

**Initial Study and  
Proposed Negative Declaration  
for  
Western Canal Water District 2012 Water Transfer Program**

**Lead Agency: Western Canal Water District**

**For additional information  
regarding this document contact:**

Ted Trimble, General Manager, Western Canal Water District  
P.O. Box 190  
Richvale, California 95974

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## SECTION 1 PROJECT DESCRIPTION

### 1.0 PROJECT INTRODUCTION AND BACKGROUND

The Western Canal Water District (WCWD) proposes to sell up to 38,372 acre-feet (af) of water to the participating member districts of the State Water Contractors Incorporated (Buyers)<sup>1</sup> during the 2012 irrigation season. Buyers are seeking up to approximately 85,000 af of transfer water from various willing sellers in the Sacramento Valley during the 2012 irrigation season. Purchasing this water would lessen potential water supply shortages to these Buyers that may occur as a result of dry hydrologic conditions and regulatory restrictions on pumping in the Delta.

As willing sellers, WCWD would make up to 38,372 af of water available to Buyers by idling cropland (i.e., non-irrigation of farmland by voluntary participants).

Water made available by crop idling within the boundaries of the WCWD could then be retained and stored by the Department of Water Resources (DWR) for delivery to Buyers.

#### Western Canal Water District

WCWD's entitlement to Feather River water is 295,000 acre-feet, subject to curtailment under a 1986 agreement with the State of California. WCWD proposes to not divert a portion of its water from the Feather River under this one-year transfer, which would allow DWR to deliver a portion of the foregone water to Buyers through the State Water Project (SWP). The WCWD boundaries encompass approximately 67,500 acres in the northern Sacramento Valley in Butte and Glenn Counties (Figure 1). Within the WCWD boundary are approximately 58,140 irrigable acres, of which approximately 52,300 acres are dedicated primarily to the production of rice.

The 1986 agreement with the State of California (1986 Agreement) requires written approval from DWR before WCWD can transfer water outside the service areas of WCWD. An agreement between DWR and the proposed water purchasers to store or implement the water through the SWP will also be required to implement the transfer.

For the last five years, on average, less than 1% of the acreage dedicated to rice production in WCWD is fallowed and temporarily removed from farm production so improvements such as weed abatement, land leveling, etc. can be made. Land idled for purposes of developing water for this transfer would be those acres above the amount of historically fallowed land not associated with water transfers.

The proposed project would idle up to 20% of the irrigable acreage in WCWD's service area that would otherwise be irrigated in 2012. Idling would occur within approximately 58,140 acres dedicated primarily to rice production, so up to 11,628 acres could be idled under this program. The accepted ETAW for rice culture is 3.3 acre feet per acre per growing season, which is consistent with the recent ETAW rates used for water transfers in the Sacramento Valley based on crop idling of rice acreage (*California Water Plan Update. Bulletin 160-05*. December 2005). Thus, the water made available for transfer

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<sup>1</sup> Buyers are the following State Water Project contractors: Dudley Ridge Water District, Kern County Water Agency, and Palmdale Water District. Depending on the hydrologic conditions existing in the spring of 2012, all or a portion of these agencies may elect to receive all or a portion of water purchased.

by reduced crop evapotranspiration for the projected idled acreage would be up to 38,372 acre feet (11,628 acres x 3.3 AF/acre).

Under the 1986 Agreement, WCWD's water entitlement is subject to curtailment under certain circumstances related to dry hydrologic conditions. If WCWD's entitlement is curtailed for the 2012 irrigation season, WCWD does not intend to participate in any transfer.

### **1.1 Project Location**

#### **WCWD**

The project area, from which the water for this transfer will be made available, is defined by the WCWD boundaries which encompass approximately 67,500 acres in the northern Sacramento Valley in Butte and Glenn Counties (Figure 1). Within the WCWD boundary are approximately 58,140 irrigable acres, of which approximately 52,300 acres are dedicated primarily to the production of rice.

Land idled for the purpose of this transfer will be drawn from the irrigable acreage within WCWD's boundaries. Since the program will be offered to all eligible growers and it is anticipated that there will be more interest than WCWD desires to offer, a wide dispersal of acreage enrolled in the program is expected. WCWD will encourage program participants to disperse idled acreage and make clear to participants that large, contiguous blocks of idled land related to this program are undesirable. Dispersing the program acres throughout WCWD assures that adequate water levels will be maintained in transmission canals so that wildlife impacts otherwise associated with dewatering the canals will be avoided, as will impacts associated with habitat loss which might occur with large, contiguous blocks of fallowed land. Only cultivated rice land that is subject to intense farming practices will be affected. Adjoining areas, non-rice land, other irrigated lands, drains, wetlands and waterfowl habitat will not be affected, as those areas will receive their normal entitlement and canals and drains will operate at normal operating capacity.

### **1.2 Water Availability and Transfer**

No new construction or improvements by WCWD, Buyers, or DWR would be necessary for the production and transfer of this water.

Water that would not be diverted would be available for transfer to Buyers through SWP facilities operated by DWR, including Lake Oroville. Water would accrue in storage on the basis of estimates of the amount of water that would have been consumed on the idled land but for the program. That is, the water that would have been consumed in the process of crop use would be available for transfer.

The portion of applied water, which would have normally returned to the Feather/Sacramento River system as tailwater or groundwater discharge to surface waters, would remain available for instream use and diversion by others and would not be transferred.

As the ETAW for rice culture in the Sacramento Valley is calculated at 3.3 acre feet per acre per growing season, each acre of idled rice production will make available for transfer 3.3 acre feet of water throughout the growing season.

The typical growing season for rice in California is May through September. The potential ETAW demand across these months is shown in Table 1.1 with the corresponding water production expectations

based on the WCWDs providing the maximum amount of transfer water from following 20% of their acreage.

**TABLE 1.1**

Water Production Schedule

	May	June	July	August	September
ETAW in Percent	15	22	24	24	15
Water Production In Acre Feet: WCWD	5,755.8	8,441.8	9,209.3	9,209.3	5,755.8
Total Production For Transfer in 2011 in Acre-Feet					38,372

During the implementation of the proposed project, water transferred by WCWD would be deemed transferred at WCWD's points of diversion on the Thermalito Afterbay and custody would then transfer to Buyers. As the operator of the SWP, depending on the hydrologic and regulatory conditions controlling SWP operations, DWR may be able to utilize Lake Oroville storage to facilitate the transfer during periods when Delta conditions prevent export of the transfer water. DWR would make every effort to use Lake Oroville to regulate the water in a manner which would allow for delivery of the water through the Sacramento-San Joaquin Delta, for export through the SWP Harvey O. Banks (Banks) Pumping Plants for ultimate delivery to Buyers.

All water exported at the SWP and CVP pumping plants is pumped consistent with existing regulatory restrictions including the criteria contained in State Water Resources Control Board (SWRCB) Water Rights Decision 1641 (D1641) and the biological opinions on the long-term operations of the Central Valley Project and the State Water Project issued by the United States National Marine Fisheries Service and United States Fish and Wildlife Service, respectively. DFG has issued consistency determinations for the two biological opinions pursuant to Fish and Game Code Section 1080.1, along with incidental take permits (ITP), and has also issued separate ITP for the protection of long-fin smelt. In issuing the biological opinions and take permit, the resource agencies determined that, if operated consistent with the conditions contained in the biological opinions, the coordinated operations of the CVP and SWP are not likely to adversely affect the covered species. As a result of litigation regarding the biological opinions, a Federal District Court has recently invalidated the biological opinions and remanded them to the agencies with deadlines for issuing new opinions in accordance with the Court's findings. However the operational restrictions contained in the biological opinions remain in effect until the new biological opinions are issued.

Restrictions in the biological opinions significantly limit SWP exports through Banks. Export of transfer water is limited to the period July through September; however that period can be reduced if available capacity is required to export SWP water or other criteria are limiting SWP operations during that period.

Export of transfer water is limited to the period July through September; however that period can be reduced if available capacity is required to export SWP water or other criteria are limiting SWP operation during that period.

A portion of the water moved across and exported from the Delta must be dedicated to Delta outflow to assure compliance with the controlling water quality objectives in the Delta. This is typically referred to as carriage water. DWR assesses carriage water losses on all transferred moved through the Delta to compensate for the potential effects of the exports made on behalf of the transfers in maintaining water quality in the Delta. DWR estimates that carriage water requirements for transfers moved across the Delta and exported at Banks is approximately 20% of the water transferred. Therefore, this transfer could yield up to approximately 30,698 acre feet [11,628 ac x 3.3 AF/ac less 20%] to Buyers.

### 1.3 Use of Water by Buyers

It is contemplated that the Buyers will be required to purchase the water by April 13, 2012. If the water is purchased, Buyers would take delivery of this water in a manner physically identical to their typical SWP deliveries. Each Buyer would be entitled to a proportionate share of the total amount of water purchased as provided in Table 1.2. The transfer water would provide additional resource options to Buyers to mitigate potential dry-year water shortage conditions in 2012. This water would represent backfilling of a shortfall of water normally and historically received into Buyers service areas. Accordingly, any water transferred under the proposed Project would not represent a dependable long-term increase in supply. As such, no adverse Project-specific impacts to Buyers' service areas due to the proposed transfer would occur.

**Table 1.2**

<b>Buyers Proportionate Share of Water Made Available by Sutter Extension Water District (Percentage)</b>	
<b>BUYERS</b>	<b>Water Purchase Percentage</b>
Dudley Ridge Water District	4.8
Kern County Water Agency	93.2
Palmdale Water District	2.0
	100



## SECTION 2 INITIAL STUDY

The following Initial Study, Environmental Checklist, and evaluation of potential environmental effects (see Section 3) were completed in accordance with Section 15063(d)(3) of the State CEQA Guidelines to determine if the proposed project could have any potentially significant impact on the physical environment.

An explanation is provided for all determinations, including the citation of sources as listed in Section 4. A "No Impact" or "Less-than-significant Impact" determination indicates that the proposed project will not have a significant effect on the physical environment for that specific environmental category. No environmental category was found to have a potentially significant adverse impact with implementation of the proposed project.

### INITIAL STUDY AND ENVIRONMENTAL CHECKLIST FORM

- 1. Project Title:** Western Canal Water District 2012 Water Transfer Program
- 2. Lead Agency Name and Address:** Western Canal Water District  
PO Box 190  
Richvale, California 95974
- 3. Contact Person and Phone Number:** Ted Trimble (530) 342-5083
- 4. Project Location:** Refer to Section 1 (1.1) of the Negative Declaration
- 5. Project Sponsor's Name and Address:** Western Canal Water District  
PO Box 190  
Richvale, California 95974
- 6. Description of Project:** Refer to Section 1 of the Negative Declaration.
- 7. Surrounding land uses and setting:** Agricultural/rural setting zoned for agricultural use.
- 8. Other agencies whose approval is required:**

Buyers are the following State Water Project contractors: Dudley Ridge Water District, Kern County Water Agency, and Palmdale Water District. Depending on the hydrologic conditions existing in the spring of 2012, all or a portion of these agencies may elect to receive all or a portion of water purchased.

California Department of Water Resources: contract approval and CEQA compliance.

**ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED:**

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact" as indicated by the checklist on the following pages.

- |                                                      |                                                             |                                                 |
|------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------|
| <input type="checkbox"/> Aesthetics                  | <input type="checkbox"/> Agriculture Resources              | <input type="checkbox"/> Air Quality            |
| <input type="checkbox"/> Biological Resources        | <input type="checkbox"/> Cultural Resources                 | <input type="checkbox"/> Geology /Soils         |
| <input type="checkbox"/> Hazards/Hazardous Materials | <input type="checkbox"/> Hydrology / Water Quality          | <input type="checkbox"/> Land Use / Planning    |
| <input type="checkbox"/> Mineral Resources           | <input type="checkbox"/> Noise                              | <input type="checkbox"/> Population / Housing   |
| <input type="checkbox"/> Public Services             | <input type="checkbox"/> Recreation                         | <input type="checkbox"/> Transportation/Traffic |
| <input type="checkbox"/> Utilities / Service Systems | <input type="checkbox"/> Mandatory Findings of Significance |                                                 |

**DETERMINATION:**

On the basis of this initial evaluation:

- I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.
- I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.
- I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.
- I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.
- I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

Ted Trimble  
 \_\_\_\_\_  
 Signature

2/27/2012  
 \_\_\_\_\_  
 Date

Ted Trimble  
 \_\_\_\_\_  
 Printed Name

WCWD  
 \_\_\_\_\_  
 For

### SECTION 3 EVALUATION OF ENVIRONMENTAL IMPACTS

**I. AESTHETICS – Would the proposed Action:**

Issues and Determination:	<u>Potentially Significant Impact</u>	<u>Less Than Significant With Mitigation Incorporation</u>	<u>Less Than Significant Impact</u>	<u>No Impact</u>
a) Have a substantial adverse effect on a scenic vista?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Discussion:

- a,b,d) **No Impact.** As there would be no construction activities with project implementation, no potential aesthetic resources would be impacted or altered. In addition, there would be no new sources of light and glare added to the project site. Hence, there would be no impacts to aesthetics with the proposed project.
  
- c) **Less-than-significant Impact.** The pattern of cropping in the area within the WCWD’s jurisdiction would be altered slightly, in that somewhat more land would be idled due to the implementation of the proposed project (i.e., up to 20% of total irrigable acreage). Idled land is a typical feature of the agricultural landscape in the WCWD’s jurisdiction and would not differ substantially from the existing environmental setting. As such, there would be a less-than-significant impact to the existing visual character within the farmlands occurring in WCWD’s jurisdiction.

**II. AGRICULTURE RESOURCES: Would the proposed Action:**

Issues and Determination:	<i>Potentially Significant Impact</i>	<i>Less Than Significant With Mitigation Incorporation</i>	<i>Less Than Significant Impact</i>	<i>No Impact</i>
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland to non-agricultural use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Discussion:

**a-c) No Impact.** As a single-year activity, the proposed project would not convert any farmland (Prime, Unique, Important or otherwise) to non-agricultural uses. The proposed activity would result in a reduction in the amount of farmland irrigation during the 2012 growing season and an increase in the amount of land idled for that year. Participation in the proposed project would be solely voluntary. Zoning, agricultural conversion and Williamson Act issues would not be changed. No impact to agricultural resources would occur with project implementation.

**III. AIR QUALITY: Would the proposed Action:**

Issues and Determination:	<i>Potentially Significant Impact</i>	<i>Less Than Significant With Mitigation Incorporation</i>	<i>Less Than Significant Impact</i>	<i>No Impact</i>
a) Conflict with or obstruct implementation of the applicable Air Quality Attainment Plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Violate any air quality standard or contribute to an existing or projected air quality violation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Issues and Determination:	<i>Less Than Potentially Significant Impact</i>	<i>Significant With Mitigation Incorporation</i>	<i>Less Than Significant Impact</i>	<i>No Impact</i>
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions, which exceed quantitative thresholds for ozone precursors)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Expose sensitive receptors to substantial pollutant concentrations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
e) Create objectionable odors affecting a substantial number of people?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Discussion:

**a-e) No Impact.** The Project site is located in the Sacramento Valley Air Basin. To the extent less agricultural land would be cultivated, less air pollutant emissions would be emitted from normal farm practices (e.g., internal combustion engine emissions from tilling, seeding, pesticide application, etc.). These reductions in air emissions would be beneficial; however, such reductions (i.e., up to 20% of typical farming activities) would not be that noticeable within the Sacramento Valley Air Basin for the short project duration. Odors associated with farming activities may lessen to a minor degree, due to the decrease in farming activities during the growing season. Overall, there would be no impacts to the air basin with project implementation.

**IV. BIOLOGICAL RESOURCES – Would the proposed Action:**

Issues and Determination:	<i>Potentially Significant Impact</i>	<i>Less Than Significant With Mitigation Incorporation</i>	<i>Less Than Significant Impact</i>	<i>No Impact</i>
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Issues and Determination:	<u>Potentially Significant Impact</u>	<u>Less Than Significant With Mitigation Incorporation</u>	<u>Less Than Significant Impact</u>	<u>No Impact</u>
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife corridors, or impede the use of native wildlife nursery sites?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Conservation Community Plan, or other approved local, regional, or state habitat conservation plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Discussion:

- a) **Less than significant Impact.** Several special-status wildlife species have the potential to occur within the project area: the giant garter snake (listed as state and federally threatened), the northwestern pond turtle (listed as a state species of special concern and federal species of concern), the winter-run Chinook salmon (listed as state and federally endangered), the spring-run Chinook salmon (listed as state and federally threatened), the delta smelt (listed as state and federally threatened), the longfin smelt (listed as state threatened), and the steelhead (listed as federally threatened), and the green sturgeon (listed as federally threatened).

**Giant Garter Snake (*Thamnophis gigas*)**

The giant garter snake can be found in agricultural wetlands such as irrigation and drainage canals. These artificial waterways can be used for purposes such as ease of movement; protection from predators; warmth to aid metabolism, gestation, and digestion and as a food source. (Draft Recovery Plan for the Giant Garter Snake. 1999.) While up to 11,628 acres of land may be idled throughout the WCWD’s jurisdiction as a result of the project, water levels in irrigation and drainage canals would be maintained at normal operating elevations and no drying of such conveyances would occur. As such, WCWD’s water conveyance system would remain watered and available to the snake and other wildlife that utilize it.

Flooded rice fields in the Sacramento Valley can be used by the giant garter snake for foraging, cover and dispersal purposes. The non-irrigated project fields would have little or no vegetation, retaining the open character that is currently present in fields that are between plantings or that otherwise have relatively little vegetative cover. Because the maximum percentage of land idled for this project would be up to 20% of the District's irrigable acreage, along with less than 1% of historically fallowed acreage, at least 80% of WCWD's irrigable acreage would remain unaffected. Lands taken out of production would be dispersed throughout the WCWD's jurisdiction such that the contiguity of idled lands would be minimized allowing for a mosaic of lands that could be utilized by the snake throughout WCWD's jurisdiction. The changes to agricultural fields that would occur under the proposed project could have minor and temporary effects on the giant garter snake through the decrease in potential cover and foraging areas as a result of the reduction in planted rice acreage. The one-year duration of the program minimizes any potential disruption to the giant garter snake.

Crop idling conservation measures that were included in the USFWS Biological Opinion for the 2009 Drought Water Bank water transfers will be incorporated into the proposed 2012 water transfer program. These include:

The water sellers will ensure a depth of at least two feet of water is maintained in the major irrigation and drainage canals to provide movement corridors for giant garter snakes;

Water will not be purchased from a field fallowed during the immediately preceding two years; however, water may be purchased from the same parcel in successive years. Because no transfers occurred in 2011, this restriction is not expected to apply to the proposed 2012 transfer;

Water transfer actions will be limited so that no more than 20 percent of rice fields are idled in any one County, parcels idled will be no more than 320 acres in size, and will be distributed across the landscape in a checkerboard pattern (idled parcels will not be adjacent to each other). Having the fallowed/idled rice acreage spread throughout the Sacramento Valley will help to assure that the total water conveyance system remains in its normal year wetted-up condition. The 320 acre blocks will not be located on opposite sides of a canal or other waterway, and will not be immediately adjacent to another fallowed parcel. The 20 percent limitation also helps alleviate potential socioeconomic effects and is based on California Water Code. California Water Code Section 1745.05 (b) states that: "The amount of water made available by land fallowing may not exceed 20 percent of the water that would have been applied or stored by the water supplier in the absence of any contract entered into pursuant to this article in any given hydrological year, unless the agency approves, following reasonable notice and a public hearing, a larger percentage."

Parcels participating in the proposed crop idling program will not include:

Lands between Refuges that serve as corridors: lands adjacent to Hunters and Logan Creeks between Sacramento and Delevan National Wildlife Refuges; the Colusa Basin drainage canal between Delevan and Colusa National Wildlife Refuges; Little Butte Creek between Llano Seco and Upper Butte Basin Wildlife Area; and Butte Creek between Upper Butte Basin and Gray Lodge Wildlife Areas;

Lands adjacent to Butte Creek, the Colusa Drainage Canal, Gilsizer Slough, the land side of the Toe Drain along the Sutter Bypass, Willow Slough and Willow Slough Bypass in Yolo County, and lands in the Natomas Basin (groundwater substitution is proposed for this area).

In addition, sellers will agree to voluntarily perform giant garter snake best management practices (BMPs), including educating all staff to recognize and avoid contact with giant garter snakes, clean only one side of a conveyance channel per year, provide rock-basking habitat in the system's water prisms, and raise flail mower blades to at least six inches above the canal operation and maintenance road surfaces.

Because the project would not convert any agricultural lands to non-agricultural land uses, the only change would be a temporary, one-year increase in the time between planting of rice crops within a percentage of the WCWD farmlands. In addition, at least 80% of WCWD's fields would remain unaffected by the proposed project. As such, the proposed project could have a less-than-significant impact to the giant garter snake within the existing farmlands due to a short-term decrease in potential cover and foraging areas for this species.

**Northwestern Pond Turtle (*Clemmys marmorata marmorata*)**

The northwestern pond turtle inhabits waters with little or no current. The banks of inhabited waters usually have thick vegetation, but basking sites such as logs, rocks, or open banks must also be present. Pond turtles lay their eggs in nests in upland areas, including grasslands, woodlands, and savannas. Pond turtles could be found in and along irrigation and drainage canals. The proposed project would not eliminate water from the conveyance canals within the WCWD's service area. Therefore the proposed project would not impact the western pond turtle.

**Chinook Salmon (*Oncorhynchus tshawytscha*), Delta Smelt (*Hypomesus transpacificus*), Longfin Smelt (*Spirinchus thaleichthyes*), Green Sturgeon (*Acipenser medirostris* and Steelhead (*Oncorhynchus mykiss*)**

The Sacramento-San Joaquin Delta is a migration corridor and seasonal rearing habitat for winter-run Chinook salmon and steelhead. It provides spawning and nursery habitat for Delta Smelt. All water exported at the SWP and CVP pumping plants is pumped consistent with existing regulatory restrictions including the criteria contained in State Water Resources Control Board (SWRCB) Water Rights Decision 1641 (D1641), the biological opinions for the protection of Delta smelt and anadromous fish and mammal species, and DFG take permit for the protection of long-fin smelt. The proposed project does not increase Delta export rates beyond the currently authorized limits. In issuing the biological opinions and take permit, the resource agencies determined that, if operated consistent with the conditions contained in those documents, the coordinated operations of the CVP and SWP are not likely to adversely affect the covered species. As such, there would be no impact from the proposed project on listed fish species in the Sacramento-San Joaquin Delta.

The proposed project would result in less-than-significant impacts to special status species because no wildlife would be directly affected by the idling activities and indirect impacts to habitat, such as a decrease in potential foraging and cover habitat for the giant garter snake, would be temporary (i.e., one year) and minimal.

- b) **No impact.** The proposed action would have no effect on riparian or other sensitive habitats. All canals serving such areas would be in normal operations and all normal water deliveries thereto would be continued to those lands. Such areas may not participate in transfers, and all canals and drains adjacent to those lands will be in operation at normal operating levels. Therefore there would be no impact to riparian or other sensitive habitats.
- c) **No Impact.** No impacts to wetlands would occur from the proposed project due to continuation of normal deliveries to such lands during the Project; such lands are ineligible to participate in land idling transfers; and all canals and drains serving or transversing such areas will be operated at normal operating elevations throughout the Project.
- d) **Less than significant Impact.**

**Waterfowl**

The proposed project would result in the fallowing of up to 20% of irrigable acreage fields within WCWD's jurisdiction. Rice fields in the project area serve as foraging habitat for many waterfowl species. However, implementation of the project would not interfere substantially with the foraging of native-resident or migratory waterfowl because other foraging habitat is abundant both locally and

regionally. Because the proposed project would not convert any agricultural lands to non-agricultural land uses, the only change would be a one-year increase in the time between planting of rice in the project farmlands and a minor reduction in the acreage of rice lands available to waterfowl for foraging in 2010. This reduction in foraging acreage is less-than-significant based upon the regional abundance of flooded foraging habitat.

**Fish Species**

The proposed project may increase flows during July through September in the Sacramento River resulting from the movement of transfer water. Such flow increases may have a beneficial effect on fishes in the river during the transfer period. Because of the relatively large volume of summer flows in the Sacramento River, changes in flows resulting from the water acquisition would be small and effects on fish in the Sacramento River would be negligible. Therefore, there would be no adverse impact on the movement of any native resident or migratory fish species from the proposed project.

**e,f) No Impact.** The proposed project would not conflict with any local, regional or state policy, ordinance or conservation plan in effect for the area. Hence no impact to adopted habitat conservation plans would occur with project implementation.

**V. CULTURAL RESOURCES – Would the proposed Action:**

Issues and Determination:	<i>Less Than Potentially Significant Impact</i>	<i>Less Than Significant With Mitigation Incorporation</i>	<i>Less Than Significant Impact</i>	<i>No Impact</i>
a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Cause a substantial adverse change in the significance of a unique archaeological resource pursuant to §15064.5?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Disturb any human remains, including those interred outside of formal cemeteries?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Discussion:

**a-d) No Impact.** The proposed project does not involve any land alteration and thus no archeological or parentologic disturbances are possible within the proposed project’s scope. In addition, with no construction activities proposed, there would be no disturbances to potential burial sites or cemeteries. Therefore, no impact to cultural resources would occur with project implementation.

**VI. GEOLOGY AND SOILS – Would the proposed action:**

Issues and Determination:	<i>Less Than Potentially Significant Impact</i>	<i>Less Than Significant With Mitigation Incorporation</i>	<i>Less Than Significant Impact</i>	<i>No Impact</i>
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving: Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
i) Strong seismic ground shaking?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
ii) Seismic-related ground failure, including liquefaction?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
iii) Landslides?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Result in substantial soil erosion or the loss of topsoil?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Be located on strata or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code, creating substantial risks to life or property?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Discussion:

- a) **No Impact.** No project facility falls within an Alquist-Priolo Earthquake Fault Zone, as presented in the most recent Division of Mines and Geology Special Publication 42. Hence, no impact relating to fault rupture zones would occur with project implementation.
- b) **No Impact.** Based upon readily available soil map information, most of the project area is underlain by fine-textured, strongly structured soils, such as clay and silty clay. Such soils have a wind erodibility index of 86 (tons per acre per year) when in a dry, unvegetated condition (U.S Department of Agriculture 1993). Highly wind-erodible soils, such as fine sands and sands, have a wind erodibility index of 134-310. Therefore, the soils in the project area have a relatively low risk of wind erosion when left in a dry, unvegetated condition.

- c) **No Impact.** Soils in the proposed project area consist of clays with a flat terrain. The proposed project would not result in instability of existing soils. The use of the soils for this short-term project is in accordance with past farming practices and no landslides, lateral spreading, subsidence, liquefaction or collapse have occurred, to date.
- d) **No Impact.** Expansive soils are not known to occur within or on the proposed project site. Therefore, no impacts pertaining to expansive soils would occur with project implementation.
- e) **No Impact.** The proposed project would not involve the use of septic tanks or alternative wastewater treatment disposal systems to handle wastewater generation. Therefore, no impacts would result with implementation of the proposed project.

**VII. HAZARDS AND HAZARDOUS MATERIALS – Would the proposed Action:**

Issues and Determination:	<i>Potentially Significant Impact</i>	<i>Less Than Significant With Mitigation Incorporation</i>	<i>Less Than Significant Impact</i>	<i>No Impact</i>
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

- h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?

Discussion:

**a-h) No Impact.** The proposed project would not involve the transport or use of hazardous materials nor change any public exposure to hazards or hazardous materials beyond what is currently occurring with existing farming practices within WCWD’s jurisdiction. Herbicide and pesticides use on irrigable lands would decrease by up to 20% from what is now occurring within WCWD’s service area due to the idling for one year. This minor decrease in the use of such chemicals may be viewed as beneficial, but would not substantially affect the overall physical environment. Overall, there would be no hazardous impacts with project implementation.

**VIII. HYDROLOGY AND WATER QUALITY –**

**Would the Proposed Action:**

Issues and Determination:	<i>Potentially Significant Impact</i>	<i>Less Than Significant With Mitigation Incorporation</i>	<i>Less Than Significant Impact</i>	<i>No Impact</i>
a) Violate any water quality standards or waste discharge requirements?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there should be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
e) Create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
f) Otherwise substantially degrade water quality?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

- g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?
- h) Place housing within a 100-year flood hazard area structures which would impede or redirect flood flows?
- i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?
- j) Inundation of seiche, tsunami, or mudflow?

Discussion:

a) **No Impact.** The proposed project does not involve any discharges and thus would not violate water quality standards or waste discharge requirements. All water exported at the SWP and CVP pumping plants is pumped consistent with existing regulatory restrictions including the criteria contained in State Water Resources Control Board (SWRCB) Water Rights Decision 1641 (D1641), the biological opinions for the protection of Delta smelt and anadromous fish and mammal species, and DFG take permit for the protection of long-fin smelt. The proposed project does not increase Delta export rates beyond the currently authorized limits. In issuing the biological opinions and take permit, the resource agencies determined that, if operated consistent with the conditions contained in those documents, the coordinated operations of the CVP and SWP are not likely to adversely affect the covered species. As a result of litigation, the Federal District Court recently invalidated the biological opinions, however the existing opinions remain operable until additional scientific work can be completed and new biological opinions issued.

Restrictions in the biological opinions significantly limit SWP exports through Banks. Export of transfer water is limited to the period July through September; however that period can be further reduced if available capacity is required to export SWP water or other criteria are limiting SWP operations during that period.

Hence, no impacts to water quality standards would occur with project implementation.

b) **No Impact.** As the proposed project would not extract groundwater supplies nor inject water into aquifers, there would be no project impacts resulting from substantial depletion of groundwater supplies or interference with groundwater recharge resulting in a net deficit in aquifer volume or lowering of local groundwater table level.

c-d) **No Impact.** The proposed project would not substantially alter the existing drainage pattern of the site or area, including the alteration of the course of a stream or river, in a manner which would result in substantial erosion, siltation on- or off-site, or increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site. The water transferred would be maintained within existing conveyance and storage systems of DWR. No drainage courses would receive transferred water from the proposed project. In addition, there are no construction activities associated with the proposed project. As such, no impacts relating to water drainage patterns would occur with project implementation.

d) **No Impact.** The proposed project would not create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems. Also refer to previous responses, (Items c-d). Hence, no impacts relating to storm water drainage systems would occur with project implementation.

- e-f) **No Impact.** The proposed project would not result in degradation of water quality. Refer to previous responses, (Items a-c). Hence, no impacts to water quality would occur with project implementation.
- g-i) **No Impact.** The proposed project would not expose people or property to water-related hazards such as flooding or impede or redirect flood flows. The proposed project would not involve constructing any housing. All facilities which would be utilized are existing facilities constructed according to standard engineering design practices to limit the potential for exposure of people or property to water-related hazards, such as flooding. Therefore, no impact relating to flooding would occur with the project implementation.
- j) **No Impact.** The proposed project would not be subject to tsunami or seiche wave inundation because the project area is not situated near a large enough body of water. Also, the associated facilities are not subject to mudslides. As such, no impacts would result from project implementation with respect to tsunamis or seiches.

**IX. LAND USE AND PLANNING – Would the project:**

Issues and Determination:	<u>Potentially Significant Impact</u>	<u>Less Than Significant With Mitigation Incorporation</u>	<u>Less Than Significant Impact</u>	<u>No Impact</u>
a) Physically divide an established community?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Conflict with any applicable habitat conservation plan or natural communities' conservation plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Discussion:

a-c) **No Impact.** The proposed project would not displace or divide an established community, as no new construction activities would occur with project implementation. Only existing facilities and equipment would be employed. Also, no zoning or land use changes would be required for the participating farmer to enter into an agreement to idle a portion of his or her farmlands. Idling of agricultural land is a typical agricultural practice. Refer to Item IV.f (Biological Resources) with regard to the question on conflicts with applicable habitat conservation plans. Overall, there would be no impacts to land use or planning with project implementation.

**X. MINERAL RESOURCES – Would the proposed Action:**

Issues and Determination:	<u>Potentially Significant Impact</u>	<u>Less Than Significant With Mitigation Incorporation</u>	<u>Less Than Significant Impact</u>	<u>No Impact</u>
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Discussion:

**a, b) No Impact.** As the area is currently used for agricultural purposes only, the one-year idling of some additional farmlands for a one-year period would not result in the loss of availability of a known mineral resource that would be of future value to the region and the residents of the State. No impacts to mineral resources would occur with the proposed water transfer.

**XI. NOISE – Would the proposed Action result in:**

Issues and Determination:	<u>Potentially Significant Impact</u>	<u>Less Than Significant With Mitigation Incorporation</u>	<u>Less Than Significant Impact</u>	<u>No Impact</u>
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport of public use airport, would the project expose people residing or working in the project area to excessive noise levels?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

- f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?

Discussion:

**a-f) No Impact.** The proposed project does not involve the development or enhancement of any new noise emitting devices. In addition, there would be no construction activities, associated with the proposed project. Only existing facilities and equipment would be utilized with the proposed water transfer. As such, no noise impacts would result with project implementation.

**XII. POPULATION AND HOUSING – Would the proposed Action:**

Issues and Determination:	<i>Potentially Significant Impact</i>	<i>Less Than Significant With Mitigation Incorporation</i>	<i>Less Than Significant Impact</i>	<i>No Impact</i>
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c) Displace substantial numbers of people necessitating the construction of replacement housing elsewhere?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Discussion:

**a-c) No Impact.** The proposed project is limited to the short term transfer of water to supplement limited SWP supplies in 2012. The quantity of water delivered to any Buyer will not exceed the Buyers Annual Table A amounts specified in its long-term SWP water supply contract. Therefore, there would be no net increase in reliable water supply. No housing would be constructed, demolished, or replaced as a result of the proposed project; no displacement of people and no substantial population growth would result. Therefore, no impacts to housing or population distribution would occur as a result of the proposed water transfer.

**XIII. PUBLIC SERVICES – Would the proposed Action:**

Issues and Determination:	<i>Potentially Significant Impact</i>	<i>Less Than Significant With Mitigation Incorporation</i>	<i>Less Than Significant Impact</i>	<i>No Impact</i>
a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable				

service ratios, response times, or other performance objectives for any of the public services:

Fire protection?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Police protection?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Schools?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Parks?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Other public facilities?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Discussion:

- a) **No Impact.** The proposed project does not create any new demand for public services or alterations to existing public facilities. The proposed water transfer would occur within existing water conveyance facilities. Hence, no impacts to public services or facilities would occur with project implementation.

**XIV. RECREATION – Would the proposed action:**

Issues and Determination:	<i>Potentially Significant Impact</i>	<i>Less Than Significant With Mitigation Incorporation</i>	<i>Less Than Significant Impact</i>	<i>No Impact</i>
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities, which might have an adverse physical effect on the environment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Discussion:

- a, b) **No Impact.** The proposed project would not create nor does it alter demand for recreational services. The proposed project is limited to the short term transfer of water to supplement limited SWP supplies in 2012. As such, there would be no net increase in recreational opportunities and no impacts to recreational facilities or activities would occur with project implementation.

**XV. TRANSPORTATION / TRAFFIC – Would the proposed action:**

Issues and Determination:	<i>Potentially Significant Impact</i>	<i>Less Than Significant With Mitigation Incorporation</i>	<i>Less Than Significant Impact</i>	<i>No Impact</i>
a) Cause an increase in traffic, which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in				

- either the number of vehicle trips, the volume-to-capacity ratio on roads, or congestion at intersections)?
- b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways?
- c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?
- d) Substantially increase hazards to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?
- e) Result in inadequate emergency access?
- f) Result in inadequate parking capacity?
- g) Conflict with adopted policies supporting alternative transportation (e.g., bus turnouts, bicycle racks)?

Discussion:

**a-g) No Impact.** The proposed project does not create any new demand for any mode of transportation services as it would involve existing facilities and to forebear water for water supply purposes. Also, there are no construction activities associated with the proposed project (such as movement of trucks). Therefore, no transportation impacts would occur with project implementation.

**XVI. UTILITIES AND SERVICE SYSTEMS – Would the proposed action:**

Issues and Determination:	<i>Potentially Significant Impact</i>	<i>Less Than Significant With Mitigation Incorporation</i>	<i>Less Than Significant Impact</i>	<i>No Impact</i>
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing				
c) Facilities, the construction of which could cause significant environmental effects?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
d) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

- d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?
- e) Result in a determination by the wastewater treatment provider, which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?
- f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?
- g) Comply with federal, state, and local statutes and regulations related to solid waste?

Discussion:

**a-g) No Impact.** The proposed project would not place additional demands on nor affect public utilities, particularly wastewater treatment facilities, water facilities, and storm drain systems in the area. The proposed project is limited to the short term transfer of water to supplement limited SWP supplies in 2012. It will not result in an increase in reliable water supplies or expand deliveries beyond existing capacity. No solid waste disposal or disposal facilities would be needed for the proposed project. Therefore no impacts to existing utilities and conveyance systems would occur with project implementation.

**XVII. MANDATORY FINDINGS OF SIGNIFICANCE - Would the proposed action:**

Issues and Determination:	<u>Potentially Significant Impact</u>	<u>Less Than Significant With Mitigation Incorporation</u>	<u>Less Than Significant Impact</u>	<u>No Impact</u>
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulative considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other				

current projects, and the effects of probable future projects)

c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?

Discussion:

- a) **Less Than Significant Impact.** As previously discussed, the proposed project has the potential to degrade the environment in some resource areas (biological resources and aesthetics). However, as noted above, these impacts are not significant individually or cumulatively. The proposed project would occur through existing facilities with no new construction. As such, implementation of the proposed project would have no significant impacts.
- b) **Less Than Significant Impact.** Water transfers from the Sacramento Valley through the Delta for consumptive uses and environmental purposes have been occurring on a large scale for over a decade. There have been no known demonstrable adverse impacts resulting from recent water transfers. The proposed transfer is one of several transfers likely to occur in 2012. This project proposes to sell Buyers up to 38,372 acre-feet of water to meet some of their needs in the event of a shortfall. Up to 211,628 acre-feet of other proposed transfers in the Sacramento River watershed could be purchased by other buyers. In total, it is possible that about 250,000 acre-feet of water may be transferred from the Sacramento Valley in 2012 as shown in table XVII-1 below. This represents about 1.7% of the average annual total water supply available in the Sacramento Valley from surface and groundwater resources for all uses and 2.9 % of total average agricultural water use in the Sacramento Valley.<sup>2</sup> As such, and recognizing that no significant impacts have been noted for transfers within this order of magnitude, no significant impacts are expected within the Sacramento Valley. Delta impacts are likewise not expected to be significant as all of the water shown in Table XVII-1 was pumped in the Delta within existing biological constraints and without incident.

Table XVII-1

Program	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Potential 2012
DWR Drought Water Banks/Dry Year Programs	22	11	0.5	0	0	0	0	74	0	0	0
Environ Water Acct	145	70	120	5	0	147	60	60	60	0	60
Others (CVP, SWP, Yuba, inter alia)	5	125	0	0	0	0	173	140	243	0	190
Totals (TAF)	172	206	120.5	5	0	147	233	274	303	0	250

\*Table reflects gross AF purchased prior to 20% Delta carriage loss (i.e., actual amounts pumped at Delta are 20% less)

- c) **No Impact.** The negative declaration assesses the potential impacts of the proposed project. There would be no construction activities associated with the proposed water transfer. Typical farming practices with the idling of land would comply with applicable health and safety requirements. Therefore, the proposed project would not cause substantial adverse effects on human beings, either directly or indirectly.

<sup>2</sup> DWR Bulletin 160-05

## SECTION 4 REFERENCES

The following documents were used in the preparation of this Negative Declaration:

California Department of Water Resources. *California Water Plan Update. Bulletin 160-05*. December 2005.

State of California, 2007. *California Environmental Quality Act, CEQA Guidelines. Amended July 11, 2006*.

U.S. Department of Agriculture, Soil Conservation Service. 1993. *U.S. Department of Agriculture Soil Conservation Service national soil survey handbook. November. Washington, DC*.

U.S. Fish and Wildlife Service. 1999. Draft Recovery Plan for the Giant Garter Snake (*Thamnophis gigas*). U.S. Fish and Wildlife Service, Portland, Oregon. ix+192 pp.

<http://www.dfg.ca.gov/hcpb/species/ssc/ssc.shtml>

<http://endangered.fws.gov/wildlife.html#Species>

**SECTION 5  
LIST OF PREPARERS**

Ted Trimble, General Manager, Western Canal Water District

Dustin C. Cooper, Attorney, Minasian Law Firm

DRAFT

# Groundwater/Conjunctive Management

Or, Why is groundwater recharge  
so important?

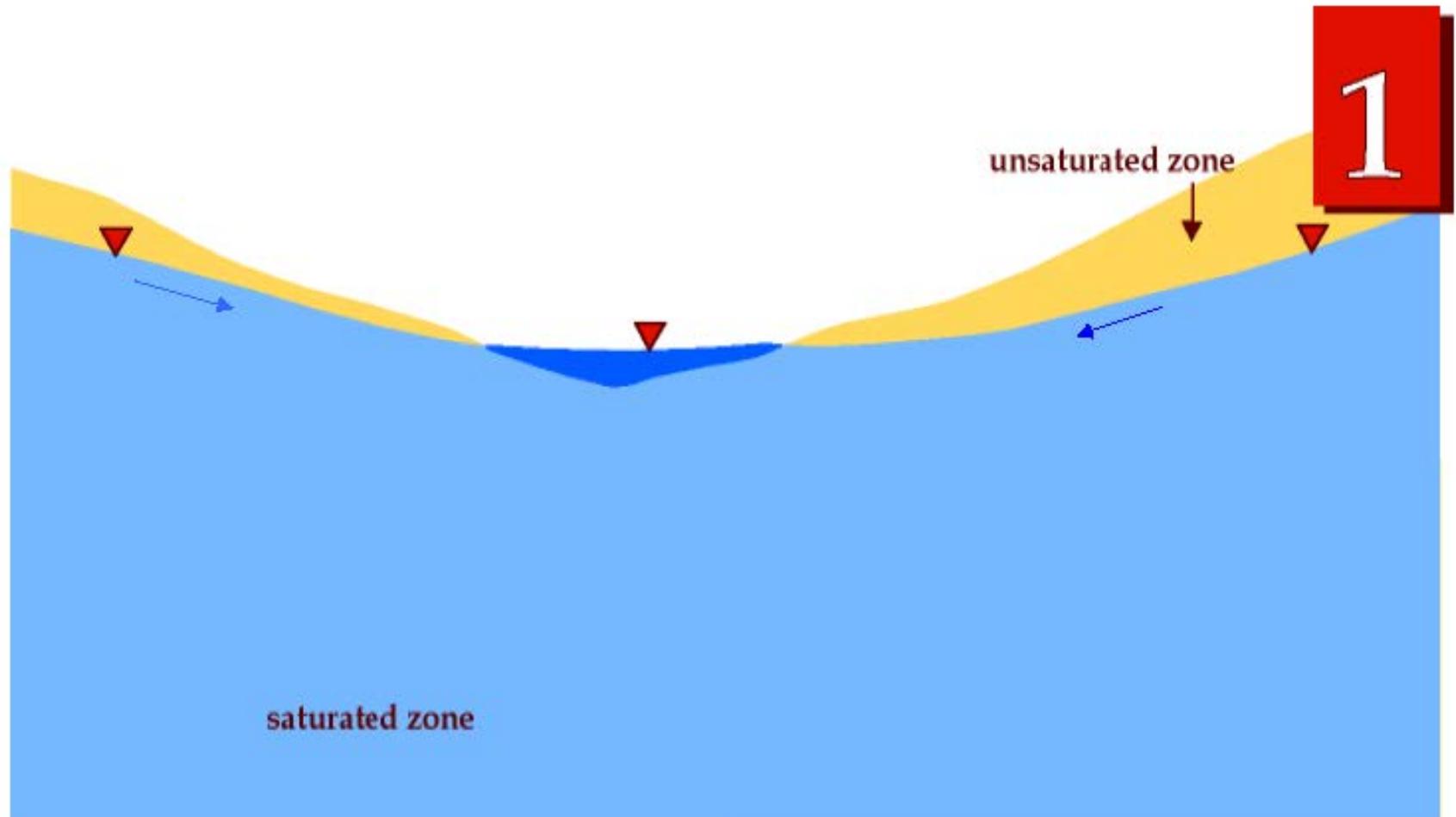
California Water Commission

14 September 2011

Carl Hauge

# Facts

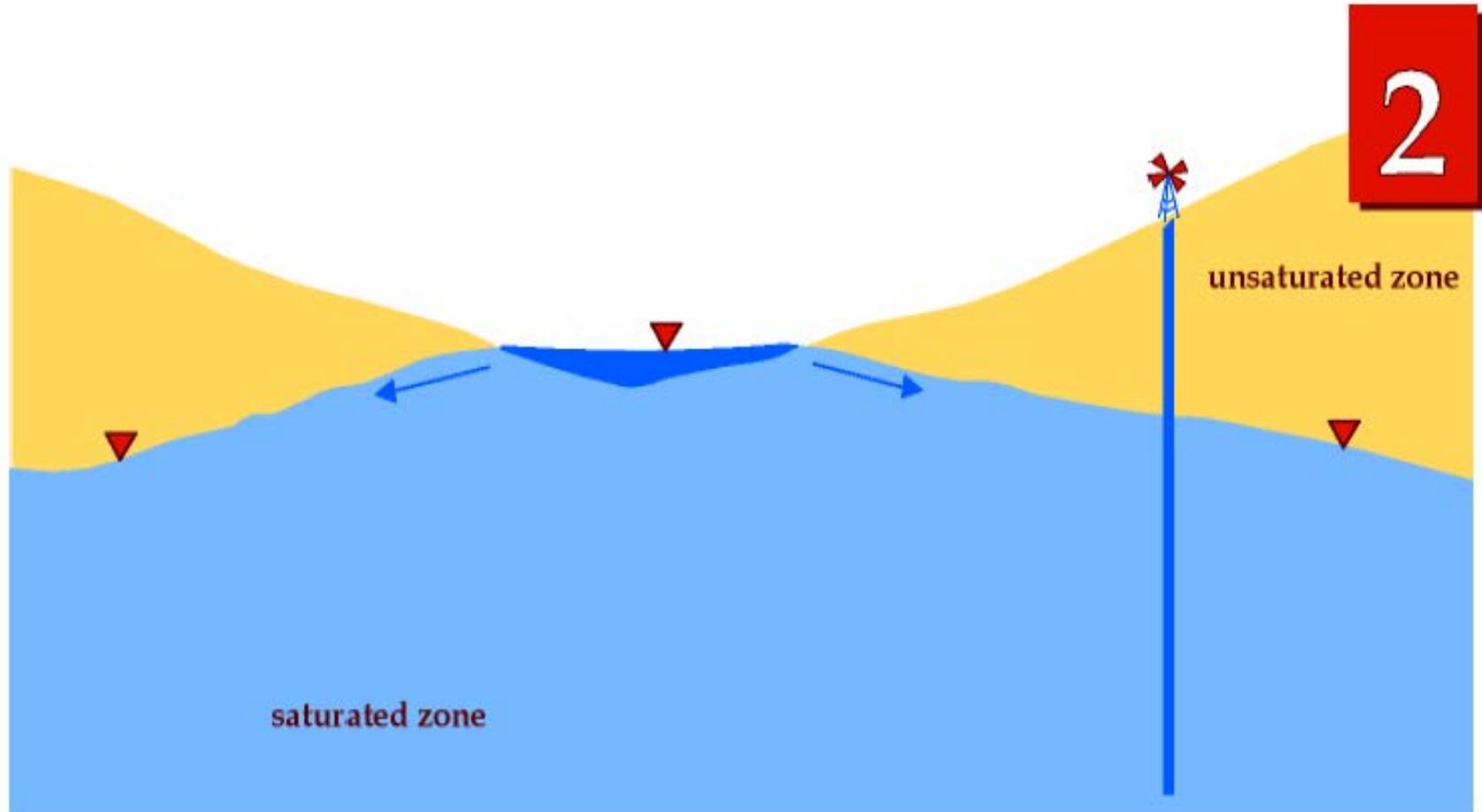
- Extraction of groundwater borrows from future surface water flows that recharge the emptied aquifer
- Replenishment and discharge are as important for aquifers as they are for dams



## Full basin

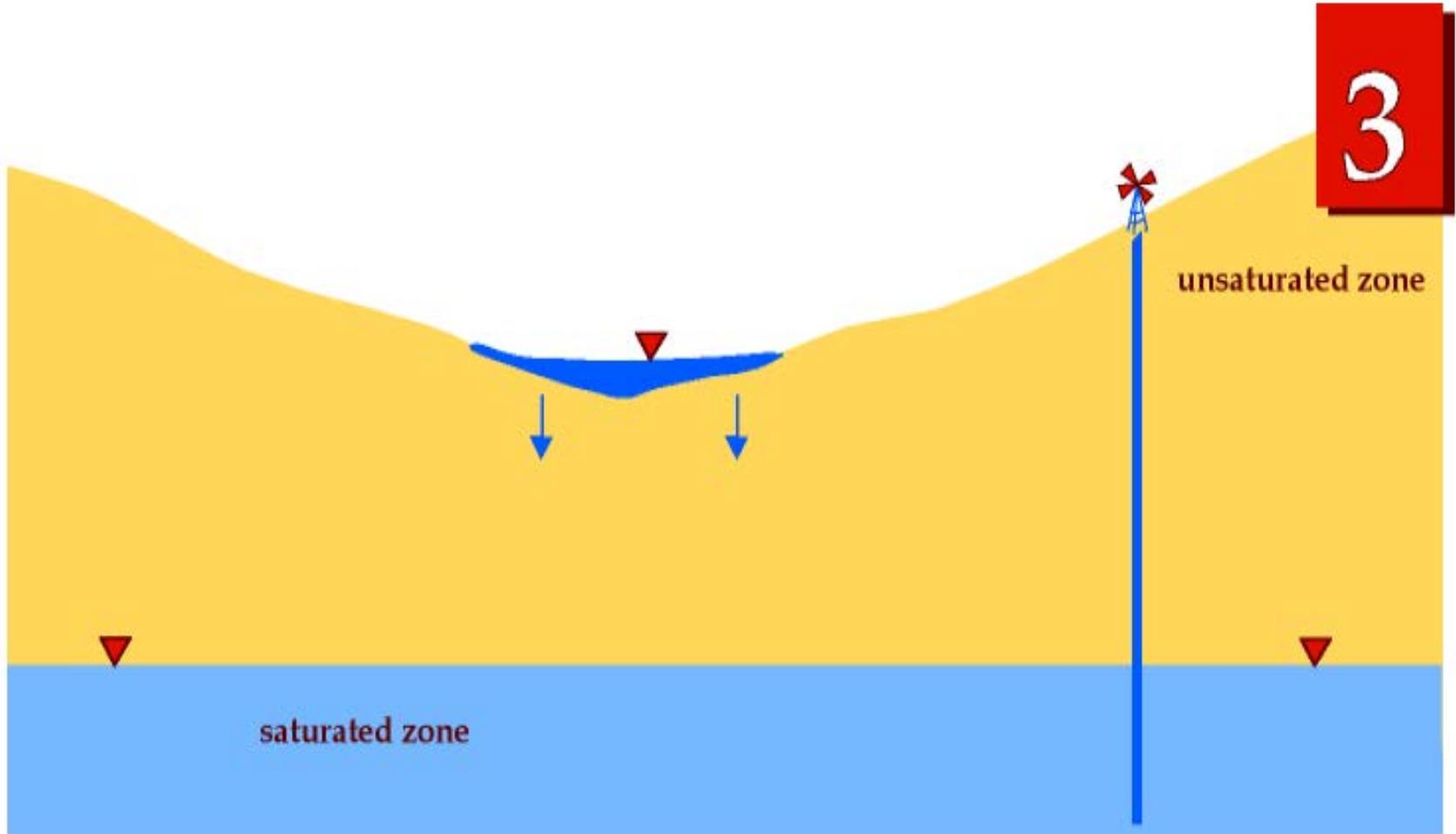
Streams are drains for the overflowing ground water reservoir

2

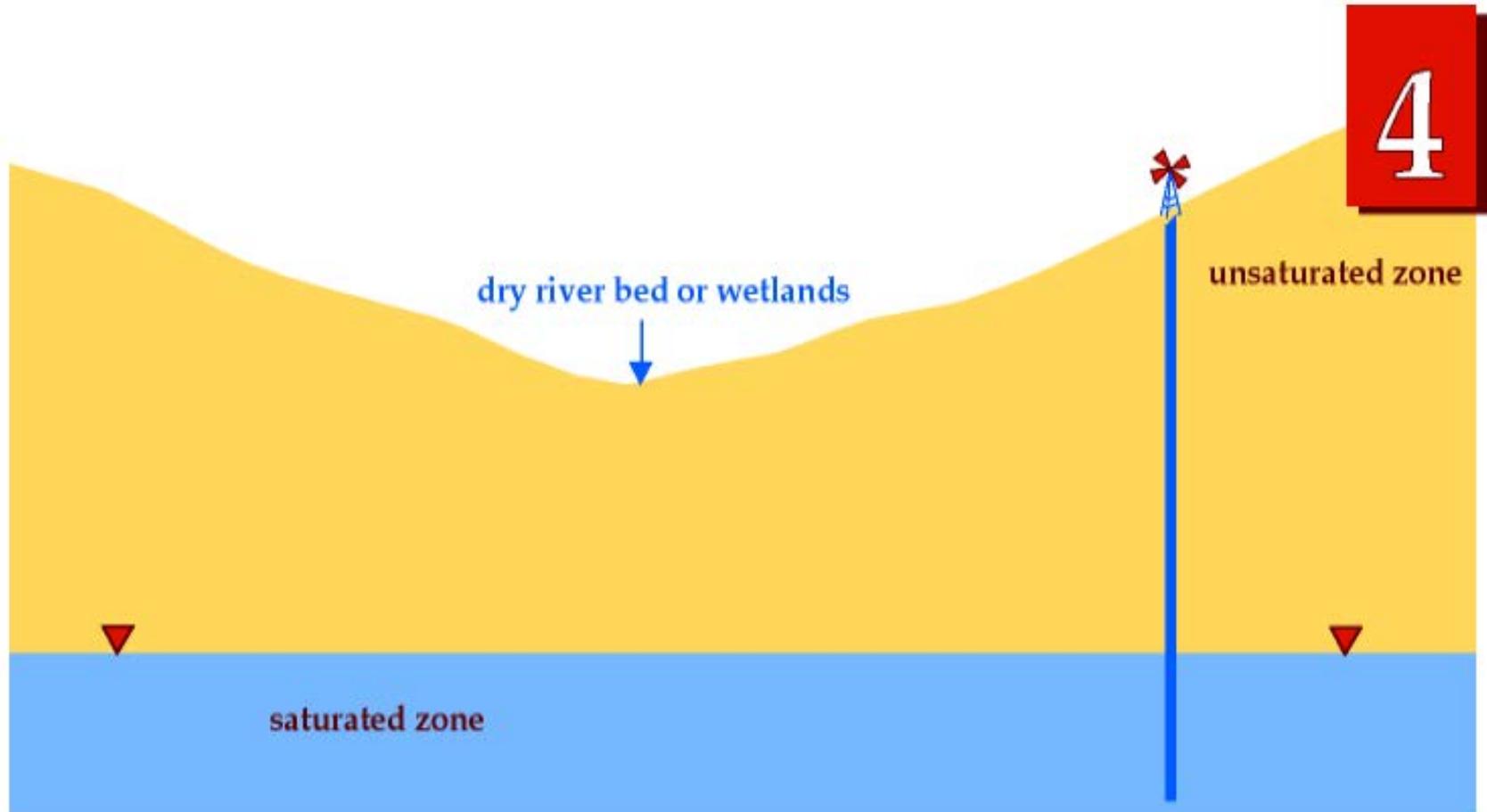


**Some extraction of ground water**  
Storage capacity is made available for additional water and a gradient is created that induces recharge from streams

3



**Rate of extraction exceeds rate of recharge**



4

## No surface water available

All surface water percolates through the channel bottom up river.



# Conjunctive use

- Can mean just turning on your well when surface water is not available
- This is a form of conjunctive use, but it is not a managed form of conjunctive use

# Conjunctive management

- Planned management of surface water and groundwater resources to optimize water supply
- Dams release sw when available to recharge aquifers when storage capacity is available
- Stored groundwater is used when surface water is not available

# DWR Bulletin 3, The California<sup>REGIRC2575.</sup> Water Plan, 1957

- 98,000,000 acre feet of storage is available in the Central Valley aquifers
- Only 31,000,000 acre feet of that storage will be necessary to implement the California Water Plan

# Components of conjunctive management RECIRC2575.

- Available surface water
- Conveyance & recharge facilities
- Empty storage capacity in the aquifer
- Extraction facilities in the discharge area
- Hydraulic continuity between recharge and discharge areas
- Political, legal, institutional, technical & economic consensus

# Empty aquifers in Southern California and San Joaquin Valley

- Recharge the aquifers with surface water when available
- Extract groundwater in dry years

# Santa Ana River in-channel & off-channel recharge

RECIRC2575.



# Full aquifers in Sacramento Valley

- Export surface water
- Irrigate local land with groundwater—called groundwater substitution
- Aquifers are emptied
- Recharge with future surface water
- May affect existing surface water rights
- Must maintain adequate flow in the Delta

# Types of conjunctive management

- Groundwater banks
  - For export
  - For local use
- Groundwater substitution—growers sell their surface water entitlement and use underlying groundwater instead
- Aquifer storage and recovery (ASR)

# Examples

- Banking
  - Kern Water Bank & others nearby
  - Arvin Edison Water Storage District
  - Semitropic Water Storage District—in lieu
  - Other local banking
- ASR
  - Roseville (not yet operating)
  - Calleguas Municipal WD

# Current recharge operations

- Orange County WD
- Semitropic WD
- Arvin-Edison WSD
- Coachella Valley WD
- Stockton East WD
- East Bay MUD
- Santa Clara VWD
- United Water CD
- Alameda CWD
- NE San Joaquin CGBA
- Monterey RWPCA
- Calleguas MWD
- Eastern MWD
- Inland Empire UD
- WRD of SoCal
- Kern Water Bank Auth
- Zone 7 WA
- Helix WD
- Mojave WA
- Fresno ID
- West Basin MWD
- Los Angeles County
- North Kern WSD
- MWD
- Kaweah-Delta WCD

# Management requires accurate data

## Surface water

- Water level
- Quality
- Runoff
- Release of diversions
- Use of released water

## Groundwater

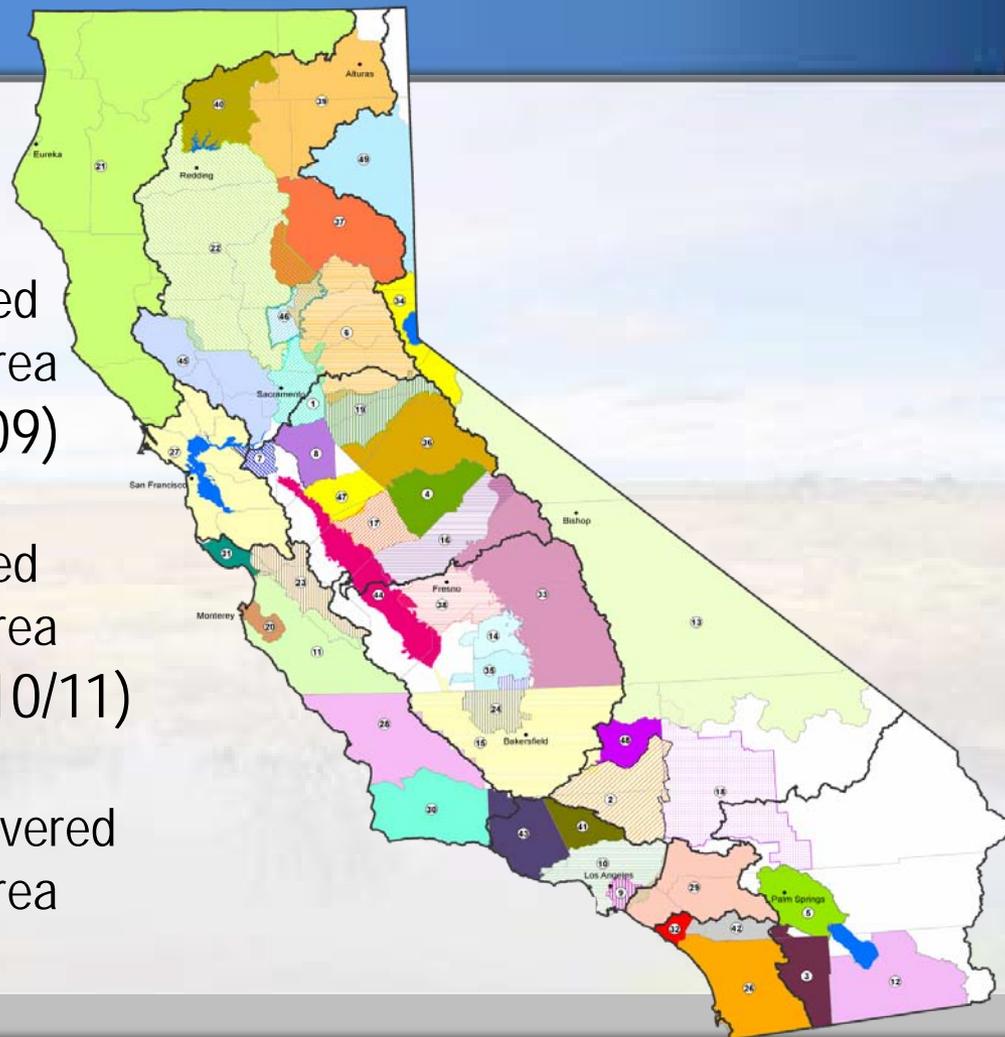
- Water level
- Quality
- **Recharge?**
- **Extraction?**
- **Use of extracted water?**

# Basin yield

- The amount of groundwater that can be withdrawn from the basin annually should not produce undesirable results:
  - Decline in groundwater levels
  - Degradation of groundwater quality
  - Land subsidence
  - Degradation of aquatic, riparian & terrestrial habitat
  - Decrease in stream flows

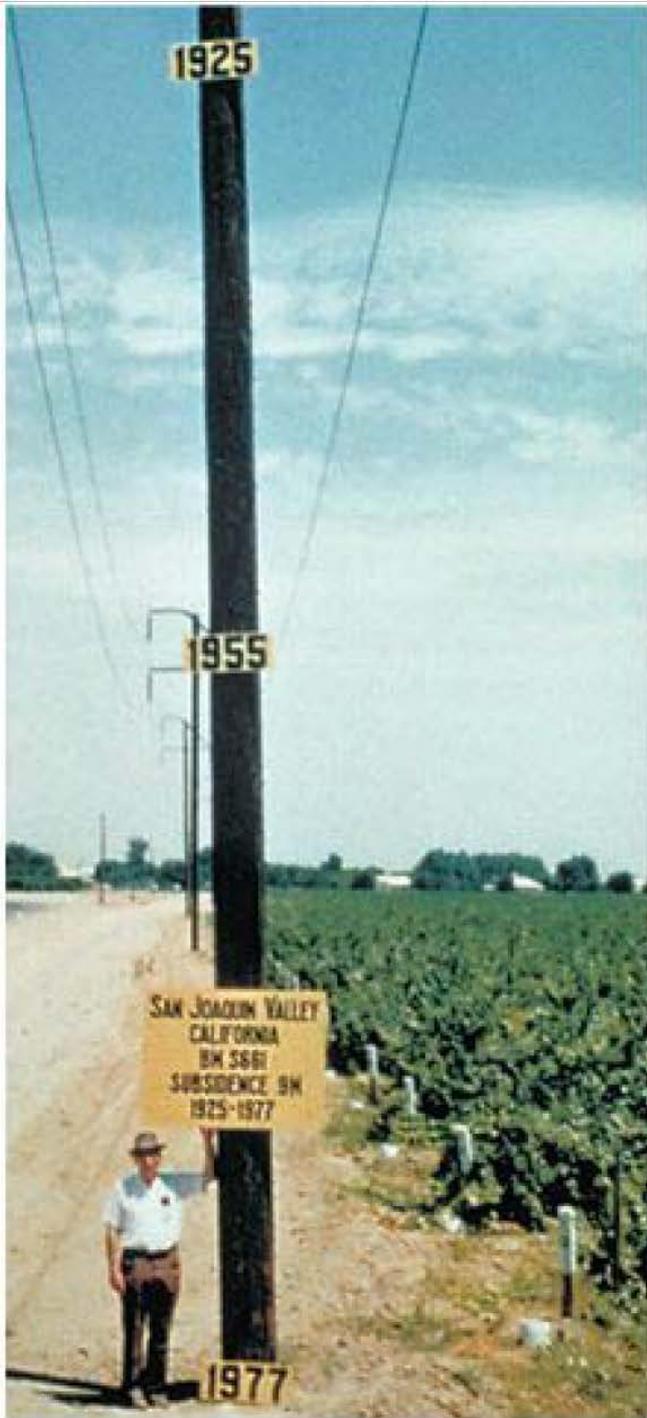
## REGIONS OF THE IRWM GRANT PROGRAM

- P50 grants (2004)
  - 19 IRWM regions
  - 94% of state population covered
  - 54% of the state geographic area
- Implement RAP process (2009)
  - 46 IRWM regions accepted
  - 97% of state population covered
  - 83% of the state geographic area
- After second round RAP (2010/11)
  - 48 IRWM regions
  - 99% of the state population covered
  - 87% of the state geographic area



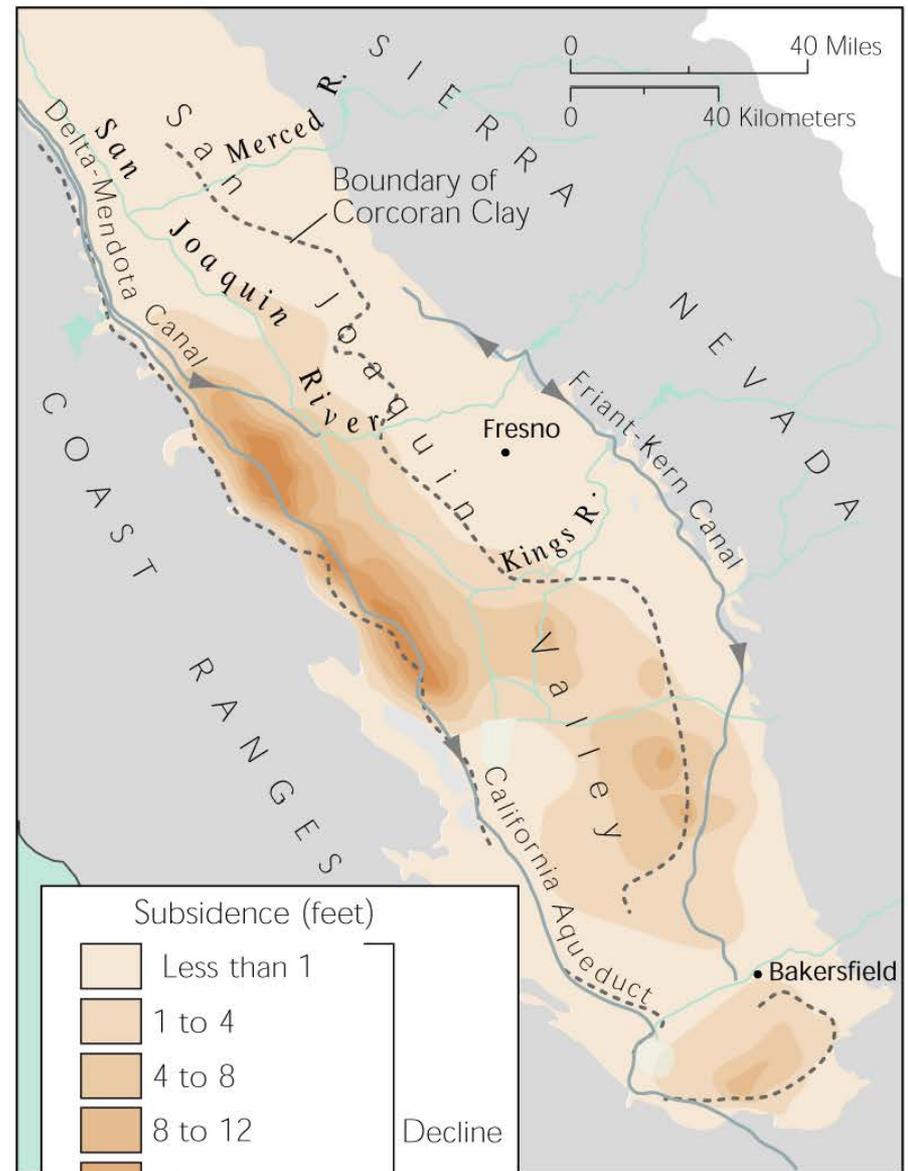
# Legislation

- AB 3030—GW Management Plans
- AB 303—start up grants, \$38 million, and some from Props 50 & 84
- SB 1938—requires some components to receive state funding
- SB x7 6—CASGEM program
- AB 1152—alternate monitoring tech.
- AB 359—map recharge areas & advise local planners
- Prop13, \$206 million
- Props 50 & 84



Land subsidence from 1926 to 1970

RECIRC2575.



(Modified from Poland and others, 1975)

# Conclusions

- Conjunctive management will not succeed without surface water
- Many agencies are recharging groundwater
- Results have not been collated
- Coordination thru IRWMPs may produce more conjunctive management
- Legislation and propositions have been helpful

# Actions

- Inventory groundwater recharge operations
  - Source of water & permits required
  - Frequency of recharge
  - Amount of water recharged
  - Users of the recharged gw
- Record extractions
- Encourage IRWMP agencies to look for recharge opportunities
- Re-operation of dams may provide additional opportunities

**Renewed Rapid Subsidence in the San Joaquin Valley, California****By Michelle Sneed\*, Mike Solt, and Justin Brandt**

U.S. Geological Survey, 3020 State University Drive East, Suite 4004, Sacramento, CA 95819

**Abstract.** Extensive groundwater withdrawal in the San Joaquin Valley (SJV) caused widespread aquifer-system compaction and resultant land subsidence that locally exceeded 8 m during 1926–70. Surface-water importation in the early 1970s resulted in decreased pumping, recovery of water levels, and a reduced rate of subsidence in some areas. However, reduced surface-water availability during subsequent droughts resulted in increased pumping, causing groundwater-level declines and renewed subsidence, which has reduced freeboard and flow capacity of the Delta-Mendota Canal, the California Aqueduct, and other canals that deliver irrigation water and transport floodwater.

The location and magnitude of land subsidence during 2006–10 in parts of the SJV were determined by using an integration of Interferometric Synthetic Aperture Radar (InSAR), Global Positioning System (GPS), and borehole extensometer techniques. Results of the InSAR measurements indicate that a 3,200-km<sup>2</sup> area was affected by at least 20 mm of subsidence during 2008–10, with a localized maximum subsidence of at least 540 mm. Furthermore, InSAR results indicate subsidence rates doubled during 2008. Results of a comparison of GPS, extensometer, and groundwater-level data suggest that most of the compaction occurred in the deep aquifer system, that the critical head in some parts of the deep system was exceeded in 2008, and that the subsidence measured during 2008–10 was largely permanent. The information derived from these integrated measurements is being used to improve coupled numerical models of groundwater flow and land subsidence, which are being used to evaluate water-resource management strategies.

# SANTA CLARA VALLEY, CALIFORNIA

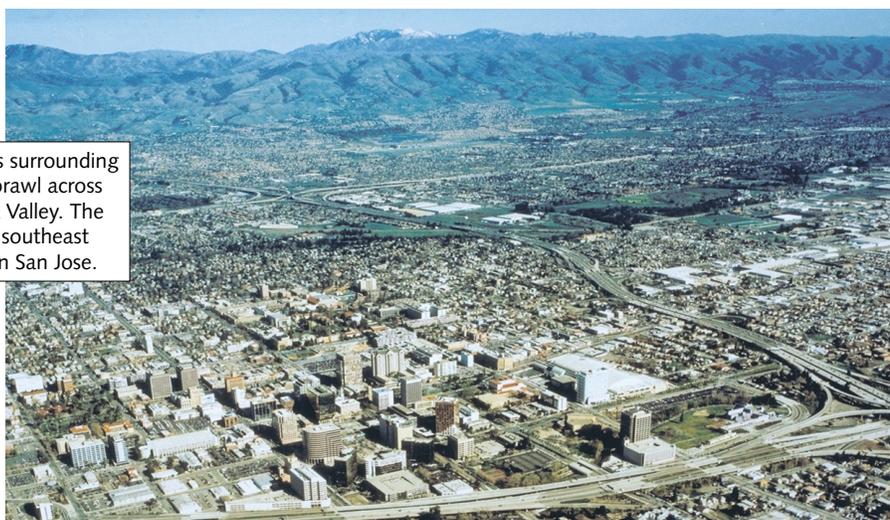
## A case of arrested subsidence



The Santa Clara Valley is part of a structural trough that extends about 90 miles southeast from San Francisco. The northern third of the trough is occupied by the San Francisco Bay, the central third by the Santa Clara Valley, and the southern third by the San Benito Valley. The northern Santa Clara Valley, roughly from Palo Alto to the Coyote Narrows (10 miles southeast of downtown San Jose), is now densely populated and known as “Silicon Valley,” the birthplace of the global electronics industry.

In the first half of this century, the Santa Clara Valley was intensively cultivated, mainly for fruit and vegetables. The extensive orchards, dominated by apricots, plums, cherries, and pears, led local boosters to dub the area a Garden of Eden or “The Valley of Heart’s Delight.” In the post-World War II era (circa 1945–1970), rapid population growth was associated with the transition from an agriculturally based economy to an industrial and urban economy. The story of land subsidence in the Santa Clara Valley is closely related to the changing land and water use and the importation of surface water to support the growing urban population.

San Jose and its surrounding communities sprawl across the Santa Clara Valley. The view is looking southeast from downtown San Jose.

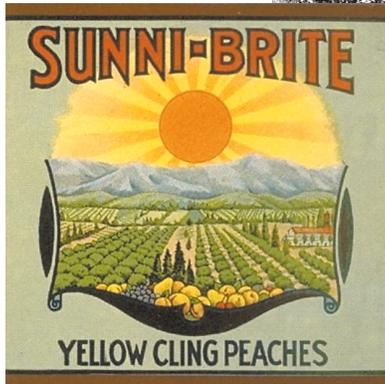


(Air Flight Service)



(Alice Iola Hare, Bancroft Library, UC Berkeley)

The Santa Clara Valley was a premier fruit growing region in the early part of the 20th century. The landscape was dotted with family orchards, each with its own well (note well house far right).



(George E. Hyde & Co. 1915-1921, Bancroft Library, UC Berkeley)

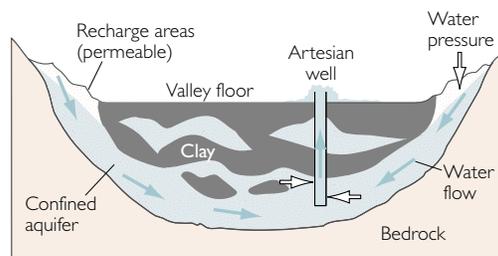
The Santa Clara Valley was the first area in the United States where land subsidence due to ground-water withdrawal was recognized (Tolman and Poland, 1940). It was also the first area where organized remedial action was undertaken, and subsidence was effectively halted by about 1969. The ground-water resource is still heavily used, but importation of surface water has reduced ground-water pumping and allowed an effective program of ground-water recharge that prevents ground-water levels from approaching the historic lows of the 1960s. The unusually well-coordinated and effective conjunctive use of surface water and ground water in the Santa Clara Valley is facilitated by the fact that much of the Valley is served by a single water-management agency, the Santa Clara Valley Water District.

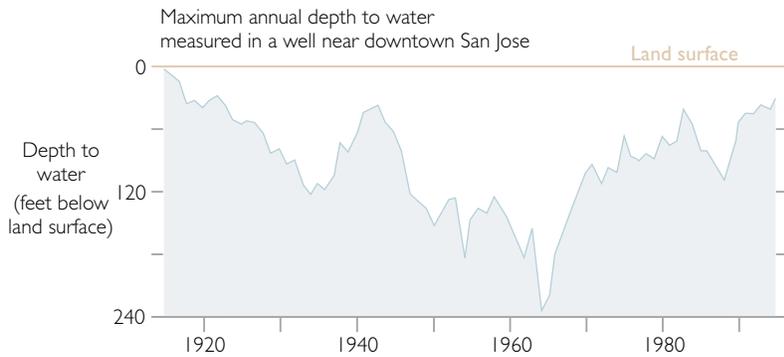
**GROUND-WATER PUMPING SUPPLIED ORCHARDS AND, EVENTUALLY, CITIES**

This free-flowing artesian well was capped to prevent waste (1910).



The moderate climate of the Santa Clara Valley has distinct wet and dry periods. During the wet season (November to April), average rainfall ranges from a high of about 40 inches in the low, steep mountain ranges to the southwest to a low of about 14 inches on the valley floor—rates that are generally insufficient to support specialty crops. Early irrigation efforts depended upon local diversions of surface water, but the acreage that could be irrigated in this manner was very limited. By the 1860s, wells were in common use.





In the late 1800s construction of railroads, refrigerator cars, and improved canning techniques gave farmers access to the growing California and eastern markets for perishable crops. The planting of orchards and associated ground-water pumping increased rapidly into the 1900s.

In the late 1880s most wells in the area between downtown San Jose and Alviso and along the Bay northwest and northeast of Alviso were artesian. That is, water flowed

freely without needing to be pumped. In fact, there was substantial waste of ground water from uncapped artesian wells. The widespread artesian conditions were due to the natural hydrogeology of the Santa Clara Valley. Water levels in the artesian wells rose above the land surface because they tapped confined aquifers that have permeable connections to higher-elevation recharge areas on the flanks of the Valley but are overlain by low-permeability clay layers.

By 1920, two-thirds of the Santa Clara Valley was irrigated, including 90 percent of the orchards, and new wells were being drilled at the rate of 1,700 per year (California History Center, 1981). By the late 1920s, about 130,000 acre-feet of ground water was pumped annually to irrigate crops and support a total population of about 100,000.

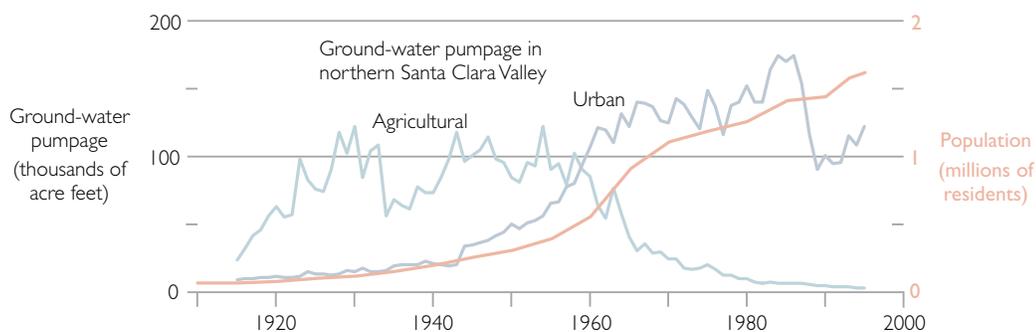
**Acre-Feet**

Hydrologists frequently use the term acre-feet to describe a volume of water. One acre-foot is the volume of water that will cover an area of one acre to a depth of one foot. The term is especially useful where large volumes of water are being described. One acre-foot is equivalent to 43,560 cubic feet, or about 325,829 gallons!

**Ground-water levels drop**

Ground water was being used faster than it could be replenished. As a result, water levels were dropping and artesian wells becoming increasingly rare. By 1930, the water level in a formerly artesian USGS monitoring well in downtown San Jose had fallen 80 feet below the land surface.

Between 1920 and 1960 an average of about 100,000 acre-feet per year of ground water was used to irrigate crops. Nonagricultural use of ground water began to increase substantially during the 1940s, and by 1960 total ground-water withdrawals approached 200,000 acre-feet per year. In 1964 the water level in the USGS monitoring well in downtown San Jose had fallen to a historic low of 235 feet below the land surface.



These photographs of the South Bay Yacht Club in Alviso show dramatic evidence of subsidence.

1914—The Yacht Club (building to the right) is practically at sea level.



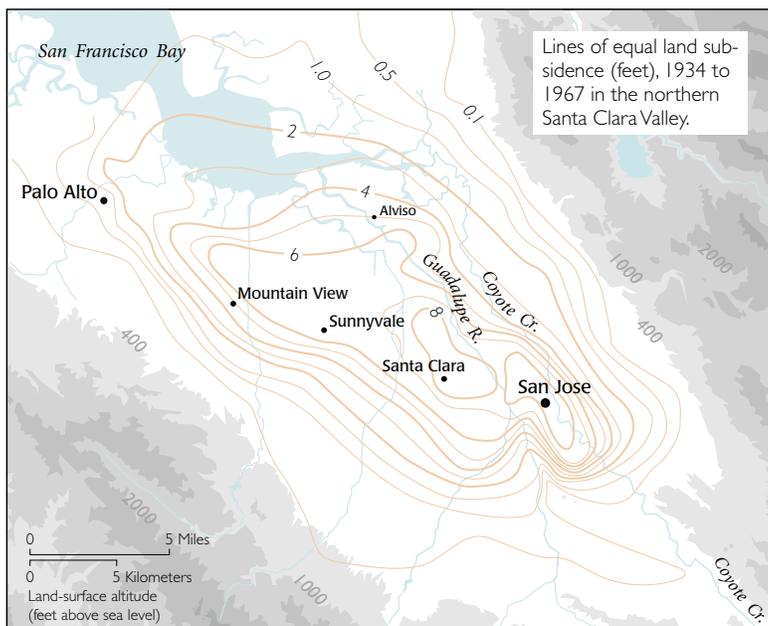
1978—The Yacht Club is now about 10 feet below sea level, and a high levee keeps bay water from inundating Alviso.



(Santa Clara Valley Water District)

During the 33-year period, subsidence ranged from 2 feet under the Bay and its tideland to 8 feet in San Jose and Santa Clara.

Total land subsidence, which probably began in the 1920s and continued to 1969 or later, is likely greater than shown on this map.



(Modified from Poland and Ireland, 1988)

### MASSIVE GROUND-WATER WITHDRAWAL CAUSED THE GROUND TO SUBSIDE

Substantial land subsidence occurred in the northern Santa Clara Valley as a result of the massive ground-water overdrafts. Detectable subsidence of the land surface (greater than 0.1 feet) took place over much of the area. The maximum subsidence occurred in downtown San Jose, where land-surface elevations decreased from about 98 feet above sea level in 1910 to about 84 feet above sea level in 1995.

Lands adjacent to the southern end of San Francisco Bay sank from 2 to 8 feet by 1969, putting 17 square miles of dry land below the high-tide level. The southern end of the Bay is now ringed with dikes to prevent landward movement of saltwater, and flood-control levees have been built to control the bayward ends of stream channels.

The stream channels must now be maintained well above the surrounding land in order to provide a gradient for flow to the Bay. In the land that has sunk below the high-tide level, local storm discharge must be captured and pumped over levees in order to prevent widespread flooding.

The fact that Santa Clara Valley was subsiding became generally known in 1933, when bench marks in San Jose that were established in 1912 were resurveyed and found to have subsided 4 feet. This finding motivated the U.S. Coast and Geodetic Survey to establish a network of bench marks tied to stable bedrock on the edges of the Valley. The bench-mark network was remeasured many times between 1934 and 1967, and forms the basis for mapping subsidence.

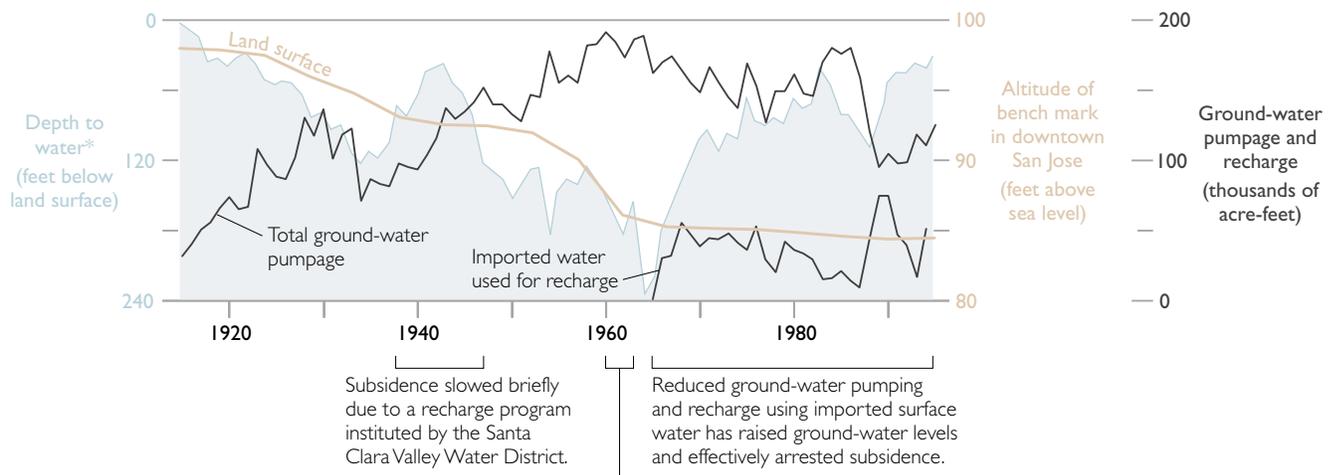
### Subsidence had to be stopped

In 1935 and 1936, the Santa Clara Valley Water District built five storage dams on local streams to capture storm flows. This permitted controlled releases to increase ground-water recharge through streambeds. Wet years in the early 1940s enhanced both natural and artificial recharge. Although subsidence was briefly arrested during World War II, these measures proved inadequate to halt water-level declines over the long term, and, between 1950 and 1965, subsidence resumed at an accelerated rate. In 1965, increased imports of surface water allowed the Santa Clara Valley Water District to greatly expand its program of ground-water recharge, leading to substantial recovery of ground-water levels, and there has been little additional subsidence since about 1969.

In fact, as of 1995, water levels in the USGS monitoring well in downtown San Jose were only 35 feet below land surface, the highest levels observed since the early 1920s. A series of relatively wet years in the mid-1990s even caused a return to artesian conditions in some areas near San Francisco Bay. Some capped and long-forgotten wells near the Bay began to leak and were thereby rediscovered!

Subsidence in the Santa Clara Valley was caused by the decline of artesian pressures and the resulting increase in the effective overburden load on the water-bearing sediments. The sediments compacted under the increasing stress and the land surface sank. Most of the compaction occurred in fine-grained clay deposits (aquitards), which are more compressible, though less permeable, than coarser-grained sediments. The low permeability of the clay layers retards and smooths the compaction of the aquifer system relative to the water-level variations in the permeable aquifers. Since 1969, despite water-level recoveries, a small amount of additional residual com-

Land subsidence was a result of intensive ground-water pumping and the subsequent drop in water levels. Once pumping was stabilized by the introduction of imported surface water, subsidence was arrested.



From 1960 to 1963 subsidence attained its greatest average rate (about 8 inches per year).

\*In USGS monitoring well in downtown San Jose

paction and subsidence has accrued. The total subsidence has been large and chiefly permanent, but future subsidence can be controlled if ground-water levels are maintained safely above their subsidence thresholds.

Surface water is delivered for use in the Valley



The South Bay aqueduct conveys water from the Sacramento-San Joaquin Delta to the Santa Clara Valley.

(Santa Clara Valley Water District)

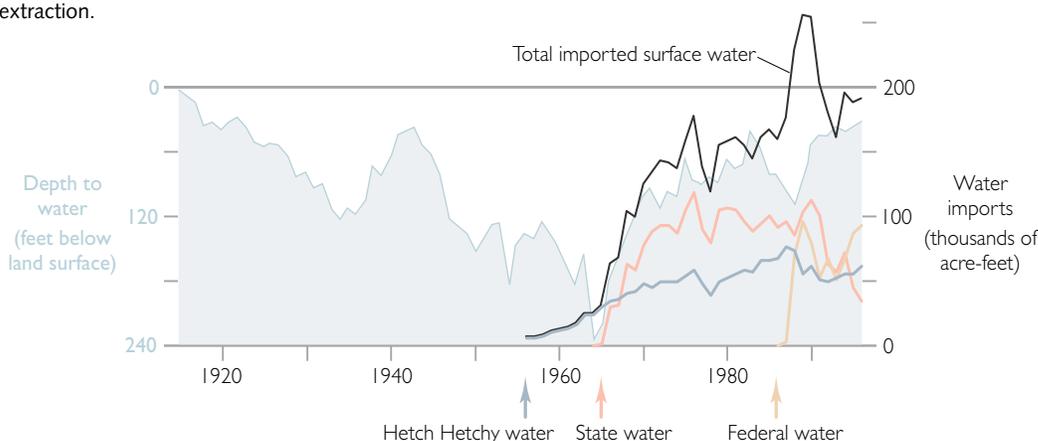
To balance Santa Clara Valley’s water-use deficit, surface water has been imported from northern and eastern California via aqueducts—Hetch Hetchy (San Francisco Water Department, 1951-), the California State Water Project (1965-), and the Federal San Felipe Water Project (1987-). Much of the imported water also feeds into various local distribution lines. But presently about one-fourth of the water imported by the Santa Clara Valley Water District (about 40,000 of the 150,000 acre-feet total) is used for ground-water recharge.

The aquifer systems are used for natural storage and conveyance, in preference to constructing expensive surface-storage and conveyance systems. In order to avoid recurrence of the land subsidence that plagued the Valley prior to 1969, ground-water levels are maintained well above their historic lows, even during drought periods. For example, ground-water levels beneath downtown San Jose were maintained even during the major California droughts of 1976–77 and 1987–91. In order to avoid large ground-water overdrafts, the Water District aggressively encourages water conservation during drought periods. Per-capita water use under current conditions is much lower than in the agrarian past. Today, about 350,000 acre-feet of surface and ground water meet the annual requirements of a countywide population of about 1,600,000, and per-capita water use is only about one-fifth of the 1920 level.

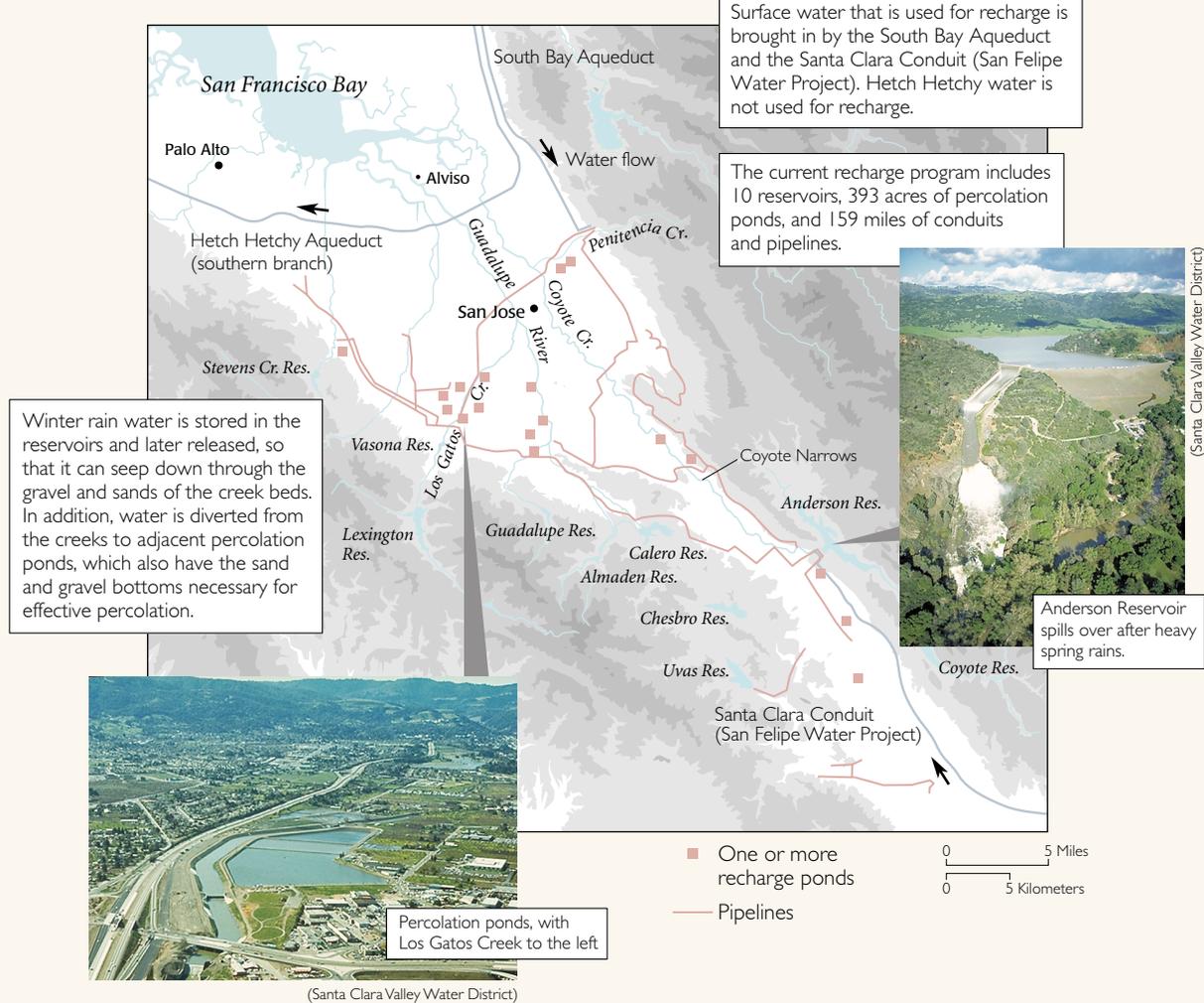
The economic impact can only be approximated

The direct costs of land subsidence in the Santa Clara Valley include the cost of constructing levees around the southern end of San Francisco Bay and the bayward ends of stream channels, main-

Water imports allow water managers to raise ground-water levels by reducing net ground-water extraction.



## Santa Clara Valley Water District Ground-water recharge system



### NATURAL CONDITIONS

Conditions are favorable for recharge in the upper reaches of several streams because there is an abundance of coarse sand and gravel deposits and the aquifer system is generally unconfined; that is, fluid pressure in the aquifer is not confined by any overlying lenses of low-permeability clay. Nearer to the Bay, sediments tend to be finer-grained, and the exploited ground-water system is generally confined by low-permeability materials that impede recharge.

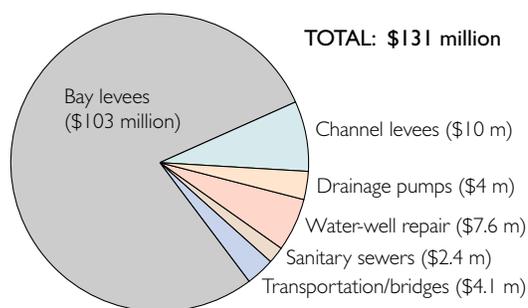
### RECHARGE FACILITIES

The first percolation facilities in the Santa Clara Valley were built in the 1930s. They relied on capturing local surface runoff, and proved inadequate to keep pace with the rate of ground-water extraction. The volume of artificial recharge was increased significantly when additional imported surface water became available in 1965. Artificial recharge rates

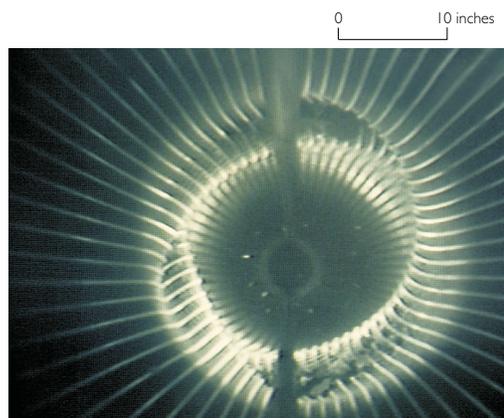
in the 1970s were sufficient to reverse ground-water level declines and arrest subsidence.

### COST-BENEFIT

In 1984, a cost-benefit approach was used to estimate the value of artificial ground-water recharge in the Santa Clara Valley (Reichard and Bredehoeft, 1984). The benefits of reduced ground-water pumping costs and reduced subsidence were found to be greater than the total costs of continuing the artificial recharge program. A second analysis compared the costs of artificial recharge with the cost of a surface system that would achieve the same storage and conveyance of water. The costs of artificial recharge proved to be much less than the costs of an equivalent surface system.



Direct costs of land subsidence in the Santa Clara Valley in 1979 dollars.



This view looking into a typical collapsed well screen shows the damage caused by compaction. This photograph was made by lowering a light into the well, followed by a camera; the crumpled vertical ribbing of the steel well screen produced this radiating effect.

taining salt-pond levees, raising grades for railroads and roads, enlarging or replacing bridges, enlarging sewers and adding sewage pumping stations, and constructing and operating storm-drainage pumping stations in areas that have subsided below the high-tide level. Most of these direct costs were incurred during the era of active subsidence. In 1981 Lloyd C. Fowler, former Chief Engineer of the Santa Clara Valley Water District, estimated the direct costs of subsidence to be \$131,100,000 in 1979 dollars, a figure that translates to about \$300,000,000 in 1998 dollars. The ongoing cost of maintaining levees and pumping facilities can also be attributed mainly to subsidence. In fact, as of this writing, the U.S. Army Corps of Engineers is building a substantial system for flood control along the lower Guadalupe River channel, with design requirements (and associated expense) influenced by past subsidence.

Some of Fowler's estimates of direct costs deserve further explanation. Land subsidence was estimated to have damaged or destroyed about 1,000 wells in the 5-year period 1960 to 1965, and the cost estimate was based on the cost of repair. By the 1960s most large wells in the Santa Clara Valley extended to depths of 400 feet or more. Many well casings were buckled or collapsed by the compaction of clay lenses at depths more than 200 feet below the land surface. The compacting clay caused the casing to buckle and eventually collapse. The cost estimate cited for the Bay levees as of 1979 applies only to the publicly maintained flood-protection levees, and likely underestimates the total cost. An additional, unknown cost was incurred by a salt company that maintained levees on 30 square miles of salt ponds within the original bayland area. Land subsidence has permanently increased the risk of saltwater flooding in case of levee breaks and the potential for saltwater intrusion of shallow aquifers.

#### Careful management will continue

The Santa Clara Valley Water District is currently managing the ground-water basin in a conservative fashion in order to avoid further subsidence. Their management strategy depends on continued availability of high-quality surface water from State and Federal projects that import water from massive diversion facilities in the southern part of the Sacramento-San Joaquin Delta. As we describe in another case study, these diversion facilities themselves are threatened by land subsidence within the Delta. Thus the prognosis for land subsidence in the Santa Clara Valley depends in part on subsidence rates and patterns in the Delta. Because much of California relies on large-scale interbasin water transfers, subsidence and water-quality issues in many parts of the State are complexly interrelated.