

SACRAMENTO - SAN JOAQUIN

DELTA *Overview*



ARNOLD SCHWARZENEGGER
Governor
State of California

MIKE CHRISMAN
Secretary for Resources
The Resources Agency

LESTER A. SNOW
Director
Department of Water Resources

Delta Overview

CALIFORNIA DEPARTMENT OF WATER RESOURCES



SACRAMENTO - SAN JOAQUIN

DELTA *Overview*





CONTENTS

2	Introduction
5	Counties
7	The Legal Delta
9	Delta Protection Commission
11	Water Districts and Agencies
13	Federal and State Highways
15	County Roads Providing Delta Access
17	Delta Waterways
19	Water Conveyance Facilities
21	Temporary Barriers Project
23	Maximum Salinity Intrusion
25	Thickness of Organic Soils
27	Land Surface Below Sea Level
29	Federal/State Flood Control Project Levees
31	Local Flood Control Non-Project Levees
33	Historical Flooding 1930-1966
35	Recent Flooding 1967-2004



INTRODUCTION

Preface

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 more than 25 million people, two-thirds of our State's population.

The maze of islands and channels 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. Agricultural, urban, industrial, environmental, and recreational interests have a vital stake in the Delta and a need to understand the physical Delta and its complex interrelationships.

This Overview describes the waterways, highways, levees, historic flooding, water supply systems and political boundaries of the Delta to convey a basic understanding of the complexity of the Delta and its significance to the people of California.

Background

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.

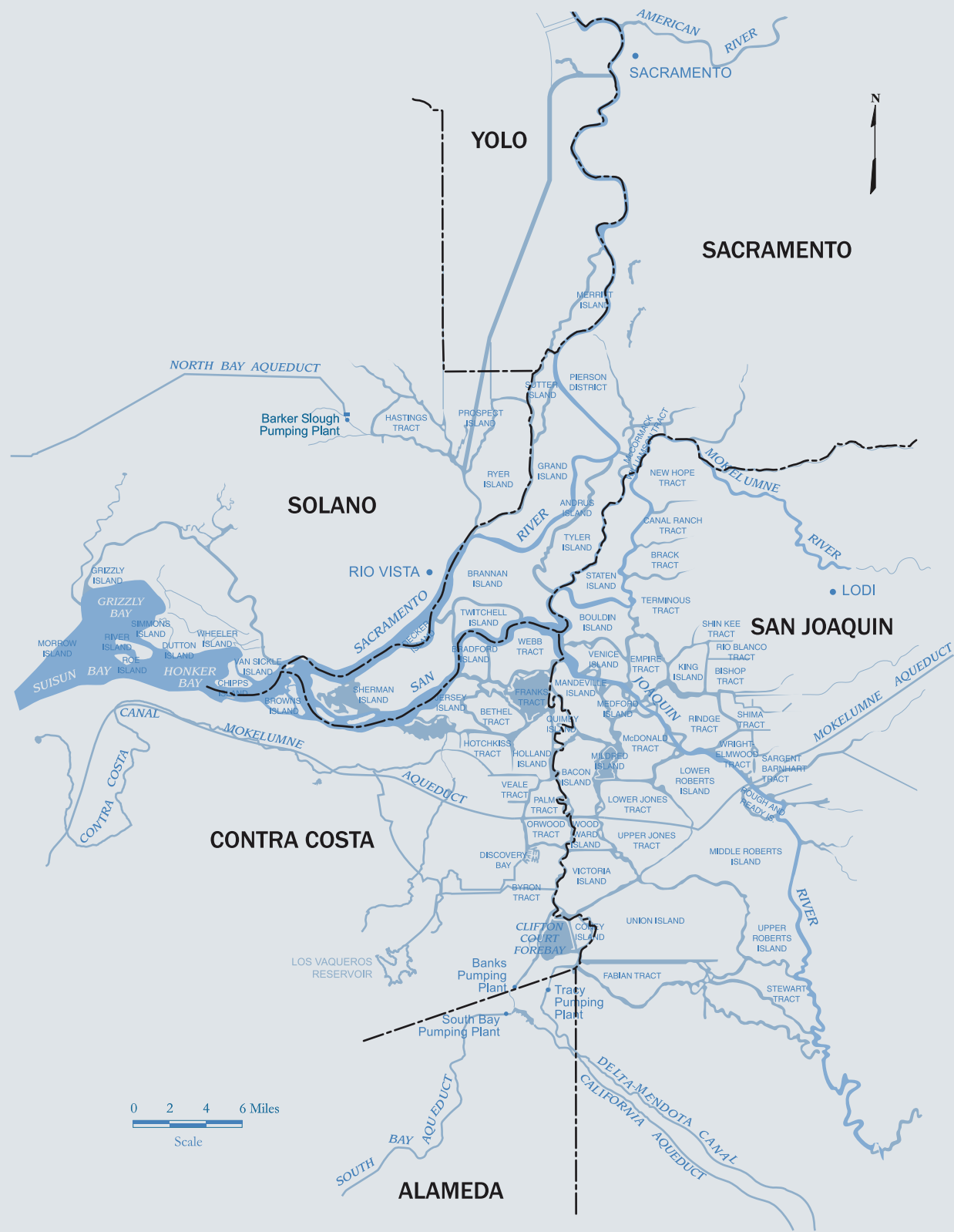
By 1874, reclamation and preservation cost for Sherman Island's levees had totaled \$500,000. This is equivalent to more than \$6 million dollars today.

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.

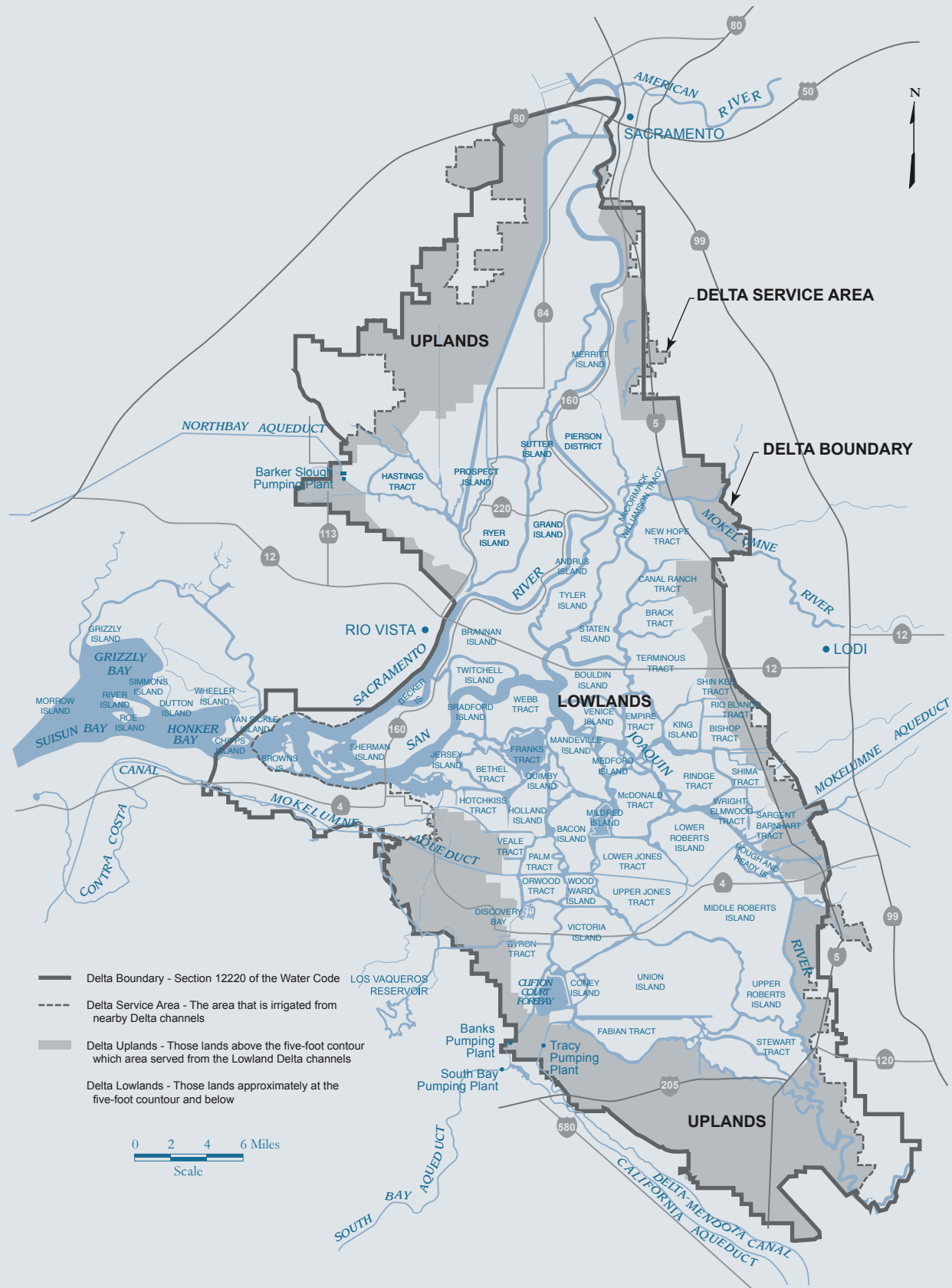


Counties

Portions of six counties – Alameda, Contra Costa, Sacramento, San Joaquin, Solano, and Yolo – make up the Delta, as shown on the map at left. Each of these counties is represented by an elected board of supervisors and has the responsibility of land use planning and zoning.



Courthouse in Courtland



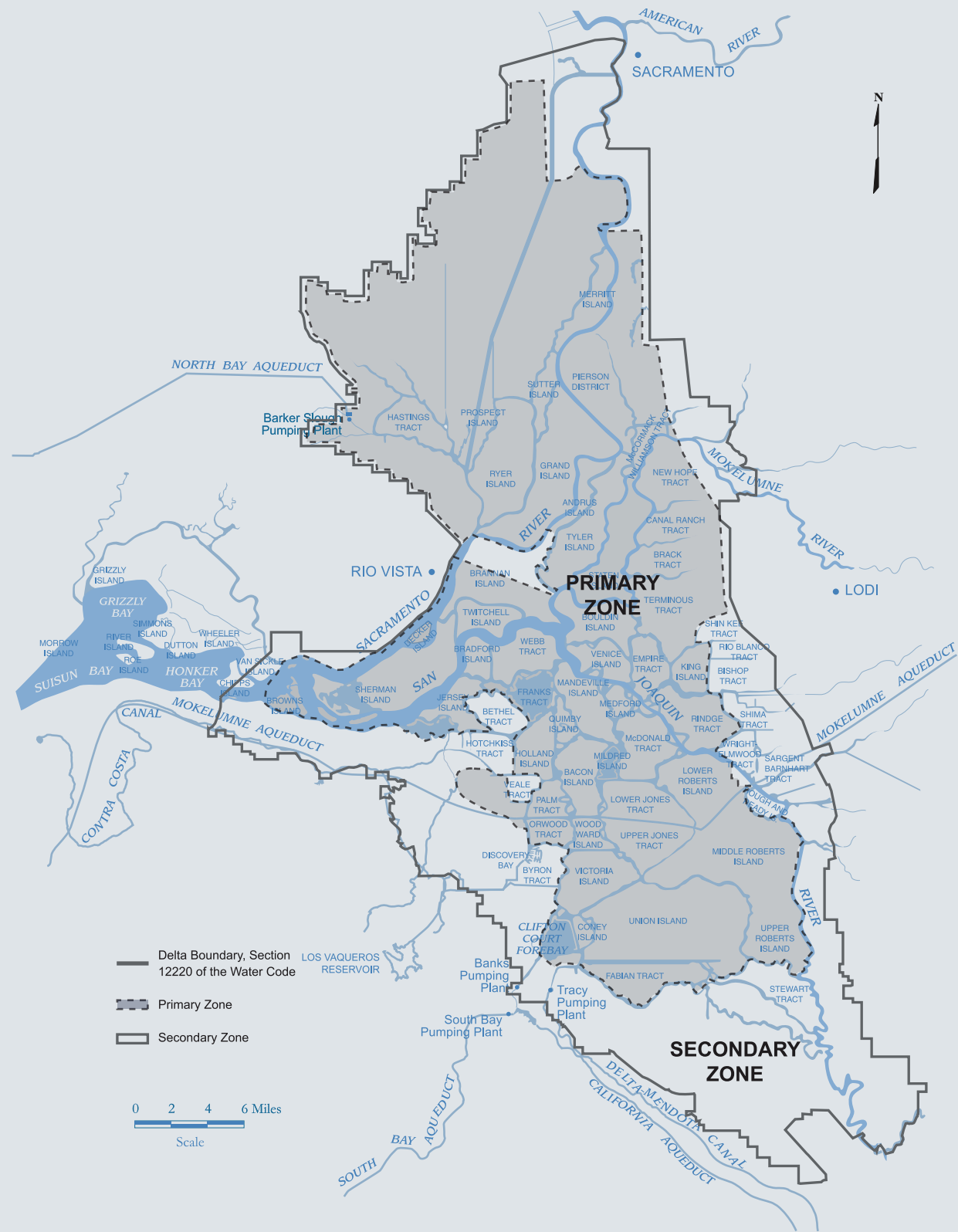
The Legal Delta

The Delta received its first official boundary in 1959 with the passage of the Delta Protection Act (Section 12220 of the Water Code). The map at left shows this statutory boundary. It also shows the Delta uplands and lowlands as well as the Delta service area, those irrigated lands within the Delta that receive water directly from its channels.



1
2

1. This high-altitude photograph shows a large portion of the Delta, including farmland, urban development, and flooded islands that have not been reclaimed.
2. This aerial photograph shows islands within channels in the central and northern Delta. Channel islands provide high-quality wildlife habitat.



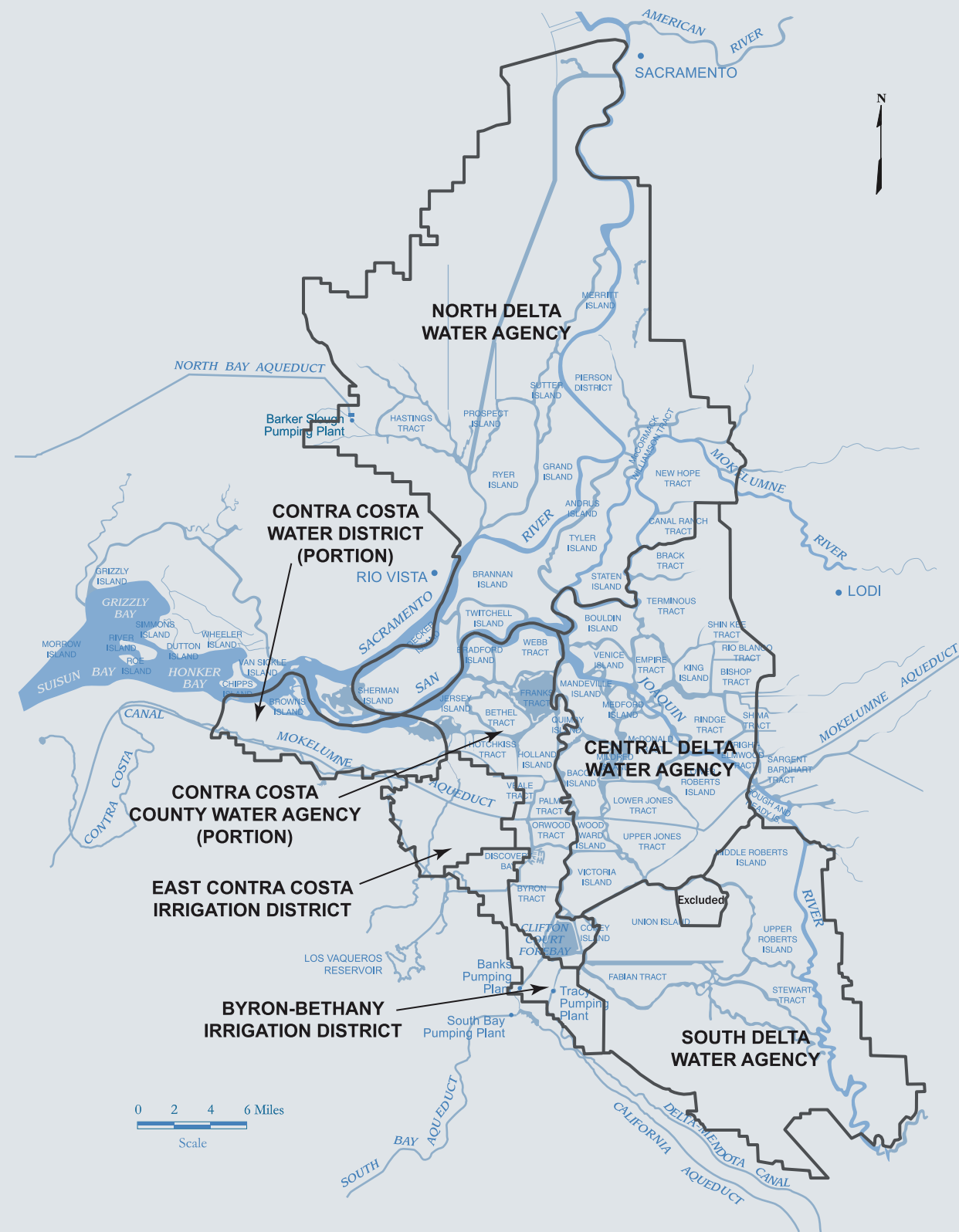
Delta Protection Commission

The Delta Protection Act of 1992 provides for regional coordination by establishing the Delta Protection Commission. The Commission is to develop a long term resources management plan for the Delta Primary Zone. The goals of this regional plan are to “protect, maintain and, where possible, enhance and restore the overall quality of the delta environment.” The Delta Primary Zone is illustrated to the left.

1
2

1. The Delta is a popular area for water-based recreation such as fishing, sailing, and water-skiing. An objective of the regional plan for the Primary Zone is to maintain, and possibly enhance, recreational opportunity in the Delta.
2. During fall and winter, agricultural fields in the Delta provide habitat for large populations of migratory waterfowl. One of the goals of the Delta Protection Act of 1992 is to preserve agricultural land within the Primary Zone.



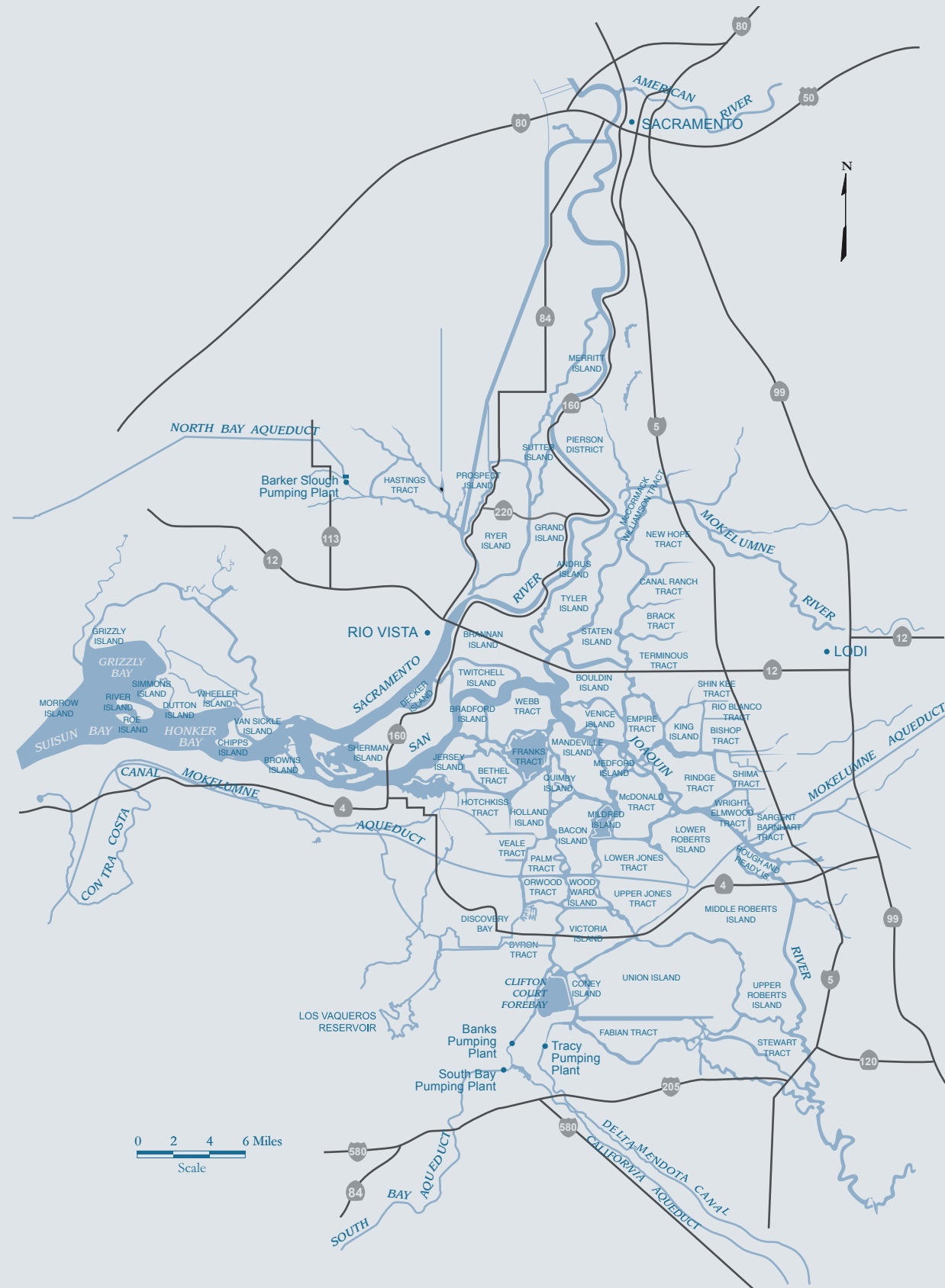


Water Districts and Agencies

In November 1965, the Department of Water Resources and the U.S. Bureau of Reclamation reached agreement with some Delta interests on the quality of agricultural water to be maintained by the State Water Project and the Central Valley Project at various locations in the Delta. There was, however, no legal entity to sign the related contracts. As a result, the California Legislature created the Delta Water Agency. This Agency was replaced with three separate agencies in 1973 – the North Delta Water Agency, the Central Delta Water Agency, and the South Delta Water Agency. Contra Costa County Water Agency, East Contra Costa Irrigation District, and Byron-Bethany Irrigation District are the remaining local water-supply organizations. They are located in the southwest area of the Delta as shown on the map to the left.



Siphons at Tom Paine Slough, installed as part of a settlement contract to improve water quality in a portion of the South Delta Water Agency.



Federal and State Highways

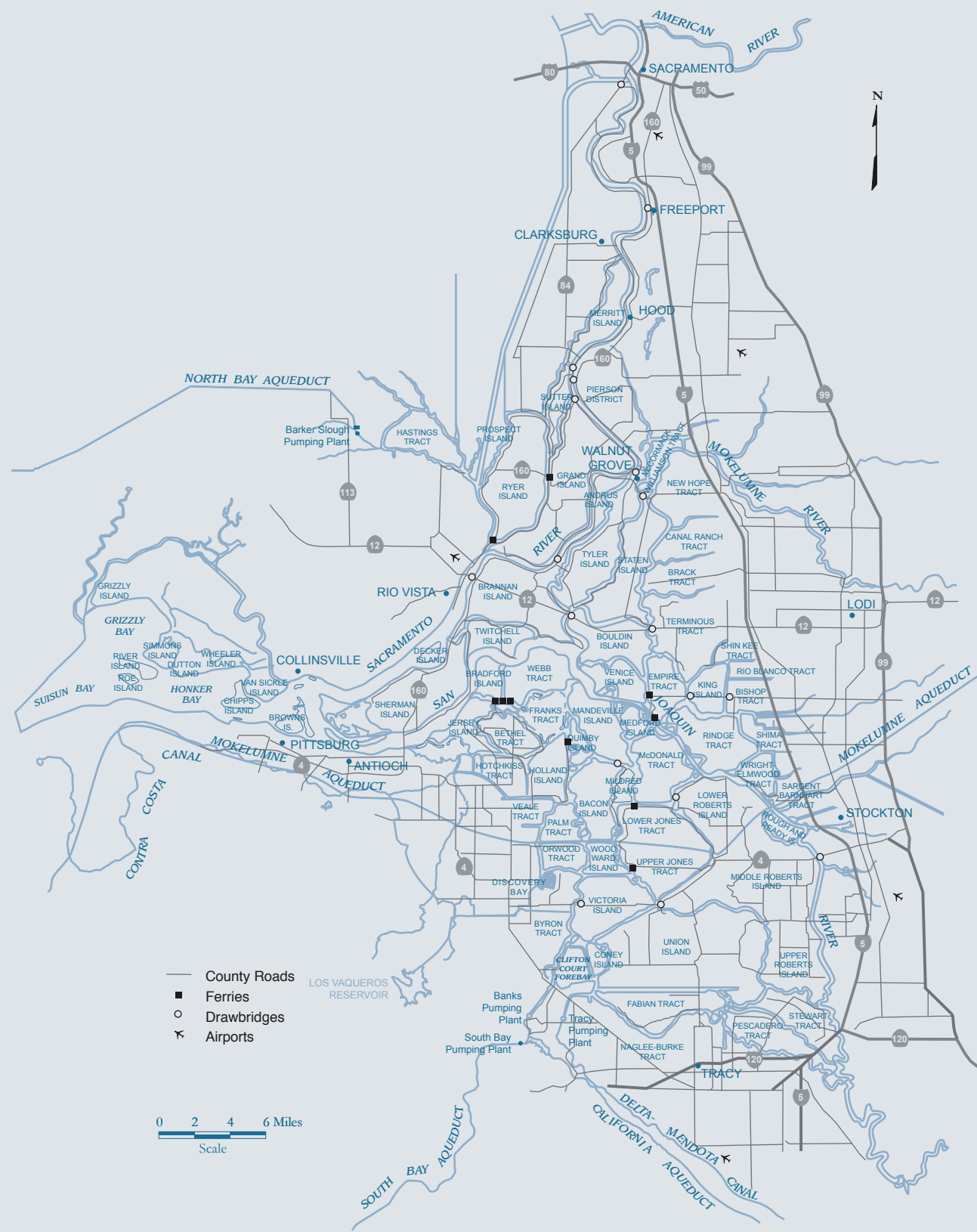
As shown on the map at left, interstate highways 5 and 205 and State Highway 99 traverse the periphery of the Delta. Road access to more central Delta areas is provided by State Highways 4, 12, and 160 and numerous County Roads (see following section).



1
2

1. Traveling north through Isleton on Highway 160, a State Scenic Route.

2. Rio Vista bridge on State Highway 12.

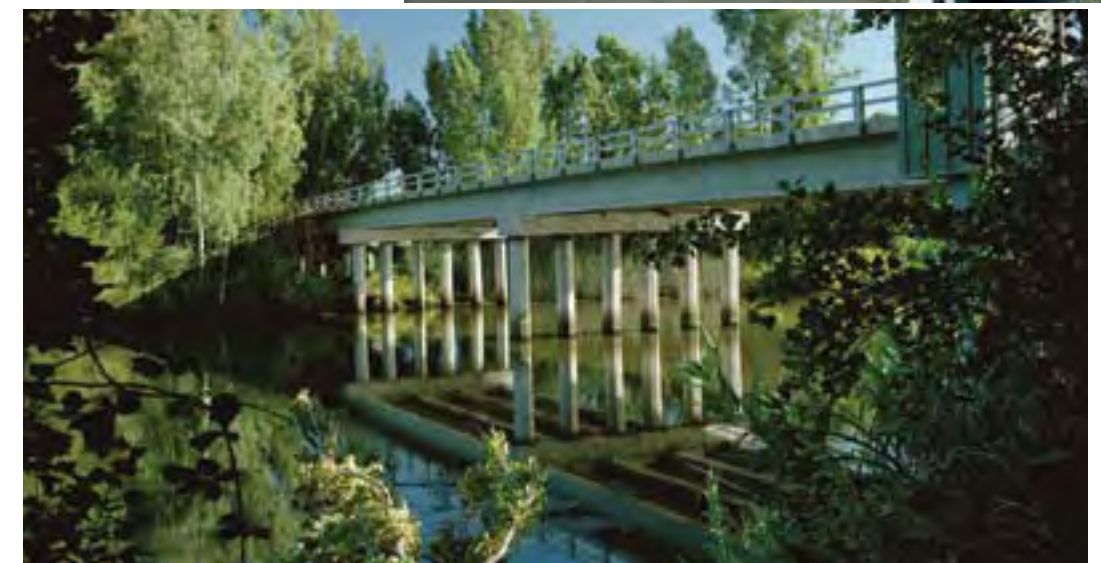


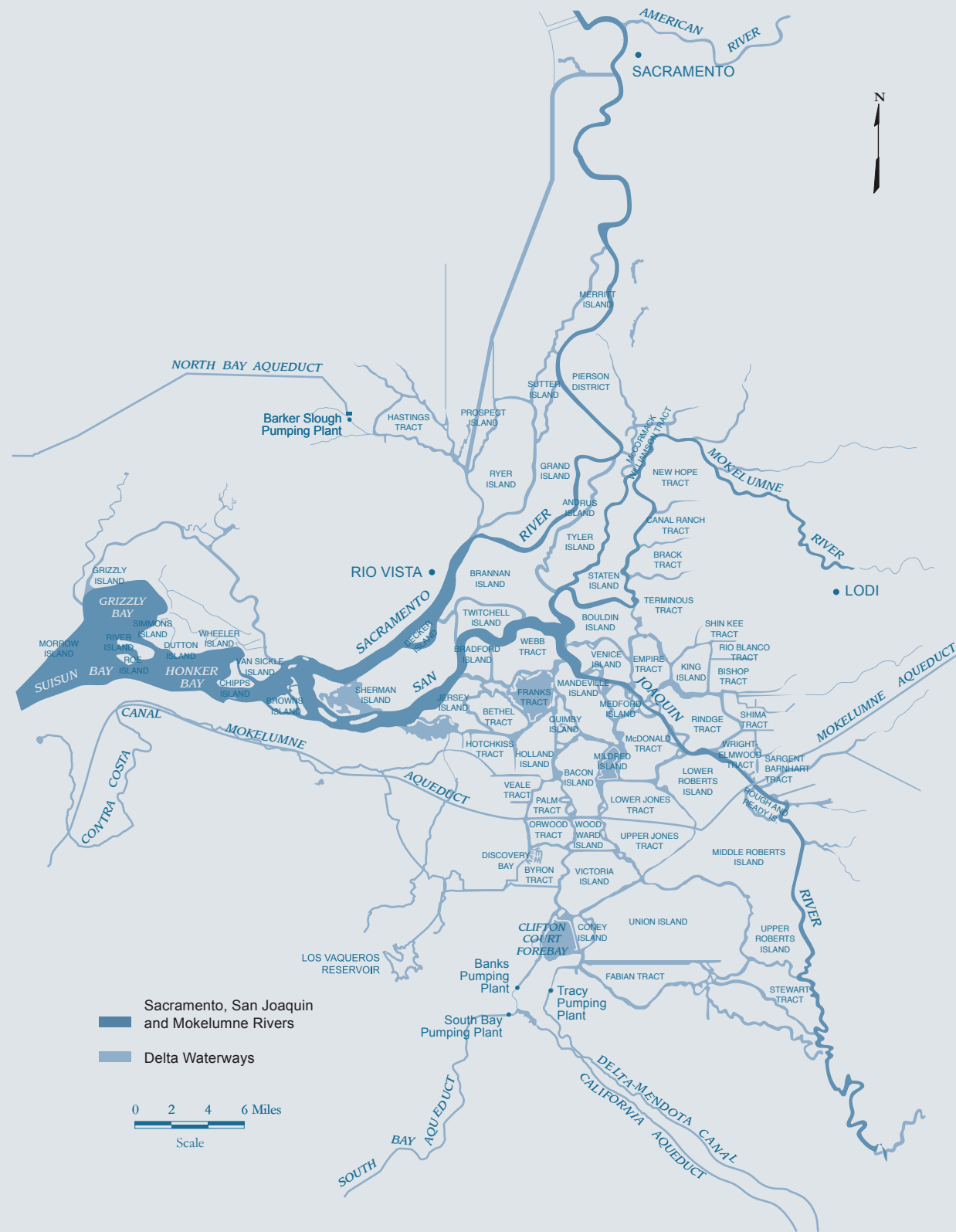
County Roads Providing Delta Access

Traffic on Delta roads continues to increase as commerce in the Delta grows. Drawbridges accommodate a combination of land and water traffic in the Delta. These bridges must be lifted frequently during the summer boating season. The map at left shows the network of county roads that serves most Delta islands.

1
2

1. Looking west on Lambert Road crossing Snodgrass Slough east of Courtland.
2. View of a bridge on local road in the south Delta.





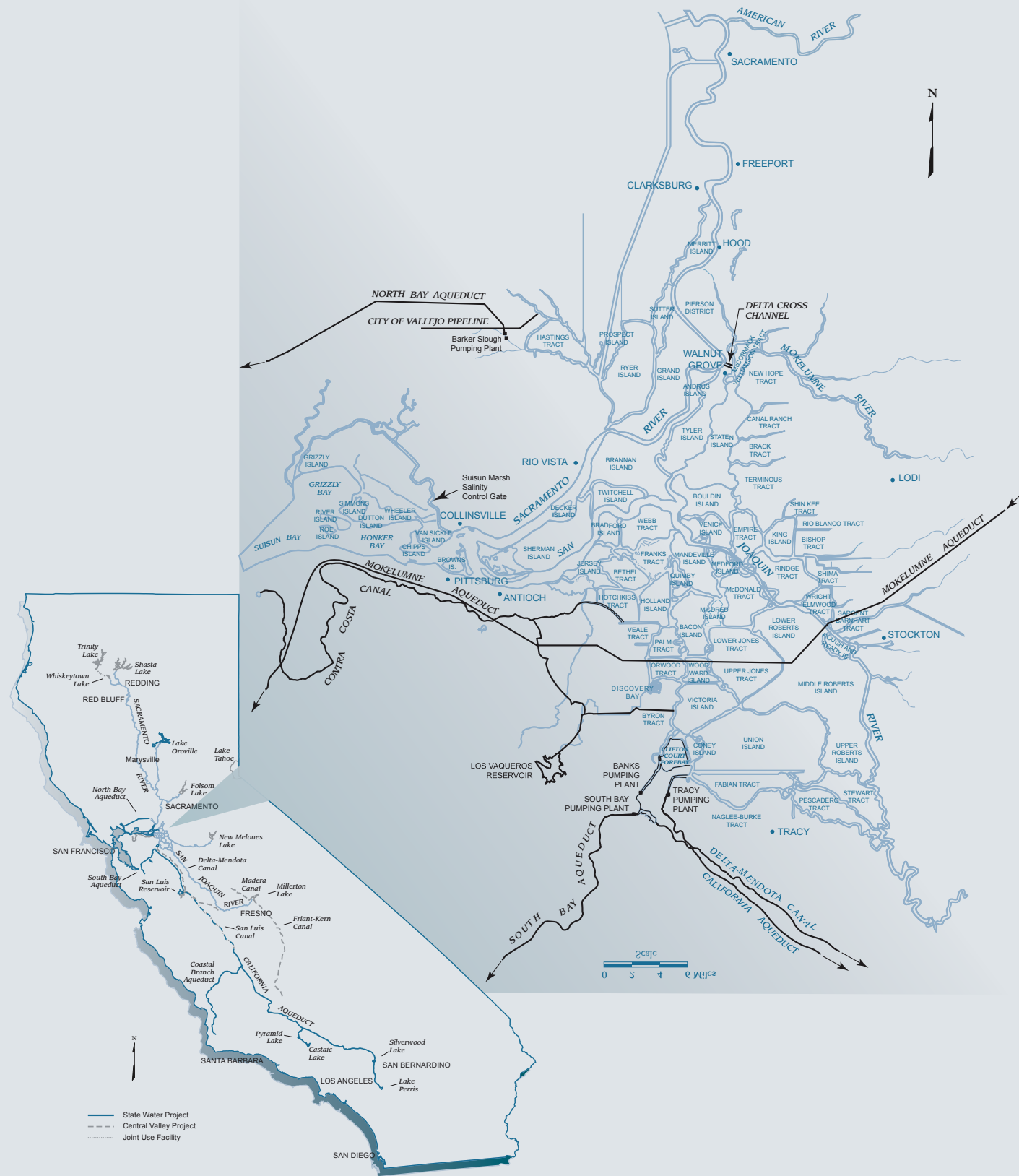
Delta Waterways

Delta waterways are the single most important geographical feature of the state's water resources system. Historically, over 40 percent of the state's runoff flowed to the Delta via the Sacramento, San Joaquin, and Mokelumne rivers. Many of the waterways follow natural courses while others have been constructed for specific purposes. The map at left shows the location of the Sacramento, San Joaquin, and Mokelumne rivers within the interconnecting mesh of Delta waterways.



1
2

1. Looking across the North Fork Mokelumne River from the northern tip of Staten Island toward Tyler Island.
2. Looking south on Old River east of Coney Island.



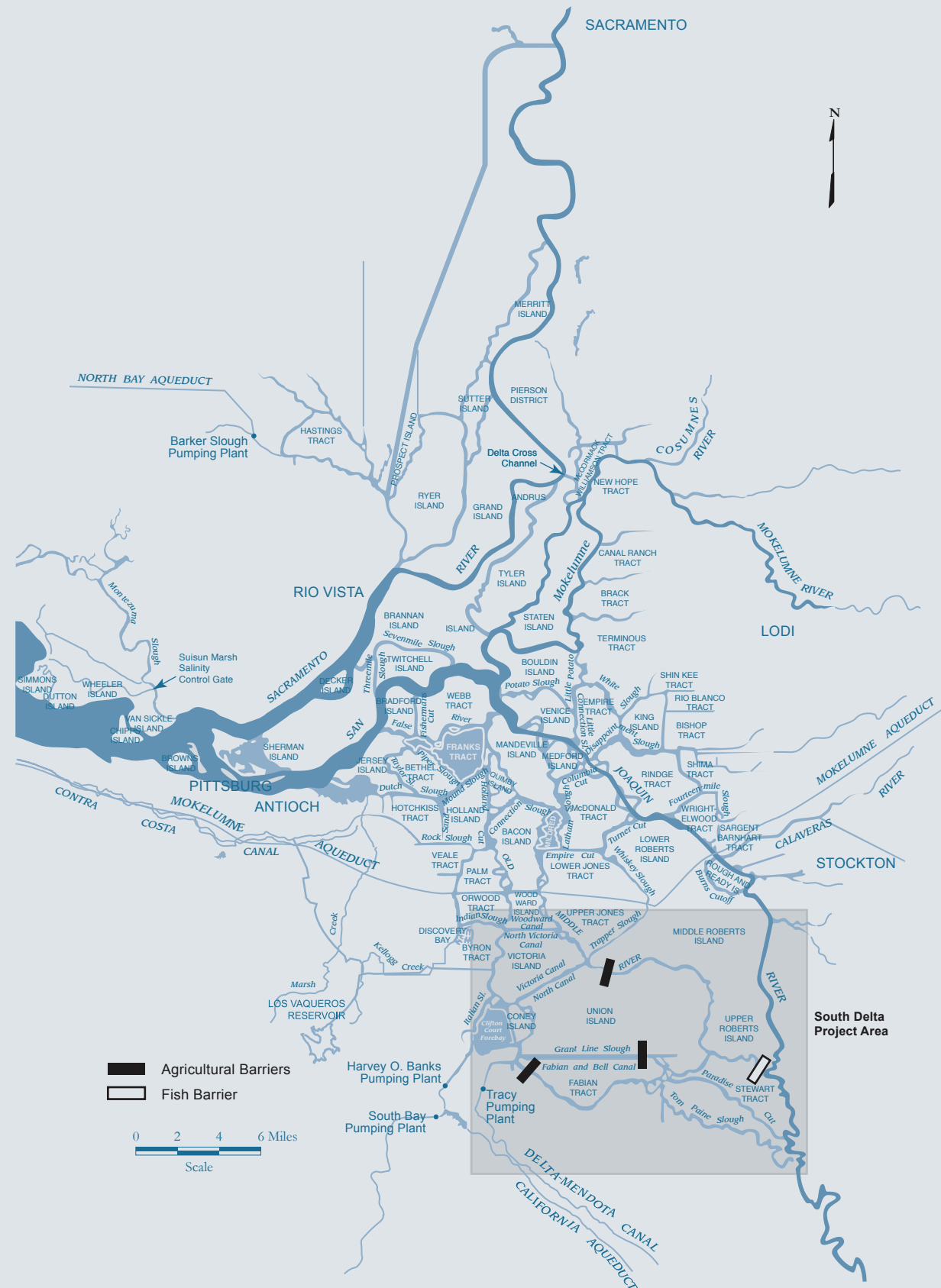
Water Conveyance Facilities

Major water conveyance facilities are dependent on Delta waterways. As shown in the figure on the left, these include the California Aqueduct, the Harvey O. Banks Delta Pumping Plant, and the North and South Bay Aqueducts of the State Water Project. Major federal facilities are the Central Valley Project's Tracy Pumping Plant, Delta-Mendota Canal, Delta Cross Channel and Contra Costa Canal. The East Bay Municipal Utility District (Mokelumne) Aqueduct (pipeline) that crosses low-lying Delta islands and is protected by levees is a locally-funded facility, along with the City of Vallejo pipeline.



1 | 2
3

1. North Bay Aqueduct Pumping Plant at Barker Slough.
2. Looking west along East Bay Municipal Utility District (Mokelumne) Aqueduct west of Orwood Tract.
3. Aerial photo of Harvey O. Banks Delta Pumping Plant.

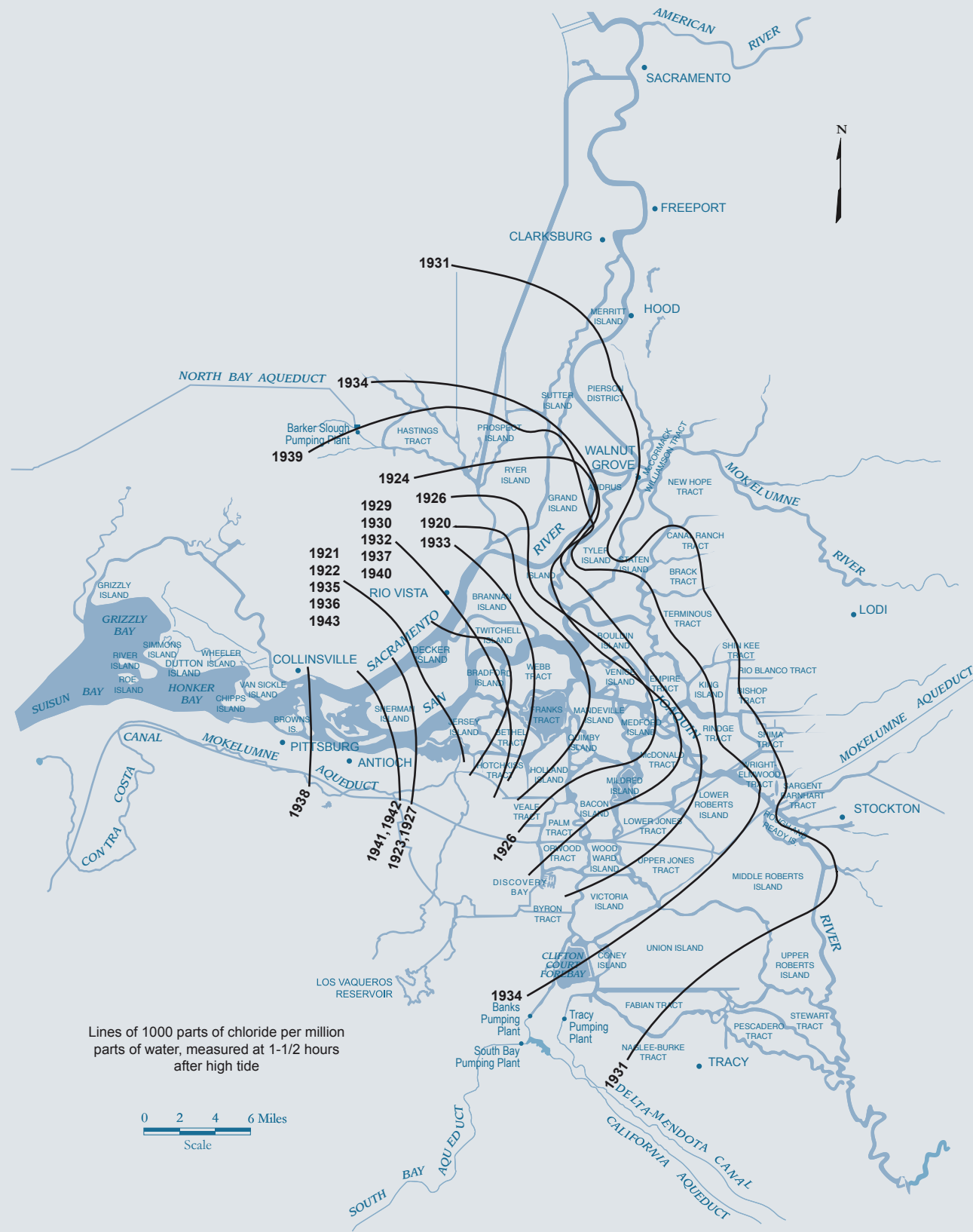


Temporary Barriers Project

The South Delta Temporary Barriers Project began in 1991. The project consists of four rock barriers across South Delta channels. Of the four rock barriers, the barrier at the Head of Old River serves as a fish barrier (intended to primarily benefit migrating San Joaquin River Chinook salmon) and is installed and operated in April-May and again in September-November. The remaining three barriers serve as agricultural barriers (intended to primarily benefit agricultural water users in the south Delta) and are installed and operated between April 15 and November 30 of each season. The objectives of the program are to increase water levels, improve water circulation patterns and water quality in the southern Delta for local agricultural diversions, and improve fish conditions.



1. Head of Old River Barrier
2. Old River at Tracy Barrier
3. Middle River Barrier (weir submerged on high tide)
4. Grant Line Canal Barrier



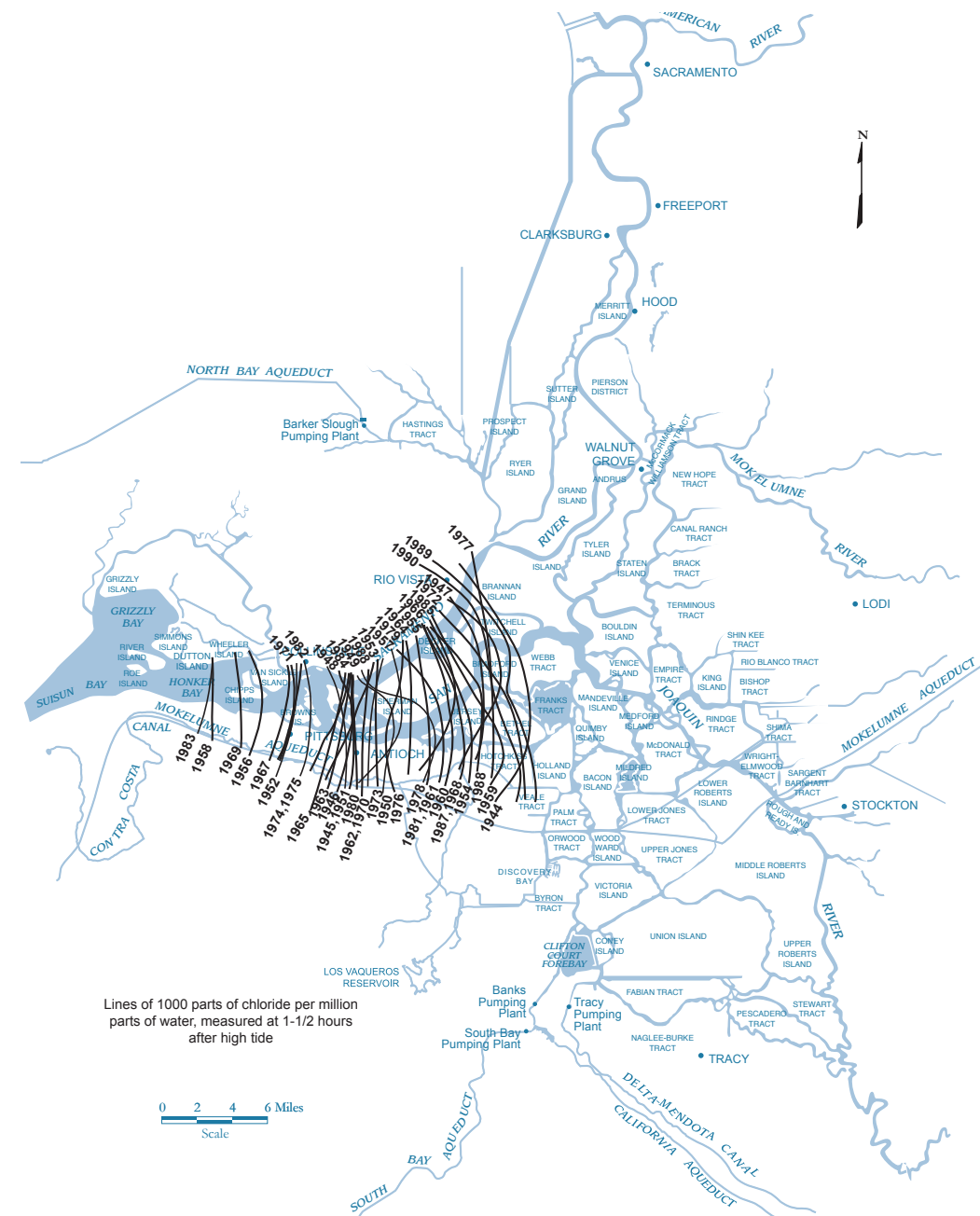
Lines of 1000 parts of chloride per million parts of water, measured at 1-1/2 hours after high tide

0 2 4 6 Miles
Scale

Maximum Salinity Intrusion

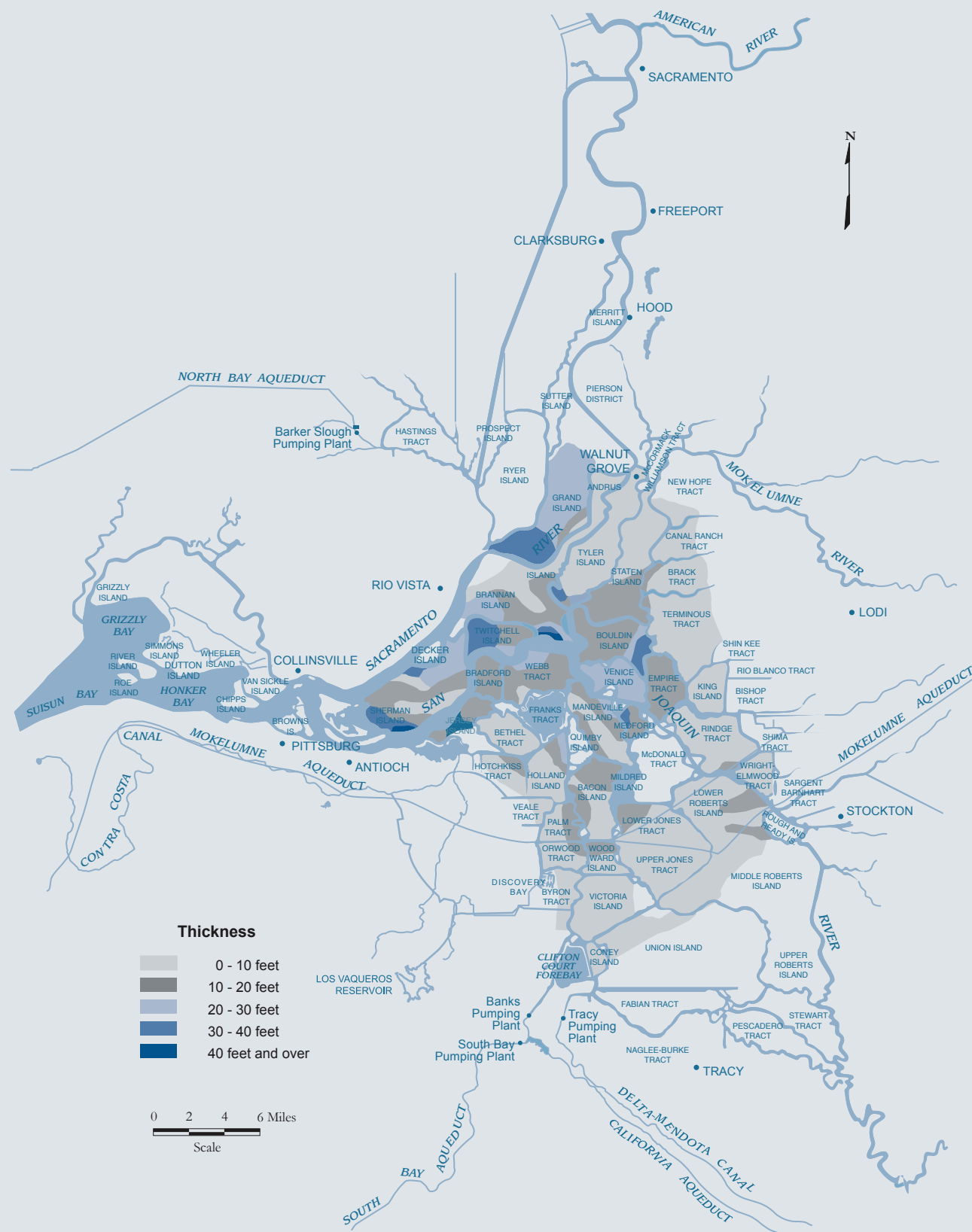
Tidal action and Delta outflow work to create a long and gradual salinity gradient from the Pacific Ocean into the Delta. Before Shasta Dam was built in 1943, the upper edge of this gradient (about 5 percent sea water) pushed far into the Delta in drier years. As shown on the map at left salinity reached as far as Stockton on the San Joaquin River and beyond Courtland on the Sacramento River in 1931. Today Shasta, Folsom, and Oroville reservoirs help control salinity intrusion by providing fresh water releases during the drier parts of the year as shown on the map below.

Maximum Salinity Intrusion 1944-1990



Lines of 1000 parts of chloride per million parts of water, measured at 1-1/2 hours after high tide

0 2 4 6 Miles
Scale



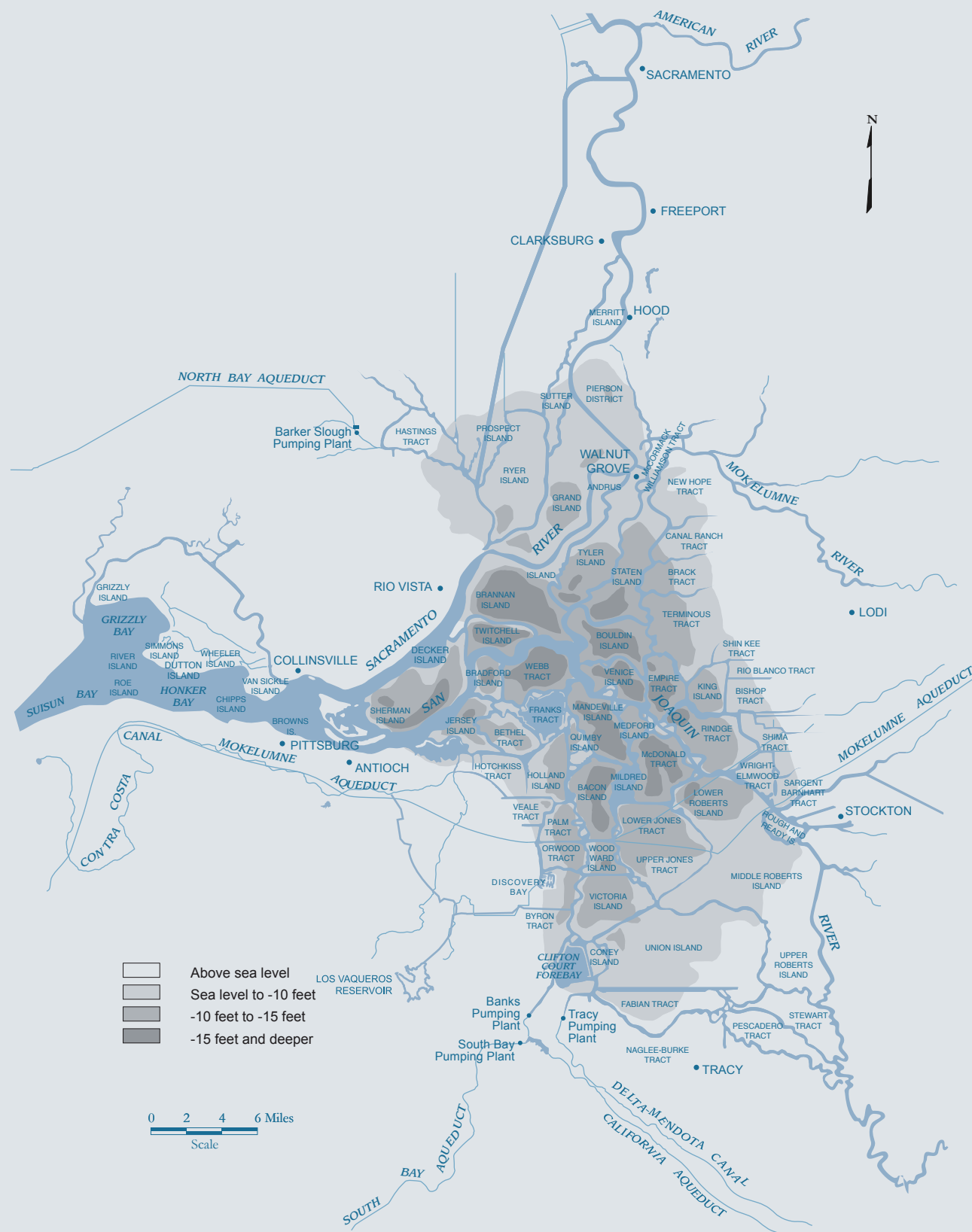
Thickness of Organic Soils

For millions of years, river flows and tidal action deposited upstream sediment in the Delta, the low point of the Central Valley. Thick organic soil, commonly referred to as peat, was formed as tules and other plants were covered by this sediment throughout the years. These organic soils, up to 60 feet deep in some areas, were first farmed in the mid-1800s. Although highly productive for agriculture, peat is also very prone to subsidence.

Because peat is comprised of decomposed, compacted plant matter, created by vegetation's reactions with its soggy surroundings, natural processes partially carbonize the plants and stores energy. This energy makes peat useful as a fuel source. Peat has historically been used by some Delta ranches where trees were scarce, who harvested the peat, drying it in barns for use as fuel. This flammable characteristic of peat can also create hazardous conditions. Peat fires are historically documented in the Delta and it continues to be a fire-hazard concern in modern days. When a peat fire starts, it spreads considerable distances underground and it continues burning underground even if the fire at the surface is extinguished. Sometimes the fire may return to the surface from underground, starting grass fires and endangering structures. Peat fires can burn for a very long time.

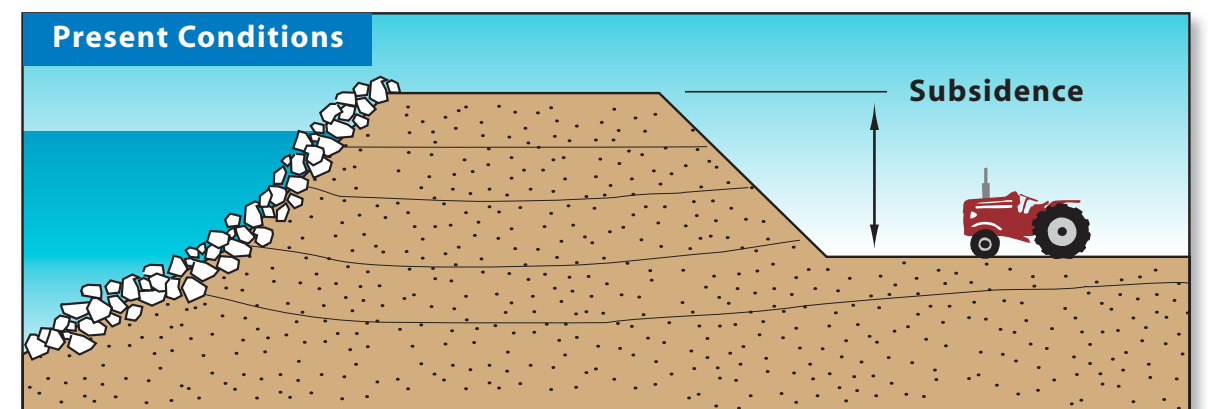
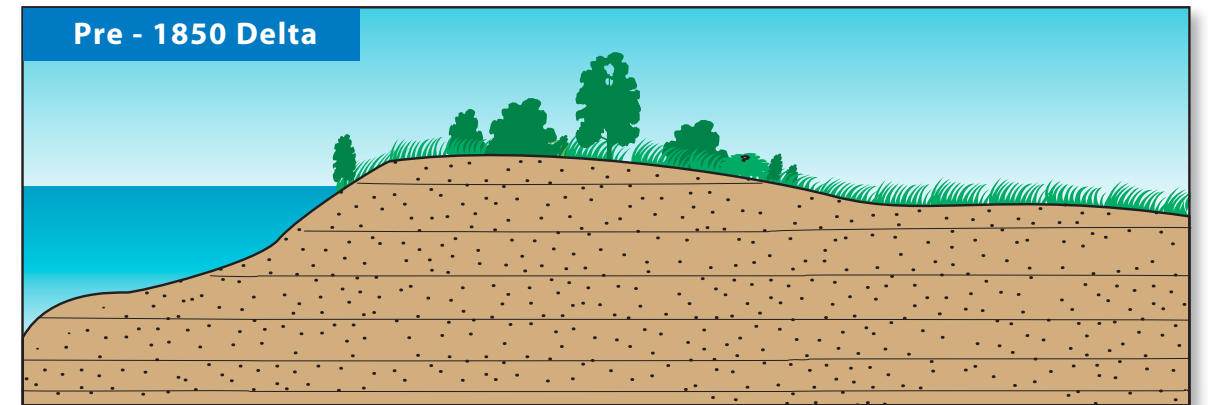


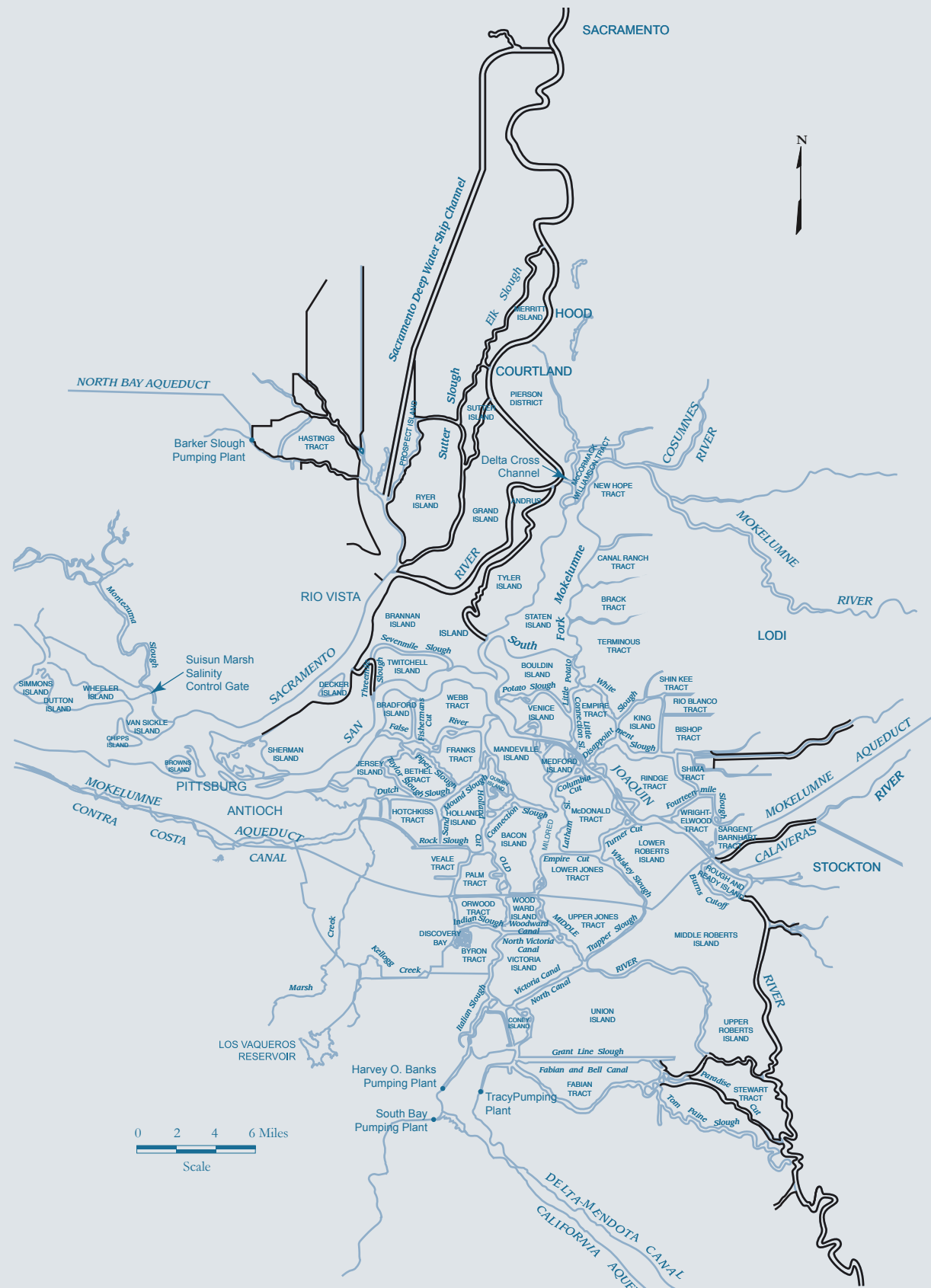
Farming on Sherman Island. Delta crops average a gross value of over \$500 million per year.



Land Surface Below Sea Level

As the map shows, some land in the central and western Delta is more than 15 feet below sea level. This situation is caused by land subsidence which is primarily the result of the loss of organic soil (peat). The loss is caused by exposure of peat to oxygen, which allows microorganisms to break down the peat, converting organic carbon solids to carbon dioxide and aqueous carbon. Subsidence is a major concern in the Delta because it increases the water pressure on levees and, therefore, the probability of levee failure and flooding.





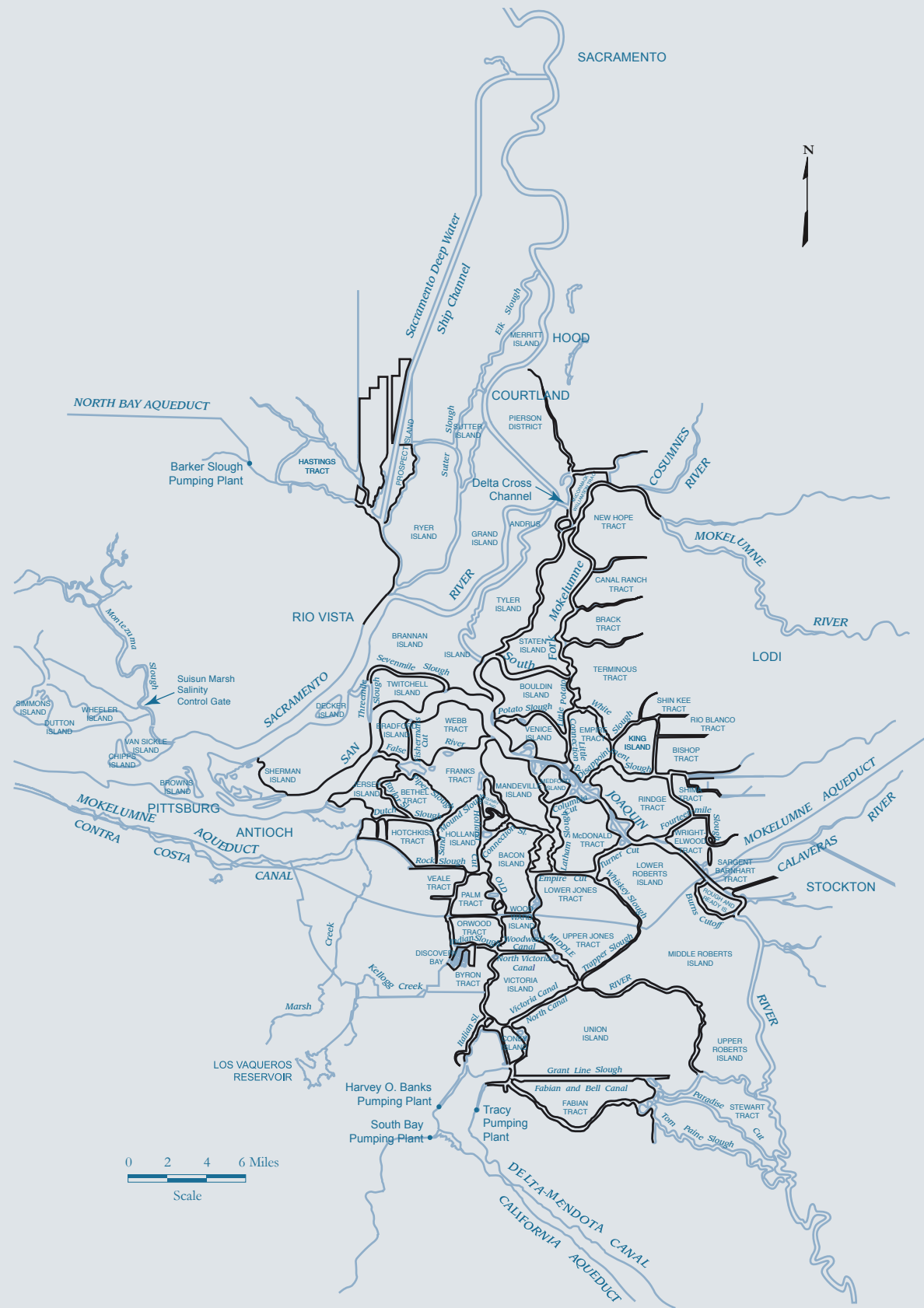
Federal/State Flood Control Project Levees

In 1880, the State Engineer designed a flood control plan for the Sacramento Valley. This plan included a system of levees and bypasses for transporting floodwaters away from protected areas. In 1917 Congress authorized the Sacramento Flood Control Project, which was completed by the U. S. Army Corps of Engineers in 1960. Storage reservoirs and similar protective measures have been provided on the San Joaquin River. As shown on the map, these systems—denoted “project levees” to distinguish them from other levees—provide effective flood control for only a small portion of the Delta. The other “non-project” levees are discussed in the following section.



Experimental levee maintenance programs are being conducted at various locations in the Delta to determine better ways to protect the environment while maintaining flood control. This photo shows a project to develop a berm that will provide for environmentally important shaded aquatic habitat.

Local Flood Control Non-project Levees



Most of the Delta lowlands are protected by levees not within the Federal/State Sacramento Flood Control Project system. These “non-project” levees are shown on the map. Improvement and maintenance of non-project levees is very challenging because of poor foundations and regulations to protect levee wildlife habitat. Local districts are responsible for maintaining these levees and may be reimbursed for a portion of the costs under the Delta Levees Subvention Program established in 1973. The Delta Flood Protection Act of 1988 significantly increased reimbursement opportunities but also added a major environmental mandate to ensure no net long-term loss of habitat.

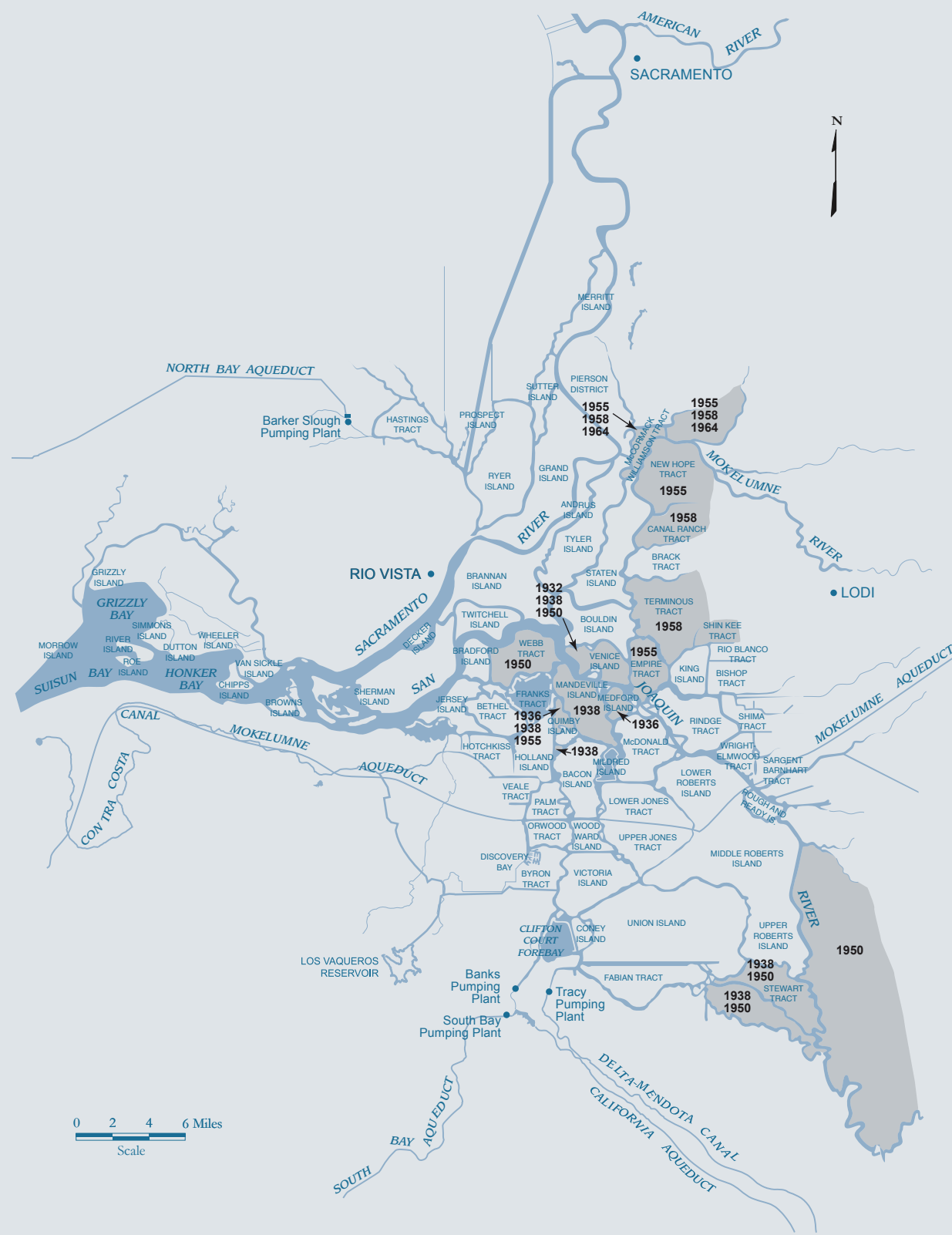
Reducing risk to land use and associated economic activities, water supply, infrastructure, and ecosystem from catastrophic breaching of Delta levees is now a major goal of the CALFED Levee System Integrity Program. The program is committed to achieving long-term protection of life and property, water quality for in-Delta and export uses, agriculture, recreation, and the environment.



Eroded non-project levee protecting hundreds of acres of agricultural land and wildlife habitat.

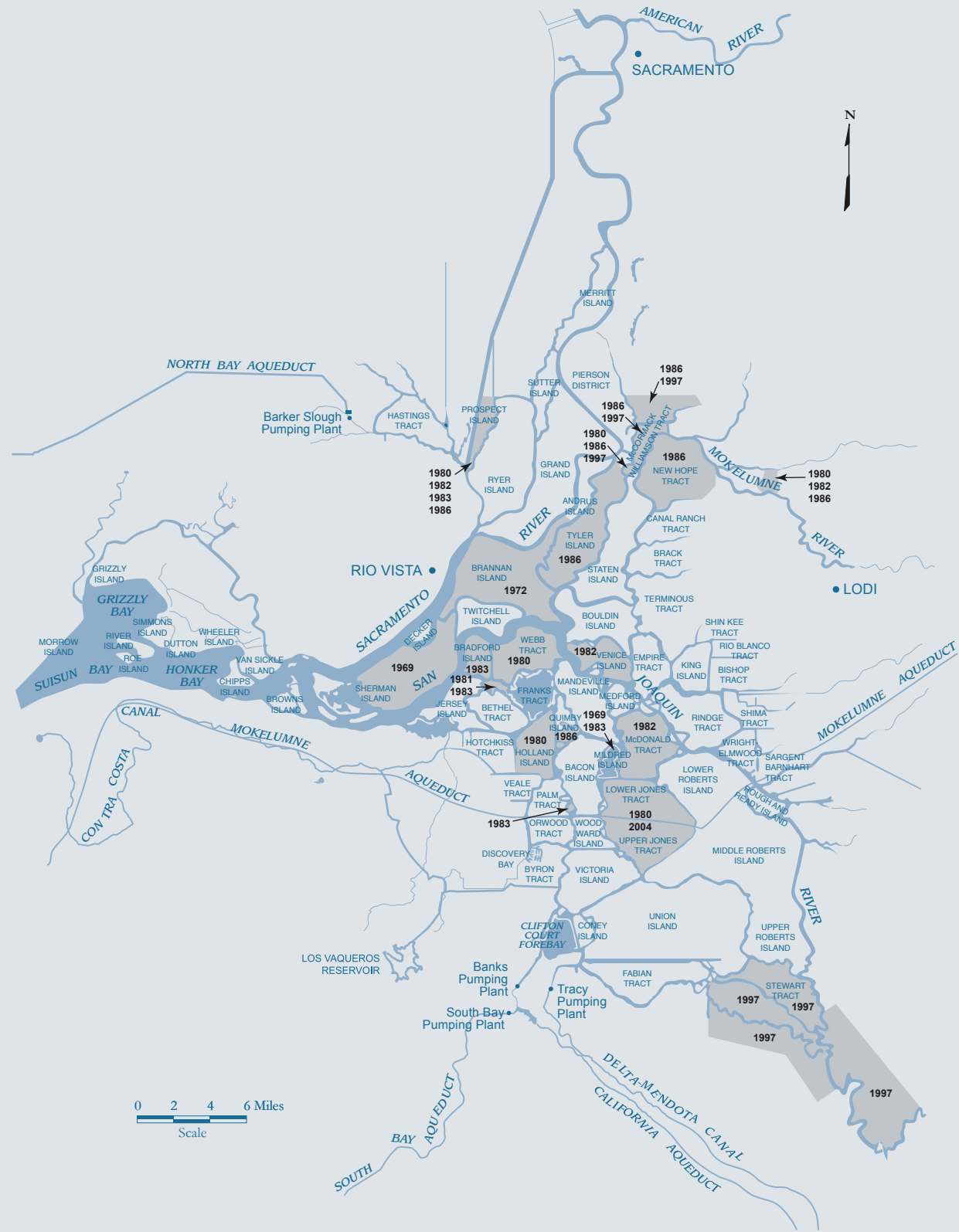
Historical Flooding 1930-1966

Levee failures are not rare in the Delta. Since original reclamation, each of the 70 islands or tracts has flooded at least once. The map at left shows those islands that flooded one or more times between 1930 and 1966. In some cases, the cost of repairs exceeded the appraised value of the land.



1
2

1. The Sacramento River north of Walnut Grove, December 1964.
2. McCormack-Williamson Tract flooded, January 1965.



Recent Flooding 1967-2004

Flood flows reaching the Delta have been estimated to exceed 600,000 cubic feet per second. The most recent flood in the Delta occurred in 2004 when Upper and Lower Jones Tracts flooded. This resulted in millions of dollars in damages. Flooding also occurred along the San Joaquin River in 1997.



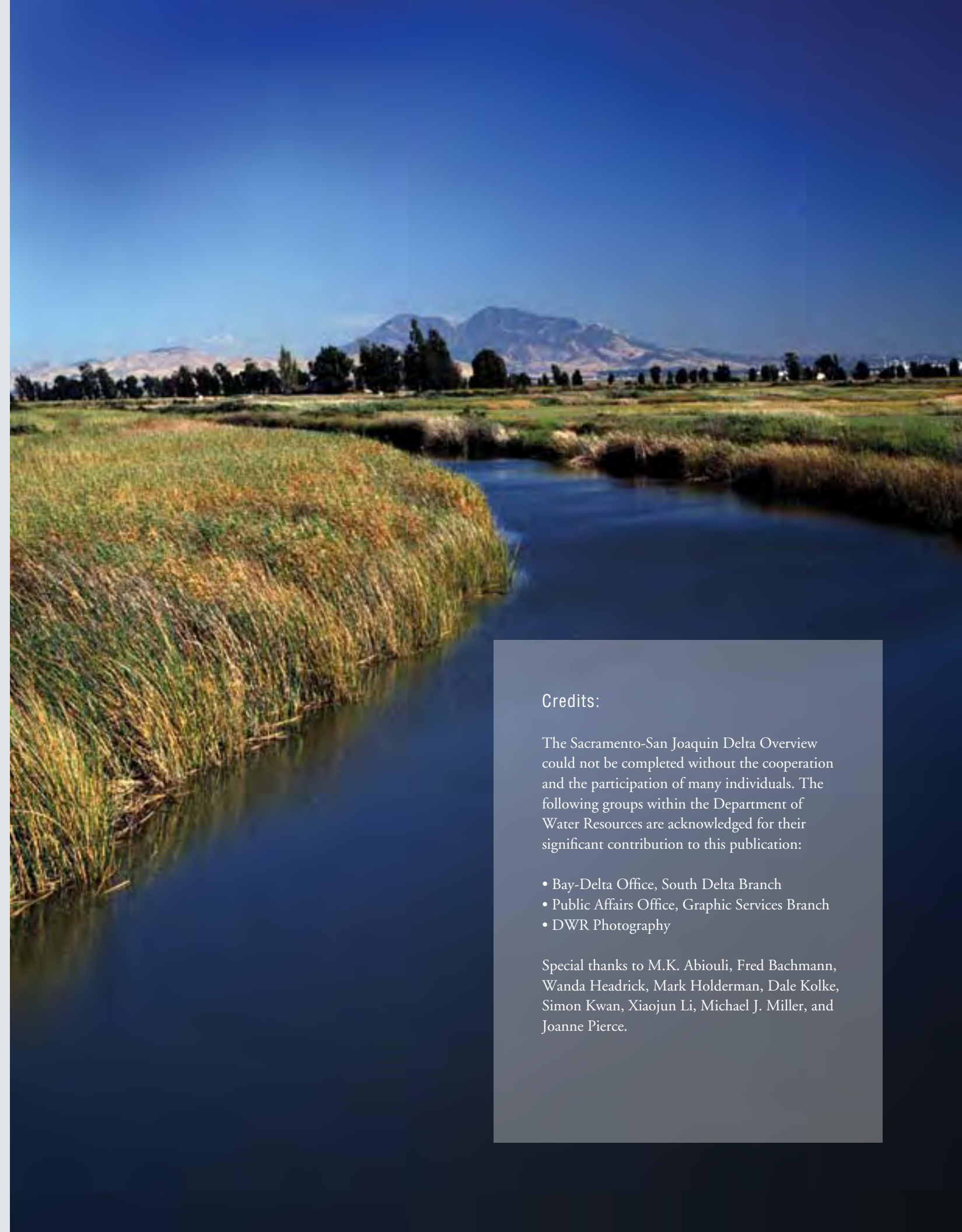
1. Levee break on Sherman Island in 1969.
2. Islands flooded in the northern Delta, February 1986.
3. The 1997 Flood caused nearly \$2 billion in damages and post-flood restoration.
4. Levee break in the 2004 flood of Jones Tract.

$\frac{1}{3} \frac{2}{4}$

Sacramento-San Joaquin **Delta Overview On-Line**

A PDF version of the Sacramento-San Joaquin Delta Overview is available on the World Wide Web:
<http://baydeltaoffice.water.ca.gov/sdb/tbp/deltaoverview/index.cfm>

As part of the Delta Vision Process, the Department of Water Resources will update and expand the Delta Overview into a comprehensive atlas of the many Delta uses, resources, and ecosystems, as well as current and future trends.



Credits:

The Sacramento-San Joaquin Delta Overview could not be completed without the cooperation and the participation of many individuals. The following groups within the Department of Water Resources are acknowledged for their significant contribution to this publication:

- Bay-Delta Office, South Delta Branch
- Public Affairs Office, Graphic Services Branch
- DWR Photography

Special thanks to M.K. Abioui, Fred Bachmann, Wanda Headrick, Mark Holderman, Dale Kolke, Simon Kwan, Xiaojun Li, Michael J. Miller, and Joanne Pierce.