

Groundwater/Conjunctive Management

Or, Why is groundwater recharge
so important?

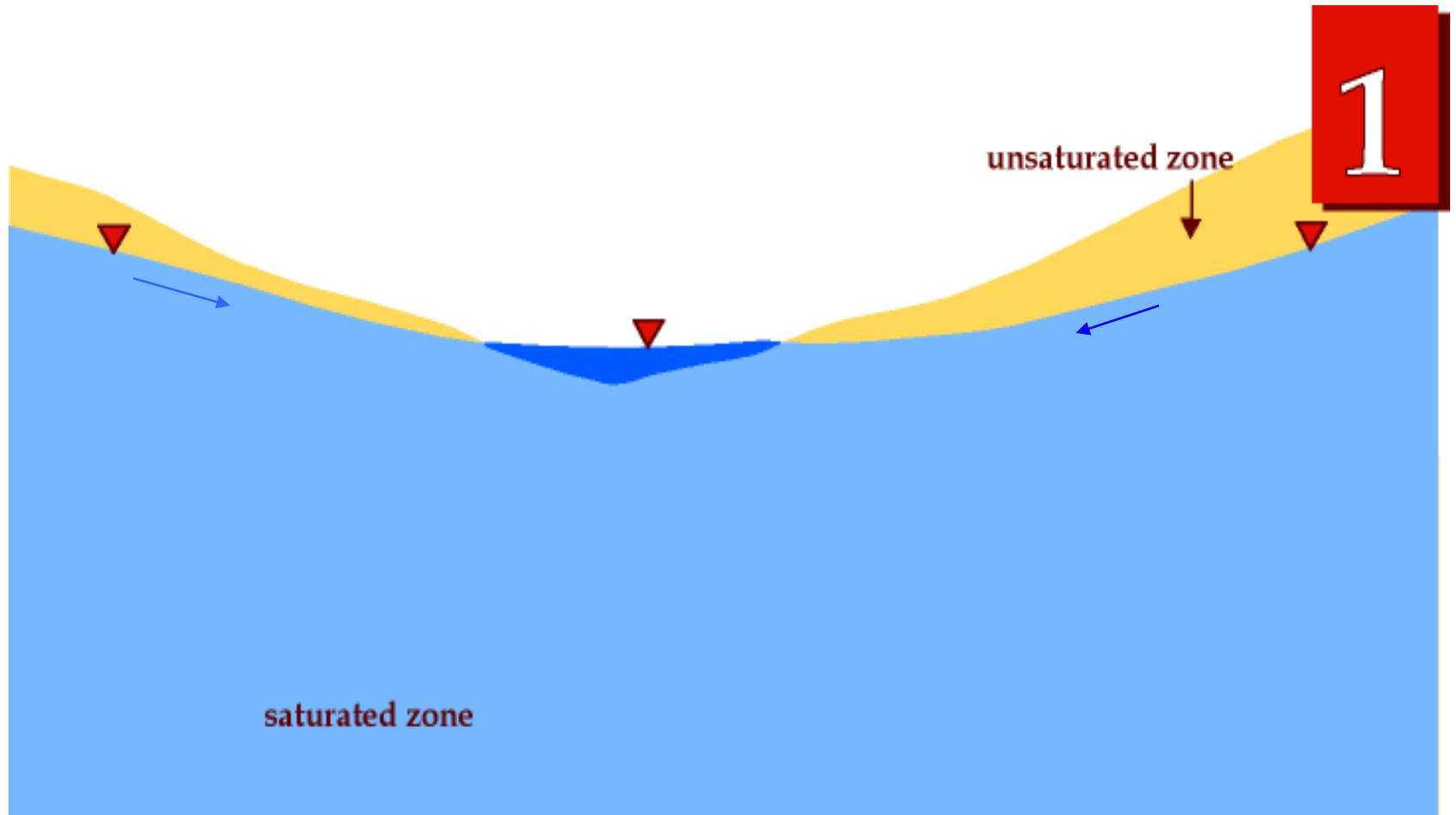
California Water Commission

14 September 2011

Carl Hauge

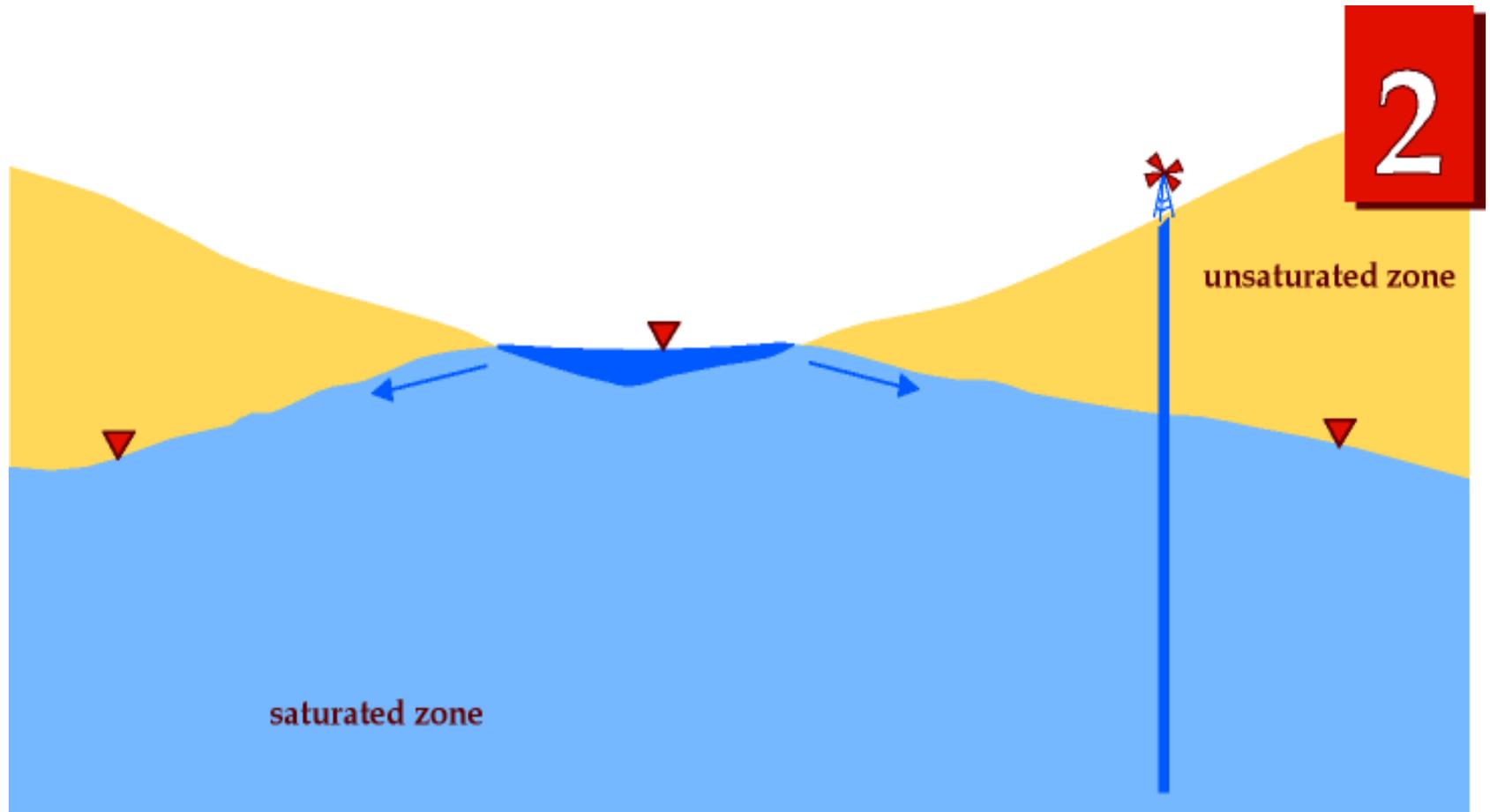
Facts

- 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



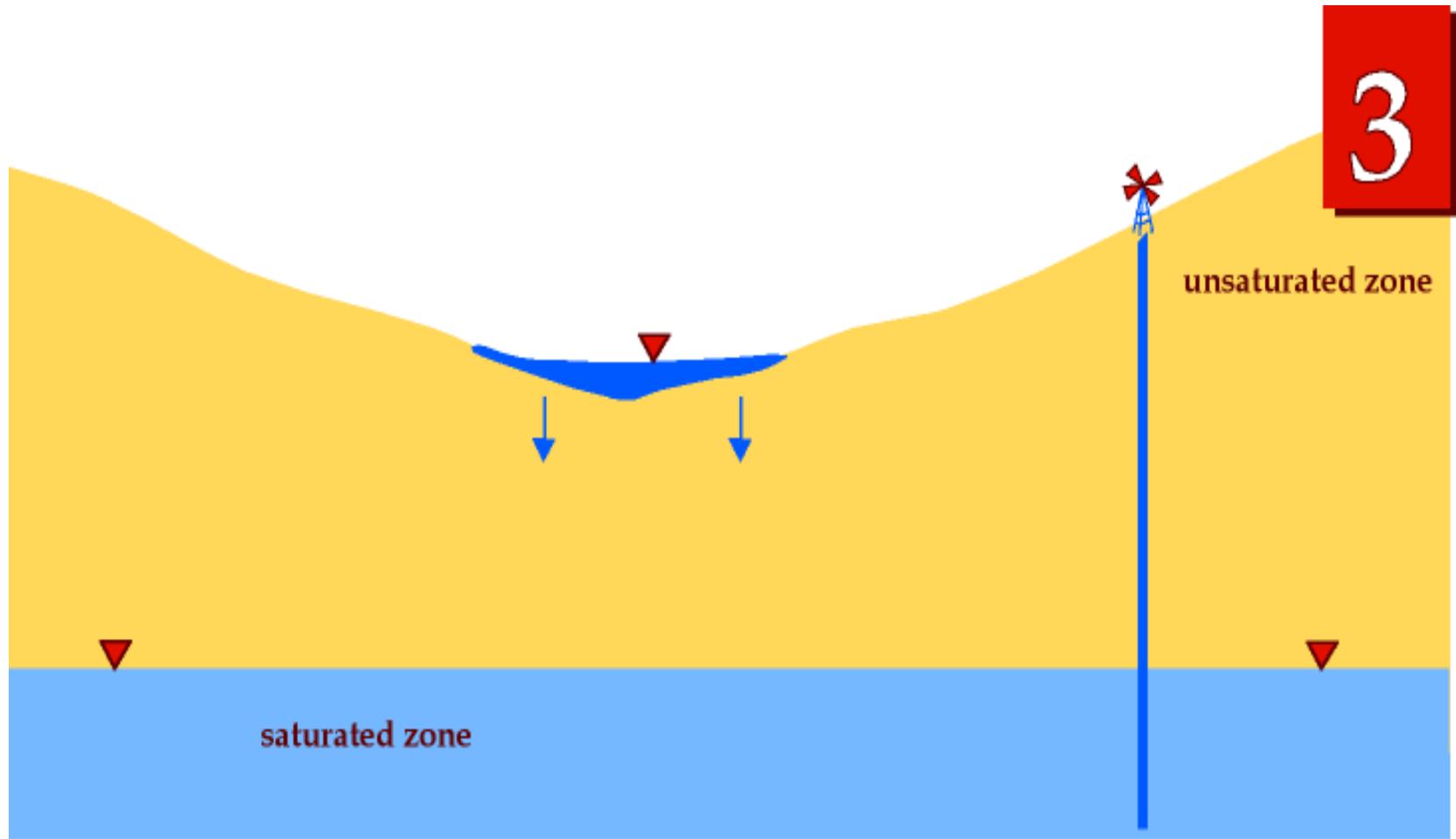
Full basin

Streams are drains for the overflowing ground water reservoir

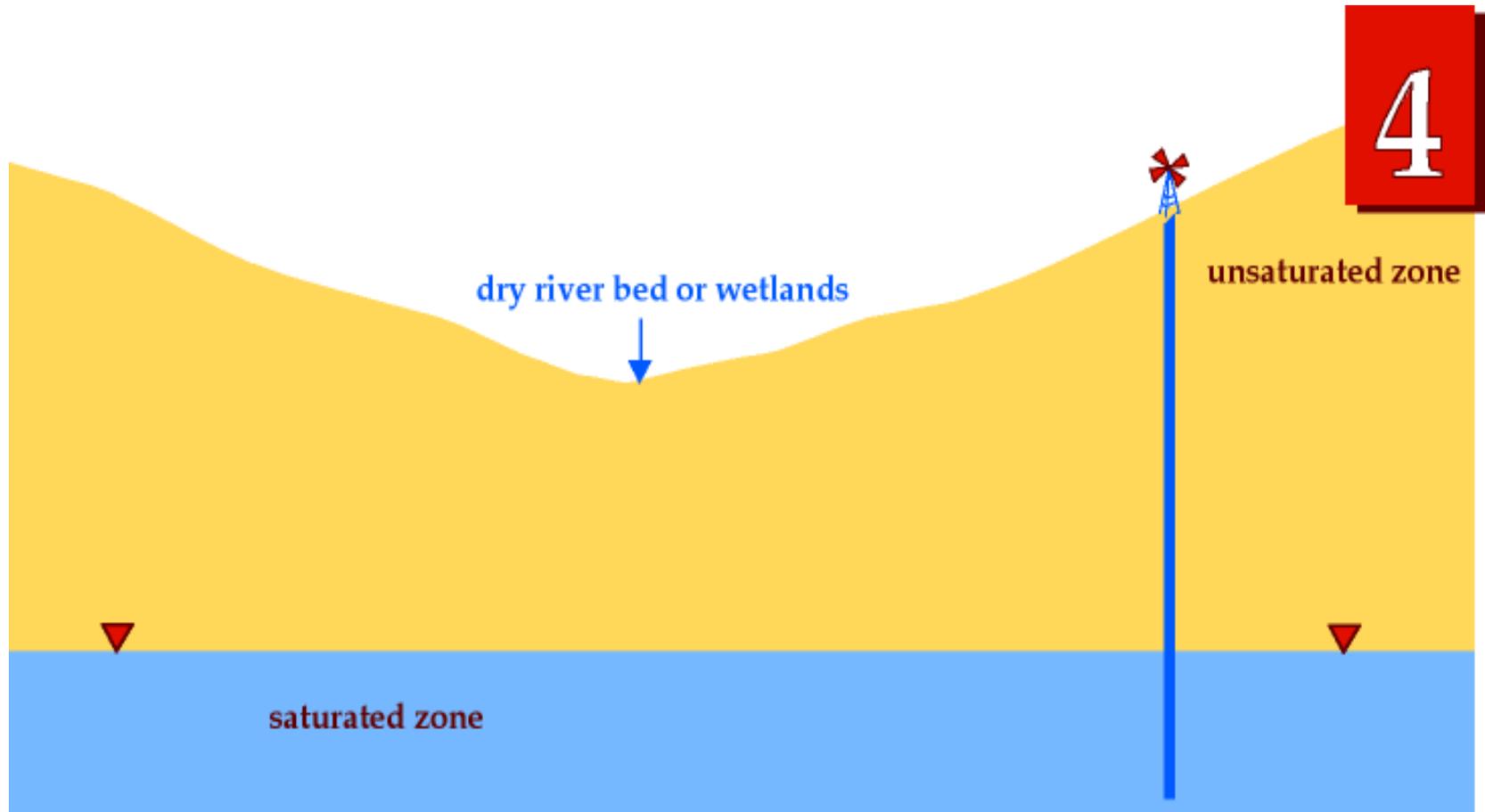


Some extraction of ground water
Storage capacity is made available for additional water and a gradient is created that induces recharge from streams

3



Rate of extraction exceeds rate of recharge



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 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

- 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



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

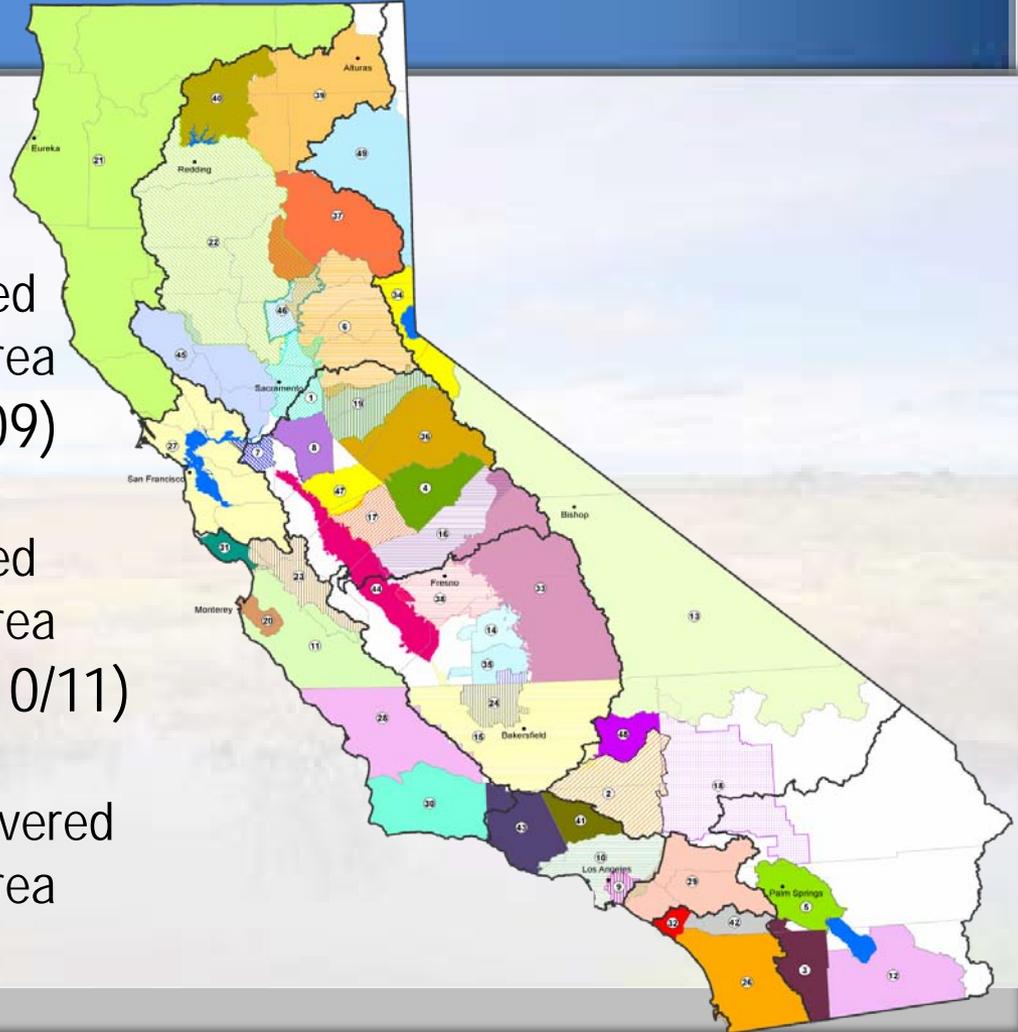
- Water level
- Quality
- **Recharge?**
- **Extraction?**
- **Use of extracted water?**

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

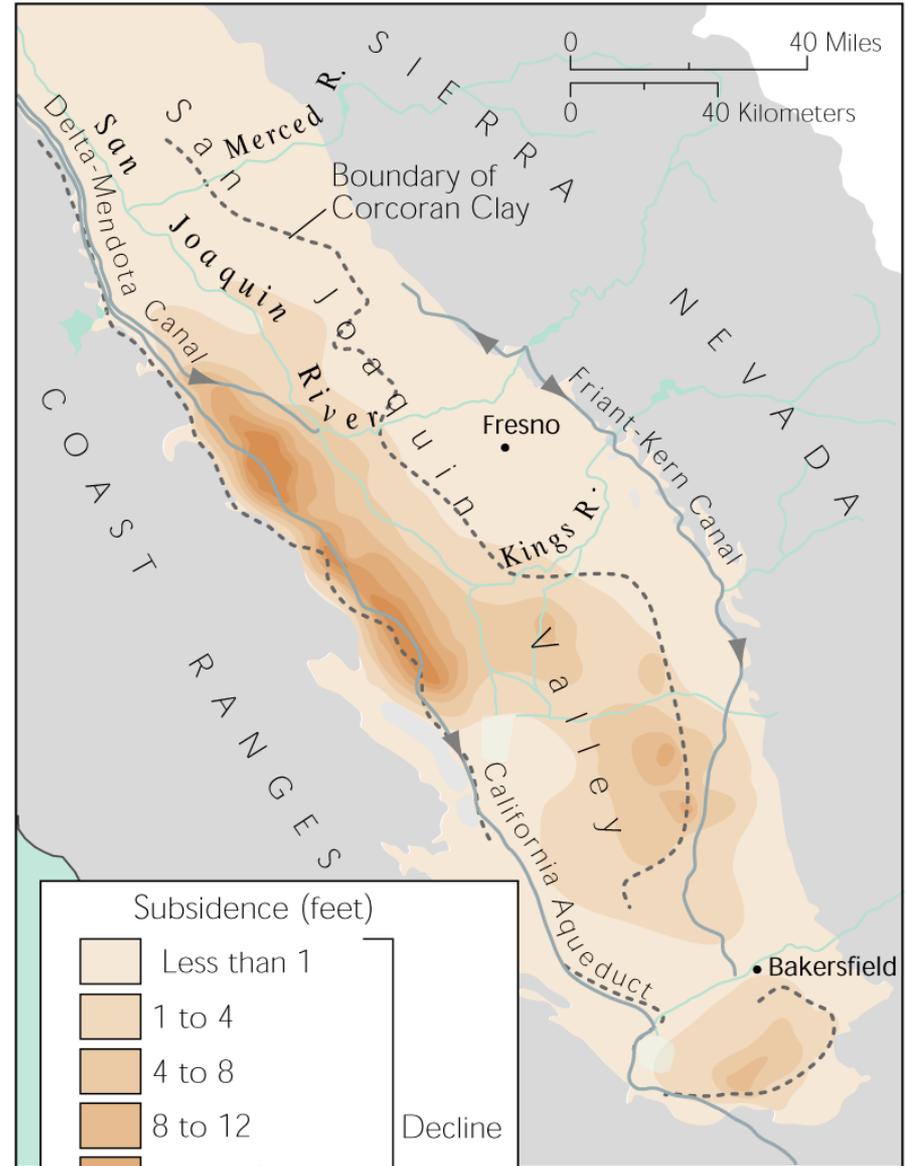
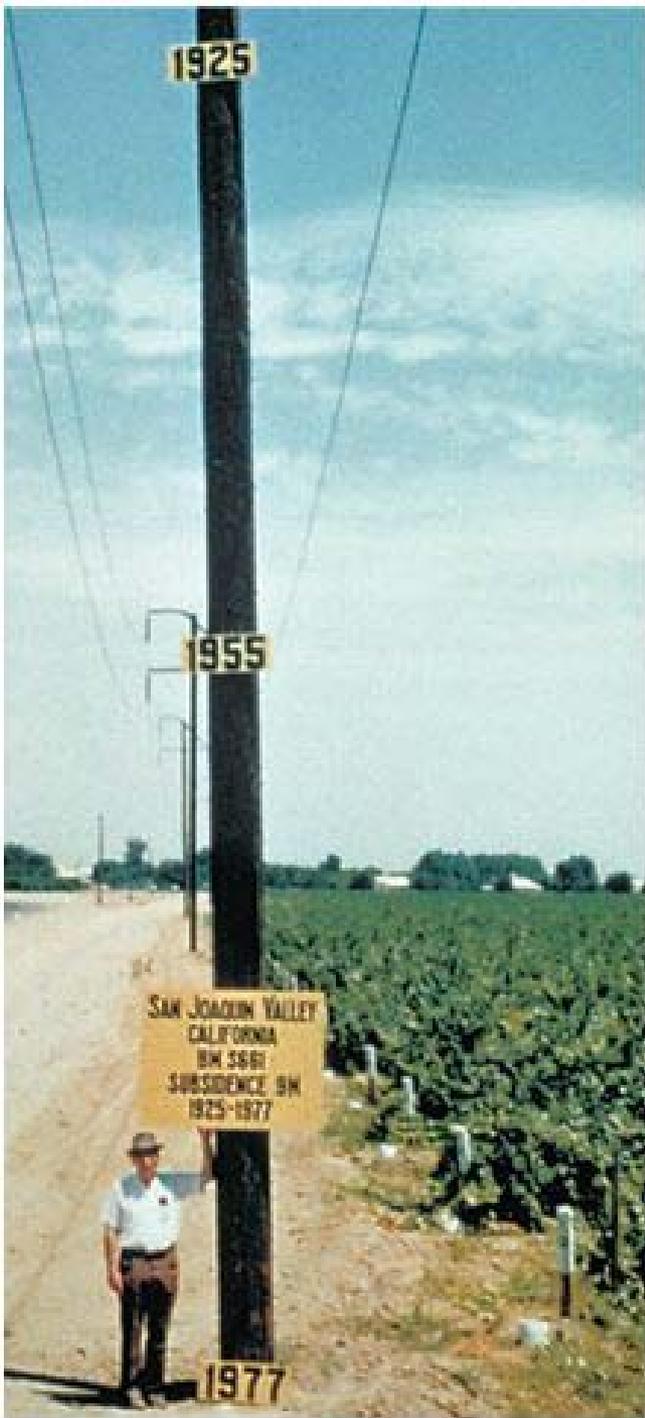
- P50 grants (2004)
 - 19 IRWM regions
 - 94% of state population covered
 - 54% of the state geographic area
- Implement RAP process (2009)
 - 46 IRWM regions accepted
 - 97% of state population covered
 - 83% of the state geographic area
- After second round RAP (2010/11)
 - 48 IRWM regions
 - 99%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



(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