

**SIMILARITIES BETWEEN SOLVING AGRICULTURAL DRAINAGE
PROBLEMS IN THE SAN JOAQUIN VALLEY AND ECOSYSTEM
RESTORATION OF THE SALTON SEA**

(Carroll Hamon, April 27, 2004)

San Joaquin Valley Agriculture

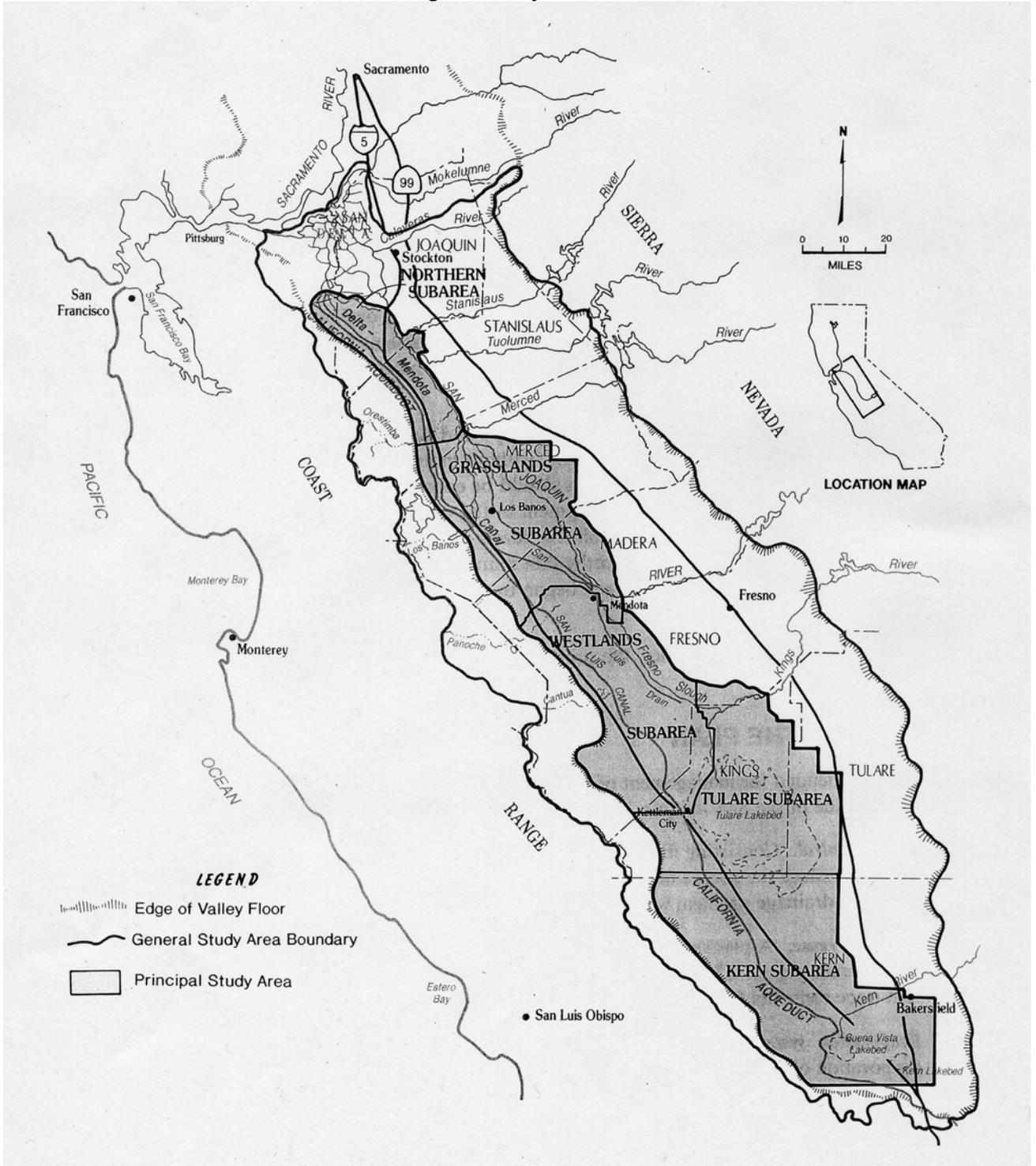
The San Joaquin Valley, like the Imperial Valley, is a major contributor to California's agriculture. The San Joaquin Valley encompasses almost 5 million acres of productive farmland. However, much of the west side of the Valley, about 750,000 acres, is plagued by poor subsurface drainage conditions that impact crop productivity. Effective subsurface drainage management is essential to prevent high groundwater conditions and the accumulation of salts in the root zone. However, irrigation drainage water in this area often contains naturally occurring but elevated levels of selenium and other trace elements that threaten the water quality, environment, and survival of fish and wildlife. This threat, first noticed in the mid 1980s at Kesterson Reservoir, resulted in closing several drainage systems on the Valley's west side adding to the drainage water disposal problem. Federal, State and local agencies continue to search for long-term ways to manage the agricultural drainage problem for the benefit of agriculture and without degradation of environmental resources. The equivalent of about 40 railroad cars of salt contained in the irrigation water are deposited into soil and shallow groundwater on the west side of the Valley daily (1.5 million U.S. tons/year). With no drainage outlet from the Tulare Lake Basin (southern San Joaquin Valley) and no significant drainage outlet to the San Joaquin River (northern portion of the Valley) after 1986, rising water tables and the related salt problems became critical to sustaining agricultural production.

San Joaquin Valley Wildlife Refuges

Wildlife refuges in the San Joaquin Valley provide major habitat for migratory birds and other waterfowl. The San Luis National Wildlife Refuge Complex, in the Gustine to Los Banos area near the northern end of the Valley, is comprised of three National Wildlife Refuges and the Grasslands Wildlife Management Area. The Complex is well known for its diverse population of bird life. During the winter, the refuges support several hundred thousand waterfowl, highlighted by large concentrations of mallards and green-winged teal. Birds of prey are common, drawn to an abundance of waterfowl, ground squirrels, meadow voles and rabbits. The wooded slough channels provide a haven for both migratory and resident songbirds. The San Luis Refuge and the Grasslands Wildlife Management Area have been directly affected by agricultural drainage management activities.

The San Luis Refuge, which includes the now closed Kesterson Reservoir site, consists of 15,322 acres of permanent and seasonal marshes, wooded sloughs and grasslands. The seasonal marshes are flooded during the fall, winter and spring, and provide habitat for thousands of migrating ducks and geese, sandhill cranes and shorebirds.

SJVDP Program Study Area



(Source: SJVDP 1990)

The meandering, wooded sloughs represent examples of ancient San Joaquin River channels and are especially important for songbirds and wading birds. The uplands support remnants of native grasslands and provide important habitat for a variety of raptors.

The Grasslands Wildlife Management Area encompasses over 80,000 acres of privately owned wetlands and uplands. Through the US Fish and Wildlife Service's conservation easement program, over 61,000 acres have been perpetually protected. The Greater Grasslands Ecological Area (which includes the SLNWR Complex) has been designated as a Western Hemisphere Shorebird Reserve Network Site of international importance. In the 1970s and 80s, agricultural drainage water was a part of the Grasslands Area water supply. There was major concern about the safety of this area when bird problems were discovered at Kesterson.

Brief History

Problems with agricultural drainage have persisted on the west side of the San Joaquin Valley since it was first irrigated. Planning for drainage facilities to serve the Westside San Joaquin Valley began in the mid 1950s. U.S. Bureau of Reclamation's 1955 feasibility report for the San Luis Unit described the proposed drain as an earth ditch that would drain 96,000 acres. In 1956, the California Legislature ordered a study of a "comprehensive master drainage works system". In 1957, DWR published its California Water Plan, which outlined the State Water Project. The Plan included a Master Drain extending from near Buena Vista lakebed in the Tulare Lake Basin to the Sacramento – San Joaquin Delta.

In 1960, Public Law No. 88-488 authorized the construction, operation, and maintenance of the San Luis Unit of the Central Valley Project, including the construction of San Luis Dam, San Luis Canal, Coalinga Canal, San Luis Drain, distribution systems, collector drains, pumping facilities, and other related works. The facilities would convey irrigation and drainage water for the westside of the San Joaquin Valley. Construction of the San Luis Unit started in 1963, and the first significant water deliveries began in 1968. The San Luis Unit serves 700,000 acres of irrigated agriculture including the Westlands, Broadview, Pacheco, and Panoche Water Districts and the southern portion of the San Luis Water District. That same year, Reclamation began construction of the San Luis Drain, an interceptor drain to collect agricultural drain water from the San Luis Unit and ultimately discharge to the Sacramento-San Joaquin Delta.

By 1975, Reclamation had constructed 83 miles of the planned 188-mile San Luis Drain and 1,283 acres of shallow ponds (later named Kesterson Reservoir) near Gustine about 80 miles south of the Sacramento-San Joaquin Delta. These shallow ponds were designed to provide temporary storage to help control the rate of discharge to the Delta upon completion of the San Luis Drain to the Delta. However, construction was suspended, pending determination of the final point of discharge for the San Luis Drain. Drainage water stored in Kesterson was so attractive to waterfowl that the US Fish and Wildlife

Service made it part of the adjacent San Luis National Wildlife Refuge. Of course at that time it was not anticipated that water quality problems at Kesterson would eventually result in its closure by the State Water Resources Control Board.

The State Water Project also began delivery of irrigation water to its service area in the landlocked Tulare Lake Basin of the San Joaquin Valley in 1968. The State service area has alternately been in and out of the Master Drain concept, but as of today, agricultural drainage water is handled by storage in large evaporation ponds, with no plan to remove drainage water from the Basin.

Bird Deformities at Kesterson Reservoir

The discovery of deformities and deaths of aquatic birds at Kesterson Reservoir in 1983 altered the perception of drainage problems on the western side of the Valley. Kesterson Reservoir was intended to be a regulating reservoir on the Drain prior to discharge in the Delta, but became a terminal storage facility with no outlet. Beginning in 1981, approximately 7,000 acre-feet of subsurface drainage was discharged per year to this facility until problems with wildlife were observed in 1983 and traced to selenium (up to 400 ppb) in the drain water. This led to the State Water Resources Control Board issuing Cleanup and Abatement Order WQ 85-1 for Kesterson, resulting in closure of both the San Luis Drain and Kesterson Reservoir. The Order required mitigation of nuisance conditions while the reservoir was being closed and provision to provide alternative wildlife habitat to replace Kesterson. The reservoir was closed and filled in as a Class II landfill.

Similarities between San Joaquin Valley agricultural drainage problems and problems at the Salton Sea

While the physical configuration of the two problem areas differ, the water quality problems resulting from high concentrations of salts in the drainage water present similar environmental challenges. Similarities between the two problem areas include:

- 1) Large quantities of drainage water to manage
- 2) High salt concentrations in drainage water
- 3) Potential toxic elements in water and /or sediments
- 4) No solution is readily available
- 5) Some solutions may create severe environmental problems
- 6) Simple solutions probably won't work
- 7) Complicated technical solutions are generally unproven and costly
- 8) Research and development of possible solutions is very costly

In the SJVDP study area, the selenium concentrations in subsurface drains discharged to evaporation ponds vary widely, ranging from less than 2 to more than 200 ppb. Currently, Salton Sea inflows are approximately 5-10 ppb depending on the tributary, time of year, and location within the tributary. However, the Salton Sea "processes" selenium so that the water borne selenium in the Sea, is about 1.5 ppb, based on filtered samples.

San Joaquin Drainage Program

In 1984, the San Joaquin Valley Drainage Program was established as a joint federal and State effort to investigate drainage and drainage-related problems and to identify possible solutions on the Westside San Joaquin Valley. The investigation was limited to the evaluation of in-valley drainage management options with a goal of permitting the present level of agricultural development in the valley to continue, while protecting and restoring fish and wildlife and their habitats.

In September 1990 the San Joaquin Valley Drainage Program summarized its findings and presented a plan to manage drainage problems in a report entitled "*A Management Plan For Agricultural Subsurface Drainage and Related Problems in the Westside San Joaquin Valley*".

- 1) Recommended actions and implementation progress
 - a) Source control - proposed to increase irrigation efficiency, thereby reducing the volume of drainage water. Drip and micro-sprinkler systems, and improved row irrigation is being installed.
 - b) Drainage reuse -- proposed reuse of drainage water on progressively more salt tolerant crops until a significantly reduced volume could be stored and evaporated. Test areas and small scale operations (e.g. Deiner Farms) are being constructed and operated.
 - c) Improved evaporation ponds - proposed to improve the design of ponds to discourage bird use and provide alternative safe habitat in the vicinity. Significant progress in redesigned old and new ponds, hazing birds, and providing alternative habitat is being carried out with good success.
 - d) Land retirement - proposed discontinuation of irrigation on the most problem lands. Both Westlands Water District and the USBR are buying severely affected private land from willing sellers and removing it from irrigation. More is planned.
 - e) Ground-water management - proposed planned pumping from shallow ground water in suitable areas to lower the water table. Not much has been accomplished in a planned way, but the late 80's - early 90's drought severely reduced surface water supply, required return to pumping, and high water tables fell, giving credence to the proposal.
 - f) Discharge to the San Joaquin River -- proposed to regulate, control and dilute drainage from northern areas with release into the San Joaquin River under strict standards. Some drainers in the northern part of problem area, have been able to collectively control and dilute drainage water to meet San Joaquin river standards. A five-year trial period was successfully completed and has been extended.
 - g) Protection, restoration, and provision of substitute water supplies for fish and wildlife habitat - proposed to provide good quality water for wildlife areas formerly served with drainage water. Existing wildlife

areas formerly served with drainage water, like the Grasslands, have been provided a safe water supply.

- h) Institutional change - proposed that irrigation districts and other local agencies make institutional changes to encourage the recommended actions. Irrigation districts are providing incentives for source control, continuing research, and taking other actions.
-
- 2) Drainage water treatment was not included as a recommended action in the 1990 Plan because of the uncertainties of its effectiveness and/or its high cost. However the SJVDP evaluated 11 treatment processes that had been conducted by federal, state, local and university researchers. These included bacterial processes, bioremediation, immobilization of selenium (using iron filings), and cogeneration (burning of agroforest biomass). DWR operated a reverse osmosis drainage water desalting demonstration plant at Los Banos from 1983 to 1986 and concluded that additional work is required on the pretreatment system to establish feasibility.
 - 3) It was noted in the SJVDP report that in-valley management might not allow irrigated agriculture to be maintained for more than 50 years without finding a way to dispose of the salts being accumulated and that a search for a more permanent solution should be undertaken soon. Nothing has been undertaken.

The interagency San Joaquin Valley Drainage Implementation Program (SJV DIP), successor to the SJVDP, was formed in 1991 to encourage and foster implementation of the recommendations in the SJVDP report. The SJV DIP undertook a re-evaluation of the recommended plan to assess the changes that have taken place since 1990, including scientific advances, availability of new data, and institutional changes. They note that significant progress has been made in some areas. But the clock is still ticking, as nearly 1.5 million tons of salt continue to be deposited each year on the Westside San Joaquin Valley with no plan for salt removal.

Federal and State Costs

Over the past fifty years, large amounts of money have been spent by state and federal agencies in an attempt to solve drainage problems on the Westside San Joaquin Valley. From 1952 to 2000, DWR spent about \$ 53.1 million and is currently spending about \$2.7 million annually.

Federal agencies have spent well over \$100 million on the agricultural drainage problem. That includes pre-1985 costs, over \$30 million in Kesterson cleanup costs, about \$50 million on San Joaquin Valley Drainage Program (1984-1990), and additional funds during subsequent years. About \$4.5 million has been appropriated for fiscal year 2004. In addition, over \$100 million is being spent in settlement of drainage-related damage claims.

Lessons Learned

- 1) It is generally not fruitful to spend time looking for a quick fix or a silver bullet that will make the problem go away.
- 2) Beware of peddlers selling snake oil. Because it is often difficult to tell the good from the bad at first blush, be wary of easy, simple solutions and investigate before expending big money or effort.
- 3) There are probably no simple solutions. Invariably, complex problems require complex solutions.
- 4) It is generally advisable to focus on smaller, environmentally acceptable solutions that can be expanded incrementally when proven effective and safe.
- 5) Expect large costs for research, planning and implementation of any solution.
- 6) Expect surprises, trust to luck, and find a deep funding pocket!