico Creek, Salt Creek, and Willow Creek including the south fork. Flow changes in these streams would be small and no substantial effect on water quality would occur in these rivers and creeks.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on special-status fish species in the following waterways within the Sacramento River Watershed: Sacramento River, Feather River, Yuba River, American River, Butte Creek, Putah Creek, Colusa Basin Drain, Deer Creek (in Tehama County), Antelope Creek, Paynes Creek, Elder Creek, Mill Creek (in Tehama County), Thomes Creek, Mill Creek (Thomes Creek tributary), Butte Creek, Cache Creek, Auburn Ravine, Freshwater Creek, Colusa Basin Drain, Putah Creek, Stony Creek, Eastside/Cross Canal, Coon Creek, Little Chico Creek, Salt Creek, and Willow Creek including the south fork. Flow changes would be small, and no substantial effect on water quality would result from this alternative, as described above.

Bear River would potentially experience a greater than ten percent change in mean monthly flows in at least one water year type and month of the year. The potential fisheries impacts in these waterways are discussed individually below.

Bear River

The No Cropland Modifications Alternative could cause Bear River flows to be lower than under the No Action/No Project Alternative. Under the No Cropland

Modifications Alternative, the only flow reduction greater than ten percent would occur in critical water years during February (approximately 18 percent, or 45 cfs lower). These flow reductions would occur only in one month during critical water years. Fish species of management concern that could be present in the Bear River during February would include green and white sturgeon and hardhead.

Green and white sturgeon are not typically found in the Bear River but are thought to enter the river during spring of most wet years and some normal years (USFWS 1995). There is no evidence of species presence in the Bear River during critical water years. Because flows would be reduced only in critical years, no sturgeon are expected to be in the Bear River during reduced flow conditions. Therefore, the impact to green and white sturgeon in the Bear River would be less than significant.

The reduction in flows under the No Cropland Modifications Alternative during critical years in February is not expected to have a substantial effect on the habitat for several reasons. First, hardhead are typically in the lower half of the water column and prefer slow moving pools (Moyle 2002). A reduction in flows would maintain the lower half of the water column and the number of slow moving pools is not expected to decrease. Second, the frequency of the reduction would be low. Critical years would occur approximately once every five years within the period of analysis (1970-2003). Third, the timing of the reduction would be during a period that would least likely affect hardhead. Water temperatures during February are already low such that a reduction in flows would not likely increase water temperatures to a level that is stressful to hardhead. In addition, hardhead typically spawn and fry are present during April through May, possibly later in smaller streams (Moyle 2002). Therefore, only juvenile and adult hardhead, the least sensitive life stages, are present in the Bear River during February. As a result of these reasons, the impact to hardhead in the Bear River would be less than significant.

Average monthly flows under the No Cropland Modifications Alternative would be higher than flows under the No Action/No Project Alternative in critical water years during July and August (203 percent, 49 cfs and 88 percent, nine cfs, respectively), and dry years during August and September (219 percent, 27 cfs and 27 percent, 12 cfs, respectively) when water is released from Camp Far West Reservoir for transfer. These flow increases during the summer months may be beneficial to fish species present.

Impacts on Fisheries Resources: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on fisheries resources in the Bear River for the reasons stated above.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on special-status fish species in Bear River for the reasons stated above.

San Joaquin River Watershed

San Joaquin River

The No Cropland Modifications Alternative could cause San Joaquin River flows to be lower than under the No Action/No Project Alternative. Under the No Cropland Modifications Alternative, flows on the San Joaquin River would be reduced by less than two percent relative to the No Action/No Project Alternative. Based on the screening level criteria, these flow changes would not be considered substantial.

Impacts on Fisheries Resources: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on fisheries resources in the San Joaquin River, as flow reductions would be small and would not substantially reduce the number of fish of special-status species.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on special-status fish species in the San Joaquin River, as flow reductions would be small and would not substantially reduce the number of fish of special-status species.

Merced River

The No Cropland Modifications Alternative could cause Merced River flows to be lower and higher than under the No Action/No Project Alternative. Under the No Cropland Modifications Alternative, flow reductions on the Merced River would not exceed ten percent in any water year type or month. Flows would be higher compared to the No Action/No Project Alternative during April and May. The greatest relative increase in flow would occur in dry water years during April (approximately 38 percent, 85 cfs higher than existing conditions). Increased flows during April and May could be beneficial to biological resources, particularly in dry and critically dry water years. The flow reductions on the Merced River would not have a significant impact on fisheries resources.

Impacts on Fisheries Resources: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on fisheries resources in the Merced River. Reductions in river flow would be small relative to the No Action/No Project Alternative and would not substantially reduce the number of fish of special-status species.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on special-status fish species in the Merced River, as flow reductions would be small and would not substantially reduce the number of fish of special-status species.

Delta

Delta Exports

The No Cropland Modifications Alternative could cause Delta exports to be higher than under the No Action/No Project Alternative. Changes in Delta exports under the No Cropland Modifications Alternative relative to the No Action/No Project Alternative would generally be very small (less than five percent), except in the summer to fall months of dry and critically dry water years. At the CVP diversion facilities (Jones Pumping Plant), changes in exports would be less than five percent, except during July through September in dry (three to 15 percent increase in exports, or 6,600 to 33,800 AF per month) and critically dry (11 to 29 percent increase in exports, or 15,200 to 54,500 AF per month) water years. At the SWP diversion facilities (Banks Pumping Plant), changes in exports would be less than five percent, except during the transfer period of dry and critical water years (four to 21 percent increase in exports, or 8,100 to 20,900 AF per month).

Exports at Contra Costa WD diversions would be similar in all water year types and months except dry and critical water years during July and August (12.7-32.3 percent increase, or 2,500 to 4,300 AF per month).

At the East Bay MUD diversion facilities at Freeport, fairly substantial proportional increases in exports would occur throughout the year under the No Cropland Modifications Alternative relative to the No Action/No Project Alternative (up to 75 percent increase). However, flows in the Sacramento River at Freeport would not be reduced in any month or water year type by more than 422 cfs (0.8 percent). Regardless, all of these facilities would continue to be operated in accordance with their existing or future regulatory requirements and the terms and conditions specified in their BOs. Both BOs contain a Reasonable and Prudent Alternative (RPA) that, when implemented, would avoid jeopardy of ESA listed fish species. In addition, the SWRCB's Water Rights Decision-1641 imposes flow and water quality objectives in the 1995 Bay-Delta Plan upon the SWP and CVP operations to assure protection of beneficial uses in the Delta. The SWP and CVP must comply with these and other regulatory requirements in order to operate. Because changes in flows in Delta channels are predicted to be small and there are additional protections for fisheries and aquatic resources already in place under the ESA and D-1641, these impacts would be less than significant.

Collectively, the largest changes in Delta diversions relating to long-term water transfers would primarily occur from July through September. This is the period when through-Delta water transfers are allowed because it is the least sensitive period for fisheries resources.

Longfin smelt are typically found in the bays and nearshore ocean during this time of year (Rosenfield 2010) and would be unaffected by the Proposed Action. Delta smelt have typically moved downstream towards Suisun Bay by this time of year because elevated water temperatures and low turbidity conditions in the Delta are less suitable than those downstream (Nobriga et al. 2008), although some delta smelt reside year-round in and around Cache Slough (Sommer et al. 2011) outside of the influence of the export facilities. An evaluation of CDFW summer tow net surveys in July and August of recent dry (2007, 2013) and critical (2008) water years indicates that the delta smelt, a species that is subject to the wide range of physical conditions typical of an estuary, will move to more suitable (lower) water temperature conditions despite being in a less suitable physiological habitat that is not the low salinity zone (see discussion under Section 3.7.2.4 and Figure 3.7-2 and 3.7-3).

Delta outflow would not be reduced and, therefore, X2 location would not increase, during these months under Alternative 3 (see "Delta Outflow" section below). In fact, Delta outflow would increase under Alternative 3 in dry and critical years during July through September, although X2 location would change minimally (less than 1.3 percent). Consequently, potential increases in exports during this period would have limited, if any effects on delta or longfin smelt.

Green and white sturgeon are rarely observed (only sporadically and in low numbers; DWR and Reclamation unpublished salvage data) at the diversion facilities and, therefore, are not likely to be affected by these changes. The vast majority of juvenile Chinook salmon and steelhead would have emigrated from the Delta region by the end of June (NOAA Fisheries 2014) and are, therefore, unlikely to be affected by increases in exports. In addition, fish screens and monitoring at the East Bay MUD (currently conducted December through June when sensitive fish species are present) and Contra Costa WD (currently conducted year-round) facilities would further ensure that special-status fish species are not affected by any increases in exports at their facilities. Reclamation is consulting frequently with USFWS and NOAA Fisheries on CVP and SWP operations relative to the BOs and special-status fish species in the Delta.

Impacts on Fisheries Resources: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on fisheries resources that are influenced by Delta exports because occurrence of these species would be unlikely during the period of increased exports, species that are present are rarely observed at diversion facilities, and fish screens and monitoring at export facilities would further ensure that there would not be a substantial increase in the number of fish of a special-status species.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on special-status fish species that are influenced by Delta exports occurrence of these species would be unlikely during the period of increased exports, species that are present are rarely observed at diversion facilities, and fish screens and monitoring at export facilities would further ensure that there would not be a substantial increase in the number of fish of a special-status species.

Delta Outflow

The No Cropland Modifications Alternative could cause Delta Outflows to be lower than under the No Action/No Project Alternative. Under the No Cropland Modifications Alternative, Delta outflows would not be more than 1.3 percent (147 cfs) lower than flows under the No Action/No Project Alternative in any month or water year type. The maximum upstream shift in X2 location would be 0.1 km (0.2 percent) upstream during periods of decreased flow, and 0.6 km (0.7 percent) downstream during periods of increased flow. Average daily fluctuations in outflow, and therefore X2 position, at Chipps Island due to tides are 170,000 cfs (DWR 1995). Therefore, a change of 500 cfs in Delta outflow would be 0.3 percent of the daily tidal change experienced in this area. These changes to Delta outflow, and resultant changes in X2 position, due to Alternative 3 would not have a substantial impact on biological resources because the change is minimal (less than ten percent).

Impacts on Fisheries Resources: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on fisheries resources that may be influenced by Delta outflow, as reductions in Delta outflow and increases in X2 location would be small (less than 1.3 percent) in all months and water year types and would therefore not cause a substantial reduction in the number of fish of a special-status species.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the No Cropland Modifications Alternative would have a less than significant impact on special-status fish species that may be influenced by Delta outflow, as reductions in Delta outflow and increases in X2 location would be small (less than 1.3 percent) in all months and water year types and would therefore not cause a substantial reduction in the number of fish of a special-status species.

3.7.2.5.2 Special-Status Species Habitat

As described in the preceding sections, long–term water transfer actions would be carried out such that that all facilities would be operated consistent with their existing or future regulatory requirements. The most current flow and temperature requirements established by various regulating agencies including the USFWS, NOAA Fisheries, FERC, and SWRCB, for the protection of downstream resources, including fish, would be met.

Reservoirs
Special-status fish species do not occupy the reservoirs that would be affected by long-term water transfer actions. These reservoirs are operated to maintain environmental conditions on the downstream rivers, as discussed in the next section.

Mainstem Rivers
Environmental Commitments would require that facilities affected by long-term water transfer actions continue to provide the existing protections for fish dependent on the mainstem rivers including the Sacramento, Feather, American, Yuba, Bear, Merced and San Joaquin rivers. Each of the special-status fish species use mainstem habitats for some portion of their life history, with the exception of delta and longfin smelt, which use only those portions of the mainstream rivers in the Delta. Spawning, rearing, holding and migration habitat on these rivers would be maintained. While minor changes in flows and temperatures would occur, these would be within the normal ranges that would occur under the No Action/No Project Alternative.

Impacts to Special-Status Fish Species: The No Cropland Modifications Alternative would have a less than significant impact on special-status fish species in mainstem rivers. Flows in all mainstem rivers would remain within their normal ranges and, therefore, there would be no substantial reduction in spawning, rearing, or migration habitat of special-status species.

Small Tributaries to the Sacramento River
Small tributaries to the Sacramento River could be impacted by groundwater substitution, which could reduce flows in these streams due the hydraulic connectivity between groundwater tables and these streams. The groundwater model results indicate that the effects of groundwater substitution on stream flow would be most pronounced during July through September when special-status fish species are unlikely to occur in the streams. In addition, these flow reductions would not be frequent or large enough to have a substantial effect on special-status fish species in the small tributaries during this period.

Impacts to Special-Status Fish Species: Groundwater substitution actions under the No Cropland Modifications Alternative would have a less than significant impact on special-status fish species that could occur in small tributaries to the Sacramento River.

Delta
All of the special-status fish species use the Delta for some portion of their life history. As previously described, the transfer operations model indicates that there would be very minor reductions in Delta outflow (less than two percent) as a result of the long-term water transfer actions. Therefore, there would be no substantial reduction in spawning, rearing, or migration habitat of special-status species.

Impacts to Special-Status Fish Species: The No Cropland Modifications Alternative would have a less than significant impact on special-status fish species in the Delta, because there would be no substantial reduction in spawning, rearing, or migration habitat of special-status species.

3.7.2.6 Alternative 4: No Groundwater Substitution

3.7.2.6.1 Fisheries Resources and Special-Status Fish Species

Reservoirs

The No Groundwater Substitution Alternative could impact reservoir storage and reservoir surface area. Under the No Groundwater Substitution Alternative, storage volumes, reservoir elevations and surface areas would change, but all reservoirs would continue to be operated according to their existing requirements and within their current range of operations. These reservoirs do not support primary populations of the fish species of management concern, including special-status fish species.

Impacts on Fisheries Resources: The No Groundwater Substitution Alternative would have no impact on fisheries resources in reservoirs, as reservoirs do not support primary populations of the fish species of management concern, including special-status fish species.

Impacts on Special-Status Fish Species: The No Groundwater Substitution Alternative would have no impact on special-status fish species, as reservoirs do not support primary populations of special-status fish species.

Rivers and Creeks

The following section provides a discussion of the impacts to fisheries resources of flow changes (timing and magnitude) for rivers, streams, and associated tributaries under the No Groundwater Substitution Alternative. These flow changes are detailed in Section 3.8.2.6. Alternative 4 does not include groundwater substitution; therefore, the flow decreases to rivers and creeks due to groundwater substitution do not occur. The modeled changes in the No Groundwater Substitution Alternative are caused by storing and moving transfer water made available through cropland idling/crop shifting, stored reservoir release, and conservation.

Sacramento River Watershed

The No Groundwater Substitution Alternative could cause flows in rivers and creeks to be lower than under the No Action/No Project Alternative. Under the No Groundwater Substitution Alternative, mean monthly modeled flows would be reduced by less than ten percent on the Sacramento, Feather, Yuba, and American rivers. Therefore, these flow reductions would not be considered substantial. Existing regulatory requirements protecting fisheries resources (flow magnitude and timing, temperature, and other water quality parameters) would continue to be met. Therefore, the effects of the No Groundwater

Substitution alternative on fisheries in these rivers would be less than significant. Among larger rivers, only Bear River flows would be reduced by more than ten percent by the No Groundwater Substitution Alternative and therefore is discussed in detail below.

Smaller streams in the Sacramento River watershed in which special-status fish species are present (see Table 3.7-3 for list of streams) would not be impacted by transfers under the No Groundwater Substitution Alternative because groundwater substitution would not occur. Therefore, there would be no impacts of the No Groundwater Substitution Alternative on fisheries in these smaller streams in the Sacramento River watershed.

Impacts on Fisheries Resources: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on fisheries resources in the Sacramento, Feather, Yuba, and American rivers and no impact on fisheries resources in smaller streams in the Sacramento River watershed.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on fisheries resources in the Sacramento, Feather, Yuba, and American rivers no impact on special-status fish species occurring in small streams in the Sacramento River watershed.

Bear River

The No Groundwater Substitution Alternative could cause Bear River flows to be lower and higher than under the No Action/No Project Alternative. Under the No Groundwater Substitution Alternative, the only flow reduction greater than ten percent would occur in critical water years during February (approximately 18 percent, or 45 cfs lower). These flow reductions would occur only in one month during critical water years. Fish species of management concern that could be present in the Bear River during February would include green and white sturgeon and hardhead.

Green and white sturgeon are not typically found in the Bear River but are thought to enter the river during spring of most wet years and some normal years (USFWS 1995). There is no evidence of species presence in the Bear River during critical water years. Because flows would be reduced only in critical years, no sturgeon are expected to be in the Bear River during reduced flow conditions. Therefore, the impact to green and white sturgeon in the Bear River would be less than significant.

An 18 percent reduction in flows during critical years in February is not expected to have a substantial effect on hardhead habitat for several reasons. First, hardhead are typically in the lower half of the water column and prefer slow moving pools (Moyle 2002). A reduction in flows would maintain the lower half of the water column and may increase the number of slow moving pools. Second, the frequency of the reduction would be low. Critical years would occur approximately once every five years within the period of analysis (1970-2003). Third, the timing of the reduction would be during a period that would least likely affect hardhead. Water temperatures during February are already low such that a reduction in flows would not likely increase water temperatures to a level that is stressful to hardhead. In addition, hardhead typically spawn and fry are present during April through May, possibly later in smaller streams (Moyle 2002). Therefore, only juvenile and adult hardhead, the least sensitive life stages, are present in the Bear River during February. As a result of these reasons, the impact to hardhead in the Bear River would be less than significant.

Average monthly flows would be higher, compared to the No Action/No Project Alternative, in critical water years during July (approximately 240 percent, 58 cfs), and dry years during August and September (52 percent, 38 cfs and 22 percent, three cfs, respectively) when water is released from Camp Far West Reservoir for transfer. These flow increases during the summer months could be beneficial to fish species present.

Impacts on Fisheries Resources: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on fisheries resources within Bear River for the reasons stated above.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on special-status fish species in Bear River for the reasons stated above.

San Joaquin River Watershed

San Joaquin River

The No Groundwater Substitution Alternative could cause San Joaquin River flows to be lower and higher than under the No Action/No Project Alternative. Under the No Groundwater Substitution Alternative, flows would be reduced by less than ten percent on the San Joaquin River relative to the No Action/No Project Alternative. Based on the screening level criteria, these flow reductions would not be considered substantial. Further, the 15 percent increase in flows in dry water years during July may benefit fisheries resources.

Impacts on Fisheries Resources: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on fisheries resources occurring in the San Joaquin River, as flow reductions would be small and all facilities would continue to meet all environmental requirements governing their operation.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on special-status fish species occurring in the San Joaquin River, as flow reductions would be small and all facilities would continue to meet all environmental requirements governing their operation.

Merced River

The No Groundwater Substitution Alternative could cause Merced River flows to be lower and higher than under the No Action/No Project Alternative. Under the No Groundwater Substitution Alternative, flow releases from McClure Reservoir would be operated under existing agreements. Under the No Groundwater Substitution Alternative, flows in the Merced River would be reduced by less than ten percent relative to the No Action/No Project Alternative. Flows would be 124 percent (163 cfs) and 59 percent (70 cfs) higher compared to the No Action/No Project Alternative in dry and critical water years, respectively, during July. Increased flows during July could be beneficial to biological resources, particularly in dry and critically dry water years. The flow reductions on the Merced River would not have a significant impact on biological resources.

Impacts on Fisheries Resources: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on fisheries resources occurring in the Merced River. Reductions in river flow would be small relative to the No Action/No Project Alternative and all facilities would continue to meet all environmental requirements governing their operation.

Impacts on Special-Status Fish Species: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on special-status fish species occurring in the Merced River, as flow reductions would be small and all facilities would continue to meet all environmental requirements governing their operation.

Delta

Delta Exports

The No Groundwater Substitution Alternative could cause Delta exports to be higher than under the No Action/No Project Alternative. Changes in Delta exports under the No Groundwater Substitution Alternative relative to the No Action/No Project Alternative and the No Action/No Project Alternative would generally be very small (less than five percent), except in the summer to fall months of dry and critically dry water years. At the CVP diversion facilities (Jones pumping plant), changes in exports would be less than 2.6 percent, except in critical water years during July (27.7 percent, 52,500 AF) and August (11.9 percent, 22,500 AF). At the SWP facilities (Banks pumping plant), changes in exports would be less than less ten percent, except in dry water years during August (28.5 percent increase in exports).

Changes in exports would generally not occur at the Contra Costa WD diversion facilities under the No Groundwater Substitution Alternative, except during July through September in dry and critical water years (8.5 to 32.3 percent increase).

At the East Bay MUD diversion facilities at Freeport, fairly substantial proportional increases in exports would occur throughout the year under the No Groundwater Substitution Alternative relative to the No Action/No Project Alternative (up to 73.1 percent increase). However, flows in the Sacramento River at Freeport would not be reduced in any month or water year type by more than 234 cfs (0.4 percent).

All of these facilities would continue to be operated in accordance with their existing or future regulatory requirements and the terms and conditions specified in their BOs. Both BOs contain a Reasonable and Prudent Alternative (RPA) that, when implemented, would avoid jeopardy of ESA listed fish species. In addition, the SWRCB's Water Rights Decision-1641 imposes flow and water quality objectives in the 1995 Bay-Delta Plan upon the SWP and CVP operations to assure protection of beneficial uses in the Delta. The SWP and CVP must comply with these and other regulatory requirements in order to operate. Because changes in flows in Delta channels are predicted to be small and there are additional protections for fisheries and aquatic resources already in place under the ESA and D-1641, these impacts would be less than significant.

Collectively, the largest changes in Delta diversions relating to long-term water transfers would primarily occur from July through September. Through Delta water transfers are allowed at that time because it is the least sensitive period for fisheries resources.

Longfin smelt are typically found in the bays and nearshore ocean during this time of year (Rosenfield 2010) and would be unaffected by the Proposed Action. Delta smelt have typically moved downstream towards Suisun Bay by this time of year because elevated water temperatures and low turbidity conditions in the Delta are less suitable than those downstream (Nobriga et al. 2008), although some delta smelt reside year-round in and around Cache Slough (Sommer et al. 2011) outside of the influence of the export facilities. An evaluation of CDFW summer tow net surveys in July and August of recent dry (2007, 2013) and critical (2008) water years indicates that the delta smelt, a species that is subject to the wide range of physical conditions typical of an estuary, will move to more suitable (lower) water temperature conditions despite being in a less suitable physiological habitat that is not the low salinity zone (see discussion under Section 3.7.2.4 and Figure 3.7-2 and 3.7-3).

Delta outflow would not be reduced and, therefore, X2 location would not increase, during these months under Alternative 3 (see "Delta Outflow" section below). In fact, Delta outflow would increase under Alternative 3 in dry and critical years during July through September, although X2 location would change minimally (less than 1.3 percent). Consequently, potential increases in exports during this period would have limited, if any effects on delta or longfin smelt.

Green and white sturgeon are rarely observed (only sporadically in low numbers; DWR and Reclamation unpublished salvage) at the diversion facilities and, therefore, are not likely to be affected by these changes. The vast majority of juvenile Chinook salmon and steelhead would have emigrated from the Delta region by June (NOAA Fisheries 2014) and are, therefore, unlikely to be affected by increases in exports. In addition, fish screens and monitoring at the East Bay MUD (currently conducted December through June when sensitive fish species are present) and Contra Costa WD (currently conducted year-round) facilities would further ensure that special-status fish species are not affected by any increases in exports at their facilities. Reclamation is consulting frequently with USFWS and NOAA Fisheries on CVP and SWP operations relative to the BOs and special-status fish species in the Delta.

Impacts on Fisheries Resources: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on fisheries resources that are influenced by Delta exports.

Impac**ts on Special-Status Fish Species:** Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on special-status fish species that are influenced by Delta exports.

Delta Outflow

The No Groundwater Substitution Alternative could cause Delta Outflows to be higher than under the No Action/No Project Alternative. Under the No Groundwater Substitution Alternative, Delta outflows would not be more than one percent lower than outflows under the No Action/No Project Alternative in any month or water year type.

The maximum upstream shift in X2 location would be 0.1 km (0.1 percent) upstream during periods of decreased flow, and 0.6 km (0.5 percent) downstream during periods of increased flow. Average daily fluctuations in outflow, and therefore X2 position, at Chipps Island due to tides are 170,000 cfs (DWR 1995). Therefore, a change of 500 cfs in Delta outflow would be 0.3 percent of the daily tidal change experienced in this area. These changes to Delta outflow, and resultant changes in X2 position, due to Alternative 4 would not have a substantial impact on biological resources because the change is minimal (less than one percent).

Impacts on Fisheries Resources: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on fisheries resources that are influenced by Delta outflow, as reductions in Delta outflow and increases in X2 location would be small (less than one percent) in all months and water year types and would therefore not cause a substantial reduction in the number of fish of a special-status species. .

Impacts on Special-Status Fish Species: Long-term water transfer actions under the No Groundwater Substitution Alternative would have a less than significant impact on special-status fish species that may be influenced by Delta outflow, as reductions in Delta outflow and increases in X2 location would be small (less than one percent) in all months and water year types and would therefore not cause a substantial reduction in the number of fish of a special-status species.

3.7.2.6.2 Special-Status Species Habitat

As described in the preceding sections, long–term water transfer actions would be carried out such that that all facilities would be operated consistent with their existing or future regulatory requirements. The most current flow and temperature requirements established by various regulating agencies including the USFWS, NOAA Fisheries, FERC, and SWRCB, for the protection of downstream resources, including fish, would be met.

Reservoirs

Special-status fish species do not occupy the reservoirs that would be affected by long-term water transfer actions. These reservoirs are operated to maintain environmental conditions on the downstream rivers, as discussed in the next section.

Mainstem Rivers

Environmental Commitments would require that facilities affected by long-term water transfer actions continue to provide the existing protections for fish dependent on the mainstem rivers including the Sacramento, Feather, American, Yuba, Bear, Merced and San Joaquin rivers. Each of the special-status fish species use mainstem habitats for some portion of their life history, with the exception of delta and longfin smelt, which use only those portions of the mainstream rivers in the Delta. Spawning, rearing, holding and migration habitat on these rivers would be maintained. While minor changes in flows and temperatures would occur, these would be within the normal ranges that would occur under the No Action/No Project Alternative.

Impacts to Special-Status Fish Species: The No Groundwater Substitution Alternative would have a less than significant impact on special-status fish species in mainstem rivers. Flows in all mainstem rivers would remain within their normal ranges and, therefore, there would be no substantial reduction in spawning, rearing, or migration habitat of special-status species.

Small Tributaries to the Sacramento River

As no groundwater substitution would occur under this alternative, the small tributaries to the Sacramento River would not be impacted by the No Groundwater Substitution Alternative.

Impacts to Special-Status Fish Species: The No Groundwater Substitution Alternative would have no impact on special-status fish species that could occur in small tributaries to the Sacramento River, as flows in these streams would not change and, therefore, there would be no substantial reduction in spawning, rearing, or migration habitat of special-status species.

Delta
As previously described, the transfer operations model indicates that there would be very minor changes in flow in the Delta (less than one percent) as a result of the long-term water transfer actions.

Impacts to Special-Status Fish Species: The No Groundwater Substitution Alternative would have a less than significant impact on special-status fish species in the Delta, as reductions to Delta outflow and increases in X2 positions would be minimal (less than one percent) and would not result in a substantial reduction in spawning, rearing, or migration habitat of special-status species.

3.7.3 Comparative Analysis of Alternatives

Table 3.7-4 summarizes the effects of each of the action alternatives. The following text supplements the table by describing the magnitude of the effects under the action alternatives and No Action/No Project Alternative.

Table 3.7-4. Comparative Analysis of Alternatives

Potential Impact	Alternatives	Significance[1] Natural Communities	Significance[1] Special-Status Species	Proposed Mitigation	Significance After Mitigation
Groundwater substitution could reduce stream flows supporting fisheries resources in small streams	2, 3	LTS	LTS	None	LTS
Transfer actions could alter flows in large rivers, altering habitat availability and suitability associated with these rivers	2, 3, 4	LTS	LTS	None	LTS
Transfer actions could alter hydrologic conditions in the Delta, altering associated habitat availability and suitability	2, 3, 4	LTS	LTS	None	LTS

[1] LTS = Less than significant

3.7.3.1 Alternative 1: No Action/No Project Alternative

There would be no changes in agricultural use or water availability in the Seller Service Area relative to existing conditions. In the Buyer Service Area, increased land idling could occur in response to CVP shortages, which could affect habitat availability, but this would be similar to existing conditions. Conditions for natural communities and special-status species would remain the same as under existing conditions.

3.7.3.2 Alternative 2: Proposed Action

Groundwater substitution and stored reservoir release transfers could affect the availability of water in the Seller Service Area and the availability and suitability of habitat. This could affect conditions for fisheries resources and special-status fish species relative to the No Action/No Project Alternative, but the effects with the implementation of the Environmental Commitments would be less than significant. The Proposed Action would increase water supplies to agricultural users in the Buyer Service Area, but the amount of water would remain within the amount allowed under the Buyers CVP contract and the effects of using the water would be within that considered under that contract and its associated environmental documentation and BOs.

3.7.3.3 Alternative 3: No Cropland Modifications Alternative

The No Cropland Modifications Alternative would not include cropland idling/shifting as a mechanism for transferring water. Effects would continue to occur from groundwater substitution and stored reservoir release transfers at the same levels described for the Proposed Action. The effects of this alternative with the implementation of the Environmental Commitments would be less than significant to both fisheries resources and special-status fish species. The No Cropland Modifications Alternative would increase water supplies to agricultural users in the Buyer Service Area, but the amount of water would remain within the amount allowed under the Buyers CVP contract and the effects of using the water would be within that considered under that contract and its associated environmental documentation and BOs.

3.7.3.4 Alternative 4: No Groundwater Substitution Alternative

The No Groundwater Substitution Alternative would not include groundwater substitution as a mechanism for transferring water. Effects would continue to occur from reservoir storage transfers at the same levels considered for the Proposed Action. The effects of this alternative with the implementation of the Environmental Commitments would be less than significant to both fisheries resources and special-status fish species. The No Groundwater Substitution Alternative would increase water supplies to agricultural users in the Buyer Service Area, but the amount of water would remain within the amount allowed under the Buyers CVP contract and the effects of using the water would be within that considered under that contract and its associated environmental documentation and BOs.

3.7.4 Environmental Commitments/Mitigation Measures

The environmental commitments described in Section 2.3.2.4 incorporated into the project will reduce or eliminate significant impacts to fisheries resources and fish species of management concern. No additional mitigation is required.

3.7.5 Potentially Significant Unavoidable Impacts

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

3.7.6 Cumulative Impacts

The timeframe for the cumulative effects analysis extends from 2015 through 2024, a 10-year period. The cumulative effects area of analysis for fisheries is the same as the area of analysis shown in Figure 3.7-1 above. This section analyzes cumulative effects using the project method, which is further described in Chapter 4.

The projects considered for the fisheries cumulative condition are the SWP water transfers, CVP Municipal and Industrial (M&I) Water Shortage Policy (WSP), Lower Yuba River Accord, SJRRP, and Exchange Contractors 25-Year Water Transfers.

The set of agreements of the Lower Yuba River Accord is designed to provide additional water to meet fisheries needs in the lower Yuba River. In addition, up to 60,000 AF of water per year would be made available for purchase by Reclamation and DWR for fish and environmental purposes. The long-term water transfer project would not affect the ability of the Accord to provide a benefit to environmental resources within its action area. Both efforts, however, could affect Delta exports.

The SJRRP would increase flows and improve habitat conditions in and along the San Joaquin River to support spring-run and fall-run Chinook salmon, steelhead and other native fish. The SJRRP would create additional habitat for fisheries resources by increasing flows and expanding floodplains.

The following sections describe potential fisheries resources cumulative effects for each of the proposed alternatives.

3.7.6.1 Alternative 2: Proposed Action

3.7.6.1.1 Fisheries Resources and Special-Status Fish Species

The Proposed Action could, in combination with other cumulative projects, cause flows in rivers and creeks in the Sacramento River watershed to be lower *than under the No Action/No Project Alternative.* The SWP transfers would make water available to transfer to a variety of sellers as described in Section 4.3. Up to 6,800 AF would be made available through groundwater substitution and up to 86,930 AF would be made available through cropland idling. The sellers for the SWP transfers are in the Feather River Basin and receive water from Lake Oroville. There would be minimal geographic overlap between this program and Long-Term Water Transfers.

The M&I WSP is primarily a policy development program and planning tool to clearly define water shortage conditions and what reductions in allocation CVP users should expect in the event of shortages. The WSP could reduce agricultural water deliveries and increase land idling in the Buyer Service Area. Effects of the WSP in the Seller Service Area would be minor as agricultural water supplies would not substantially change relative to existing conditions.

As modeled, Cache Creek, Stony Creek, Coon Creek, Little Chico Creek, and the Bear River may experience a greater than ten percent change in mean monthly flows in at least one water year type and month of the year. Fish species of management concern and special status fish species would not likely be present in these streams when flows would be reduced. In addition, historical flow data was limited or not available for Eastside/Cross Canal, and Salt Creek. Generally, these waterways are not immediately adjacent to groundwater substitution transfers, and other nearby small waterways are not experiencing flow decreases that are causing significant impacts to aquatic resources. In addition, flow reductions as the result of groundwater declines would be observed at monitoring wells in the region and adverse effects on riparian vegetation would be mitigated by implementation of Mitigation Measure GW-1 (See Section 3.3, Groundwater Resources), because it requires monitoring of wells and implementing a mitigation plan if the seller's monitoring efforts indicate that the operation of the wells for groundwater substitution pumping are causing substantial adverse impacts. The mitigation plan would include curtailment of pumping until natural recharge corrects the environmental impact. Therefore, the impacts to fisheries resources would be less than significant in these streams.

With implementation of Mitigation Measure GW-1, the Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact related to groundwater quality.

The Proposed Action could, in combination with other cumulative projects, cause San Joaquin River flows to be lower than under the No Action/No Project Alternative. Under the Exchange Contractors 25-Year Water Transfers the Exchange Contractors in the San Joaquin Valley would sell up to 150,000 AF to willing buyers, including many of the Buyers for the long-term water transfers. These transfers could include a small amount of groundwater pumping; however, this pumping would not be adjacent to the San Joaquin River. The

SJRRP would increase flows and improve fisheries resources on the San Joaquin River; this program would have a beneficial effect.

Long-term water transfer actions under the Proposed Action would reduce flows by a small amount during reservoir refill, but this would occur during very wet periods when it would not likely affect fisheries resources. Therefore, the Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact on fisheries resources occurring in the San Joaquin River.

The Proposed Action could in combination with other cumulative projects cause Delta exports to be higher than under the No Action/No Project Alternative. All cumulative water operations projects affecting Delta exports would be required to meet Delta water quality standards (e.g., D-1641) and meet the requirements of the BOs and other current and future regulatory requirements for the long-term coordinated operations of the CVP and SWP. In addition, during the period of increased exports because of the Proposed Action, species that are present are rarely observed at diversion facilities, and fish screens and monitoring at export facilities would further ensure that there would not be a substantial increase in the number of fish of a special-status species. The Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact to fisheries resources associated with changing Delta exports.

The Proposed Action in combination with other cumulative projects could cause Delta outflows to be lower than under the No Action/No Project Alternative. Long-term water transfer actions under the Proposed Action would have a less than significant impact on fisheries resources that may be influenced by Delta outflow, as changes in Delta outflow and X2 location would be small (less than three percent) in all months and water year types. In addition, all cumulative water operations projects affecting Delta exports would be required to meet Delta water quality standards (e.g., D-1641) and meet the requirements of the USFWS and NOAA Fisheries BOs for the long-term coordinated operations of the CVP and SWP. Because changes in Delta outflow and X2 location are predicted to be small and there are additional protections for fisheries and aquatic resources already in place under the ESA and D-1641, these impacts would be less than significant. The Proposed Action in combination with other cumulative actions would not result in a cumulative significant impact on fisheries resources related to changes in Delta outflow and X2 location.

3.7.6.1.2 Special-Status Species Habitat

All water operations related to SWP transfers, WSP, Yuba Accord, the SJRRP and the Exchange Contractors 25-Year Water Transfers would be carried out such that all facilities would be operated consistent with their existing or future regulatory requirements. The most current flow and temperature requirements established by various regulating agencies including the USFWS, NOAA Fisheries, FERC, and SWRCB, for the protection of downstream resources, including fish, would be met. Under the Proposed Action all these regulatory criteria would also be met and thus the Proposed Action would have a less than significant cumulative impact on special-status fish species in mainstem rivers because its effects would not be cumulatively considerable. Flows in all mainstem rivers would remain within their normal ranges and, therefore, there would be no substantial reduction in spawning, rearing, or migration habitat of special-status species.

Small tributaries to the Sacramento River could be affected by SWP water transfers, WSP, and the Proposed Action groundwater substitution transfers, which could reduce flows in these streams due the hydrologic connectivity between groundwater tables and these streams. The groundwater model results indicate that the Proposed Action's effects of groundwater substitution on stream flow would be most pronounced during July through September. During this time, flows in these small streams on the valley floor where flow reductions would occur are generally quite low and water temperatures are quite high. Thus, coldwater fish species, including salmon and steelhead, are unlikely to occur in these portions of the stream during these months. The Proposed Action's effects on flow-related special status fish habitat in small streams would not be cumulatively considerable, and the cumulative effect would be less than significant.

3.7.6.2 Alternative 3: No Cropland Modifications Alternative

The cumulative impacts of Alternative 3 would be the same as for groundwater substitution under the Proposed Action in the Seller Service Area. Additionally, the cumulative effects of Alternative 3 in the Buyer Service Area would be the same as the Proposed Action. The effects of the Proposed Action would not be cumulatively considerable.

3.7.6.3 Alternative 4: No Groundwater Substitution

The cumulative impacts of Alternative 4 would be the same as for crop idling/shifting under the Proposed Action in the Seller Service Area. The cumulative effects of Alternative 4 in the Buyer Service Area would be the same as the Proposed Action. The effects of the Proposed Action would not be cumulatively considerable.

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