SACRAMENTO AND SAN JOAQUIN DELTA

Before reclamation, the Delta was an enormous area of tule and reed swamps subject to frequent inundations by both the Sacramento — San Joaquin river system and tidal inflow from San Francisco Bay. The potential of the rich Delta soil was developed rapidly, particularly following legislation in the 1850's which provided for the sale of swamp and overflow land to individuals who would attempt to reclaim it.

Levee construction began on the higher ground utilizing Chinese labor and hand tools. As lower marsh ground was reclaimed the size and height of the levees grew proportionally and reclamation districts were formed. The reclamation scheme was to put a levee around each of the island-like tule marshes, following the banks of the meandering natural channels. By the 1920's when most of the sizeable areas had been reclaimed, there were over 1100 miles of levee protecting some 420,000 acres of what may be the most productive farm land in the world. At one time, 80 percent of the world's asparagus was grown in the Delta.

The construction of such reclamation systems, an engineering feat in its own right, is perhaps overshadowed by the efforts that have been required to hold and maintain the levees through the years. Hydraulic mining, begun in the Sierra about the same time as the development of the Delta, ultimately dumped 1½ billion cubic yards of sediment into the rivers. Much of this settled in the Delta, significantly raising water levels. The very soil which makes the Delta so attractive causes even more trouble. The rich peat soil slowly oxidizes in the air resulting in a continuous subsidence of both land and levee. Land originally at sea level is now 25 feet or more below, requiring ever higher and stronger levees to keep the water out. The occasional breech or overtopping of a levee dramatically demonstrates the magnitude of the struggle. Many of the levees are still privately owned and maintained. However, over the last six decades much of the burden has been carried by the United States Army Corps of Engineers who, in addition to building and maintaining many levees, has direct responsibility for the maintenance of the channels and the general improvement of the flow of water.

The Delta levee system can best be seen by driving around some of the Delta islands and noting the different degrees of protection afforded. In particular, observe the difference in levels between the water outside and the farm land inside. Full appreciation of the extent and complexity of the system requires a flight over the area.

Levee repair, slope dressing and rip-rapping at Merrit Island on the Sacramento River.

SACRAMENTO
DELTA
SAN JOAQUIN
ATLAS

California Department of Water Resources
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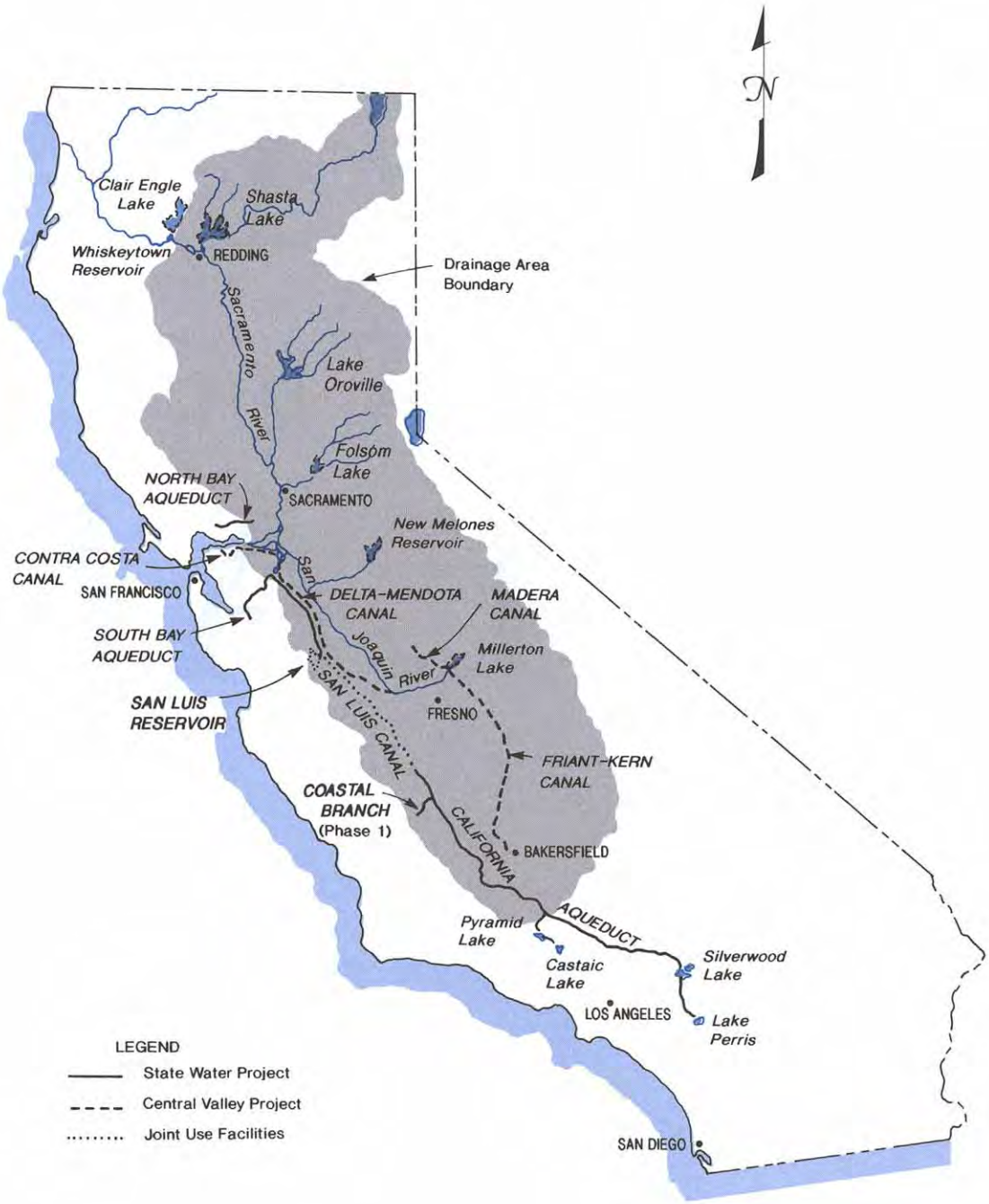


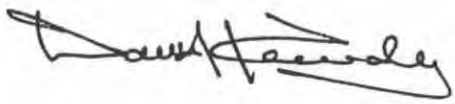
Major Features of State Water Project and Central Valley Project

FOREWORD

The Delta of the Sacramento and San Joaquin rivers is California's water supply crossroads. It is the major collection point for water that serves over 20 million people, two-thirds of our State's population.

The maze of islands and channels lying at the confluence of these two large rivers has long been the focal point of debate surrounding a number of complicated water-related issues of statewide importance. People with a wide variety of interests—agricultural, urban, industrial, environmental, and recreational—have a vital stake in the Delta and a need to understand the physical Delta and its complex interrelationships.

This atlas provides information that we hope will be helpful in addressing the complex problems of the estuary. The atlas is a revision of the Sacramento-San Joaquin Delta Atlas that was published in 1987. It contains updates on many Delta facts and features. It also introduces new information on the Suisun Marsh and tides and hydrology in the Delta as well as in San Francisco Bay.



David N. Kennedy, Director
Department of Water Resources
The Resources Agency
State of California

INTRODUCTION

The Delta is a unique and valuable resource and an integral part of California's water system. It receives runoff from over 40 percent of the State's land area including flows from the Sacramento, San Joaquin, Mokelumne, Cosumnes, and Calaveras rivers. The Delta provides habitat for many species of fish, birds, mammals, and plants; supports agricultural and recreational activities; and is the focal point for water distribution throughout the State.

The development of today's Delta began in late 1850 when the Swamp and Overflow Land Act conveyed ownership of all swamp and overflow land, including Delta marshes, from the federal government to the State of California. Proceeds from the sale of swampland by the State were to go toward reclaiming the swamplands. In 1861, the State Legislature created the Board of Swamp and Overflowed Land Commissioners to manage reclamation projects. In 1866, the Board's authority was transferred to county boards of supervisors. In 1868, the Legislature removed acreage ownership limitations and by 1871 most of California's swampland was in private ownership.

Developers first thought levees 4 feet high and 12 feet at the base would protect Delta lands from tides and river overflow, but that proved inadequate for Delta peat soils. By 1869, substantial levees had been constructed on Sherman Island and Twitchell Island by Chinese laborers, and in 1870 and 1871 the owners reaped bountiful harvests of grain and row crops. Small-scale reclamation projects were started on Rough and Ready Island and Roberts Island in the 1870s, but the peat soils showed their weakness as levees. The peat soils would sink, blow away when dry, and develop deep cracks and fissures throughout the levee system. Sherman and Twitchell Islands flooded annually in the early 1870s. By 1874, reclamation and preservation costs for Sherman Island's levees had totaled $500,000. This is equivalent to $6.2 million dollars today.

In the late 1870s, the developers had begun to realize that hand- and horse-powered labor could not maintain the reclaimed Delta islands. Steam-powered dredges began to be used to move the large volume of alluvial soils from the river channels to construct the large levees. These dredges were capable of moving material at about half the cost of hand labor.

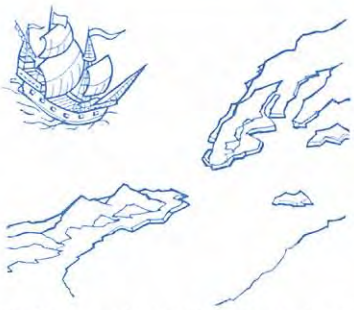
The peak of Delta land reclamation was reached with the clamshell-type dredge, still commonly used. Advantages of this machine over its predecessors were versatility, ease of operation, and modest capital and operating costs.

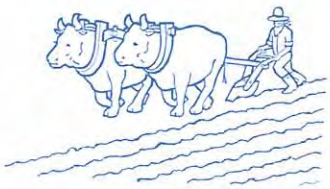
After World War I, the number of operating dredges decreased greatly, as nearly all Delta marshland had been reclaimed. By this time, the Delta had been transformed from a large tidal marsh to the series of improved channels and leveed islands we know today.

The Delta covers 738,000 acres interlaced with hundreds of miles of waterways. Much of the land is below sea level and relies on more than 1,000 miles of levees for protection against flooding. Its land and waterways support communities, agriculture, and recreation, and provide essential habitat for fish and wildlife.

The Sacramento-San Joaquin Delta Atlas provides information for readers who wish to understand the complex interrelationships within the Delta and grasp its significance to the State.

DELTA TIME LINE



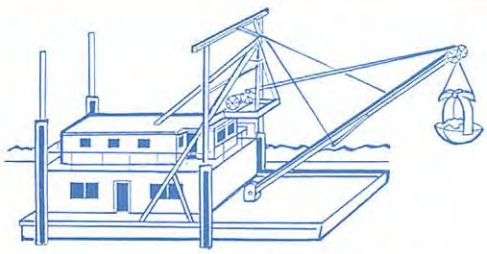


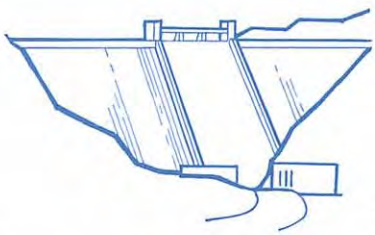
HISTORICAL

First recorded sighting of Delta — 1772

San Carlos explores San Francisco Bay — 1776

Settlers begin farming — 1849





FACILITIES

Dredges developed to build Delta levees — 1880-1916

Dredging of Stockton Deep Water Channel — 1933

Export begins via Contra Costa Canal — 1940

Shasta Dam and Reservoir — 1944

Delta-Mendota Canal and Delta Cross Channel — 1951

LEGISLATIVE

Federal Swamp and Overflow Act — 1850

State Reclamation District Act — 1861

Federal Reclamation Act — 1902

State Reclamation Board — 1911

Federal Authorization of CVP — 1933

Burns-Porter Act and Delta Protection Act — 1959

ACTIONS

Hydraulic Mining Outlawed — 1884

Surface water right law revised — 1914

Delta salinity investigation — 1930

Interagency Delta Committee report recommends Peripheral Canal — 1965

Delta Water Rights D-1379 — 1971

Selected References

The Department of Water Resources has published many documents relating to the Delta over the years. The following reports are the most pertinent ones released between 1978 and 1992:

Delta Water Facilities, Program for: Delta Protection and Water Transfer, Water Conservation, Water Recycling, and Surface and Ground Water Storage. Bulletin 76. July 1978.

Delta Levees Investigation. Bulletin 192-82. December 1982.

Delta Alternatives Material (four volumes). December 1982. Reference copies only. Volumes III and IV contain material on Senate Bill 200 and Assembly Concurrent Resolution 90 (Proposition 8). Division of Planning.

Alternatives for Delta Water Transfer. November 1983.

Sacramento-San Joaquin Delta Water Quality Surveillance Program, Monitoring Results Pursuant to Delta Water Rights Decision 1485. Text and three volumes of data. August 1985. Central District.

Final Environmental Impact Report on Proposed Additional Pumping Units, H. O. Banks Delta Pumping Plant, Summary. January 1986. Central District.

Interagency Delta Health Aspects Monitoring Program, Project Report. December 1986. Central District.

Sacramento-San Joaquin Delta Emergency Water Plan. Report to Legislature. December 1986. Central District.

Flood Protection of State Highways in the Sacramento-San Joaquin Delta. December 1987. Central District.

Sacramento-San Joaquin Delta Flood Hazard Mitigation Plan. January 1989. Central District.

The Delta as a Source of Drinking Water, Summary of Monitoring Results: 1983-1987. January 1989. Central District.

Water Quality Conditions in the Sacramento-San Joaquin Delta During 1987. Report to the State Water Resources Control Board in Accordance with Water Rights Decision 1485, Order 4(f). May 1989. Central District.

The Delta as a Source of Drinking Water, Monitoring Results: 1983-1987. August 1989. Central District.

Delta Subsidence Investigation. October 1989. Central District.

Proposed Sherman Island Wildlife Management Plan -- Initial Study and Negative Declaration. January 1990. Division of Planning.

Delta Levee Slope Protection Alternatives. February 1990. Division of Design and Construction.

Actions and Priorities, Delta Flood Protection Act, Eight Western Delta Islands. March 1990. Division of Planning.

Negative Declaration: Proposed South Delta Water Management Program -- Land Purchase. April 1990. Division of Planning.

Water Quality Conditions in the Sacramento-San Joaquin Delta During 1987. (Text and three volumes of data.) Text, May 1990; Volume 1, *Water Quality*, May 1990; Volume 2, *Phytoplankton,* May 1990; Volume 3, *Benthos,* May 1990. Central District.

Delta Island Drainage Investigation, Report of the Interagency Delta Health Aspects Monitoring Program. June 1990. Division of Local Assistance.

Draft Environmental Impact Report/Environmental Impact Statement: South Delta Water Management Program (Phase I of Water Banking Program). June 1990. Division of Planning.

Management of the State Water Project. Appendix E, *1987 Water Operations in the Sacramento-San Joaquin Delta.* Bulletin 132-88. October 1990.

Interagency Delta Health Aspects Monitoring Program, Summary of Monitoring Results, January 1988--December 1989. October 1990. Division of Local Assistance.

Draft Environmental Impact Report/Environmental Impact Statement: North Delta Program. November 1990. Division of Planning.

Water Quality Conditions in the Sacramento-San Joaquin Delta During 1989. Report to the State Water Quality Control Board in Accordance with Water Rights Decision 1485, Order 4(f). July 1991. Central District.

Use of Global Positioning System to Establish a Common Vertical Datum in the Sacramento-San Joaquin Delta, California. August 1991. Division of Land and Right of Way.

Early Stages and Early Life History of the Delta Smelt in the Sacramento-San Joaquin Estuary, with Comparison of Early Life Stages of the Long Fin Smelt. August 1991. Central District.

Long-term Trends in Zooplankton Distribution and Abundance in the Sacramento-San Joaquin Estuary. May 1992. Environmental Services Office.

Water Quality Conditions in the Sacramento-San Joaquin Delta in 1990. June 1992. Environmental Services Office.

Biological Assessment -- Effects of Central Valley Project and State Water Project Operations on Winter-run Chinook Salmon. October 1992. Environmental Services Office.

Evaluation of Selected Biological Factors That May Have Contributed to the Drought and Post-drought Decline in Chlorophyll, a Concentration. April 1990 (released in December 1992). Environmental Services Office.

Time Line of Delta Events

1772 First recorded sighting of Delta by Fray Juan Crespi and Captain Pedro Farges.

1776 San Carlos—first ship to enter San Francisco Bay.

1849 Settlers begin arriving in the Delta to farm its rich soils while Forty-Niners pass through on their way to strike gold in the Sierra foothills.

1850 Congress passes the Federal Swamp and Overflow Act, which provided for the title of wetlands to be transferred from the Federal Government to the states.

1861 California Legislature authorizes the Reclamation District Act, allowing drainage of Delta lands and construction of sturdier levees.

1869 Sherman Island is the site of the first coordinated levee system in the Delta.

1879 Prized by fisherman, the Striped Bass is brought by rail from the East Coast to the Delta. Two more shipments are required before the fish is established.

1880 Most of the Delta reclaimed using dredges developed to build levees quickly and inexpensively. By 1930, all but minor areas of swampland had been leveed and were being farmed.

1884 Federal Circuit Court decision in Woodruff v. North Bloomfield, et al., requires termination of mining debris discharges into California rivers. Hydraulic mining had deposited tons of silt and sand in Delta channels and upstream rivers.

1900 California's population is estimated at 1.5 million.

1902 Congress passes the Reclamation Act for development of irrigated lands in the western United States.

1911 The Reclamation Board is created by the California Legislature to implement a comprehensive flood control plan for the Sacramento and San Joaquin rivers.

1914 California Legislature passes bill to revise water right law regarding appropriation of surface water.

1930 State completes comprehensive investigation of Delta salinity and its control, and also the State Water Plan (now the Central Valley Project) to transfer northern California water throughout the Central Valley.

1933 Corps of Engineers dredges Stockton Deep Water Ship Channel to Port of Stockton.

Congress authorizes the Central Valley Project (CVP).

1940 Export of Delta water begins with U.S. Bureau of Reclamation (USBR) completion of the Contra Costa Canal, the first unit of the CVP.

1944 Shasta Dam and Reservoir completed as a key feature of the CVP; adds water to Delta channels during low-flow periods, thereby limiting salinity intrusion.

1951 Delta export increases with completion of the Delta-Mendota Canal, another unit of the CVP.

USBR constructs the Delta Cross Channel to aid in transferring water from the Sacramento River across the Delta to the Tracy Pumping Plant, which serves the Delta Mendota Canal.

1959 State Legislature passes the Delta Protection Act and the Burns-Porter Act to assist in financing the State Water Project, including Delta facilities. The SWP, which would increase Delta exports, was approved by California voters in 1960.

1960 California voters approve the Burns-Porter Act (also called the State Water Project Development Bond Act) authorizing the sale of $1.75 billion of general obligation bonds to help finance the SWP. California's population is 15.7 million.

1963 Corps of Engineers dredges the Sacramento Deep Water Channel to the port of Sacramento.

1965 Interagency Delta Committee, formed in 1961, completed its report recommending various Delta facilities, including the Peripheral Canal, to offset adverse effects of increasing Delta exports.

1967 Oroville Dam and Reservoir is completed as a key feature of the SWP and the Feather River Fish Hatchery is opened to replace spawning areas lost as a result of the dam.

The first stage of the Harvey O. Banks Delta Pumping Plant is completed along with the John E. Skinner Fish Facility.

1971 State Water Resources Control Board (SWRCB) adopts its Delta Water Rights Decision 1379 establishing Delta water quality standards to be met by the Central Valley Project (CVP) and SWP.

1973 California Aqueduct completed to Southern California.

Legislature passes Senate Bill 541 (also known as the Way Bill) to provide State financial assistance for maintenance and improvement of certain Delta levees.

Delta Environmental Advisory Committee (DEAC) concludes that a federal-State Peripheral Canal, properly designed and operated, is necessary to protect the Delta.

1978 SWRCB issues Water Right Decision 1485 updating Delta water quality standards and establishing water quality standards for Suisun Marsh.

Delta Atlas On-Line

A version of the Sacramento-San Joaquin Delta Atlas is available on the World Wide Web.

The address for the on-line Delta Atlas is **http://locke.water.ca.gov**, which is the Division of Planning's home page. From there you may access the Delta Atlas or several other DWR Planning reports, such as Bulletin 160-93, *The California Water Plan Update.*

You may also be interested in other DWR or California Resources World Wide Web sites. Below is a partial list of water and other natural resources related sites.

- ❑ Department of Water Resources Home Page:
  http:// wwwdwr.water.ca.gov

- ❑ California Cooperative Snow Surveys Home Page:
  http:// snow.water.ca.gov

- ❑ California Environmental Resources Evaluation System (CERES) Home Page:
  http://resources.agency.ca.gov

- ❑ California Home Page:
  http://www.ca.gov/gov/calhome.html

- ❑ California's Natural Resources Home Page:
  http://resources.agency.ca.gov/ceres/calweb/Natural_Resources.html

References

Delta Conservancy

Sacramento–San Joaquin River Delta - Wikipedia

Sacramento-San Joaquin Delta Chronology - Water Education Foundation

Sacramento-San Joaquin Delta Atlas - California Water Library