Chapter 11
Agricultural Resources

11.1 Introduction

This chapter describes the environmental setting for agricultural resources and the regulatory setting associated with these resources. It also evaluates environmental impacts on agricultural resources that could result from the Lower San Joaquin River (LSJR) and southern Delta water quality (SDWQ) alternatives and, if applicable, offers mitigation measures that would reduce significant impacts.

The LSJR area of potential effects for agricultural resources includes Madera, Merced, Stanislaus, and part of San Joaquin Counties. It is based on the Central Valley Production Model (CVPM) regional units and California Department of Water Resources Detailed Analysis Units (DAUs) used in the Statewide Agricultural Production (SWAP) model[1]. The SDWQ area of potential effects is comprised of agricultural resources in the southern Delta, which are primarily within the boundaries of the Southern Delta Water Agency (SDWA).

Potential impacts of the LSJR and SDWQ alternatives on agricultural resources can generally be characterized as (1) those that result in the conversion of Prime, Unique, and Farmland of Statewide Importance (e.g., irrigated farmland), or (2) changes in the existing environment which, due to their location or nature, could result in the conversion of farmland to nonagricultural uses. In general, this evaluation focuses on the potential for the conversion of irrigated farmland to nonagricultural uses as a result of a reduction in surface water supplies (LSJR alternatives) or a change in water quality (SDWQ alternatives). A summary of the impacts of LSJR alternatives and SDWQ alternatives on agricultural resources is provided in Table 11-1.

Impacts related to LSJR Alternative 1 and SDWQ Alternative 1 (No Project) are presented in Chapter 15, *LSJR Alternative 1 and SDWQ Alternative 1 (No Project Alternative)*, and the supporting technical analysis is presented in Appendix D, *Evaluation of LSJR Alternative 1 and SDWQ Alternative 1 (No Project Alternative)*. Impacts related to methods of compliance are discussed in Appendix H, *Evaluation of Methods of Compliance*.

[1]The LSJR alternatives area of potential effects includes: CVPM Region Units 11, 12, and 13, DAUs 205–215, and a portion of DAU 182.

Table 11-1. Summary of Agricultural Impacts

Alternative	Summary of Impact(s)	Significance Determination
AG-1: Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance to nonagricultural uses		
LSJR Alternative 1	See note.[1]	
LSJR Alternative 2	Surface water diversions in the LSJR area of potential effects are expected to be similar to past and present diversions, and no significant reduction in surface water supply is expected; therefore, therefore, conversion of Prime or Unique farmland or farmland of Statewide Importance to nonagricultural uses would not occur.	Less than significant
LSJR Alternative 3	Reductions in surface water diversions are expected to result in a 10% (or greater) reduction in acres of irrigated land for Corn, Field, Pasture, and Rice. Approximately 81,858 acres of Prime or Unique farmland or Farmland of Statewide Importance requiring irrigation in 8 out of every 10 years could potentially be converted to nonagricultural use.	Significant and unavoidable
LSJR Alternative 4	Reductions in surface water diversions are expected to result in a 10% (or greater) reduction in acres of irrigated land for Alfalfa, Corn, Field, Pasture, and Rice. Approximately 210,812 acres of Prime or Unique Farmland or Farmland of Statewide Importance requiring irrigation in 8 out of 10 years could potentially be converted to nonagricultural use.	Significant and unavoidable
SDWQ Alternative 1	See note.[1]	
SDWQ Alternatives 2 and 3	Water quality within the southern Delta is expected to remain unchanged as USBR would be responsible for complying with the same salinity requirements that currently exist at Vernalis. No reduction or conversion of agricultural acreage is likely.	Less than significant
AG-2: Other changes in the existing environment which, due to their location or nature, could result in a conversion of farmland to nonagricultural use		
LSJR Alternative 1	See note.[1]	
LSJR Alternative 2	No significant reduction in surface water supply and corresponding reduction in agricultural acreage are expected; therefore, no conversion of farmland to nonagricultural uses is likely. Impacts on irrigated agriculture from a high water table resulting from increased river flows on the Stanislaus River are expected to occur on less than 0.01% of irrigated acreage therefore crop production would not be substantially reduced.	Less than significant
LSJR Alternative 3	The total irrigated acreage is likely to be reduced due to reduction in surface water supply; however, acreage could be rotated through alternate year irrigated production on approximately 40,000 acres such that less than 10% of the remaining acreage could be converted to nonagricultural uses. Impacts on irrigated agriculture from a high water table resulting from increased river flows on the Stanislaus River are expected to occur on less than 0.01% of irrigated acreage; therefore, crop production would not be substantially reduced.	Less than significant

Alternative	Summary of Impact(s)	Significance Determination
LSJR Alternative 4	The total irrigated acreage potentially reduced, due to surface water supply reductions, would be too great to maintain less than a 10% reduction through the use of dryland faming in alternating years and the acreage could be converted to nonagricultural uses. Impacts on irrigated agriculture from a high water table resulting from increased river flows on the Stanislaus River are expected to occur on less than 0.01% of irrigated acreage therefore, crop production would not be substantially reduced.	Significant and unavoidable
SDWQ Alternative 1	See note.[1]	
SDWQ Alternatives 2 and 3	Water quality within the southern Delta is expected to remain unchanged as USBR would be responsible for complying with the same salinity requirements that currently exist at Vernalis. This is not expected to result in the conversion of farmland to nonagricultural use.	Less than significant

Note:

[1] The No Project Alternative would result in implementation of flow objectives and salinity objectives identified in the 2006 Bay-Delta Plan. See Chapter 15, *LSJR Alternative 1 and SDWQ Alternative 1 (No Project Alternative)*, for the No Project impact discussion and Appendix D, *Evaluation of LSJR Alternative 1 and SDWQ Alternative 1 (No Project Alternative)*, for the No Project Alternative technical analysis.

USBR = U.S. Bureau of Reclamation

11.2 Environmental Setting

This section characterizes the agricultural resources in the LSJR area of potential effects and SDWA. The description of agricultural resources includes soils, farmland, crop mix, methods of irrigation and drainage, and water supply, and describes the connection between crop production and water quality. General information regarding soil and water quality is first discussed to provide context for the crop production in the LSJR area of potential effects and SDWA. Information on soils and farmland is from the Natural Resources Conservation Service (NRCS) and the California Department of Conservation; crop production and cropping trends are from Department of Water Resources (DWR) land use surveys; water supply and quality information is from previous chapters in this document. Additionally, the current state of knowledge for salinity and its applicability to the LSJR area of potential effects and SDWA is fully discussed in Appendix E, *Salt Tolerance of Crops in the Southern Sacramento–San Joaquin Delta*.

11.2.1 Soil and Water Quality

Soils are intrinsic features of a landscape. They develop over time through physical, chemical, and biological processes. In the LSJR area of potential effects and SDWA, the suitability of soils to support agricultural enterprises is classified by NRCS and is based on the soil type, adequate drainage, and the availability of water supply for irrigation. The State of California uses this information to develop maps that identify Prime Farmland, Farmland of Statewide Importance, and Unique Farmland. In addition, counties may identify Farmland of Local Importance. The definitions for each of the land use categories are provided in Section 11.3.1.

All waters contain soluble salts, collectively referred to as salinity. The major components of either water or soil salinity include cations (calcium, sodium, and magnesium) and anions (bicarbonate, chloride, and sulfate) (Ayers and Westcott 1985). In soil, salinity refers to the soluble plus readily dissolvable salts in the soil or in an extract of a soil sample. Salinity is quantified in terms of the total concentration of soluble salts. In practical terms, salinity is measured as electrical conductivity (EC) of the solution (USDA 1954).

Salts in soil are generally at higher concentrations than those found in water. The extent to which salts accumulate in the soil depends on the irrigation water quality, irrigation management, and the adequacy of drainage. Crop water use (evapotranspiration) of irrigation water results in a salt load to the soil because crop evapotranspiration removes water from the soil profile but leaves the salt. Although crops uptake salt, the amount is insignificant. If salts in the soil become excessive, losses in yield will result. To prevent yield loss, soil salinity must be controlled at a concentration below that which might affect yield. A plant's response to salt stress leads to a yield reduction, whereas specific ion toxicity can lead to yield reductions at concentrations that would not lead to salinity issues. Factors considered when establishing a salinity standard for irrigated agriculture include plant response to soil salinity, effective rainfall, and irrigation management and method.

The method of irrigation and water management affects how a plant tolerates water or soil salinity. The main methods of irrigation in both areas include surface (border strip, furrow, and basin), sprinkler, and micro-irrigation (Edinger-Marshall and Letey 1997). In some areas of the southern Delta, subirrigation is also practiced. Poorly managed border and furrow irrigation can result in salt buildup in the soil profile in areas that do not receive adequate irrigation water of sufficient quality. Salt buildup can occur with micro-irrigation if the systems are not properly managed to push salts away from the rootzone. Subirrigation results in salt buildup in the top portion of the soil profile, unless this is flushed with surface irrigation or precipitation (Grattan 2002).

To reduce salinity impacts on crops, a leaching fraction is added to the crop's irrigation water requirement. The amount of water used for leaching is considered a beneficial use and is based on a plant's salinity tolerance and the salinity of the irrigation water. However, depending on the efficiency of the irrigation system being used and the effectiveness of rainfall, the leaching requirement may be inherently satisfied through the inefficiency of irrigation. Another important factor is that a plant's sensitivity to soil salinity changes during plant development. Many crops are most sensitive to soil salinity during emergence and early seedling development (Ayers and Westcott 1985; USSL 2011).

11.2.2 Lower San Joaquin River Watershed and Eastside Tributaries

This section summarizes the types of farmland and recent changes in farmland, crop production, and water supply in the LSJR area of potential effects.

Types of Farmland

The LSJR area of potential effects covers more than 1 million acres of agricultural lands in California's San Joaquin Valley. The majority (55 percent) of farms in the San Joaquin Valley are less than 100 acres, while approximately 20 percent of farms are between 100 and 250 acres (Agricultural Water Management Council 2010). Statewide, the average farm size is 312 acres (DFA 2010).

The majority of farmland in the LSJR area of potential effects is classified as Prime, Unique, or of Statewide Importance (Section 11.3.1 provides the definitions and characteristics of Prime, Unique, or Farmland of Statewide Importance). These lands are designated as such because of certain characteristics, including availability and amount of irrigation water, soil characteristics such as drainage, and frequency of irrigation. The lands must be irrigated 8 out of every 10 years and there must be adequate depth to the water table for commonly cultivated crops. Table 11-2 identifies the acres of these various categories of land and Figure 11-1 identifies the location and type of farmland within the LSJR area of potential effects (e.g., CVPM Region Units 11, 12, and 13 and DAUs 205–215, and a portion of DAU 182).

Table 11-2. California Department of Conservation's Land Use Classification in the LSJR Area of Potential Effects

Land Use Category	Acres
Prime Farmland (irrigated)	439,414
Grazing Lands	382,226
Unique Farmland (irrigated)	351,245
Farmland of Statewide Importance (irrigated)	273,593
Urban Built-Up Land	123,503
Farmland of Local Importance	89,968
Nonagricultural and Natural Vegetation	34,010
Confined Animal Agriculture	28,596
Rural Residential Land	28,256
Vacant or Disturbed Land	23,691
Water	8,697
Semi-Agricultural and Rural Commercial Land	6,626
Total	1,789,825

Source: California Department of Conservation 2007, 2006–2008; NRCS 1999
Note: Includes land located in CVPM Region Units 11, 12, and 13
CVPM = Central Valley Production Model

The LSJR area of potential effects, like other parts of the Central Valley and California, has generally experienced a decline in agricultural lands in the past 20 years. Table 11-3 identifies the changes in Prime, Unique, Farmland of Statewide Importance, and Farmland of Local Importance to other land uses. Madera and San Joaquin Counties had the biggest net losses in these classifications; Merced had a slight decline, whereas Stanislaus County had a slight gain.

Table 11-3. Changes in Prime, Unique, and Farmland of Statewide and Local Importance, Acreages for Given Dates

Land Use Category	San Joaquin County (1990–2008)	Stanislaus County (2004–2010)	Merced County (1992–2008)	Madera County (1984–2010)
Prime Farmland	-40,874	-8,610	-18,276	-6,535
Farmland of Statewide Importance	-13,978	1,727	-10,918	-1,701
Unique Farmland	19,761	17,390	8,896	11,208
Farmland of Local Importance	12,643	-3,684	15,202	-29,392
Total	-22,448	6,823	-5,096	-26,420

Source: California Department of Conservation 2011

Note: Data include the entire counties, and therefore it is assumed that changes in the LSJR area of potential effects are proportional in the plan area portion of the respective county. Includes CVPM Region Units 11, 12, and 13.

CVPM = Central Valley Production Model

Crop Production

Irrigated crop production in the LSJR area of potential effects is diverse, with a wide variety of crops grown on more than 1 million acres, as shown in Table 11-4. The land in the LSJR area of potential effects is primarily irrigated by surface water diversions from the three eastside tributaries, (the Stanislaus, Tuolumne, and Merced Rivers). Dryland cropping is practiced on some acreage in the LSJR area of potential effects; however, most crops rely on a supply of irrigation water. The majority of irrigated land is located in CVPM Regions 11, 12, and 13, but also includes irrigated crop production in the Stockton East Water District (SEWD) and Central San Joaquin Water Conservation District (CSJWCD), as represented by a portion of DAU 182 (DWR 2005) (Table 11-4). These two water districts receive surface water from the Stanislaus River and have cropping patterns that are similar to the cropping pattern in DAU 205, which is included in CVPM region 11 (Table 11-5). High value crops such as orchards and vineyards account for almost 66% of DAU 205 and just under 60% in DAU 182 (Table 11-5).

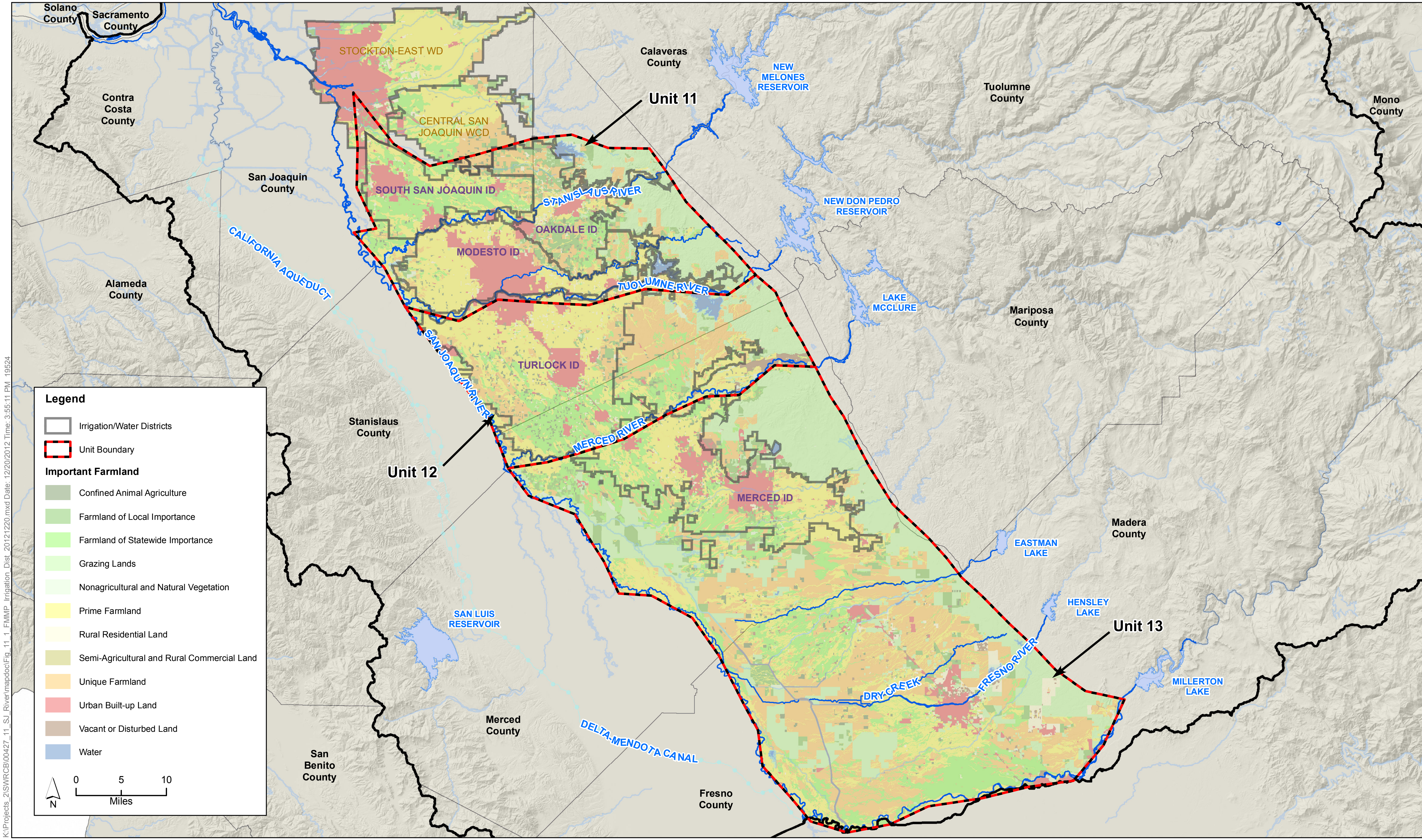

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Figure 11-1
Important Farmland Data

Table 11-4. Crop Production in the LSJR Area of Potential Effects for 2005

Crop Group	CVPM Irrigated Crop Area Acres	SEWD and CSJWCD (DAU 182)
Alfalfa	97,704	7,946
Almonds and Pistachios	296,773	1,922
Corn	148,872	14,610
Cotton	31,577	0
Cucurbits	2,709	519
Dry Bean	1,937	1,416
Field	92,576	673
Fresh Tomato	6,778	2,505
Grain	21,446	10,438
Onion and Garlic	819	199
Orchards	66,200	33,878
Pasture	112,218	8,003
Rice	6,370	1,115
Safflower	446	51
Subtropical	5,859	32
Sugarbeet	2,495	0
Tomato (Processing)	12,428	11,733
Truck Crops	30,435	2,448
Vine	112,602	53,537
Total	1,050,244	151,025

Source: Howitt, undated.

Notes: Each crop category is a consolidation of several different crop types and several DAUs. For example, Grain includes barley, wheat, and oats.

DAUs (DWR 2005) are typically river basin- and water supplier-specific.

The CVPM acreage listed represents the area within CVPM Region Units 11, 12, and 13, and is composed of DAUs 205 through 215.

CVPM = Central Valley Production Model
SEWD = Stockton East Water District
CSJWCD = Central San Joaquin Water Control District
DAU = California Department of Water Resources Detailed Analysis Units

Table 11-5. Comparison of Crops in DAU 182 and DAU 205 (CVPM Region Unit 11)

	DAU 182	DAU 205
Crop Group	% of Area	
Alfalfa	5.3	6.6
Almonds and Pistachios	1.3	44.8
Corn	9.7	13.9
Cotton	None	None
Cucurbits	Less than 1%	Less than 1%
Dry Bean	Less than 1%	Less than 1%
Field	Less than 1%	Less than 1%
Fresh Tomato	1.7	Less than 1%
Grain	6.9	4.6
Onion and Garlic	Less than 1%	Less than 1%
Orchards	22.4	10.7
Pasture	5.2	4.5
Rice	Less than 1%	Less than 1%
Safflower	None	Less than 1%
Subtropical	None	Less than 1%
Sugarbeet	None	None
Tomato (Processing)	7.8	1.1
Truck Crops	1.6	1.6
Vine	35.4	10.1
Total	100	100

Source: Howitt, undated.
DAU = California Department of Water Resources Detailed Analysis Units
CVPM = Central Valley Production Model

Cultural crop practices in the LSJR area of potential effects include crop rotation and fallowing. The extent of fallowed land and crop rotation cannot be quantified because data is not readily available. Crop rotation involves the use of the same piece of land cultivated for various crops, such as corn followed by winter wheat. Land fallowing, or removing land from agricultural production for a period of time, is the deliberate idling of land for a cultural crop practice, such as disease control. Fallowed land is typically cultivated to keep down weed growth.

Water Supply, Irrigation, and Water Quality

Surface water supply for irrigation is provided to agricultural users by organized irrigation and water districts. In addition to surface water, many growers have access to groundwater. Details on surface water supply availability and groundwater supply to irrigation and water districts are discussed in Chapter 2, *Water Resources*; Chapter 9, *Groundwater Resources*; and Chapter 13, *Service Providers*. Irrigation district operations are generally based on diverting river flow into open channels that provide service to parcels of various sizes (Merced ID 2003; MID 1999; OID 2003; TID 1999). Typically, surface water irrigation deliveries begin in April and continue through September, with peak delivery in the summer months. Delivery of water to a farm can vary between a rotating schedule with a fixed flow rate and duration to a user-requested schedule with a variable flow rate and duration. In addition, some irrigation districts operate canals and make deliveries in the off-season for groundwater recharge.

In general, irrigation districts state that they emphasize equity and fairness (Merced ID 2003; OID 2003, TID 1999) in the distribution of surface water supplies during normal and dry periods. Irrigation districts acknowledge an increase in the use of groundwater by growers during normal and dry periods to meet on-farm flexibility needs, and some level of groundwater overdraft (Merced ID 2003; MID 1999; OID 2003; TID 1999). Merced Irrigation District (Merced ID) reported in their 2003 Agricultural Water Management Plan that shortages in surface water are met through increased groundwater pumping (Merced ID 2003). Turlock Irrigation District (TID) allows for internal water transfers but does not distinguish between crop types when making surface water supply allocations (TID 1999).

On-farm irrigation methods in the LSJR area of potential effects include surface, sprinkler, drip, and micro-irrigation (Table 11-6) (DWR 2010). Sometimes other methods of irrigation are used, such as subirrigation, in which the water table is controlled (Table 11-6) (DWR 2010). For the most part, higher value crops, such as trees and vines, are irrigated with pressurized systems, such as hand-moved sprinklers or micro-sprayers. Generally, crops with lower net revenue, such as grains and pasture, are irrigated with surface methods.

Table 11-6. Irrigation Method Types in Merced, San Joaquin, and Stanislaus Counties

County	Surface	Sprinkler	Drip and Micro	Other
Madera	33.2%	3.8%	61.6%	1.5%
Merced	57.2%	6.2%	34.0%	2.7%
San Joaquin	36.0%	14.2%	36.6%	13.2%
Stanislaus	44.1%	9.5%	44.8%	1.6%

Source: DWR 2010

Surface water quality is very good in the three eastside tributaries, with an average salinity (ECw) value of less than 0.1 dS/m, as discussed in Chapter 5, *Water Supply, Surface Hydrology, and Water Quality*. Groundwater quality in the LSJR area of potential effects varies depending on the groundwater basin, hydrogeology, and depth to groundwater, and is discussed in Chapter 9, *Groundwater Resources*. In general, groundwater is known to have elevated salts and nitrates in the LSJR area of potential effects, but is considered of better quality within the three tributary watersheds than in other locations because of the low concentration of dissolved constituents in the recharge water from the Sierra Nevada snowmelt and surface waters.

11.2.3 Southern Delta

This section summarizes the SDWA's existing setting, including types of farmland; crop production; and water supply, irrigation, and water quality. Figure 11-2 shows the location of the SDWA with respect to San Joaquin County and the legal boundary of the Delta.

Prior to development, lands in the SDWA existed in a natural state with both organic and mineral soils (NRCS 1999). Over many millennia, histosols, commonly known as organic soils, peats, or mucks, developed in the Delta as plants grew and died. Delta reclamation took place between 1900 and 1920 on lands in the Delta's interior. When adequate drainage was provided to these lands, microbial oxidation of the organic material began, resulting in loss of soil volume (subsidence) over time. Soil subsidence is compounded by wind erosion. Depending on the location, subsidence and erosion rates of 0.5–1.5 inches per year can be common in certain areas. Since the early 1900's to present time, as much as half of the original accumulated soil volume has been lost. The result of the reclamation efforts is largely what is seen as the Delta today—approximately 700 miles of waterways and 1,100 miles of levees that protect over 538,000 acres of farmland, homes, and other structures (DWR 2009).

Types of Farmland

As depicted on Figure 11-2 and described in Table 11-7, the majority of agricultural land in the SDWA is classified as Prime Farmland (California Department of Conservation 2007 and NRCS 1999).

Table 11-7. California Farmland Mapping Program Land Use Classification for the SDWA (2008)

Land Use Classification	Acres
Prime Farmland (irrigated)	97,639
Grazing Lands	15,491
Unique Farmland (irrigated)	8,684
Farmland of Statewide Importance (irrigated)	5,293
Farmland of Local Importance	4,762
Nonagricultural and Natural Vegetation	3,656
Vacant or Disturbed Land	1,471
Confined Animal Agriculture	1,268
Rural Residential Land	1,126
Semi-Agricultural and Rural Commercial Land	926
Grazing Lands	339
Water	227
Total	140,880

Source: California Department of Conservation 2007, 2006–2008
SDWA = Southern Delta Water Agency

Some Prime Farmland in San Joaquin County (Table 11-3) has undergone conversion to urban and other lands (California Department of Conservation 2011).

Crop Production

A wide variety of crops are grown on over 100,000 acres in the SDWA (Table 11-8) (DWR 2005). About 60 percent of the land is cultivated as annual crops (Truck & Berry, Field, and Grain & Hay). Alfalfa is cultivated on roughly 30 percent of the land. There has been about a 15 percent drop in cultivated acreage since 1996, with most of the decline coming from a reduction in dry beans and safflower (Field Crops) acreage (Appendix E, *Salt Tolerance of Crops in the Southern Sacramento–San Joaquin Delta*).

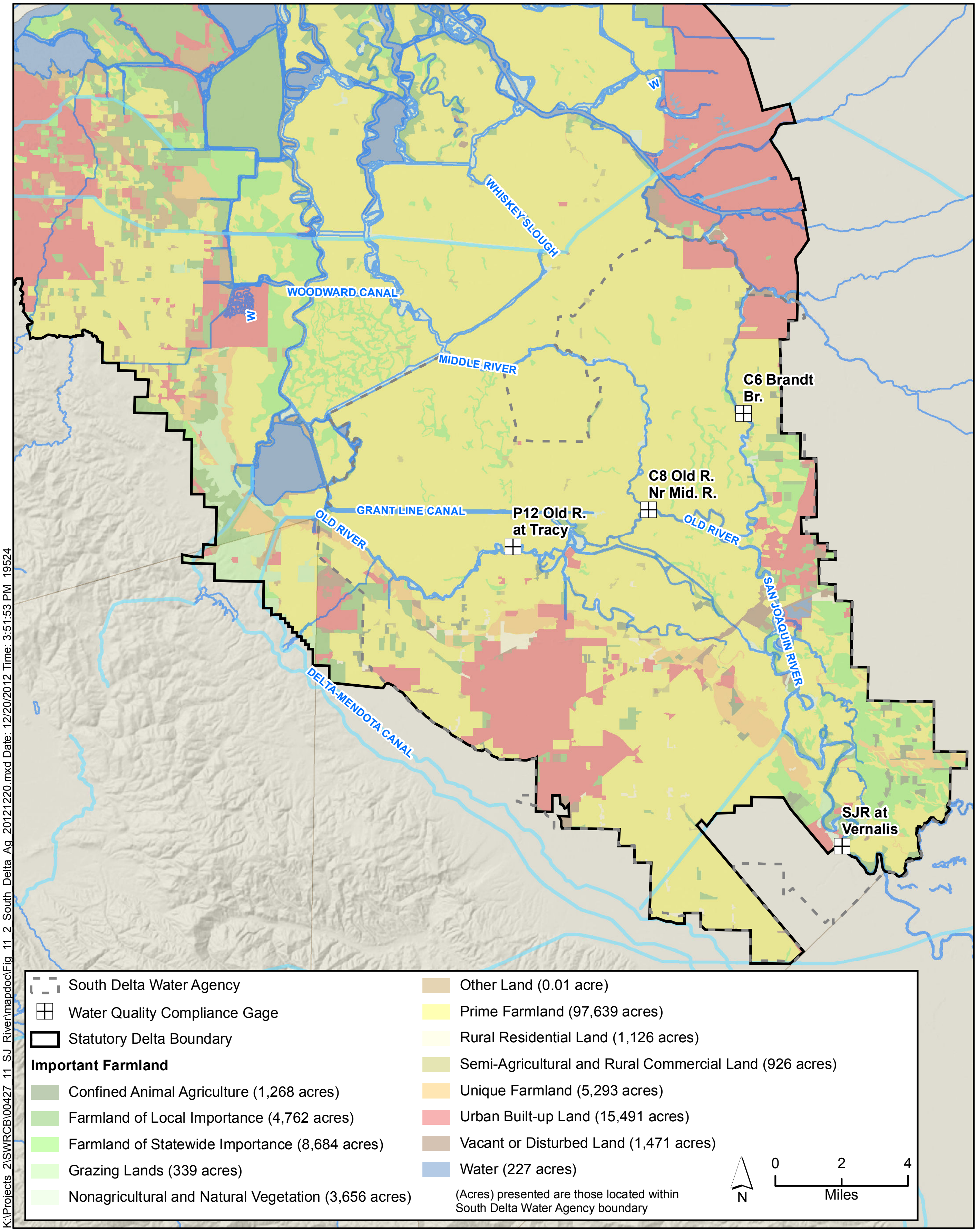

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Figure 11-2
Agriculture - South Delta

Table 11-8. Crop Production in the South Delta Water Agency Area of Potential Effects for 2005

Crop Category & Crop	Acres
Fruits & Nuts	
Apples	18
Apricots	204
Olives	77
Peaches & Nectarines	0
Pears	0
Plums	5
Almonds	3,107
Walnuts	2,051
Pistachios	18
Fruit or Nut < 10 acres	56
Subtotal	5,536
Field Crops	
Cotton	34
Safflower	2,684
Sugar Beets	135
Corn	15,481
Grain Sorghum	0
Sudan	1,286
Castor	0
Dry Beans	4,417
Sunflowers	0
Hybrid sorghum/sudan	71
Subtotal	24,108
Grain & Hay	
Wheat & Oat	7,297
Pasture	
Alfalfa	31,342
Clover	0
Turf Farm	324
Pasture	3,148
Subtotal	34,814
Truck & Berry	
Asparagus	3,651
Green Beans	24
Cole	257
Carrots	197
Celery	105
Cucurbits	2,628
Onion & Garlic	165
Tomatoes	16,444

Crop Category & Crop	Acres
Strawberries	4
Peppers	253
Misc	555
sub-total	24,283
Vineyards	2,902
Idle	2,114
Total	101,054

Note: Data was adapted from Appendix E (*Salt Tolerance of Crops in the Southern Sacramento–San Joaquin Delta* [2010]).

Water Supply, Irrigation, and Water Quality

Water users in the SDWA claim riparian or appropriative rights that allow for direct diversion of surface water from Delta waterways onto farmland. Diversions are through pumps, siphons, or through subirrigation. The operation of diversion pumps and siphons is dependent upon sufficient water depth and quality. When the depth of water in conveyance canals is too shallow, pumps and siphons cannot operate. Also, when the salinity of water exceeds a crop's salinity tolerance, Delta water cannot be used for irrigation. Although growers have access to groundwater, it is not commonly used as an irrigation supply source because the majority of growers claim riparian or appropriative water rights and obtain their water supply from surface water sources (San Joaquin County 2009).

The salinity in the southern Delta is strongly influenced by the concentrations at Vernalis. Historically salinity in the southern Delta has generally ranged between 0.2 dS/m and 1.4 dS/m and is suitable for irrigating a wide variety of agricultural crops (Appendix E, *Salt Tolerance of Crops in the Southern Sacramento–San Joaquin Delta*). Chapter 5, *Water Supply, Surface Hydrology, and Water Quality,* and Appendix F.2, *Evaluation of Historical Flow and Salinity Measurements of the Lower San Joaquin River and Southern Delta* provide additional information regarding water quality and historical and existing salinity concentrations in the southern Delta.

On-farm irrigation methods include surface, sprinkler, drip and micro-irrigation, and "other" (Table 11-9). For the most part, higher value crops, such as trees and vines, are irrigated with pressurized systems, such as hand-moved sprinklers or micro-sprayers (Edinger-Marshall and Letey 1997). Generally crops with lower net revenue, such as grains and pasture, are irrigated with surface methods. There is significant subirrigation in the area, which provides irrigation water by controlling the water table. Dryland cropping is practiced on some acreage in the SDWA; however, most of the crops rely on a supply of irrigation water.

Table 11-9. Irrigation Method Types in San Joaquin County

Surface	Sprinkler	Drip and Micro	Other
36.0%	14.2%	36.6%	13.2%

Source: 2010 DWR Survey of Irrigation Methods

Maintaining the leaching fraction is an important management tool in the southern Delta. Over time, the use of irrigation water and water management techniques, particularly leaching, brings soil salinity to equilibrium. There are 7,041 acres of saline soils in the SDWA, or about 5 percent of the total acreage. Several leaching fraction studies examining salt are based on an irrigation water quality of 0.7 dS/m. Among the studies, the leaching fractions averaged between 21 and 27 percent, with a low of 11 percent and a high of 44 percent. Bean and Alfalfa, the two crops with significant acreage (Table 11-8) in the area of potential effects, have the highest sensitivity to salinity. These crops are successfully grown on lands with low infiltration rates but maintain leaching fractions that average between 21 percent and 27 percent (Appendix E, *Salt Tolerance of Crops in the Southern Sacramento–San Joaquin Delta*). Further information on soil salinity and leaching fractions in the SDWA is provided in Appendix E.

11.3 Regulatory Setting

11.3.1 State

Relevant state programs, policies, plans, or regulations related to agricultural resources are described below.

Farmland Mapping and Monitoring Program

Through the Department of Conservation, California administers the Farmland Mapping and Monitoring Program (FMMP). This program maps farmland throughout the state (California Department of Conservation 2007). The farmland categories listed under the FMMP are the basis of certain significance thresholds in the State CEQA Guidelines, discussed in Section 11.4.1. The categories are defined based on the U.S. Department of Agriculture's (USDA) land inventory and monitoring criteria and modified for California.

Prime Farmland is land with the best combination of physical and chemical characteristics for the production of crops. It has the soil quality, growing season, and moisture supply needed to produce sustained high yields of crops when treated and managed in accordance with accepted farming methods. In addition, the land must have been used for irrigated agricultural production in the last 4 years to qualify as Prime Farmland. It does not include publicly owned lands for which there is an adopted policy preventing agricultural use. Prime Farmland must meet several criteria, some of which are listed below.

(a) Water —The soils have xeric, ustic, or aridic (torric) moisture regimes in which the available water capacity is at least 4.0 inches (10 cm) per 40 to 60 inches (1.02 to 1.52 meters) of soil, and a developed irrigation water supply that is dependable and of adequate quality. A dependable water supply is one which is available for the production of the commonly grown crops in 8 out of 10 years.

(d) Water Table—The soils have no water table or have a water table that is maintained at a sufficient depth during the cropping season to allow cultivated crops common to the area to be grown.

(f) Flooding—Flooding of the soil (uncontrolled runoff from natural precipitation) during the growing season occurs infrequently, taking place less often than once every 2 years.

Farmland of Statewide Importance is land other than Prime Farmland that has a good combination of physical and chemical characteristics for the production of crops. It must have been used for the production of irrigated crops at some time during the two update cycles (4 years) prior to the mapping date. It does not include publicly owned lands for which there is an adopted policy preventing agricultural use.

Unique Farmland is land that does not meet the criteria for Prime Farmland or Farmland of Statewide Importance, and that has been used for the production of specific high–economic value crops at some time during the two update cycles prior to the mapping date. This land is usually irrigated but may include nonirrigated orchards or vineyards. Land must have been cropped at some time during the 4 years prior to the mapping date. It has the special combination of soil quality, location, growing season, and moisture supply needed to produce sustained high quality or high yields of a specific crop when treated and managed according to current farming methods. Examples of such crops may include oranges, olives, avocados, rice, grapes, and cut flowers. It does not include publicly owned lands for which there is an adopted policy preventing agricultural use.

Williamson Act and Farmland Security Zone Contracts

The California Land Conservation Act of 1965 (Williamson Act) recognizes the importance of protecting the public interest in agricultural land and provides a tax incentive for the voluntary enrollment of agricultural and open space lands in contracts between local government and landowners (California Department of Conservation 2010; Gov. Code, § 51200 et seq.). The contract restricts the land use to agricultural and open space or compatible uses defined in state law and local ordinances. An agricultural preserve, which is established by local government, defines the boundary of an area within which a city or county will enter into contracts with landowners; only land located within an agricultural preserve is eligible for a Williamson Act contract.

The Williamson Act also provides for the establishment of Farmland Security Zone contracts (Gov. Code, § 51296 et seq.). A Farmland Security Zone is an area created within an agricultural preserve by a board of supervisors upon the request of a landowner or group of landowners. Farmland Security Zone contracts offer landowners greater property tax reduction and have a minimum initial term of 20 years.

Central Valley Water Board Basin Plan Amendment for Control of Salt and Boron Discharges in the Lower San Joaquin River

The Central Valley Water Board has adopted the *Water Quality Control Plan for the Sacramento River and San Joaquin River Basins* (Basin Plan). In 2004, it adopted a total maximum daily load (TMDL) and Basin Plan amendment that establishes a control program for salt and boron discharges into the LSJR to Vernalis (Central Valley Water Board 2004).

The Delta Protection Act and Delta Reform Act

The California legislature has established a policy of recognizing, protecting, and preserving Delta resources, including agriculture, in various statutes. These statutes include the Delta Protection Act and the Delta Reform Act.

The Delta Protection Act created the Delta Protection Commission and required that the commission prepare and adopt a comprehensive long-term resource management plan for land uses within the primary zone of the Delta (Delta Protection Act 1992). The *Land Use and Resource Management Plan* *for the Primary Zone of the Delta* was prepared and adopted by the Delta Protection Commission in 1995 and revised in 2002. For agriculture, the plan is required to conserve and protect the quality of renewable resources, preserve and protect agricultural viability, preserve and protect the water quality of the Delta, and protect the Delta from any development that results in any significant loss of habitat or agricultural land. This plan identifies nine general policies in support of Delta agriculture. Among these policies are prioritizing low-value lands for conversion to nonagricultural uses, encouraging the acquisition of agricultural conservation easements, managing agricultural lands to maximize wildlife habitat, and supporting efforts to maintain a viable agricultural economy, such as educational programs, ag-tourism, and value-added production activities.

The Sacramento-San Joaquin Delta Reform Act of 2009 (Wat. Code, § 85000 et seq.) established a new legal framework for Delta management, emphasizing the coequal goals of "providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem," as a foundation for state decisions about Delta management. (Wat. Code, § 85054.) The act also created a new Sacramento–San Joaquin Delta Conservancy (Conservancy), to support efforts that advance environmental protection and the economic well-being of Delta residents. (Pub. Resources Code, § 32320, et seq.)

11.4 Impact Analysis

This section lists the thresholds used to define impacts on agricultural resources. It describes the methods of analysis and the approach to determine the significance of impacts on agricultural resources. It also identifies impacts that are not evaluated further in the impact discussion. The impact discussion describes the changes to baseline resulting from the alternatives and incorporates the thresholds for determining whether those changes are significant. Measures to mitigate (i.e., avoid, minimize, rectify, reduce, eliminate, or compensate for) significant impacts accompany the impact discussion, where appropriate.

11.4.1 Thresholds of Significance

The thresholds for determining the significance of impacts for this analysis are based on the State Water Board's Environmental Checklist in Appendix A of the Board's CEQA regulations (Cal. Code Regs, tit. 23, §§ 3720–3781) and the Environmental Checklist in Appendix G of the State CEQA Guidelines. The thresholds derived from the checklist(s) have been modified, as appropriate, to meet the circumstances of the alternatives (Cal. Code Regs., tit. 23, § 3777, subd. (a)(2)). Agricultural resource impacts were determined to be potentially significant (see Appendix B, *State Water Board's Environmental Checklist* in this SED) and therefore are discussed in the analysis. Impacts would be significant if the LSJR or SDWQ alternatives result in any of the following conditions.

- Conversion of Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland) to nonagricultural use.
- Other changes in the environment which, due to their location or nature, could result in conversion of farmland to nonagricultural use.

As described in Appendix B, *State Water Board's Environmental Checklist* the alternatives would result in either no impact or less-than-significant impacts on the following, and therefore are not discussed within this chapter.

- Conflict with existing zoning for agricultural use or a Williamson Act contract.
- Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Pub. Resources Code, § 12220(g)), timberland (as defined by Pub. Resources Code, § 4526), or timberland zoned Timberland Production (as defined by Government Code, § 51104(g)).
- Loss of forest land or conversion of forest land to nonforest use.

11.4.2 Methods and Approach

Under the LSJR alternatives and SDWQ alternatives, two basic mechanisms could result in significant impacts on agricultural resources: reduction in surface water diversions for crop production in the LSJR area of potential effects; or a change in water quality that could result in crop yield reductions in the SWDA. Both of these mechanisms have the potential to affect crop production and lead to conversion of irrigated lands to nonirrigated or nonagricultural uses in either the LSJR area of potential effects or the SDWA. The methods for analyzing impacts under the LSJR alternatives and SDWQ alternatives are described below.

LSJR Alternatives

The LSJR alternatives could result in a reduction of surface water diversions currently used to irrigate agricultural lands. This analysis assumes surface water diversion reductions associated with the LSJR alternatives are not replaced with increased groundwater pumping. For the purpose of evaluating the potential impacts in this chapter, this is a conservative assumption. To the extent there is an increase in groundwater pumping in response to the LSJR alternatives, the impacts evaluated in this chapter would likely be reduced. Environmental effects associated with a potential increase in groundwater pumping are discussed in Chapter 9, *Groundwater Resources*.

The primary tool used to assess the impacts associated with a decrease in surface water supply under the LSJR alternatives was the Statewide Agricultural Production (SWAP) model. The SWAP model simulates the decisions of growers at a regional level based on the principles of economic optimization. The model assumes that farmers maximize profit subject to resources and market constraints, and it selects crop categories that maximize profit subject to given constraints. The model accounts for land and water availability and production prices and calibrates to observed yearly values of land, labor, and water supplies. Tables of annual crop production for the LSJR alternatives are the basic model outputs. SWAP is fully described in Chapter 5, *Water Supply, Surface Hydrology, and Water Quality*, and Appendix G, *Agricultural Economic Effects of Lower San Joaquin River Flow Alternatives*.

Results from DWR's and USBR's CALSIM Water Resources Simulation Model (CALSIM) and the State Water Board's Water Supply Effects (WSE) model were used in SWAP to generate annual crop production under each LSJR alternative. CALSIM and WSE generated monthly surface water diversion volumes and estimated the availability of water delivery for crop production expected under each LSJR alternative. Monthly values were aggregated to cropping season requirements. Annual crop production under each LSJR alternative is represented as acreage of a given crop category for 1922–2003.

Using the quantitative results of SWAP, the impact analysis first evaluates if significant reductions in agricultural acreage or significant reductions in crop mix would occur under the LSJR alternatives. The SWAP generated baseline was the basis for comparison and determination of irrigated cropland impacts. A summary of the SWAP model baseline is presented below and detailed in Appendix G, *Agricultural Economic Effects of Lower San Joaquin River Flow Alternatives*. The analysis compared the crop acreage that had an 80 percent exceedance level (i.e., 80th percentile) for the 82 years of estimates under baseline against the 82 years of estimates under LSJR Alternatives 2–4. If crop acreage under an alternative decreased by more than 10 percent when compared to baseline, at 80 percent exceedance level (i.e., 80th percentile), then the impact on crop acreage was deemed significant. Put another way, a decrease in irrigated crop acreage greater than 10 percent, above the 80 percent exceedance for LSJR Alternatives 2–4 compared with baseline at the 80 percent exceedance, would result in a significant impact on crop acreage. The 80 percent exceedance was selected because the criteria for the Prime Farmland and Farmland of Statewide Importance described by the 2006 FMMP requires a dependable water supply in 8 out of 10 years (California Department of Conservation 2007). The 10 percent reduction criterion, at the 80 percent exceedance level, was also applied to the conversion of irrigated land to nonagricultural use or lands under Williamson Act contracts to nonagricultural uses. The SWAP results are then quantitatively and qualitatively discussed as to the expected impacts under each LSJR alternative with respect to conversion of Prime, Unique, or Farmland of Statewide Importance to nonagricultural uses; or conversion of farmland to nonfarmland. In some cases, irrigated agricultural lands could be converted to a nonirrigated agricultural use, such as dryland farming or grazing. For purposes of the following impact analysis, such conversions would not constitute a significant impact.

The cropping patterns in the LSJR area of potential effects vary by watershed and irrigation district; however, as described in more detail in Appendix G, *Agricultural Economic Effects of Lower San Joaquin River Flow Alternatives*, the SWAP analysis combines all acreage within CVPM Regions 11, 12, and 13 into one unit. Additionally, some areas that receive Stanislaus surface water diversions outside of the combined CVPM Regions 11, 12, and 13, such as SEWD and CSJWCD, could not be explicitly included in the SWAP analysis. The reduction in diversions attributable to SEWD and CSJWCD, however, were accounted for by imposing them on the CVPM Regions 11, 12, and 13, thereby including the associated impact within those results. Cropping patterns in the SEWD and CSJWCD are similar to CVPM region 11 (Table 11-5), and therefore it is assumed that the SWAP model would predict similar results in these districts. Additionally, the Tuolumne and Merced may receive greater surface water diversion reductions compared to baseline than the Stanislaus, which has generally greater baseline flows (Chapter 5, *Water Supply, Surface Hydrology, and Water Quality*, and Appendix F.1, *Hydrologic and Water Quality Modeling*, provide additional information regarding the expected diversion reductions by watershed). A detailed evaluation of this difference between watersheds, however, is not possible with the available modeling tools; therefore, a qualitative discussion is presented for the LSJR alternatives to provide context for these potential differences between watersheds. Furthermore, information from Chapter 5 and Chapter 6, *Flooding, Sediment, and Erosion,* is incorporated to identify Stanislaus River flow levels that may result in elevated shallow groundwater in areas previously identified as being affected by Stanislaus River flows.

SWAP Modeled Baseline

Based on CALSIM II estimates of allowable surface water diversions under baseline for the 1922–2003 period, SWAP model output shows that 80 percent of the time, 934,820 acres are in production (Figure 11-3). Under the modeled baseline, a relatively large change in crop production and acreage occurs at the 90 percent exceedance (e.g., 90th percentile) and above. This decline in production acreage is attributed to extremely dry years. The breakdown of acreage by crop for the modeled baseline shows that there are four crop categories with dramatic reductions in acreage at the 90 percent exceedance level; Corn, Field, Rice, and Pasture, all crops with low net revenue (Figure 11-4). The remaining crop categories have slight decreases. Figures 11-5 and 11-6 show crop categories with more or less than 10,000 acres, respectively. There is a slight drop in Alfalfa production (Figure 11-5), which has 98 percent (93,599) of its acreage in production at the 80 percent exceedance level compared to an average production of 94,591 acres. Similarly, Dry Bean (Figure 11-6) has 90 percent (1,883) of its acreage in production at the 80 percent exceedance level compared to an average production of 1,897 acres, a difference of 14 acres.

Salinity Impacts of LSJR Flow Alternatives

The effects of the LSJR Alternatives on salinity concentrations on the SJR at Vernalis and the southern Delta are evaluated using the WSE model presented in Appendix F.1, *Hydrologic and Water Quality Modeling*. The impacts of these salinity concentrations relative to baseline are analyzed in Chapter 5, *Water Supply, Surface Hydrology, and Water Quality* (WQ-2) and determined to be less than significant for all LSJR Alternatives. Therefore the associated salinity impacts on agricultural resources are also considered to be less than significant.

SDWQ Alternatives

The program of implementation for the numeric salinity objectives contained in SDWQ Alternatives 2 and 3 includes continued U.S. Bureau of Reclamation (USBR) compliance with the Vernalis salinity requirement currently established in the 2006 Bay-Delta Plan and implemented through D-1641. Accordingly, salinity conditions in the southern Delta would not be degraded and would not result in significant impacts. Moreover, if salinity loading is further reduced through actions by the Central Valley Regional Water Quality Control Board (Central Valley Water Board) (such as modifying the National Pollution Discharge Elimination System [NPDES] permit effluent limitations for wastewater treatment plants [WWTPs] that discharge into the southern Delta and reduce salinity loading from WWTPs) salinity conditions in the southern Delta are likely to improve relative to baseline.

SDWQ Alternatives 2 and 3 include numeric salinity objectives of 1.0 dS/m and 1.4 dS/m applicable in all months, respectively. The existing salinity objectives are 0.7 dS/m for April–August and 1.0 dS/m for September–March, and as described in Chapter 5, *Water Supply, Surface Hydrology, and Water Quality,* and Appendix F.2, *Evaluation of Historical Flow and Salinity Measurements of the Lower San Joaquin River and Southern Delta*, baseline salinity conditions have historically ranged from generally 0.2 dS/m to 1.2 ds/m. The potential agricultural acreage impact (AG-1 and AG-2 for the SDWQ Alternatives) is estimated by assuming year-round irrigation salinity concentrations of 1.0 dS/m and 1.4 dS/m for SDWQ Alternatives 2 and 3, respectively. The analysis compares the associated crop yield impacts for this salinity concentration against crop yields under baseline. Based on the conclusions of Appendix E, *Salt Tolerance of Crops in the Southern Sacramento–San Joaquin Delta*, however, baseline salinity conditions are suitable for all agricultural crops, so the crop yield and agricultural acreage impacts of Alternatives 2 and 3 would simply be those associated respectively with 1.0 dS/m and 1.4 dS/m irrigation water salinity concentrations.

The potential for salinity-related impacts was evaluated using the information and modeling approaches contained in Appendix E. It is first determined if significant reductions in agricultural acreage or significant reductions in crop mix or crop production would occur under the SDWQ alternatives using the quantitative and qualitative results presented in Appendix E. These results are then qualitatively discussed as to the expected impacts under each SDWQ alternative with respect to

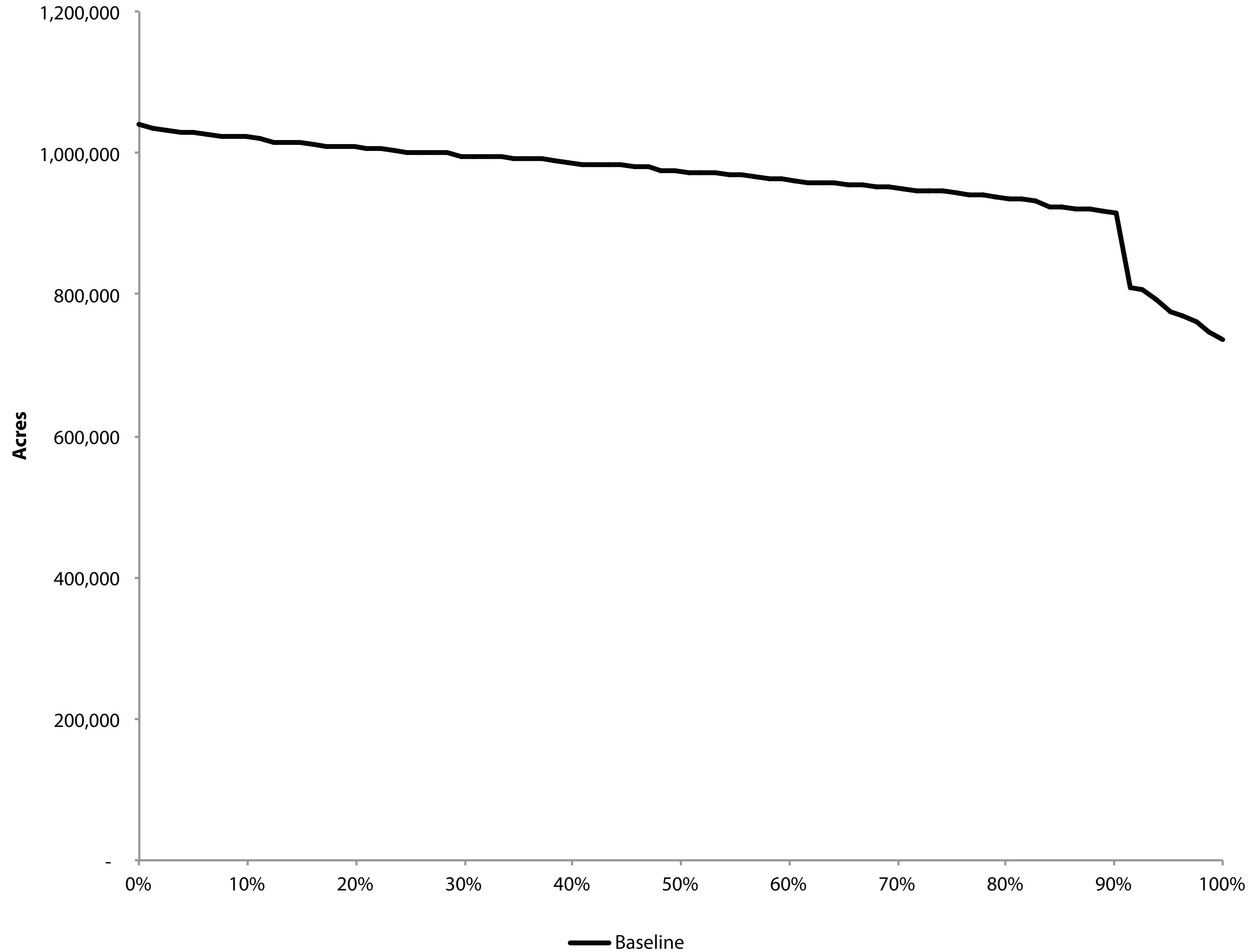

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Figure 11-3
Baseline acreage for all crop categories

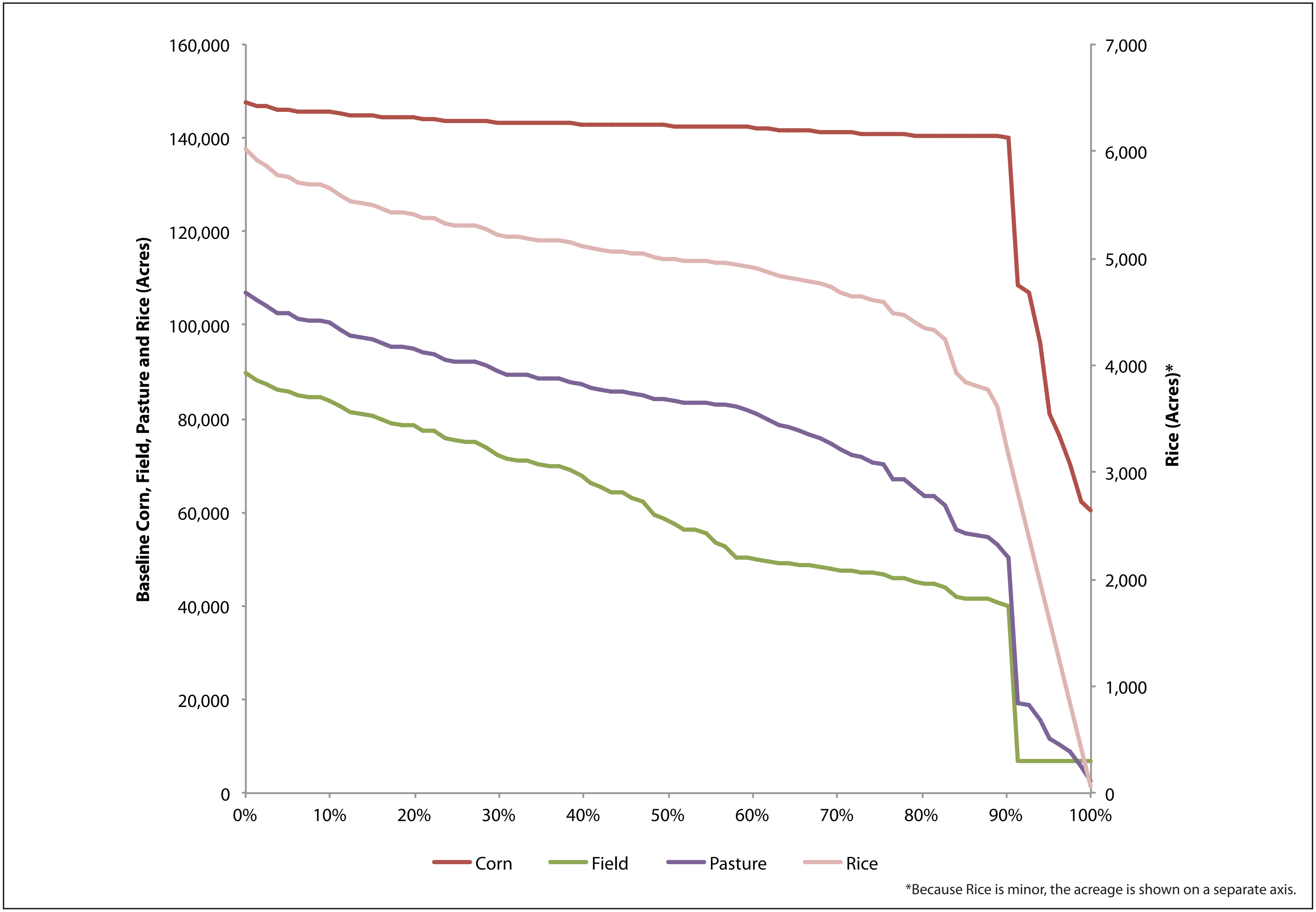

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Figure 11-4
Baseline acreage for Corn, Field, Pasture, and Rice

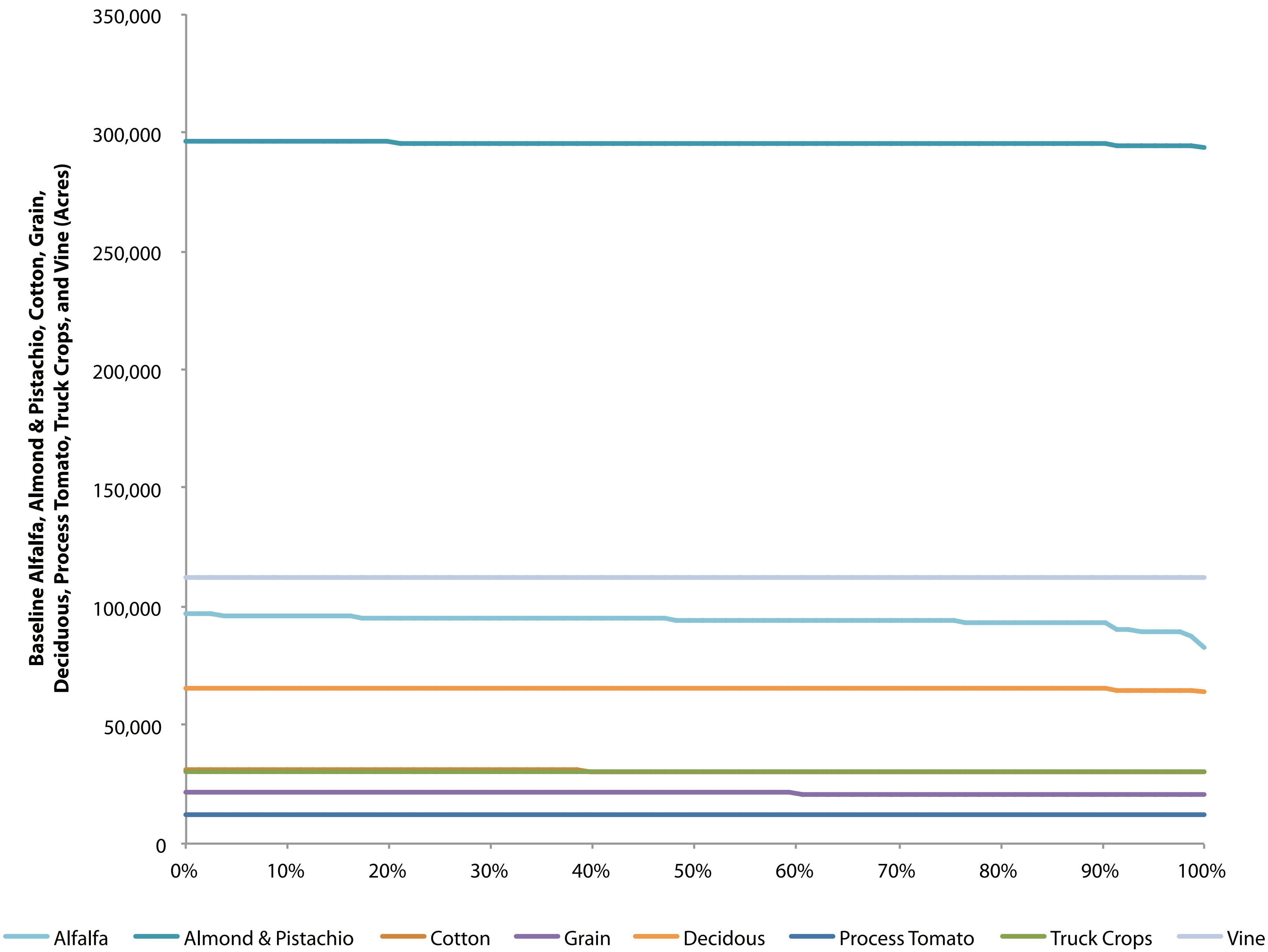

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Figure 11-5
Baseline acreage for crop categories greater than 10,000 acres with minor decline

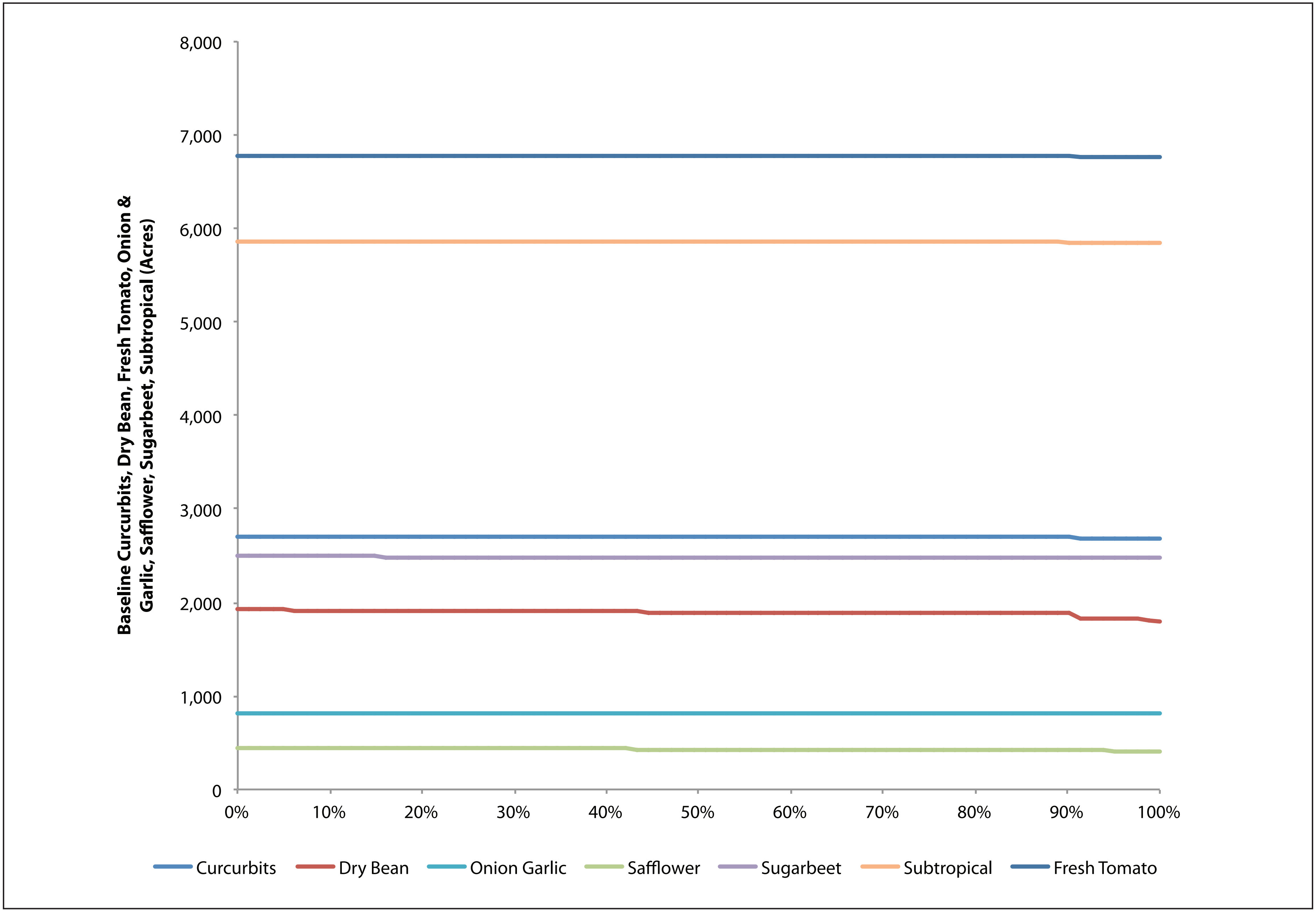

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Figure 11-6
Baseline SWAP acreage for crop categories less than 10,000 acres with minor decline

conversion of Prime, Unique, or Farmland of Statewide Importance to nonagricultural uses; or conversion of farmland to nonfarmland.

Appendix E describes the models that are commonly used when assessing the suitability of a particular water quality (ECw) for crop production. A summary is provided here. Such models estimate the soil water salinity (ECe) that would result from using a certain quality of irrigation water (ECw) under specified irrigation management practices (i.e. leaching fraction) and then uses the relationship between salinity and crop yield to develop an estimate of an associated impact. As recommended in Appendix E, the exponential steady-state model results presented in Appendix E are used in this analysis to determine ECe. ECe threshold levels, and the rates at which increasing levels affect crop production, are unique for each crop, a crop's growth stage, and potentially for a cultivar (Ayers and Westcott 1985).

Maas and Hoffman (1977) developed a relationship (Eqn. 11-1) between rootzone salinity and yield decline using the salinity tolerance of crops. This relationship states that at rootzone salinity (ECe) levels greater than a threshold (salinity tolerance of a crop), yield decline begins and increases based on the percent decline for the given increase in salinity (ECe).

$$\text{Yield} = 100\% - \text{slope}\ (\%) * (\text{measured rootzone ECe} - \text{threshold ECe}) \qquad \text{(Eqn. 11-1)}$$

This equation (Eqn. 11-1) uses quantitative salinity tolerance information available for many of the crops grown in the SDWA, presented in Table 11-10. Relative salt tolerance, on an annual basis, for each crop group is ranked from sensitive (S), moderately sensitive (MS), moderately tolerant (MT), to tolerant (T). Qualitative salinity tolerance information, presented in Table 11-11, is available for crops without quantitative data.

Table 11-10. Available Soil Salinity Threshold, Slope Information, and Relative Salinity Tolerance for Crops Grown in within the South Delta Water Agency Boundaries

Crop Category & Crop	Threshold ECe (dS/m)	Slope %/dS/m	Relative Salt Tolerance
Fruits & Nuts			
Apricots	1.6	24	S
Almonds	1.5	19	S
Field Crops			
Cotton	7.7	5.2	T
Sugar Beets	7	5.9	T
Corn	1.7	12	MS
Sudan	2.8	4.3	MT
Dry Beans	1	19	S
Sorghum	6.8	16	MT
Grain & Hay (Wheat)	5.9	3.8	MT
Pasture			
Pasture (clover)	1.5	12	MS
Alfalfa	2	7.3	MS
Truck & Berry			
Asparagus	4.1	2	T
Cole (broccoli)	2.8	9.2	MS
Carrots	1	14	S
Celery	1.8	6.2	S
Cucurbits	2.5	13	MS
Onion & Garlic	1.2	16	S
Tomatoes	2.5	9.9	S
Peppers	1.5	14	MS
Vineyards	1.5	9.6	MS

Source: United States Salinity Lab 2012

Notes: Because Pasture typically contains a mixture of grasses and legumes, the crop with the lowest tolerance to salinity (clover) was selected to represent all Pasture.

United States Salinity Lab quantifies the impact of salinity on crop production and catalogs crops into salt tolerance categories.

ECe = soil salinity
dS/m = deciSiemens per meter
S = Sensitive
MS = Moderately sensitive
MT = Moderately tolerant
T = Tolerant

Table 11-11. Relative Salinity Tolerance for Crops Grown within the South Delta Water Agency Boundaries that do not have Quantitative Threshold Information

Crop Category & Crop	Relative Salt Tolerance
Fruits & Nuts	
Apples	S
Olives	T
Walnuts	S
Pistachios	MS
Field Crops	
Safflower	MT
Sudan	MT
Pasture	
Turf Farm	MT
Truck & Berry	
Green Beans	S

Source: Appendix E, *Salt Tolerance of Crops in the Southern Sacramento–San Joaquin Delta*

Note: There is no quantitative data for the crops with only the relative salt tolerance information; however, these crops can be compared against crops with quantitative data. For example, there is no specific information on apples, but when comparing apples to another sensitive crop (S), yield decline should not occur unless the salinity of the soil extract (ECe) becomes greater than 1 to about 1.5 dS/m.

ECe = soil salinity
dS/m = deciSiemens per meter
S = Sensitive
MS = Moderately sensitive
MT = Moderately tolerant
T = Tolerant

As an example, using Eqn 11-1 above and information from Table 11-10, the decrease in apricot yield can be calculated. Apricots have an ECe tolerance of 1.6 dS/m with a decline of 24 percent for each unit increase in rootzone salinity (ECe). Therefore, using equation 11-1, if the rootzone salinity (ECe) was 2.6 dS/m, then the yield would be expected to decrease by 24 percent and the total apricot yield would be 76 percent, as presented below in Eqn. 11-2.

$$\textit{Apricot yield} = 100\% - .24 * (2.6 - 1.6) = 76\% \qquad \textit{(Eqn. 11-2)}$$

The methodology uses the results presented in Appendix E, *Salt Tolerance of Crops in the Southern Sacramento–San Joaquin Delta* for three crops: Alfalfa, Almonds, and Dry Bean. All of these crops are grown on significant acreage in the southern Delta (Table 11-8) and have relatively low thresholds to soil salinity (ECe) (Table 11-10). Appendix E presents estimates of soil water salinity and yield impact estimates for Dry Beans, Alfalfa, and Almonds across a range of different irrigation water salinity levels and leaching fractions. The analysis considers both a minimum and median level of precipitation, as precipitation influences the level of salinity in the soil, and higher precipitation can result in lower salinity levels. For the purpose of this analysis, a significant impact would result if the impact on crop yield for salt-sensitive crops is greater than 10 percent. Above this level, it would become more difficult for farmers to mitigate impacts with modified irrigation practices (e.g., increased leaching) and would start to substantially reduce the acreage of these types of crops in the southern Delta.

Central Valley Water Board's TMDLs for salt and boron determined that EC objectives protective of beneficial uses in this part of the watershed also protect those uses from the potential impacts from boron. Therefore, boron toxicity to agricultural resource is not considered in this analysis.

11.4.3 Impacts and Mitigation Measures

AG-1: Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance to nonagricultural uses

The LSJR alternatives would require flows for fish and wildlife beneficial uses in the rivers. As a result, modifications to reservoir operations and reductions in the available surface water supply for irrigation diversions are expected to occur. A reduction in water supply availability for irrigation purposes could potentially lead to a reduction in crop acreage and a potential conversion to nonagricultural uses. The precise amount of lands that are designated as Prime Farmland, Unique Farmland, or Farmland of Statewide Importance that could be converted to nonagricultural uses cannot be precisely quantified. However, potential impacts are based on the crop reduction modeling results and this information is used to qualitatively discuss whether conversion to nonagricultural uses would occur. In other words, the analysis uses decreased crop production as a proxy for potential conversion to nonagricultural uses.

While the range of historical salinity is expected to be maintained in the southern Delta as a result of the objectives, the potential crop yield is estimated by assuming year-round irrigation salinity concentrations of 1.0 dS/m and 1.4 dS/m for SDWQ Alternatives 2 and 3, respectively, and comparing the associated crop yield impacts to those for baseline. This information is used to qualitatively discuss if conversion to nonagricultural uses would occur.

LSJR Alternative 1: No Project

The No Project Alternative would result in implementation of flow objectives identified in the 2006 Bay-Delta Plan. See Chapter 15, *LSJR Alternative 1 and SDWQ Alternative 1 (No Project Alternative)*, for the No Project impact discussion and Appendix D, *Evaluation of LSJR Alternative 1 and SDWQ Alternative 1 (No Project Alternative)* for the No Project Alternative technical analysis.

LSJR Alternative 2: 20% Unimpaired Flow (Less than significant)

Irrigated crop acreage under LSJR Alternative 2 as estimated by the SWAP agricultural production model for the 1922–2003 period (Figure 11-7) shows that 80 percent of the time, 915,569 acres are in production. When compared to baseline (934,820 acres in production 80 percent of the time), this is a reduction of approximately 2 percent in total cropping for the LSJR area of potential effects.

A breakdown of acreage by crop category (Figure 11-8) shows that there are three crop categories with acreage reduction above the 80 percent exceedance level (Table 11-12). These are Field, Rice, and Pasture; these crops have low net revenue. For these crop categories, the acreage reduction above the 80 percent exceedance level varies from 10 percent for Field crops to 25 percent for Rice. The model predicts additional surface water diversions for the LSJR area of potential effects and

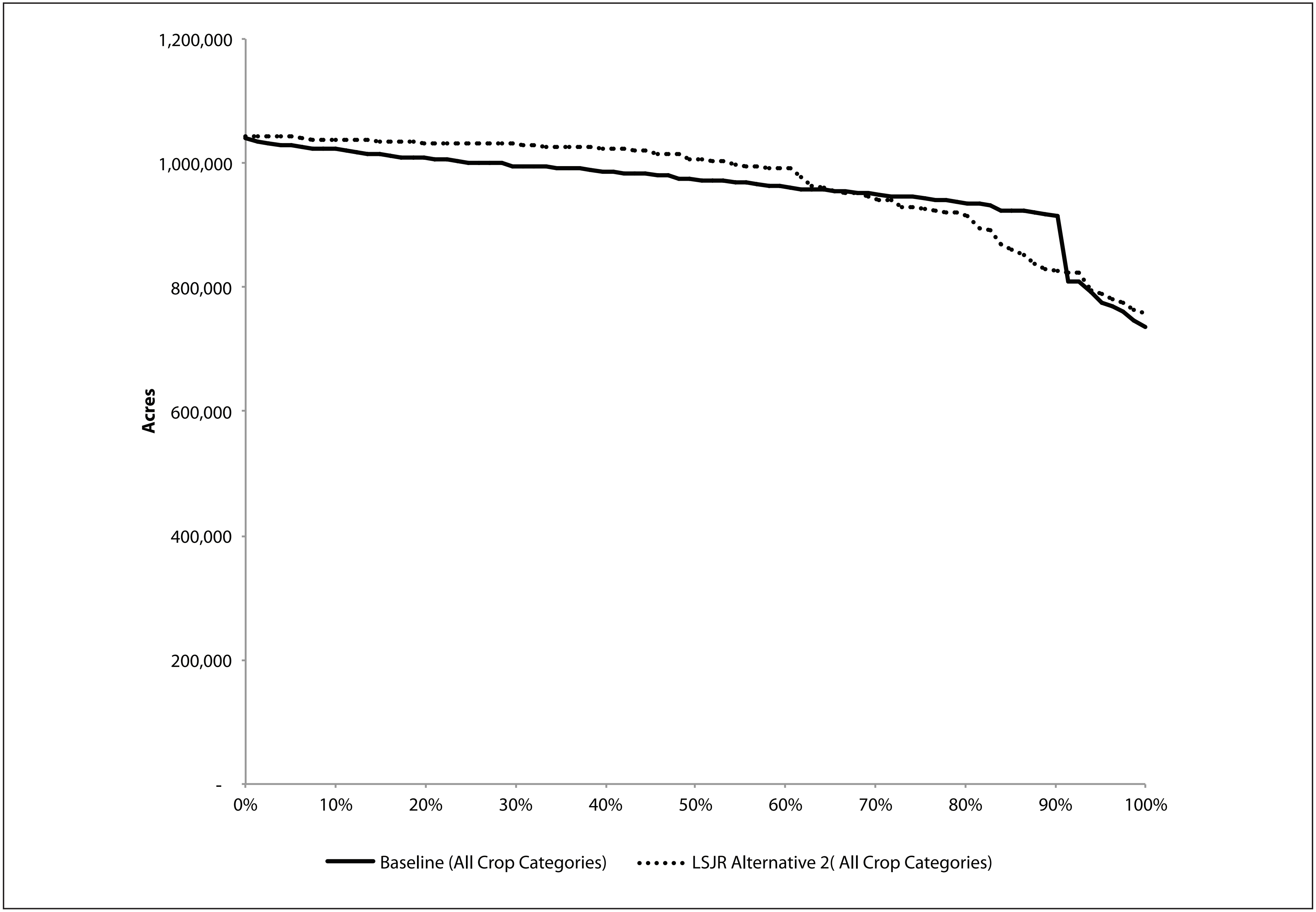

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Figure 11-7
LSJR Alternate 2 and baseline acreage for all crop categories

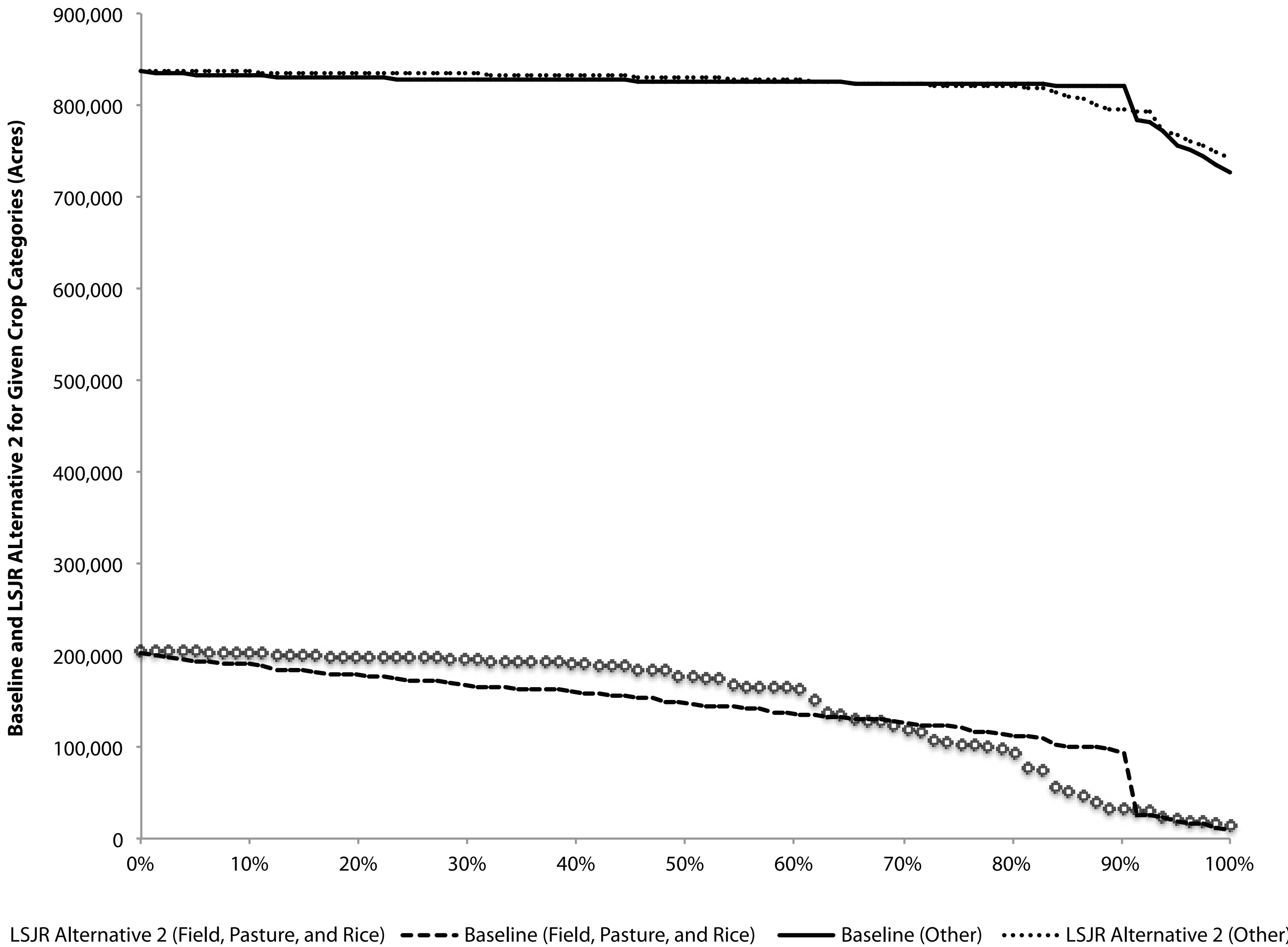

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Figure 11-8
Alternative 2 and baseline acreage for crop categories with significant acreage decline (Field, Pasture, and Rice) and for crop categories without decline (Other)

more water is expected in the Stanislaus River as a result of the required unimpaired flow (Table 11-13); therefore, crop production for Field, Rice, and Pasture under LSJR Alternative 2 and under baseline are equivalent at 91 percent exceedance level for Field, Rice, and Pasture.

LSJR Alternative 2 modeling results predict an increase in the production of crops with a higher net revenue and a decrease in production of crops with a lower net revenue (Tables 11-12 and 11-14). Therefore, average production for the Other crop categories shown in Figure 11-8 and Table 11-14 under LSJR Alternative 2 compared to baseline are expected to result in a potential increase in crop production. Although Field, Rice, and Pasture would experience a decrease in production greater than 10 percent at the 80 percent exceedance level, other crops would experience an increase and would likely replace these crops. Furthermore, the overall decrease would be only a 2 percent reduction in the total cropping for the LSJR area of potential effects. Thus, crop acreage would not be substantially reduced. Therefore, it is expected surface water diversions would not be reduced beyond baseline under LSJR Alternative 2 and crop acreage would not be substantially reduced.

Table 11-12. Crop Categories with Acreage Reductions under LSJR Alternative 2

Crop Category	Crop Acres at 80% Baseline Acres	Crop Acres at 80% for LSJR Alternative 2	Acreage Reduction	Reduction from Baseline
Field	44,667	40,108	4,559	10%
Pasture	63,479	50,685	12,794	20%
Rice	4,340	3,254	1,086	25%

Table 11-13. Exceedance Percentage where there are more Acres out of Production under Baseline than under LSJR Alternative 2

Crop Category	Exceedance % Where Baseline Acreage Reduction Compared to Baseline is Greater than LSJR Alternative 2
Field	91
Pasture	91
Rice	91

Table 11-14. Crop Acreage Change for Average Production Level Compared with the Baseline for the Other Crop Categories from Figure 11-8

Crop Category	Average Baseline Cropping Acres	Average LSJR Alternative 2 Cropping	Difference (Baseline–LSJR Alternative 2)
Alfalfa	94,185	94,754	-569
Almond & Pistachio	295,627	295,784	-157
Corn	137,020	137,965	-945
Cotton	30,656	30,835	-180
Curcurbits	2,698	2,700	-2
Dry Bean	1,892	1,898	-6
Fresh Tomato	6,770	6,772	-2
Grain	21,218	21,293	-75
Onion & Garlic	817	818	-1
Deciduous	65,417	65,528	-111
Truck Crops	30,413	30,418	-4
Processing Tomato	12,326	12,346	-20
Safflower	431	434	-3
Sugarbeet	2,482	2,486	-3
Subtropical	5,851	5,853	-2
Vine	112,386	112,428	-42

Note: A negative value indicates an increase in acreage compared with baseline.

Since LSJR Alternative 2 is not expected to result in a substantial reduction in crop production in the LSJR area of potential effects, this alternative would not result in the conversion of Prime, Unique, or Farmland of Statewide Importance to nonagricultural uses. Impacts would be less than significant.

LSJR Alternative 3: 40% Unimpaired Flow (Significant and unavoidable)

The reduction in water supply for irrigation was modeled for the LSJR area of potential effects shown in Figure 11-1; however, as shown in Chapter 5, *Water Supply, Surface Hydrology, and Water Quality*, the reduction in surface water supply diversions on the Stanislaus River would be expected to be less than the reductions on the Tuolumne or Merced Rivers. This is because Stanislaus River flows currently are approximately 40 percent of the average unimpaired flow, and thus the flow available for surface water diversions would generally be considered similar to current surface water diversions. However, the Tuolumne and Merced Rivers currently have flows that are approximately 20 percent of the average unimpaired flow; therefore, these watersheds would be expected to experience a greater reduction in surface water diversions. In addition, the cropping pattern is unique in each river basin. For example, Pasture represents 33 percent of all irrigated acreage in DAU 207 (i.e., OID lands) but only 11 percent of land in DAU 210 (i.e., Merced ID lands). Using this information with the SWAP results, presented below, indicates that there may be fewer impacts on Pasture supplied by Stanislaus River water and more impacts on crops with higher net revenue, such as Alfalfa, in areas served by the Tuolumne and Merced Rivers.

Under LSJR Alternative 3, 799,904 acres are in production 80 percent of the time, as estimated by the SWAP model for the 1922–2003 period (Figure 11-9), compared to 934,820 acres in production under baseline conditions. Accordingly, total acreage decreases at the 80 percent exceedance level for LSJR Alternative 3 is 14.5 percent less than baseline. A breakdown of acreage by crop category (Figure 11-10) shows that there are four categories with significant reductions in acreage above the 80 percent exceedance level (Table 11-15). These are Corn, Field, Rice, and Pasture, all of which have low net revenue. For these crop categories, the acreage reduction above the 80 percent exceedance level varied from 28 percent for Corn to 99 percent for Rice. Alfalfa production (Figure 11-10) was also affected slightly, with 4 percent acreage reduction above the 80 percent exceedance level. Table 11-16 shows that Field and Pasture have greater than 10 percent reduction in acreage in all years. Table 11-16 also shows Rice with impacts at 20 percent compared to baseline and Corn at 67 percent. Therefore, a reduction of approximately 128,295 acres of irrigated Corn, Field, Pasture, and Rice under LSJR Alternative 3 is expected, which constitutes a substantial reduction in crop acreage.

Table 11-15. Acreage Reduction for Crop Categories with Significant Impacts under LSJR Alternative 3 Compared with Baseline

Crop Category	Crop Acres at 80% for Baseline Acres	Crop Acres at 80% for LSJR Alternative 3	Acreage Reduction	Reduction from Baseline
Corn	140,550	100,862	39,688	28%
Field	44,667	6,772	37,895	85%
Pasture	63,479	17,041	46,437	73%
Rice	4,340	65	4,275	99%

Table 11-16. Level of Baseline Production where Significant Impacts Occur under Alternative LSJR 3 for Corn, Field, Pasture, and Rice

Crop Category	% of Baseline Where Crop Impact is Greater Than 10%	% of Baseline Where Crop Affected is Greater Than 20%
Alfalfa*	94	95
Corn	67	77
Field	All	12
Pasture	All	37
Rice	20	47

* Alfalfa is shown because there is a 4% reduction at 80% exceedance but no significant impacts until acreage is greater than 94% of baseline production.

LSJR Alternative 3 would result in a substantial reduction in crop acreage in the LSJR area of potential effects. Total acreage affected for the three annual crops, Corn, Field, and Rice, are 81,858 acres; and 46,437 acres for Pasture, a permanent crop. Combined, this acreage (128,295 acres) represents a greater than 10 percent reduction in acreage at the 80 percent exceedance level. Since this land would need irrigation 8 out of 10 years to qualify for Prime, Unique, or Farmland of Statewide Importance and would not receive the irrigation water, it is expected that lands classified as Prime, Unique, or Farmland of Statewide Importance would be reduced as a result of LSJR

Alternative 3. It is unknown whether the reduction in irrigation water would result in a direct conversion of Prime, Unique, or Farmland of Statewide Importance to nonagricultural use, but it is conservative to assume that if irrigation water is unavailable to sustain these three specific categories of land, which require regular irrigation water, some of the land would be converted to nonagricultural uses. While it would be speculative to quantify the amount of Prime, Unique or Farmland of Statewide Importance that might be converted, the substantial reduction in these types of existing irrigated agricultural land as a result of LSJR Alternative 3 could result in of the conversion of these lands to non-agricultural uses, in which case impacts would be significant.

The modeling results predict the potential reduction in crops in the LSJR area of potential effects based on water supply reductions, and conservatively assume no replacement of the reduced surface water supply. However, irrigators could pump groundwater or implement irrigation efficiency to replace or augment some of the lost surface water supply. Local groundwater sources could be pumped to supply irrigation delivery channels and many growers can directly access groundwater through existing agricultural wells (see Chapter 9, *Groundwater Resources*). Many agricultural users currently pump groundwater during drought conditions because groundwater is considered a reliable source of irrigation water (Chapter 9; Merced ID 2003). To the extent that groundwater would be pumped to replace any portion of reduced surface water diversions, the impact on crop production and thus the conversion to nonagricultural uses would be reduced. However, it is unknown the extent to which groundwater would be used to replace the reduced surface water supplies under LSJR Alternative 3. Impacts would be significant.

An SED must identify feasible mitigation measures for each significant environmental impact identified in the SED. (Cal. Code Regs., tit. 23, § 3777(b)(3)). In order to reduce significant impacts on agricultural lands identified above, the State Water Board would need to require lower flows than would be required by LSJR Alternative 3 on the Merced and Tuolumne Rivers. Evaluating the effects of lower flows on the different rivers is part of other alternatives (i.e., LSJR Alternatives 1 and 2) and is separately considered in this document. Requiring lower flows to reduce agricultural impacts cannot be independently applied under LSJR Alternative 3 as a mitigation measure because requiring lower flows would be inconsistent with the terms of LSJR Alternative 3 (i.e., requiring 40 percent of unimpaired flow on the Merced and Tuolumne Rivers). CEQA does not grant agencies new, discretionary powers independent of the powers granted to the agencies by other laws. (Pub.Resources Code, § 21004; Cal. Code Regs., tit. 14, § 15040.) Accordingly, a mitigation measure may be legally infeasible if the lead agency does not have the discretionary authority to implement it. (Pub. Resources Code, § 21004; Cal. Code Regs., tit. 14, § 15040.) While it may be possible for water diverters to reduce their reliance on surface water diversions, thereby reducing the significant impact related to agriculture (discussed further below), the State Water Board does not have the authority to mandate the actions of others that would offset reduced surface water diversions.

The State Water Board has limited authority of the State Water Board over the conversion of agricultural resources to non-agricultural uses and limited authority to require irrigation efficiency measures. Specifically, the State Water Board does not regulate or have authority over the designation of farmlands. While cities or counties may designate boundaries for agricultural preserves, create farmland security zones, enter into conservation easements, or enter into Williamson Act contracts, they do not have the authority to require landowners to participate in such measures in the first instance. They may, however, enforce existing Williamson Act contracts. But it is unknown to what extent such preserved agricultural lands meet the criteria for designation as Prime Farmland, Unique Farmland, or Farmland of Statewide Importance or whether any contracts covering such lands may be enforced or renewed.

Local water suppliers, regional groundwater management agencies, and/or irrigation districts could require modifications to existing agricultural practices that increase irrigation efficiency. Implementing irrigation efficiency measures is expected to reduce overall the amount of irrigation water needed by more efficiently applying the water to crops. Furthermore, increasing irrigation efficiency may reduce the amount of supplemental groundwater pumping required to replace reduced surface water diversions. Increasing irrigation efficiency reduces the amount of water required for application without reducing the amount available for consumptive use. Increasing the irrigation efficiency could be accomplished with the following methods.

- Increase the use of irrigation management services to better determine how much water is needed by a crop and when to apply it.
- Convert current less efficient irrigation systems (e.g., surface irrigation) to more efficient ones (e.g., microirrigation).
- Increase the capability of irrigation water suppliers to provide delivery flexibility, such as the use of irrigation district regulating reservoirs to allow flexible delivery durations, scheduling and flow rates.

The State Water Board has authority to regulate waste and unreasonable use of water through the California Constitution and the authority to regulate waste, unreasonable use, unreasonable method of use, and unreasonable method of diversion of water through quasi-legislative action. However, any authority the State Water Board has to impose irrigation efficiency requirements would be outside the scope of this standard-setting, and would have to occur in individual water right hearings based on findings of waste or unreasonable use. Whether water use by any water right holder in these watersheds constitutes waste or unreasonable use is speculative. Furthermore, any broader regulatory action to implement the irrigation efficiencies would be under the jurisdiction of local water suppliers, or local and regional groundwater management agencies. While it is possible that some of the water-diversion and use measures, including irrigation efficiency, may have some applicability to reducing impacts or could be implemented as part of the individualized water right proceedings that are expected to occur to implement the flow objectives, any application of these measures at this point would be speculative. Because of the number of acres of Prime, Unique, or Farmland of Statewide Importance lost as predicted by the model, and the possibility of conversion to nonagricultural land uses, impacts on agricultural resources would remain significant and unavoidable.

LSJR Alternative 4: 60% Unimpaired Flow (Significant and unavoidable)

The reduction in water supply for irrigation was modeled for the LSJR area of potential effects shown in Figure 11-1; however, as shown in Chapter 5, *Water Supply, Surface Hydrology, and Water Quality*, the reduction in agricultural surface water supply on the Stanislaus River would be expected to be less than the reductions on the Tuolumne or Merced Rivers. This is because current Stanislaus River flows are approximately 40 percent of the average unimpaired flow, whereas the Tuolumne and the Merced are currently at 20 percent of unimpaired flow. In addition, the cropping pattern is unique in each river basin. For example, Pasture represents 33 percent of all irrigated acreage in DAU 207 (i.e., OID lands) but only 11 percent of land in DAU 210 (i.e., Merced ID lands). Using this information with the SWAP results, presented below, indicates that there may be fewer impacts on

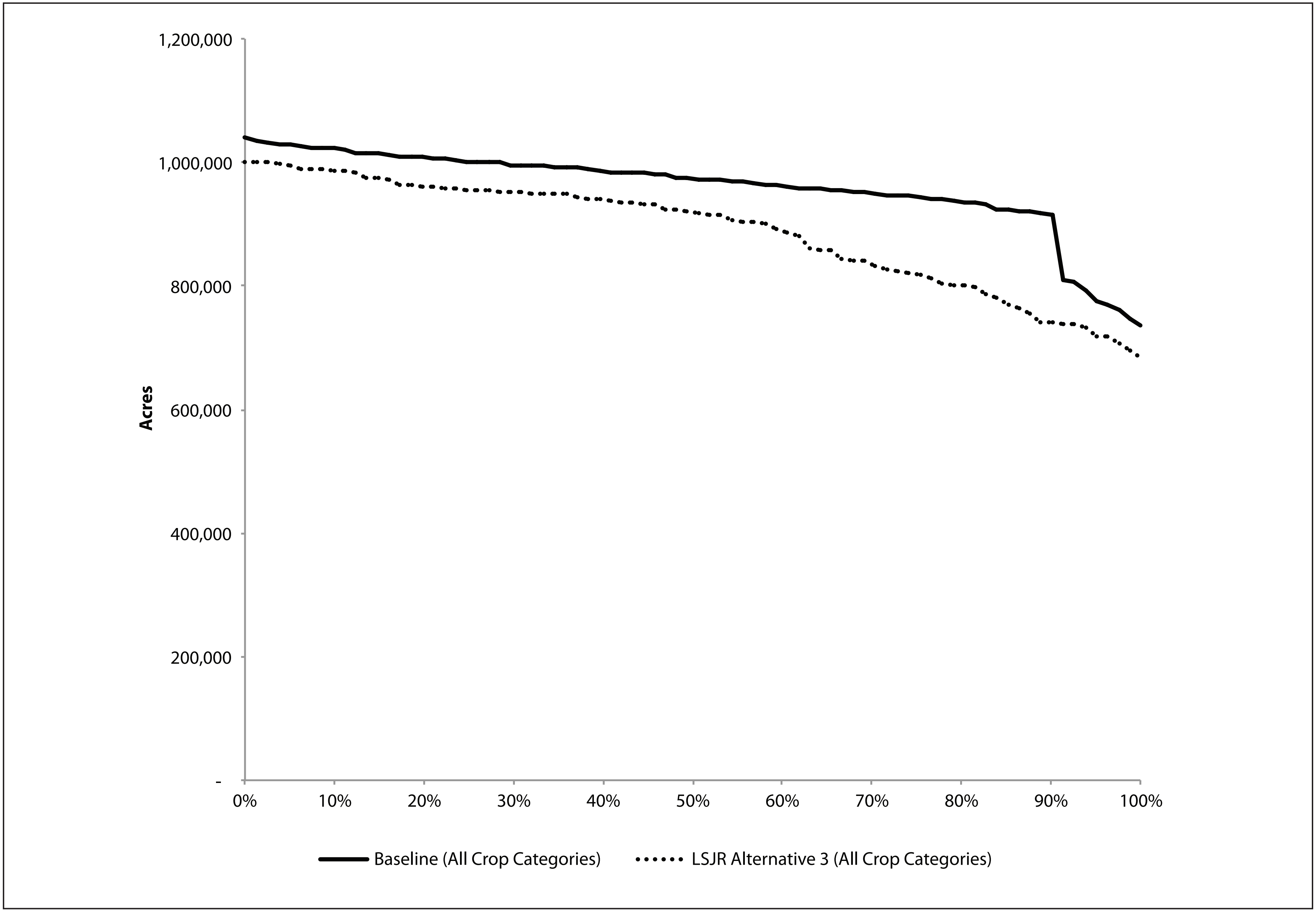

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Figure 11-9
LSJR Alternative 3 and baseline acreage for all crop categories

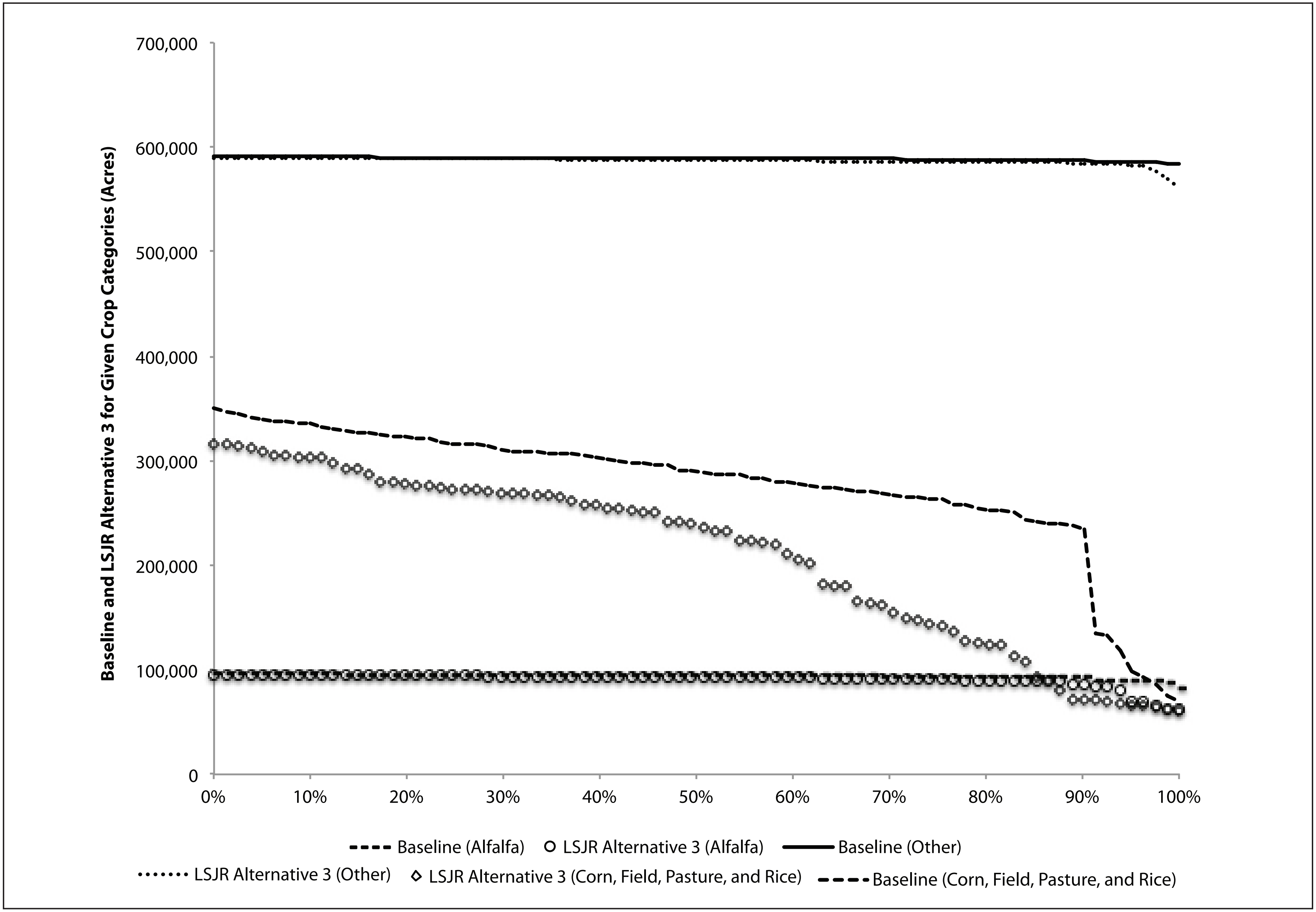

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Figure 11-10
LSJR Alternative 3 and baseline acreage for crop categories with significant acreage decline (Field, Pasture, and Rice), for Alfalfa and for crop categories with minimal decline (Other)

Pasture supplied by Stanislaus River water and more impacts on crops with higher net revenue, such as Alfalfa, Dry Bean, and Safflower, in areas served by the Tuolumne and Merced Rivers.

Irrigated crop acreage under the LSJR Alternative 4 for the 1922–2003 period as estimated by the SWAP model (Figure 11-11) shows that 80 percent of the time, 717,893 acres are in production compared to the 934,820 acres in production under baseline. Total production decrease at the 80 percent exceedance level for LSJR Alternative 4 is just over 23 percent of baseline. A breakdown of acreage by crop category (Figure 11-12 and Table 11-17) shows that there are five crop categories with significant reductions in acreage above the 80 percent exceedance level: Alfalfa, Corn, Field, Rice, and Pasture. For these crop categories, the acreage reduction above the 80 percent exceedance level varied from 26 percent for Alfalfa to 99 percent for Rice. Table 11-18 shows that Field, Pasture, and Rice have greater than 10 percent reduction in acreage in all years. Table 11-18 also shows Corn is affected at the 33 percent exceedance level and Alfalfa at 73 percent exceedance level when compared to baseline. Therefore, a reduction of approximately 210,812 acres of irrigated Alfalfa, Corn, Field, Pasture, and Rice is expected, which results in a substantial (approximately 23 percent) reduction in crop acreage.

Table 11-17. Acreage Reduction for Crop Categories with Significant Impacts under LSJR Alternative 4 Compared with Baseline

Crop Category	Crop Acres at 80% of Baseline Acres	Crop Acres at 80% of LSJR Alternative 4	Acreage Reduction	% Reduction from Baseline at 80% of Acres
Alfalfa	93,599	69,688	23,911	26
Corn	140,550	58,165	82,385	59
Field	44,667	6,772	37,895	85
Pasture	63,479	1,133	62,346	98
Rice	4,340	65	4,275	99

Table 11-18. Level of Baseline Production where Significant Impacts Occur under LSJR Alternative 4 for Alfalfa, Corn, Field, Pasture, and Rice

Crop Category	% of Baseline Where Crop Affected >10%	% of Baseline Where Crop Affected >20%
Alfalfa	73	77
Corn	33	49
Field	All	All
Pasture	All	All
Rice	All	All
Dry Bean*	83	84
Safflower*	80	82

* Dry Bean and Safflower are shown because there is a 5% and 8% reduction, respectively, at 80% exceedance but no significant impacts until acreage is greater than 83% and 82% of the baseline.

Total acreage affected for the three annual crops, Corn, Field, and Rice, is 124,555 acres; and 86,257 acres for two permanent crops, Alfalfa and Pasture. This acreage represents a greater than 10

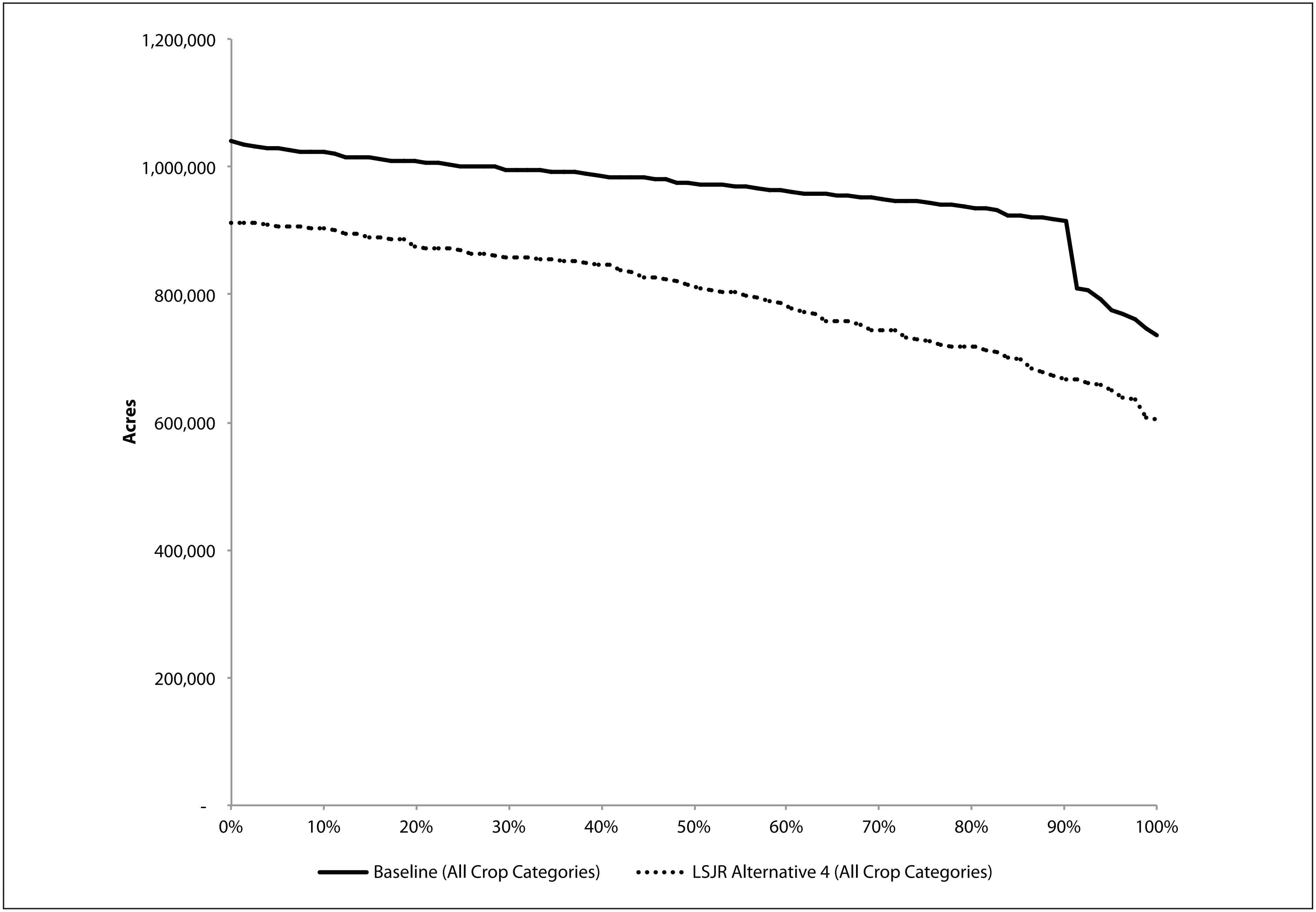

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Figure 11-11
LSJR Alternative 4 and baseline acreage for all crop categories

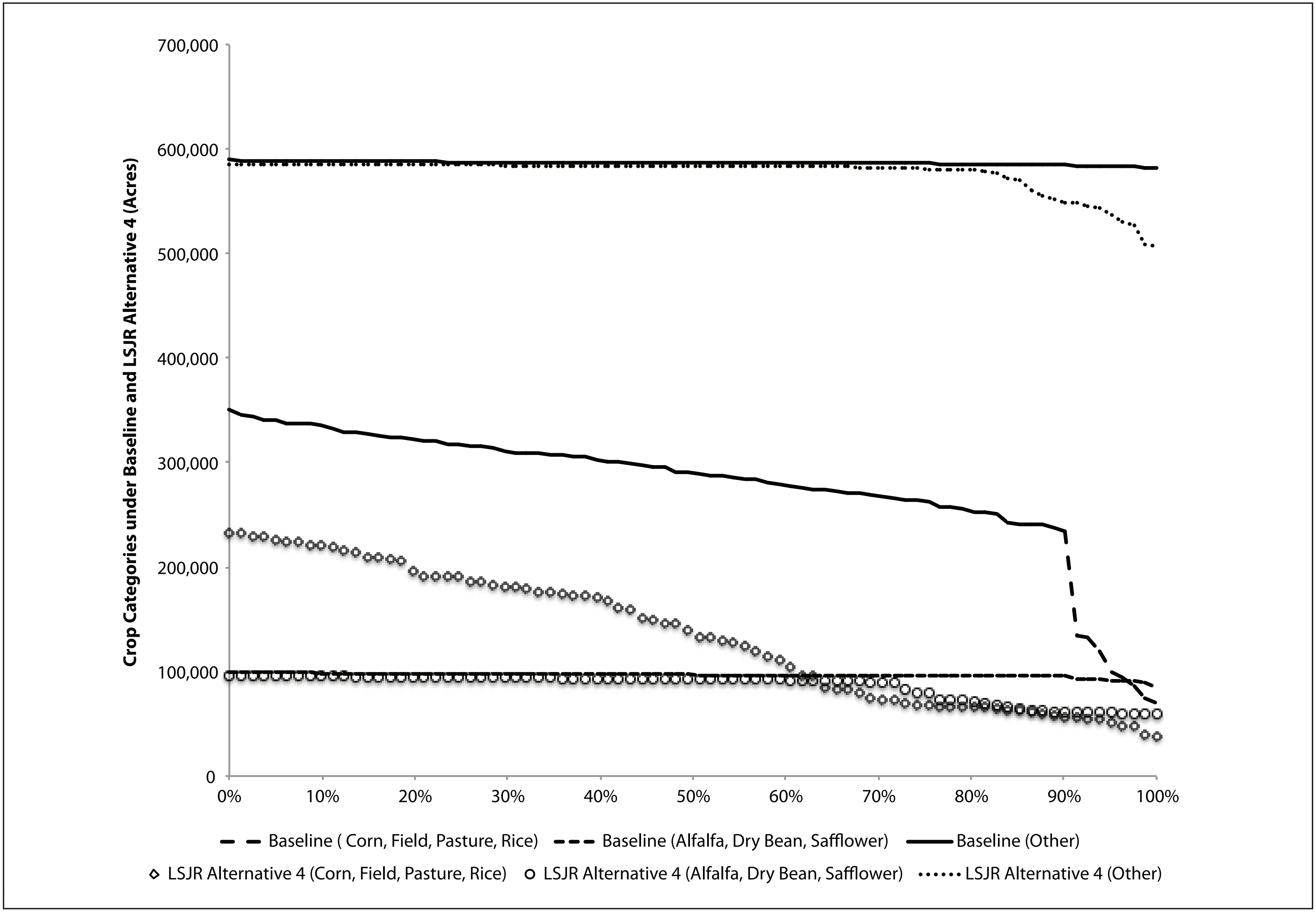

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Figure 11-12
LSJR Alternative 4 and baseline acreage for crop categories with significant acreage decline (Field, Pasture, and Rice), for Alfalfa and for crop categories with minimal decline (Other)

percent reduction in acreage at the 80 percent exceedance level. Impacts would be similar to but greater than those described above for LSJR Alternative 3 because the acreage of affected irrigated agricultural land is greater. Because of the number of acres of Prime, Unique, or Farmland of Statewide Importance lost as predicted by the model, and the possibility of conversion to nonagricultural land uses, impacts on agricultural resources would be significant

The modeling results predict the potential reduction in crops in the LSJR area of potential effects based on water supply reductions with no groundwater pumping to replace the reduced surface water supply. However, as discussed under LSJR Alternative 3, groundwater is an alternative water supply available to most irrigation districts and agricultural users in the LSJR area of potential effects. To the extent that groundwater would be pumped to replace any portion of reduced surface water diversions, the impact of such reductions on crop production would be lessened. However, it is unknown the extent to which groundwater would be used to replace the surface water supply diversion reductions under LSJR Alternative 4. Therefore, the extent to which the crop acreage impacts identified above would be reduced cannot be quantified or described.

As discussed above for LSJR Alternative 3, in order to reduce significant impacts on agricultural lands, the State Water Board would need to require lower flows than would be required by LSJR Alternative 4. Evaluating the effects of lower flows on the different rivers is part of other alternatives (i.e., LSJR Alternatives 1 and 2) and is separately considered in this document. Requiring lower flows to reduce agricultural impacts cannot be independently applied under LSJR Alternative 4 as a mitigation measure because requiring lower flows would be inconsistent with the terms of LSJR Alternative 4 (i.e., requiring 60 percent unimpaired flow). CEQA does not grant agencies new, discretionary powers independent of the powers granted to the agencies by other laws. (Pub.Resources Code, § 21004; Cal. Code Regs., tit. 14, § 15040.) Accordingly, a mitigation measure may be legally infeasible if the lead agency does not have the discretionary authority to implement it. (Pub. Resources Code, § 21004; Cal. Code Regs., tit. 14, § 15040.) While it may be possible for water diverters to reduce their reliance on surface water diversions, thereby reducing the significant impact related to agriculture (discussed further below), the State Water Board does not have the authority to mandate the actions of others that would offset reduced surface water diversions. As discussed for LSJR Alternative 3, irrigation efficiency measures could be implemented by local water purveyors, irrigation districts, or groundwater management districts to reduce the amount of water applied to crops while still meeting crop water demands. Irrigation efficiency would serve to keep as much agricultural acreage in production as possible. However, it is unknown whether it would reduce the significant impacts to less-than-significant levels. Therefore, the significant impacts on agricultural resources are based on the number of acres of crop loss predicted by the model and the unknown ability of pumping groundwater or irrigation efficiencies to offset the loss of crop acreage. As discussed above and under LSJR Alternative 3, there is no feasible mitigation to reduce this significant impact. Impacts would remain significant and unavoidable.

SDWQ Alternative 1: No Project

The No Project Alternative would result in implementation of salinity objectives identified in the 2006 Bay-Delta Plan. See Chapter 15, *LSJR Alternative 1 and SDWQ Alternative 1 (No Project Alternative)*, for the No Project impact discussion and Appendix D, *Evaluation of LSJR Alternative 1 and SDWQ Alternative 1 (No Project Alternative),* for the No Project Alternative technical analysis.

SDWQ Alternative 2: 1.0 dS/m Salinity (Less than significant)

Using the modeling approach described in Section 11.4.2, with a 20 percent leaching fraction, under either a median or minimum amount of precipitation there was no yield reduction for Dry Beans irrigated with water containing a salinity level (ECw) of 1.0 dS/m. In addition, Appendix E, *Salt Tolerance of Crops in the Southern Sacramento–San Joaquin Delta,* reports that studies in the plan area have shown that the highest soil salinities (ECe) and lowest apparent leaching fractions occurred at locations where water quality was the best and that higher leaching fractions and lower salt accumulations (ECe) were found at the locations where more saline irrigation water was used (1.1 dS/m or more). For this reason, it is expected that salt-sensitive crops would not be affected. Since Dry Bean is the southern Delta crop most sensitive to salinity (Table 11-10), and given that the yield for Dry Bean is not affected, then the yield of crops with higher salt tolerance would not be affected. Crop production would not be substantially reduced and Prime Farmland, Unique Farmland or Farmland of Statewide Importance would not be converted to nonagricultural uses. Impacts on agricultural resources would be less than significant.

SDWQ Alternative 3: 1.4 dS/m Salinity (Less than significant)

Using the modeling approach described in Section 11.4.2, there is a 5 percent yield reduction for Dry Bean irrigated with 1.4 dS/m water, with minimum amount of precipitation and a leaching fraction of 20 percent. When the median level of precipitation is used, the yield decline is less than 1 percent. For Almonds, the yield decline is 3 percent with a leaching fraction of 15 percent and minimal precipitation; with the median level of precipitation the yield decline is less than 1 percent. For Alfalfa there was no yield decline under the 15 percent leaching fraction with minimal precipitation. In addition, Appendix E, *Salt Tolerance of Crops in the Southern Sacramento–San Joaquin Delta,* reports that southern Delta studies have shown that the highest soil salinities (ECe) and lowest apparent leaching fractions occurred at locations where water quality was the best and that higher leaching fractions and lower salt accumulations (ECe) were found at the locations where more saline irrigation water was used (1.1 dS/m or more). Since Dry Bean is the southern Delta crop most sensitive to salinity (Table 11-10) and given that the reduction in yield for Dry Bean is less than 10 percent, crops with higher salt tolerance are expected to have no yield impacts. Accordingly, a 10 percent yield decline is not expected and it is not expected that Prime Farmland, Unique Farmland, or Farmland of Statewide Importance would be converted to non-agricultural uses. Therefore, impacts would be less than significant.

AG-2: Other changes in the existing environment which, due to their location or nature, could result in a conversion of farmland to nonagricultural use

Farmland is considered all agricultural land that is in production, therefore it is not necessary for these lands to be irrigated as it is for Prime Farmland, Unique Farmland, or Farmland of Statewide importance. If changes in the existing environment do not result in the Farmland being converted to nonagricultural use, i.e., the farmlands can be managed such that they remain in agricultural production, then significant impacts would not occur. Other changes to the existing environment, due to their location or nature, would be the reduction of surface water deliveries under each LSJR alternative and change in flows in the rivers and the amount of farmland in production that could be reduced as a result of these changes.

LSJR Alternative 1: No Project

The No Project Alternative would result in implementation of flow objectives identified in the 2006 Bay-Delta Plan. See Chapter 15, *LSJR Alternative 1 and SDWQ Alternative 1 (No Project Alternative)*, for the No Project impact discussion and Appendix D, *Evaluation of LSJR Alternative 1 and SDWQ Alternative 1 (No Project Alternative),* for the No Project Alternative technical analysis.

LSJR Alternative 2: 20% Unimpaired Flow (Less than significant)

As discussed under AG-1, LSJR Alternative 2 would not result in a substantial decrease in agricultural acreage or substantial change in cropping production in the LSJR area of potential effects. Therefore, it is expected that the conversion of farmland to nonagricultural uses would not occur. Impacts would be less than significant.

Agricultural lands along the Stanislaus River include orchard, field, and vegetable crops. An investigation by the U.S. Attorney in Sacramento, California (USDOI 1982) found that when the river is over 1,250 cubic feet per second (cfs) at Ripon, a 60-acre sugar beet field on the Collier Ranch was affected by a high water table (i.e. seepage), and that at flows above 1,500 cfs, the water tables rises sufficiently to damage almond and walnut orchards adjacent to the river. To monitor the water table, auger holes were dug on six properties that were thought to be susceptible under high river flow conditions. Flows greater than 1,500 cfs currently exist on the Stanislaus. Flows typically occur more than 30 percent of the time in March, April, and May and less than 15 percent of the time the remainder of the year (Tables 6-12 and 6-13 in Chapter 6, *Flooding, Sediment, and Erosion)*. Flows greater than 1,500 cfs would occur annually approximately 15 percent of the time in the Stanislaus River (Tables 6-12 and 6-13 in Chapter 6).

For this analysis, it is assumed that regardless of what crop is grown on the land, the high water table could still impact production. However, if this land is in sugar beet production it would represent less than 3 percent of the total sugar beet production in the LSJR area of potential effects and less than 0.01 percent of the total agricultural production in the area (Table 11-4). Therefore, this is expected to be a localized effect that would have a less-than-significant impact on the overall production of sugar beets in the area and would not substantially reduce crop production. Six properties of walnut and almond orchards adjacent to the Stanislaus River also were previously reported as being susceptible to damage at flows above 1,500 cfs. Flows greater than 1,500 cfs at Ripon are expected to be reduced throughout the year and overall on an annual basis under LSJR Alternative 2 (Table 6-13 in Chapter 6). Specifically, flows during March, April, and May would be reduced from greater than 30 percent to less than 10 percent of the time. Therefore, it is not expected that a substantial reduction in agricultural production would occur in the LSJR area of potential effects as a result of seepage when compared to baseline. Because crop production would not be substantially reduced, impacts would be less than significant.

LSJR Alternative 3: 40% Unimpaired Flow (Less than significant)

Total irrigated lands would be reduced by 128,295 acres under LSJR Alternative 3. Under Alternative 3, Corn acreage (39,688 acres) out of production could be rotated such that all Corn lands are irrigated at least once every other year and dryland farmed or fallowed in other years, maintaining agricultural use. The remaining acreage (88,607 acres) could also be converted to dryland farming or fallowed, thus maintaining agricultural use. However, if this remaining acreage is not dryland farmed or fallowed and is converted to a non agricultural use, it would still represent less than 10 percent of the baseline (934,820) irrigated lands within the LSJR area of potential effects at the 80 percent exceedance. Therefore, impacts on agricultural resources would be less than significant.

The impact on sugar beets adjacent to the Stanislaus River would be the same under this alternative as described for LSJR Alternative 2, because the affected acres would represent less than 3 percent of the total production and effects are expected to be localized. Flows greater than 1,500 cfs on the Stanislaus River would increase in frequency under LSJR Alternative 3 when compared to baseline. Specifically, flows would increase in February, May, and June by a maximum of approximately 20 percent but decrease in March by a maximum of approximately 17 percent (Table 6-13 in Chapter 6, *Flooding, Erosion, and Sediment*). The overall annual frequency of flows greater than 1,500 cfs would remain at 15 percent (Table 6-13 in Chapter 6). The six properties of Walnuts and Almonds susceptible to damage at flows greater than 1,500 cfs would likely range in size; however, the average farm size in California is 312 acres[2]. Therefore, properties that are considered susceptible to damage would be expected to be approximately 1,872 acres, assuming that 100 percent of the acreage within the properties is affected by seepage. These properties represent less than 1 percent of Almond and Pistachio acreage in the LSJR area of potential effects and less than 0.02 percent of all agricultural production in the LSJR area of potential effects (Table 11-4). Therefore, it is not expected that a substantial reduction in agricultural production would occur in the LSJR area of potential effects as a result of seepage when compared to baseline. Because there is no substantial reduction in crop production and thus acreage, impacts would be less than significant.

LSJR Alternative 4: 60% Unimpaired Flow (Significant and unavoidable)

Total irrigated lands would be reduced by 210,812 acres under LSJR Alternative 4. If acreage cannot be converted to another agricultural use, such as dryland farming or grazing lands, it would no longer be used for agriculture. Furthermore, this reduction in acreage would be greater than 10 percent of the baseline irrigated lands within the LSJR area of potential effects at 80 percent exceedance (934,820 acres). As discussed above under AG-1, in order to reduce significant impacts on agricultural lands, the State Water Board would need to require lower flows than would be required by LSJR Alternative 4. Evaluating the effects of lower flows on the different rivers is part of other alternatives (i.e., LSJR Alternatives 1 and 2) and is separately considered in this document. Requiring lower flows to reduce agricultural impacts cannot be independently applied under LSJR Alternative 4 as a mitigation measure because requiring lower flows would be inconsistent with the terms of LSJR Alternative 4 (i.e., requiring 60 percent unimpaired flow). Also, discussed above under AG-1, irrigation efficiency measures could reduce the conversion of irrigated farmland to nonagricultural uses; however, the extent of land conversion is unknown, and therefore the effectiveness of irrigation efficiency in reducing impacts cannot be quantified. Thus, because the rotation of crops, use of dryland farming, and irrigation efficiency would not reduce the amount of cropland affected, impacts would be significant and unavoidable.

Flows greater than 1,500 cfs on the Stanislaus River would increase in frequency under LSJR Alternative 4 when compared to baseline. The overall annual frequency of flows greater than 1,500 cfs would increase from 15 percent to 24 percent (Table 6-13 in Chapter 6). However, as described under LSJR Alternative 3, the affected properties represent less than 1 percent of Almond and Pistachio acreage in the LSJR area of potential effects and less than 0.03 percent of all agricultural production in the LSJR area of potential effects (Table 11-4). Therefore, it is not expected that a

[2] It is estimated that over half of the farms in the San Joaquin Basin are less than 100 acres (AWMC 2010).

substantial reduction in agricultural production, and thus acreage, would occur in the LSJR area of potential effects as a result of seepage when compared to baseline. Impacts would be less than significant.

SDWQ Alternative 1: No Project

The No Project Alternative would result in implementation of salinity objectives identified in the 2006 Bay-Delta Plan. See Chapter 15, *LSJR Alternative 1 and SDWQ Alternative 1 (No Project Alternative)*, for the No Project impact discussion and Appendix D, *Evaluation of LSJR Alternative 1 and SDWQ Alternative 1 (No Project Alternative),* for the No Project Alternative technical analysis.

SDWQ Alternatives 2 and 3: 1.0 dS/m Salinity and 1.4 dS/m Salinity (Less than significant)

As discussed under AG-1 for SDWQ Alternatives 2 and 3, reductions in crop acreage in the SDWA are not expected beyond what may typically occur in the area as a result of normal farming practices. Therefore, it is not expected that a conversion of farmland to nonagricultural uses would occur in the SDWA. Impacts would be less than significant.

11.5 Cumulative Impacts

11.5.1 Definition

Cumulative impacts are defined in the State CEQA Guidelines (Cal. Code Regs., tit. 14, § 15355) as "two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts." A cumulative impact occurs from "the change in the environment which results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time" (Cal. Code Regs., § 15355(b)).

Consistent with the State CEQA Guidelines (Cal. Code Regs., tit. 14, §15130(a)), the discussion of cumulative impacts in this chapter focuses on significant and potentially significant cumulative impacts. The State CEQA Guidelines (14 CCR 15130(b)) state the following:

> The discussion of cumulative impacts shall reflect the severity of the impacts and their likelihood of occurrence, but the discussion need not provide as great detail as is provided for the effects attributable to the project alone. The discussion should be guided by the standards of practicality and reasonableness, and should focus on the cumulative impact to which the identified other projects contribute rather than the attributes of other projects which do not contribute to the cumulative impact.

11.5.2 Past, Present, and Reasonably Foreseeable Future Projects

Chapter 16, *Cumulative Impact Summary, Growth-Inducting Effects, and Irreversible Commitment of Resources*, includes a list of past, present, and reasonably foreseeable future projects considered for the cumulative analysis.

Present and reasonably foreseeable future projects are projects that are currently under construction, approved for construction, or in final stages of formal planning. These projects were identified by reviewing available information regarding planned projects and are summarized in Chapter 16. These projects include the following.

- Agricultural Drainage Selenium Management Program
- Bay-Delta Conservation Plan and Alternative Delta Conveyance Facilities
- National Marine Fisheries Service (NMFS) Biological Opinion and Conference Opinion on the Long-Term Operations of the CVP and SWP and U.S. Fish and Wildlife Service (USFWS) Biological Opinion on the Long-Term Operations of CVP and SWP (delta smelt)
- CALFED Ecosystem Restoration Program
- Central Valley Water Board's Salt and Boron TMDL (at Vernalis).
- City of Stockton DWSP
- City of Tracy Connection to the South San Joaquin Irrigation District (SSJID)
- City of Tracy Desalination and Green Energy Project
- Conditional Waiver of Waste Discharge Requirements for Irrigated Lands
- Contra Costa Alternative Intake Project
- Delta-Mendota Canal Recirculation Project
- Dos Rios Ranch
- Eastern San Joaquin Integrated Conjunctive Use Program
- Farmington Groundwater Recharge Project
- Federal Energy Regulatory Commission (FERC) Relicensing of the Don Pedro Project (FERC Project No. 2299)
- FERC Relicensing of the Merced River Hydroelectric Project (FERC Project No. 2179)
- Grasslands Bypass Project discharges of salt, selenium, and boron
- Grayson River Ranch Conservation Easement
- Habitat Restoration Plan for the Lower Tuolumne River Corridor
- Levee Repair–Levee Evaluation Program
- Lower Tuolumne River Big Bend Project
- Lower San Joaquin Flood Improvement Project
- San Joaquin River Salinity Management Plan
- San Joaquin Water Quality Project Selenium TMDL
- SEWD Dr. Joe Waidhofer Water Treatment Plant Expansion
- South Delta Improvements Program
- South Delta Temporary Barriers Project
- South County Water Supply Project

- SSJID and SEWD water transfer agreement
- SSJID Division 9 Irrigation Enhancement Project
- SSJID increased surface water agreements/sales to municipalities and associated infrastructure
- SSJID On-Farm Water Conservation Program
- Upper San Joaquin River Restoration Program
- Update to Bay-Delta Water Quality Control Plan: Phase II
- Vernalis Adaptive Management Program (VAMP)

11.5.3 Significance Criteria

Two significance criteria must be met for an environmental consequence to have a significant cumulative impact: (1) the effect must make a cumulatively considerable incremental contribution to an overall cumulative impact, and (2) the overall cumulative impact (considering past, present, and reasonably foreseeable future projects) must be significant. (See Cal. Code Regs., tit. 14, §§ 15064, 15065, 15130.) The cumulative analysis uses the impact threshold topics discussed in the impact analysis (i.e., conversion of agricultural lands).

11.5.4 Mitigation Measures for Significant Cumulative Impacts

As specified by Section 15130 of the State CEQA Guidelines (2012), the analysis of cumulative impacts will examine feasible options for mitigating or avoiding a project's contribution to any significant cumulative effects. With some projects, the only feasible mitigation for cumulative impacts may be the adoption of ordinances or regulations rather than the imposition of conditions on a project-by-project basis. Mitigation measures to reduce an alternative's contribution to significant cumulative effects is presented below where feasible and appropriate.

11.5.5 Cumulative Impact Analysis

Methodology

The methodology to analyze cumulative impacts associated with agricultural resources identifies the significant impacts from the alternatives, qualitatively describes the cumulative impacts expected from past, present, and reasonably foreseeable projects, and then determines whether the alternatives have a cumulatively considerable impact when evaluated with the past, present and reasonably foreseeable future projects impacts. This analysis assumes that reasonably foreseeable future projects would develop and adopt mitigation to minimize the significance of the impacts on agricultural resources to the extent feasible. Nonetheless, it may not be feasible to fully mitigate the impacts on agricultural resources. Where appropriate, the cumulative analysis is combined for various alternatives.

Geographic Scope

Cumulative impacts on agricultural resources can result from a reduction in the acreage of irrigated cropland or a reduction in water supply for irrigation as it can potentially lead to a conversion of agricultural land to nonagricultural uses. Changes in croplands can occur along river corridors where agricultural lands are converted to nonagricultural uses, and on other irrigated lands where there is a decrease in production acreage or lack of adequate water supply. The geographic scope of the cumulative impact analysis includes the LSJR area of potential effects, and the SEWD and CSJWCD service areas. This includes Madera, Merced, Stanislaus, and San Joaquin Counties. It also includes the SDWA boundaries.

Analysis

Past and present projects have led to the conversion of natural vegetation in the plan area to irrigated agricultural land. The development and operation of reservoirs and irrigation diversions, and the development of groundwater resources for irrigation, supported the land conversion.

Population increases and the conversion of agricultural land to urban uses are expected to continue, as will the use of water resources to serve urban uses. River restoration efforts may require Prime or Unique Farmland or Farmland of Statewide Importance along river corridors to be converted to nonagricultural uses. The change from irrigated land to nonagricultural uses would be required because river restoration efforts might require staging areas for construction purposes or additional riparian habitat to complete the restoration projects. These changes could be permanent or temporary, depending on the need. While flood control projects may result in a reduction of some agricultural lands, generally they are assumed to be beneficial because upgrading and maintaining levees would serve to protect agricultural lands. Overall, past projects that reclaimed land and provided water to areas generally expanded agricultural uses; however, present and future projects are likely to continue to constrict or reduce agricultural lands. Therefore, the cumulative impacts of past, present, and reasonably foreseeable future projects have been cumulatively considerable with respect to agricultural resources.

LSJR Alternative 2 is not expected to result in the loss of Prime, Unique, and Farmland of Statewide importance because the reduction of surface water diversions is expected to be less or very similar when compared to baseline. Therefore, it is expected that irrigation water can continue to be used to support these specific farmland designations. Accordingly, the incremental contribution of LSJR Alternative 2 is not expected to be cumulatively considerable and when considered with past, present and reasonably foreseeable future projects, cumulative impacts would be less than significant.

LSJR Alternatives 3 or 4 are expected to result in the loss of Prime, Unique, and Farmland of Statewide Importance acreage and the conversion to nonagricultural uses. This is because with the reduction of surface water diversions, it is expected that there would not be enough irrigation water to maintain these specific farmland designations. As discussed in Section 11.4.3, while groundwater pumping and irrigation efficiency measures would be expected to offset the loss of Prime, Unique, and Farmland of Statewide Importance acreage, these effects of these measures cannot be fully quantified and likely would not fully mitigate expected conditions. Therefore, it is expected that the incremental contribution of LSJR Alternative 3 or 4 would be cumulatively considerable as either alternative could result in the conversion of Prime, Unique, and Farmland of Statewide Importance to nonagricultural uses. When considered with past, present and reasonably foreseeable future projects, cumulative impacts would be significant and unavoidable.

In the SDWA, past, present, and reasonably foreseeable future projects have resulted in the conversion of wetland areas to agriculture. Agricultural uses have increased over time and are currently the primary land use in the southern Delta. There are a number of present and reasonably foreseeable future projects that are expected to result in an improvement in water quality in the southern Delta (e.g., Conditional Waiver of Waste Discharge Requirements for Irrigated Lands, Central Valley Water Board's Salt and Boron TMDL, Grasslands Bypass Project discharges of salt, selenium, and boron, San Joaquin Salinity Management Plan, and, San Joaquin Water Quality Project salinity TMDL). This improvement in water quality is expected to support agricultural uses in the southern Delta. Therefore, past, present, and reasonably foreseeable future projects have not resulted in a cumulatively considerable impact on agriculture in the SDWA.

The impacts of SDWQ Alternatives 2 or 3 on agricultural resources in the southern Delta are considered to be less than significant because water quality would not be degraded such that agricultural uses would be affected. Furthermore, these alternatives are meant to protect agricultural beneficial uses in the southern Delta. Therefore, the incremental contribution of SDWQ Alternatives 2 or 3 would not be cumulatively considerable, and when considered with past, present, and reasonably foreseeable future projects, cumulative impacts from these alternatives would be less than significant.

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