

DRAFT

CALFED Bay-Delta Program Draft Delta Conveyance and Storage Components

Introduction

This technical report describes some preliminary Delta conveyance components which may be combined to build a wide range of configurations within the context of CALFED Bay-Delta Program Alternative 2 (Through-Delta) and Alternative 3 (Dual Transfer). The range of components includes conceptual approaches which have been evaluated in previous planning efforts at various levels of detail, as well as new conceptual approaches which have been proposed by stakeholders in the CALFED Bay-Delta Process. The component descriptions are in the form of check lists, with suggested sub-components, preliminary conceptual design criteria, and issues of concern. The components described here are presented in order to initiate productive discussions among CALFED agencies and stakeholders, leading to refinement and agreement upon a range of alternatives for more detailed analysis.

It is important to emphasize that the next step is refining the components and combining them into alternative configurations, rather than selection of a preferred alternative. During Phase I of the program a wide range of alternative configurations were proposed to reflect various assumptions, beliefs, and technical information available to the CALFED agencies and stakeholders. The goal of this component refinement step is to develop a reasonably small set of alternatives configurations which take into consideration practical matters such as flood flows, road crossings, and fisheries impacts, while faithfully encompassing the range of alternatives developed during Phase I of the CALFED process.

Linkages

CALFED staff has sought to incorporate a range of components broad enough to encompass the interests of CALFED agencies and stakeholders, without making any pre-determinations regarding preferred alternative configurations. At the same time, staff has given some consideration to linkages (i.e. potential benefits and impacts for a wide range of resource categories). Some of the key linkages are listed below, without regard to priority:

- Flood risk
- Water quality
- Water supply reliability
- Fisheries: First paradigm--Keep fish in the Sacramento River by screening diversions from the river
- Fisheries: Second paradigm-- Make the interior Delta more hospitable to anadromous fish by creating slow-moving cross-Delta flow with a large and diverse expanse of habitats
- Utilities: Pipelines, radio towers, gas wells, power lines, etc.
- Transportation: Highways and bridges
- Land use, agriculture, and wildlife habitat: First paradigm-- Minimize change in Delta configuration and loss of agricultural land from production. Preserve current agricultural land for its wildlife habitat value. Allow market forces and cooperative management agreements to dictate land use patterns.
- Land use, agriculture, and wildlife habitat: Second paradigm-- Seek extensive conversion of agricultural land to open water, shallow water habitat, riparian forest, wetlands, and dedicated wintering waterfowl habitat because it represents a net improvement in environmental quality. Recognize that current agricultural trends in Delta region include rapid loss of pasture and row crops to viticulture, decreasing concentrations of waste grain due to better harvesting techniques, and urbanization.
- Topography (Hills, land surface elevations, etc.)
- Geology: seismic risk, soils, foundation conditions, depth of peat
- Sociological impacts: Presence of cities, farms, and other infrastructure along facilities alignments. Compatibility with local land use plans (example: San Joaquin County plans for population growth on New Hope Tract)
- Recreation: Separation of recreationists from landowners, channel island destination sites, separation of fast and slow boat traffic, boat wakes, law enforcement
- Navigation: Preservation of navigation access for levee repair, commerce, and recreation
- Climatic effects: Wind waves, sea surface rise
- Seepage: Impacts on areas adjacent to flooded areas

Adaptive Management

The range of components described in the following pages offer various levels of flexibility in terms of incremental implementation and responding to changes in the Bay-Delta system and our understanding of it. Some physical and operational changes are readily implemented in small steps (i.e. creation of desirable habitats). Others, such as channel modifications for flood control, must be made with the total system response in mind, to prevent shifting a problem from one area to another. Adaptive management embodies these concepts, and should be kept in mind when refining components and alternative configurations. The reader may wish to ask

- Is the component or alternative configuration amenable to incremental implementation?
- How easily can one backtrack or take a different approach if expected results do not occur?

Delta Conveyance Components

This section lists the various Delta Conveyance Components which are described in greater detail in later sections. In general, each component has several alternative configurations and can be implemented to provide varying conveyance capacities. They are presented in shorthand format. For example, Through-Delta Component 1 shows three alternative screening options and three different capacities. There are thus $3 \times 3 = 9$ combinations of screening and capacity options which could be assembled. For simplicity, only the sub-options are listed, rather than all the possible combinations.

Through-Delta Component 1: Minimize Change in Delta Configuration (NDP)

Screened at Hood

Screened at Delta Cross Channel

Unscreened at Delta Cross Channel

Capacity 5,000 cfs

Capacity 10,000 cfs

Capacity 15,000 cfs (Delta Cross Channel Option only)

Through-Delta Component 2: Extensive Habitat, Low Velocity

Screened at Hood

Unscreened at Hood

Screened at Delta Cross Channel

Unscreened at Delta Cross Channel

Capacity 5,000 cfs

Capacity 10,000 cfs

Capacity 15,000 cfs

Through-Delta Component 3: Tyler Island Habitat

Unscreened at Andrus Island

Through-Delta Component 4: Multiple Intakes

Three **unscreened** isolated intake channels from San Joaquin River to Clifton Court

Three **screened** isolated intake channels from San Joaquin River to Clifton Court

Capacity 5,000 cfs

Capacity 10,000 cfs

Capacity 15,000 cfs

Isolated Conveyance Component 1: Hood to Clifton Court Open Channel

Screened at Hood

Capacity 5,000 cfs
Capacity 10,000 cfs
Capacity 15,000 cfs

Isolated Conveyance Component 2: Hood to Clifton Court Pipeline

Screened at Hood

Capacity 5,000 cfs
Capacity 10,000 cfs
Capacity 15,000 cfs

Isolated Conveyance Component 3: Chain of Lakes

Screened at Delta Cross Channel

Capacity 5,000 cfs
Capacity 10,000 cfs
Capacity 15,000 cfs

Isolated Conveyance Component 4: Deep Water Ship Channel and West Delta Tunnel

Screened at Sacramento Ship Channel Lock Structure

Dam at lower end
Lock at lower end
Capacity 5,000 cfs
Capacity 10,000 cfs
Capacity 15,000 cfs

THROUGH-DELTA COMPONENTS

Common Assumptions

In order to complete prefeasibility cost estimates with the appropriate level of effort, the following conceptual design assumptions should be made:

- Levee slopes: 3:1 on land and water sides, unless otherwise noted
- On the water side of new setback levees it is assumed that a riparian berm of about 20-foot width, at +2 MSL, is provided.
- Water side slopes are protected against erosion by a layer of construction fabric and rip-rap, up to the 100-year flood design elevation, except for the water side berm horizontal surface, which is vegetated.
- Where new setback levees are constructed on unconsolidated peat, assume 50 % additional levee material is required to consolidate foundations
- For isolated open channel construction assume side slopes 1:8 to a depth of 3 feet below normal water surface elevation, then 1:3 side slopes to a maximum depth of 30 feet, 15 foot wide waterside berm, levees 1:3 side slopes, 20-foot crown width on levees.
- Wherever islands or tracts are permanently flooded, seepage interception wells are assumed to be required on adjacent islands or tracts to mitigate for increased seepage.
- Whenever existing levees are breached to create new channels and flooded areas it is assumed that they will remain in all areas except where the breaches are specified, to provide wave wash protection for adjacent islands, habitat areas, and recreation destination sites. The land side of the breached levees must be protected against erosion by using construction fabric and rip rap, up to 2 feet above mean high tide.

Through-Delta Component 1: Minimize Change in Delta Configuration

This configuration includes some of the planning concepts of DWR's North Delta Program (several phases) and the Interim South Delta Program. It includes levees setbacks along the lower Mokelumne River system, enlargement of the Delta Cross Channel or a new diversion point near Hood on the Sacramento River, a new gate for Clifton Court Forebay, south Delta barriers, and south Delta channel enlargement by channel dredging or levee setbacks

Delta Cross Channel Intake Option, including the following components:

1) Enlarge Delta Cross Channel Option

- Purchase 300 foot alignment along north Bank of Delta Cross Channel
- Construct new Highway 160 Bridge
- Construct 2 new radial gates north of existing gates, in supplemental intake channel
- Construct new setback levee, 200 feet back from existing north levee
- Relocate radio tower cable anchors as necessary
- Remove existing north levee

2) Delta Cross Channel Fish Screen Option

- Construct multiple folded "V" fish screen installation in Delta Cross Channel downstream of radial gates, including trash racks, crane, screens, fish bypass system, and upstream migrant passage facilities
- Construct low lift pump station downstream from fish screens to control hydraulic performance of fish screens
- Fish Bypass System: Pump, Evaluation Facility, Return Pipe, Discharge Structure
- Control Building, Parking, Access, Lighting, Fencing
- Capacities: 5,000 cfs, 10,000 cfs, 15,000 cfs

3) Snodgrass Slough-Dead Horse Cut Setback Channel

- Purchase southern tip of McCormack Williamson Tract
- Construct new setback levees across southern tip of McCormack Williamson Tract
- Remove existing levee sections opposite Delta Cross Channel and along Dead Horse Cut
- Convert existing levee into channel island; place rip-rap on previous land side to prevent erosion

Hood Intake Option, Including the Following Components

1) Screened Intake at Hood Option

- Relocation of Highway 160 and new bridge over diversion
- Trashrack
- Flood Gates or stop logs
- Crane
- Levees
- Sedimentation Basin
- Pumping Plant and discharge pipes to open channel
- Fish Bypass System: Pump, Evaluation Facility, Return Pipe, Discharge Structure
- Control Building, Parking, Access, Lighting, Fencing
- Capacities: 5,000 cfs, 10,000 cfs, 15,000 cfs

2) Open Channel, Hood to Lambert Road along West Side of Southern Pacific RR Alignment Option

- Acquire land along alignment, 2000-foot swath
- Open channel construction
- Discharge structure, including at least 2 radial gates
- Bridge, for Lambert Road
- Upstream Migrant Passage Structure: Attraction, collection, and transport

3) Glanville Tract Setback Channel

- Acquire land along alignment, including leveed island in channel, and 2000-foot swath on southwest portion of Glanville Tract
- Construct new setback levee, southwestern corner of Glanville Tract, 1000 feet east of existing alignment

- Extend Twin Cities Road bridge. Assume elevated causeway 1000 feet long
- Breach existing levees at north and south end of channel island west of Glanville Tract, to allow full 1000 foot width channel
- Protect east slope of remaining west levee, which would become a channel island
- Purchase or rebuild any gas wells which might be inundated by the new setback levee channel
- Provide railroad trestle in future if State Museum excursion railroad plans are executed

• **4) McCormack Williamson Tract Setback Channel**

- Acquire land along alignment, 600-foot swath
- Remove east levee, 400 feet of north levee on western end of tract, remove 500 feet of south levee
- Protect remaining interior levee slopes with rip-rap; remaining levees would become channel islands
- Construct setback levee from northwest corner of Tract to tie in with proposed setback levee noted in item 3 of Delta Cross Channel Intake Option

New Hope Tract Setback Channel(conveyance emphasis)

- Purchase 600 foot alignment along Mokelumne River, I-5 to New Hope Landing
- Construct new setback levees from I-5 to New Hope Landing, set back 500 feet from existing channel
- Relocate New Hope Landing and Wimpy's Marina to coincide with new setback levee
- Remove existing levee sections where they would obstruct new channel, west and south levee sections
- Construct new 500 foot bridge across setback channel, with sufficient elevation to allow small craft passage
- Rebuild existing New Hope Tract levee, New Hope Landing to
- Beaver Slough
- Construct new, relocated irrigation diversions and drainage pumps for New Hope Tract
- Convert existing levee into channel island; place rip-rap on previous land side to prevent erosion

North Mokelumne Setback Channel

- Purchase 600 foot alignment along North Mokelumne River, New Hope Landing to south end of Tyler Island, alternating between Staten Island and Tyler Island sides as shown
- Construct new setback levees along North Mokelumne River, New Hope Landing to south end of Tyler Island, alternating between Staten Island and Tyler Island sides as shown
- existing levee sections where they would obstruct new channel, at each junction of new setback levee with existing levee, as shown
- Construct new 500 foot bridge, Thornton-Walnut Grove Road across setback channel, with sufficient elevation to allow small craft passage
- Construct new, relocated irrigation diversions and drainage pumps for Staten Island and Tyler Island
- Convert existing levee into channel island; place rip-rap on previous land side to prevent erosion

Lower Mokelumne Setback Channel

- Purchase 600 foot alignment along lower Mokelumne River on western portion of Bouldin Island
- Construct new setback levees along lower Mokelumne River on western portion of Bouldin Island, approximately 500 feet east of existing levees, as shown
- Excavate existing levee sections where they would obstruct new channel, at each junction of new setback levee with existing levee, as shown
- Convert existing levee into channel island; place rip-rap on previous land side to prevent erosion
- Construct new 500 foot bridge, Highway 12 crossing of lower Mokelumne River across setback channel, with sufficient elevation to allow small craft passage
- Construct new, relocated irrigation diversions and drainage pumps for western portion of Bouldin Island

Interim South Delta Program Improvements

Refer to DEIR/EIS for preferred alternative, which includes channel dredging, a new gate for Clifton Court Forebay, a permanent fish barrier at the head of Old River, and three permanent agricultural barriers on Middle River, Grant Line Canal, and Old River near Tracy.

Victoria Island Setback Levee Option

An alternative to channel dredging in Old River adjacent to Victoria Island would be a setback levee along this reach on Victoria Island, as described below:

- Purchase 500-foot alignment on western portion of Victoria Island
- Remove 300 feet of levee along North Victoria Canal from Old River eastward
- Breach levee along 3000 feet of levee along Old River, between its junction with Italian Slough and West Canal. Total breach length should be about 600 feet
- Construct setback levee parallel with Old river, set back about 400 feet to the east
- Construct new, relocated irrigation diversions and drainage pumps
- Place rip-rap on east side of Old River levee, which becomes a channel island
- Construct new 400-foot causeway over new setback channel and new bridge and alignment over Old River

Through-Delta Component 2: Extensive Habitat, Low Velocity

Screened Intake at Hood: Offstream folded "V"

- Relocation of Highway 160 and new bridge over diversion
- Trashrack
- Flood Gates or stop logs
- Crane
- Levees
- Sedimentation Basin
- Pumping Plant and discharge pipes to open channel
- Fish Bypass System: Pump, Evaluation Facility, Return Pipe, Discharge Structure
- Control Building, Parking, Access, Lighting, Fencing
- Capacities: 5,000 cfs, 10,000 cfs, 15,000 cfs

Unscreened Gravity Diversion at Hood

- Relocation of Highway 160 and new bridge over diversion
- 200 foot long concrete sill, with wing walls and piers to support stop logs or radial gates, crane
- Inflatable rubber dams to control overflow into diversion channel
- training levees with rip-rap to guide flow to channel
- sedimentation basin
- upstream migrant passage facilities

Open Channel, Hood to Lambert Road along West Side of Southern Pacific RR Alignment

- Acquire land along alignment, 2000-foot swath
- Open channel construction
- Discharge structure, including at least 2 radial gates
- Bridge, for Lambert Road
- Upstream Migrant Passage Structure: Attraction, collection, and transport

Glanville Tract Setback Channel

- Purchase Glanville Tract
- Construct new setback levee, southwestern corner of Glanville Tract, 2000 feet east of existing alignment
- Extend Twin Cities Road bridge. Assume elevated causeway 1000 feet long
- Breach existing levees at north and south end of channel island west of Glanville Tract, to allow full 2000 foot width channel
- Protect east slope of remaining west levee, which would become a channel island
- Purchase or rebuild gas wells which would be inundated by the new setback levee channel
- Create habitat or cooperative wildlife management practices on land between I-5 and new setback levee
- Provide railroad trestle in future if State Museum excursion railroad plans are executed

McCormack Williamson Tract Floodway

- Purchase entire McCormack-Williamson Tract

- Remove east levee, 2000 feet of north levee on western end of tract, remove 3000 feet of south levee
- Breach existing levees at north and south end of Glanville Tract, to allow full 2000 foot width setback channel.
- Protect remaining interior levee slopes with rip-rap; remaining levees would become channel islands
- Construct appropriate works to allow continued access and maintenance, transmitter tower, including elevated access road

Create New Hope Tract Setback Channel(Habitat Emphasis)

- Purchase western half of New Hope Tract for habitat creation
- Construct new setback levees north to south from Mokelumne River to Beaver Slough, 2000 feet east of existing alignment
- Relocate New Hope Landing and Wimpy's Marina to coincide with new setback levee
- Remove existing levee sections where they would obstruct new channel, west and south levee sections
- Construct new 2000 foot bridge across setback channel, with sufficient elevation to allow small craft passage
- Rebuild existing New Hope Tract levee, from Mokelumne River at I-5 crossing to junction with setback levee on northwest side of levee
- Construct new, relocated irrigation diversions and drainage pumps for New Hope Tract
- Reinforce Beaver Slough levee
- Construct seepage interception wells along Beaver Slough levee
- Reinforce Beaver Slough levee
- Convert existing levee into channel island; place rip-rap on previous land side to prevent erosion

Canal Ranch Tract Wetlands

- Purchase Canal Ranch Tract
- Remove 2000-foot sections of levee at west end of Beaver Slough and Hog Slough
- Protect remaining interior levee slopes with rip-rap; remaining levees would become channel islands, and would help protect adjacent tracts from wave wash
- Relocate gas pipelines and other utilities as required

Brack Tract Wetlands

- Purchase Brack Tract
- Remove 2000-foot sections of levee at west end of Hog Slough and Sycamore Slough
- Protect remaining interior levee slopes with rip-rap. Remaining levees would become channel islands, and would help protect adjacent tracts from wave wash
- Relocate gas pipelines and other utilities as required

Terminus Tract Setback Channel

- Purchase 2000-foot wide section at northwest corner of Terminus Tract
- Remove 2000-foot sections of levee at west end of Sycamore Slough and on the east bank of the South Mokelumne River to create flow path
- Construct new setback levees north to south from Sycamore Slough to South Mokelumne River, 2000 feet east of existing alignment

- Protect east slope of remaining west levee along the South Mokelumne River, which would become a channel island
- Reinforce existing levee along Sycamore Slough
- Place seepage interception wells along Sycamore Slough levee, South Mokelumne levee, and Little Potato Slough levee
- Construct new, relocated irrigation diversions and drainage pumps

Staten Island Setback Channel

- Purchase 4000-foot wide section at the southeast corner of Staten Island
- Remove 4000-foot sections of levee along west bank of South Mokelumne River north of Terminous and on north bank west of Terminous to create flow path
- Construct new setback levee north to south to cut off southeast corner of Staten Island creating 4000-foot wide channel
- Protect west slope of remaining levee along the South Mokelumne River with rip-rap; this levee would become a channel island
- Place seepage interception wells along South Mokelumne River

Bouldin Island Aquatic Habitat

- Purchase Bouldin Island
- Remove 4000-foot section of levee, south bank of South Mokelumne River, just west of Terminous.
- Remove 4000-foot section of levee along San Joaquin River, between Potato Slough and Mokelumne River
- Protect remaining interior levee slopes of island with rip-rap; these would become channel islands and help protect adjacent islands against wave wash
- construct 3 miles of elevated embankment roadway for Highway 12, beginning at the Terminous Bridge access ramp. Protect both north and south sides with rip-rap.
- Construct 2,000-foot bridge in near east end of Bouldin Island to facilitate flood and transfer flows to move from South Mokelumne River to San Joaquin River

Brannan Andrus Island, Venice Island, Empire Tract, Terminous Tract, Staten Island

- Construct seepage interception wells along channels adjacent to Bouldin Island

Palm Tract

- Purchase 3000-foot alignment on eastern portion of Palm Tract
- Remove 3000 feet of levee on Rock Slough from Old River westward
- Remove 3000 feet of levee on southeast corner of tract from Old River westward
- Construct setback levee parallel with Old river, set back about 3000 feet to the west
- Construct new, relocated irrigation diversions and drainage pumps
- Place rip-rap on west side of Old River levee, which becomes a channel island

Orwood Tract

- Purchase 3000-foot alignment on eastern portion of Orwood Tract
- Remove 3000 feet of levee on northeast corner from Old River westward
- Remove 3000 feet of levee on Indian Slough from Old River westward
- Construct setback levee parallel with Old river, set back about 3000 feet to the west

- Construct new, relocated irrigation diversions and drainage pumps
- Place rip-rap on west side of Old River levee, which becomes a channel island
- Construct ring levee around Mokelumne River Aqueduct

Byron Tract

- Purchase 3000-foot alignment on eastern portion of Byron Tract, north of Highway 4
- Remove 1000-feet of levee on Indian Slough from Old River westward
- Remove 1000-feet of levee along Old River north of Highway 4
- Construct setback levee parallel with Old river, set back about 3000 feet to the west as far south as Highway 4
- Construct new, relocated irrigation diversions and drainage pumps
- Place rip-rap on west side of Old River levee, which becomes a channel island
- Construct new 3000-foot embankment causeway over new setback channel and new bridge and alignment over Old River for Highway 4

Victoria Island

- Purchase 3000-foot alignment on western portion of Victoria Island south of Highway 4
- Remove 1000 feet of levee on Old River, south of Highway 4
- Remove 1000 feet of levee along Old River near Clifton Court Forebay
- Construct setback levee parallel with Old river, set back about 3000 feet to the west as far south as Clifton Court Forebay
- Construct new, relocated irrigation diversions and drainage pumps
- Place rip-rap on east side of Old River levee, which becomes a channel island

Clifton Court Forebay

- Construct new intake at northern end of Clifton Court
- Construct new, state-of-the-art fish screens at the Skinner Fish Facility

Tracy Pumping Plant

- Construct interconnection with Clifton Court Forebay, with 2 sets of radial gates and 10,300 cfs capacity
- Construct new, state-of-the-art fish screens at the Tracy Pumping Plant intake.

Bacon Island, Woodward Island, and Victoria Island

Construct seepage interception wells along Old River levees

Through Delta Component 3: Tyler Island Habitat

Andrus Island Setback Channel

- Purchase Alignment, northeast corner of Andrus Island
- Construct setback levee, 500 feet west of Georgiana Slough, from Sacramento River to weir intake as shown
- Excavate existing levee sections where they would obstruct new channel, at each junction of new setback levee with existing levee, as shown
- Construct new 500 foot bridge and elevated roadway from Georgiana Slough swing bridge to junction with existing Isleton Road, with sufficient elevation to allow small craft passage
- Convert existing levee into channel island; place rip-rap on previous land side to prevent erosion

Dead Horse Island Floodway and Habitat

- Purchase Dead Horse Island (200 ac) including 1 residence
- Excavate levee on southwest side of Dead Horse Island, 2000-foot width
- Excavate levee on northeast side of Dead Horse Island (adjacent to Dead Horse Cut), 2000-foot width
- Place erosion control rip-rap on remaining interior levee slopes

McCormack-Williamson Tract Floodway and Habitat

- Purchase McCormack-Williamson Tract
- Excavate levee on northeast end, near I-5, 2000-foot width
- Excavate levee on southwest , adjacent to Dead Horse Cut, 2000-foot width
- (Don't rip-rap interior slopes, due to general elevation above sea level)
- Build bridge and secure access road to radio tower control building

Tyler Island Aquatic Habitat

- Construct 600-foot wide North Weir in levee near northwest section of Tyler Island, with inflatable rubber dam to control weir elevation
- Construct bridge across North Weir apron for maintenance access and access to levee road
- Construct channel section control in Georgiana Slough to prevent accelerated erosion of channel bottom; armoring with rip-rap or gabion baskets across entire section, for 100 feet
- Place rip-rap along interior levee slopes of remaining levees around island to protect against wave wash. Georgiana Slough levee must remain intact to maintain flood flow distribution
- Breach 2000 feet of levee on northeast side of island
- Construct new levee from North Weir to breach of levee on northeast side of island
- Construct bridge over new flood channel created by northeast levee breach for Thornton-Walnut Grove Road

Bouldin Island

- Purchase Bouldin Island

- Remove 2000-foot section of levee, east bank lower Mokelumne, north of Highway 12
- Remove 3000-foot section of levee along San Joaquin River between Potato Slough and Mokelumne River
- Protect remaining interior levee slopes of island with rip-rap; these would become channel islands and help protect adjacent islands against wave wash
- Construct elevated embankment roadway across Bouldin Island, except for new bridge; protect both north and south sides with rip-rap.
- Construct 2,000-foot bridge at west end of Bouldin Island to facilitate flood and transfer flows to move to San Joaquin River

Brannan Andrus Island, Venice Island, Empire Tract, Terminous Tract, Staten Island

- Construct seepage interception wells along channels adjacent to Bouldin Island and Tyler Island

Palm Tract

- Purchase 3000-foot alignment on eastern portion of Palm Tract
- Remove 3000 feet of levee on Rock Slough from Old River westward
- Remove 3000 feet of levee on southeast corner of tract from Old River westward
- Construct setback levee parallel with Old river, set back about 3000 feet to the west
- Construct new, relocated irrigation diversions and drainage pumps
- Place rip-rap on west side of Old River levee, which becomes a channel island

Orwood Tract

- Purchase 3000-foot alignment on eastern portion of Orwood Tract
- Remove 3000 feet of levee on northeast corner from Old River westward
- Remove 3000 feet of levee on Indian Slough from Old River westward
- Construct setback levee parallel with Old river, set back about 3000 feet to the west
- Construct new, relocated irrigation diversions and drainage pumps
- Place rip-rap on west side of Old River levee, which becomes a channel island
- Construct ring levee around Mokelumne River Aqueduct

Byron Tract

- Purchase 3000-foot alignment on eastern portion of Byron Tract, north of Highway 4
- Remove 1000-feet of levee on Indian Slough from Old River westward
- Remove 1000-feet of levee along Old River north of Highway 4
- Construct setback levee parallel with Old river, set back about 3000 feet to the west as far south as Highway 4
- Construct new, relocated irrigation diversions and drainage pumps
- Place rip-rap on west side of Old River levee, which becomes a channel island
- Construct new 3000-foot embankment causeway over new setback channel and new bridge and alignment over Old River for Highway 4

Victoria Island

- Purchase 3000-foot alignment on western portion of Victoria Island south of Highway 4

- Remove 1000 feet of levee on Old River, south of Highway 4
- Remove 1000 feet of levee along Old River near Clifton Court Forebay
- Construct setback levee parallel with Old river, set back about 3000 feet to the west as far south as Clifton Court Forebay
- Construct new, relocated irrigation diversions and drainage pumps
- Place rip-rap on east side of Old River levee, which becomes a channel island

Clifton Court Forebay

- Construct new intake at northern end of Clifton Court
- Construct new, state-of-the-art fish screens at the Skinner Fish Facility

Tracy Pumping Plant

- Construct interconnection with Clifton Court Forebay, with radial gates and 10,300 cfs capacity
- Construct new, state-of-the-art fish screens at the Tracy Pumping Plant intake.

Bacon Island, Woodward Island, and Victoria Island

- Construct seepage interception wells along Old River levees

Trough Delta Component 4. Multiple Intake Channels

This Component combines three distinct intake channels which draw water from Rock Slough (Western Intake), from the San Joaquin River near Turner Cut (Northern Intake), and from the San Joaquin River near Lathrop (Eastern Intake). The intake channels are gated at their entrances, unscreened, and isolated from the surrounding waterways.

Western Intake Components

Palm Tract Intake and Isolated Conveyance

- Purchase 1000-foot alignment on eastern portion of Palm Tract
- Gated entrance on northeast corner of Palm Tract, on Rock Slough
- Siphon under Mokelumne River Aqueduct and railroad
- Construct setback levee parallel with Old river, set back about 500 feet to the west
- Construct new, relocated irrigation diversions and drainage pumps
- Place rip-rap on existing interior levee slopes of new conveyance channel, particularly west side of Old River levee, which becomes the east bank of conveyance channel

Orwood Tract Isolated Channel

- Purchase 1000-foot alignment on eastern portion of Orwood Tract
- Construct setback levee parallel with Old river, set back about 500 feet to the west
- Construct new, relocated irrigation diversions and drainage pumps
- Siphon under Indian Slough
- Place rip-rap on existing interior levee slopes of new conveyance channel, particularly west side of Old River levee, which becomes the east bank of conveyance channel

Fish Screen and Bypass Option

- Construct multiple folded "V" fish screen installation in isolated open channel, including stop logs for hydraulic isolation during repair and inspection, trash racks, crane, screens, fish bypass system
- Construct low lift pump station downstream from fish screens to control hydraulic performance of fish screens
- Fish Bypass System: Pump, Evaluation Facility, Return Pipe, Discharge Structure
- Control Building, Parking, Access, Lighting, Fencing. Discharge screened fish to Indian Slough

Byron Tract Isolated Channel

- Purchase 1000-foot alignment on eastern portion of Byron Tract north of Highway 4
- Construct setback levee parallel with Old river, set back about 500 feet to the west
- Construct new, relocated irrigation diversions and drainage pumps
- Construct new 500-foot causeway over new setback channel and new bridge and alignment over Old River for Highway 4
- Siphon under Old River to Victoria Island
- Place rip-rap on existing interior levee slopes of new conveyance channel, particularly west side of Old River levee, which becomes the east bank of conveyance channel

Victoria Island Isolated Channel

- Purchase 1000-foot alignment on western portion of Victoria Island south of Highway 4
- Construct setback levee parallel with Old river, set back about 500 feet to the east
- Construct new, relocated irrigation diversions and drainage pumps alignment
- Siphon under Old River to Clifton Court Forebay
- Place rip-rap on existing interior levee slopes of new conveyance channel, particularly east side of Old River levee, which becomes the west bank of conveyance channel

Clifton Court Forebay

- Construct new, state-of-the-art fish screens at the Skinner Fish Facility

Tracy Pumping Plant

- Construct interconnection with Clifton Court Forebay, with 2 sets of radial gates and 10,300 cfs capacity
- Construct new, state-of-the-art fish screens at the Tracy Pumping Plant intake (for 5,000 cfs and 10,000 cfs Components)

Northern Intake Components

Lower Roberts Island Intake and Isolated Conveyance

- Acquire land along alignment, 2000-foot swath
- Gated intake structure
- <<< May require low lift pumps >>>
- Open channel construction
- McDonald Road Bridge
- Atchison Topeka RR bridge
- Relocation, Mokelumne River Aqueduct
- Holt Road bridge
- Holt Community relocations (note: check aerial photography; a slight relocation of alignment can miss this community)
- Highway 4 bridge
- Kingston School Road bridge
- Siphon under Middle River
- Check structures as required

Fish Screen and Bypass Option at Middle River near Trapper Slough

- Construct multiple folded "V" fish screen installation in isolated open channel, including stop logs for hydraulic isolation during repair and inspection, trash racks, crane, screens, fish bypass system
- Construct low lift pump station downstream from fish screens to control hydraulic performance of fish screens
- Fish Bypass System: Pump, Evaluation Facility, Return Pipe, Discharge Structure

- Control Building, Parking, Access, Lighting, Fencing. Discharge screened fish to Middle River
- Capacities: 5,000 cfs, 10,000 cfs, 15,000 cfs

Open Channel, Union Island

- Acquire land along alignment, 2000-foot swath
- Open channel construction
- Bonetti Road bridge
- Siphon under Old River
- Check structures as required

Open Channel, Coney Island

- Acquire land along alignment, 2000-foot swath
- Open channel construction
- Siphon under West Canal

Eastern Intake Components

Upper Roberts Island Intake and Isolated Conveyance

- Acquire land along alignment, 2000-foot swath
- Gated intake structure, San Joaquin River at latitude of Undine Road
- <<< May require low lift pumps >>>
- Open channel construction
- Roberts Road Bridge
- Crocker Road Bridge
- Relocation/Utility crossing: High voltage electric transmission oh cables
- Siphon under Middle River
- Check structures as required

Fish Screen and Bypass Option at Middle River Crossing near Old River

- Construct multiple folded "V" fish screen installation in isolated open channel, including stop logs for hydraulic isolation during repair and inspection, trash racks, crane, screens, fish bypass system
- Construct low lift pump station downstream from fish screens to control hydraulic performance of fish screens
- Fish Bypass System: Pump, Evaluation Facility, Return Pipe, Discharge Structure
- Control Building, Parking, Access, Lighting, Fencing. Discharge screened fish to Middle River

Open Channel, Union Island

- Acquire land along alignment, 2000-foot swath
- Open channel construction. Where new channel is adjacent to existing levee (i.e. Grant Line Canal), it is assumed that existing levee interior slope will be rip-rapped and strengthened as required.
- Wing Levee Road bridge
- Undine Road bridge

- Tracy Blvd. bridge
- Bonetti Road bridge
- Siphon under Old River
- Check structures as required

Open Channel, Clifton Court

- Open channel construction
- Gate at Clifton Court Forebay

Tracy Pumping Plant

- Construct interconnection with Clifton Court Forebay, with 2 sets of radial gates and 10,300 cfs capacity

Construct new, state-of-the-art fish screens at the Tracy Pumping Plant intake (for 5,000 cfs and 10,000 cfs Components)

ISOLATED CONVEYANCE COMPONENTS

Isolated Conveyance Component 1: Hood to Clifton Court Open Channel, 5,000 cfs, 10,000 cfs, and 15,000 cfs

Screened Intake at Hood: Offstream folded "V"

- Relocation of Highway 160 and new bridge over diversion
- Trashrack
- Flood Gates or stop logs
- Crane
- Levees
- Sedimentation Basin
- Pumping Plant and discharge pipes over levee
- Fish Bypass System: Pump, Evaluation Facility, Return Pipe, Discharge Structure
- Control Building, Parking, Access, Lighting, Fencing
- Capacities: 5,000 cfs, 10,000 cfs, 15,000 cfs

Alternate Intake at Babel Slough (River Mile 30)

- Relocation of South River Road and new bridge over diversion
- Trashrack
- Flood Gates or stop logs
- Crane
- Levees
- Sedimentation Basin
- Pumping Plant and discharge to open channel
- Fish Bypass System: Pump, Evaluation Facility, Return Pipe, Discharge Structure
- Control Building, Parking, Access, Lighting, Fencing
- Capacities: 5,000 cfs, 10,000 cfs, 15,000 cfs
- Open channel southeast Sacramento River at RM 25
- Siphon under Sacramento River
- Open channel south to Hood
- Bridge, Hood-Franklin Road

Open Channel, Hood to Lambert Road along west side of SPRR embankment

- Acquire land along alignment, 2000-foot swath
- Open channel construction
- Siphon under Snodgrass Slough

Open Channel, Glanville Tract

- Acquire land along alignment, 2000-foot swath, include existing borrow pits 1-4
- Open channel construction
- Siphon under Mokelumne River floodway
- Check structures as required

Open Channel, New Hope Tract

- Acquire land along alignment, 2000-foot swath, include existing borrow pit 5
- Open channel construction
- Barber Road bridge
- Thornton-Walnut Grove bridge
- Siphon under Beaver Slough
- Check structures as required

Open Channel, Canal Ranch

- Acquire land along alignment, 2000-foot swath
- Open channel construction
- Siphon under Hog Slough
- Check structures as required

Open Channel, Brack Tract

- Acquire land along alignment, 2000-foot swath
- Open channel construction
- Woodbridge Road bridge
- Siphon under Sycamore Slough
- Check structures as required

Open Channel, Terminous Tract

- Acquire land along alignment, 2000-foot swath, include existing borrow pits
- Open channel construction
- Highway 12 bridge
- Check structures as required

Open Channel, Shin Kee Tract

- Acquire land along alignment, 2000-foot swath, include existing borrow pits 9-12
- White Slough local drainage structures
- Open channel construction
- Check structures as required

Open Channel, Rio Blanco Tract

- Acquire land along alignment, 2000-foot swath, include existing borrow pit 13
- Open channel construction
- Telephone Cut, Relocate pumping station and cut off easterly end of Telephone Cut
- Check structures as required

Open Channel, Bishop Tract

- Acquire land along NEW alignment, 2000-foot swath as shown
- Open channel construction
- Eightmile Road bridge
- Siphon under Disappointment Slough
- Check structures as required

Open Channel, Ringe Tract

- Acquire land along alignment, 2000-foot swath

- Open channel construction
- Siphon under San Joaquin River
- Check structures as required

Open Channel, Roberts Island

- Acquire land along alignment, 2000-foot swath
- Open channel construction
- House Road bridge
- Relocation, Mokelumne River Aqueduct
- Jacobs Road bridge
- Inland Road bridge
- Atchison Topeka RR bridge
- Highway 4 bridge
- Kingston School Road bridge
- Siphon under Middle River
- Check structures as required

Open Channel, Union Island

- Acquire land along alignment, 2000-foot swath
- Open channel construction
- Bonetti Road bridge
- Siphon under Old River
- Check structures as required

Open Channel, Coney Island

- Acquire land along alignment, 2000-foot swath
- Open channel construction
- Siphon under West Canal

Clifton Court Forebay

- Gate structure at end of West Canal Siphon

Tracy Pumping Plant

- Construct interconnection with Clifton Court Forebay, with 2 sets of radial gates and 10,300 cfs capacity
- Construct new, state-of-the-art fish screens at the Tracy Pumping Plant intake (for 5,000 cfs and 10,000 cfs Components)

**Isolated Conveyance Component 2: Hood to Clifton Court Pipeline,
5,000 cfs, 10,000 cfs, and 15,000 cfs**

(See separate report by Buer, 12/95)

Isolated Conveyance Component 3: Chain of Lakes, 5,000 cfs, 10,000 cfs, and 15,000 cfs

Enlarge Delta Cross Channel

- Purchase 300 foot alignment along north bank of Delta Cross Channel, for gates and transition channel. Purchase 1000-foot alignment along south bank of Delta Cross Channel and Snodgrass Slough
- Construct new Highway 160 Bridge
- Construct 2 new radial gates north of existing gates, in supplemental intake channel
- Construct open channel, 500 feet wide. Close d/s end of Delta Cross Channel. Existing Snodgrass Slough levee is strengthened and rip rapped, new setback levee constructed, including rip-rap, to create new isolated channel.
- Relocate radio tower cable anchors as necessary

Delta Cross Channel Fish Screen

- Construct multiple folded "V" fish screen installation in Delta Cross Channel downstream of radial gates
- Construct low lift pump station downstream from fish screens to control hydraulic performance of fish screens
- Fish Bypass System: Pump, Evaluation Facility, Return Pipe, Discharge Structure
- Control Building, Parking, Access, Lighting, Fencing
- Capacities: 5,000 cfs, 10,000 cfs, 15,000 cfs

Tyler Island Isolated Conveyance

- Purchase Tyler Island, except for northwest corner along Thornton-Walnut Grove Road. Purchase or rebuild gas wells. Purchase other infrastructure.
- Levees, with patrol roads to remain intact. Rip-rap interior slopes of levees to protect against wave wash. Strengthen levees as required
- Extend north levee of new isolated conveyance channel to Georgiana Slough, southwest of Thornton-Walnut Grove Road
- Distributed pump stations with cylindrical screens to facilitate filling island from adjacent channel and returning flow from storage
- New bridge for Thornton-Walnut Grove Road across new isolated channel
- Siphons under Mokelumne River, from Tyler island to Bouldin Island (note deep peat in this area)

Bouldin Island Isolated Conveyance

- Purchase Bouldin Island, including 4 homes along north levee
- Protect interior levee slopes of island with rip-rap. Strengthen levees as required
- Construct elevated embankment roadway across Bouldin Island, except for new bridge; protect both north and south sides with rip-rap.

- Construct 500-foot bridge at west end of Bouldin Island to facilitate transfer flows to move to San Joaquin River
- Construct low lift pump station and siphons under Potato Slough to Venice Island
- Distributed pump stations with cylindrical screens to facilitate filling island from adjacent channel and returning flow from storage

Brannan Andrus Island, Medford Island, Empire Tract, Terminous Tract, Staten Island, Bradford Island

- Construct seepage interception wells along channels adjacent to islands and tracts devoted to isolated conveyance

Venice Island Isolated Conveyance

- Purchase Venice Island
- Protect interior levee slopes of island with rip-rap. Strengthen levees as required
- Siphons under San Joaquin River to Mandeville Island, southwest corner of island
- Distributed pump stations with cylindrical screens to facilitate filling island from adjacent channel and returning flow from storage

Mandeville Island Isolated Conveyance

- Purchase Mandeville Island
- Protect interior levee slopes of island with rip-rap. Strengthen levees as required
- Low lift pump station and siphons under Old River to Bacon Island, located on southeast side of Mandeville Island
- Distributed pump stations with cylindrical screens to facilitate filling island from adjacent channel and returning flow from storage

Bacon Island Isolated Conveyance

- Purchase Bacon Island
- Protect interior levee slopes of island with rip-rap. Strengthen levees as required
- Low lift pumps and siphons under borrow channel, railroad, and Mokelumne River Aqueduct to Woodward Island, on middle of south levee
- Distributed pump stations with cylindrical screens to facilitate filling island from adjacent channel and returning flow from storage

Woodward Island Isolated Conveyance

- Purchase Woodward Island
- Protection of Mokelumne River Aqueduct through appropriate relocation (elevation?) or construction of new levee across north end of Woodward Island
- Protect interior levee slopes of island with rip-rap. Strengthen levees as required
- Siphons under Woodward Canal to Victoria Island, located on center of south end of island

- Distributed pump stations with cylindrical screens to facilitate filling island from adjacent channel and returning flow from storage

Victoria Island Isolated Conveyance

- Purchase Victoria Island
- Protect interior levee slopes of island with rip-rap. Strengthen levees as required
- Construct elevated embankment roadway for Highway 4 across Victoria Island, except for new bridge; protect both north and south sides with rip-rap.
- Construct 500-foot bridge at center of Victoria Bouldin Island to facilitate transfer flows to move across island
- Construct siphons under Old River to Clifton Court Forebay, just south of Kings Island
- Distributed pump stations with cylindrical screens to facilitate filling island from adjacent channel and returning flow from storage

Tracy Pumping Plant

- Construct interconnection with Clifton Court Forebay, with 2 sets of radial gates and 10,300 cfs capacity
Construct new, state-of-the-art fish screens at the Tracy Pumping Plant intake.

Notes:

- This set of alternative components does not address north Delta flood flow concerns. They can be paired with other Delta channel modifications to achieve this function also.

For each low-lift pump station, need to consider bringing in electric power supply

D. Isolated Conveyance Component 4: Deep Water Ship Channel and west Delta Tunnel, 5,000 cfs, 10,000 cfs, and 15,000 cfs

Screened Diversion from Sacramento River

- Trashrack
- Flood Gates or stop logs
- Crane
- Levees
- Sedimentation Basin
- Pumping Plant and discharge pipes into turning basin
- Fish Bypass System: Pump, Evaluation Facility, Return Pipe, Discharge Structure
- Control Building, Parking, Access, Lighting, Fencing
- Capacities: 5,000 cfs, 10,000 cfs, 15,000 cfs

Sacramento River Deep Water Ship Channel Closure and Pumps

- Sub-Component 1: Close Port of Sacramento. Purchase port facilities and channel from Corps and Port Authority. Build rock dam at mouth of ship channel, near mile 18.7
- Sub-Component 2: Assume continued large boat traffic which requires construction of a lock at mile 19, to protect water quality and prevent fish passage into channel

Unscreened Pumping Plant at mile 18.7

- Build elevated foundation pad and access road down west ship channel levee
- Construct unscreened pumping plant to pump water to Brentwood via pressure pipeline. Dual intake Component included: Can draw from downstream or upstream of dam/lock structure.
- Valve structure: Two incoming pipelines-- from Berryessa Intertie and to Brentwood. Facility should have capability of pumping to Berryessa Intertie, to Brentwood, allowing flow to go from Berryessa Intertie to Brentwood, or be released into Ship Channel or Cache Slough
Siphon under Cache Slough

Pipeline to Sacramento River Downstream of Rio Vista

- Siphon under Sacramento and San Joaquin River, west end of Sherman Island
- Pipeline terminus structure at Brentwood
-
-

Open Channel to Clifton Court Forebay

Tracy Pumping Plant

Construct interconnection with Clifton Court Forebay, with 2 sets of radial gates and 10,300 cfs capacity

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DELTA WATERWAYS

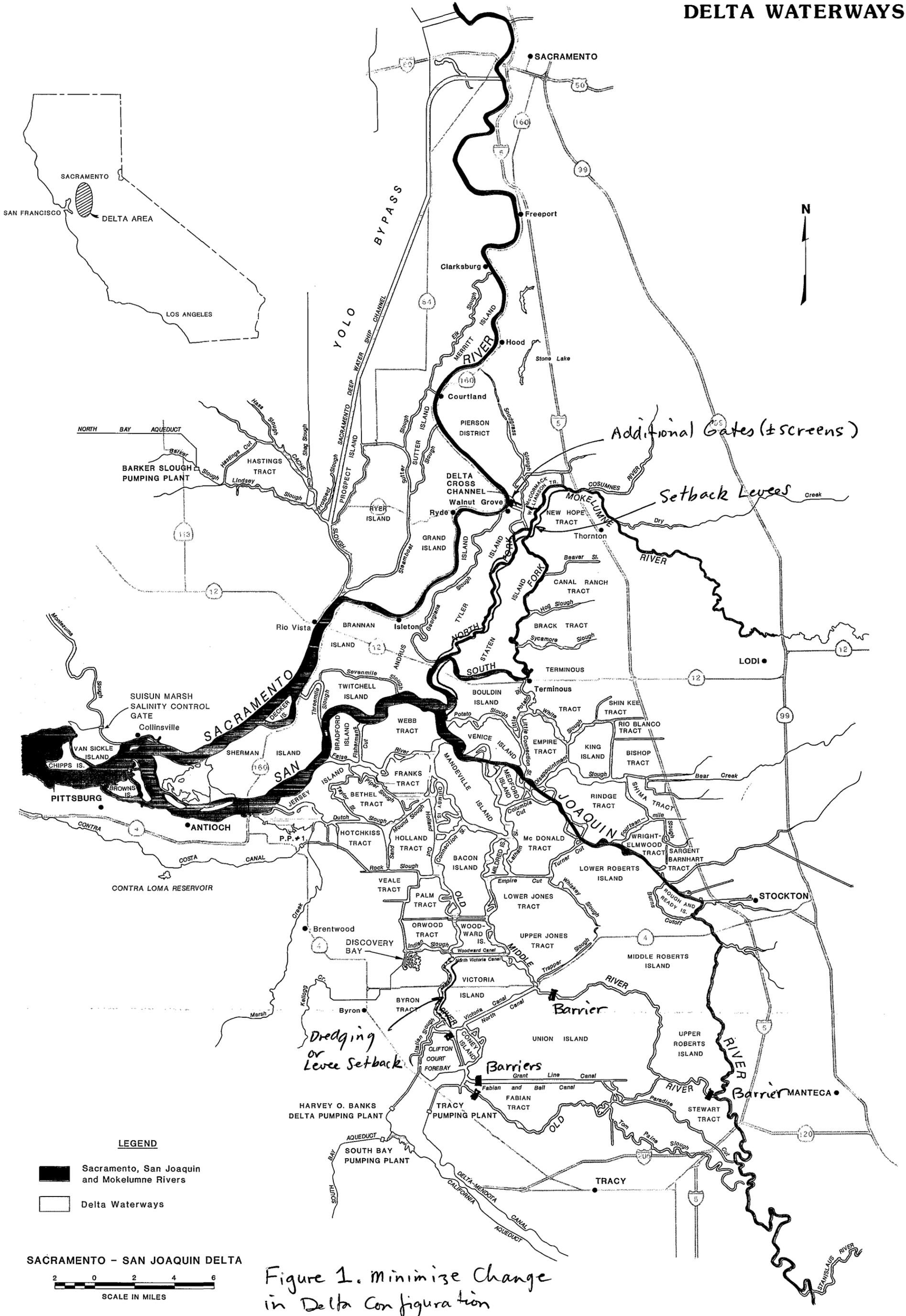


Figure 1. Minimize Change in Delta Configuration

DELTA WATERWAYS

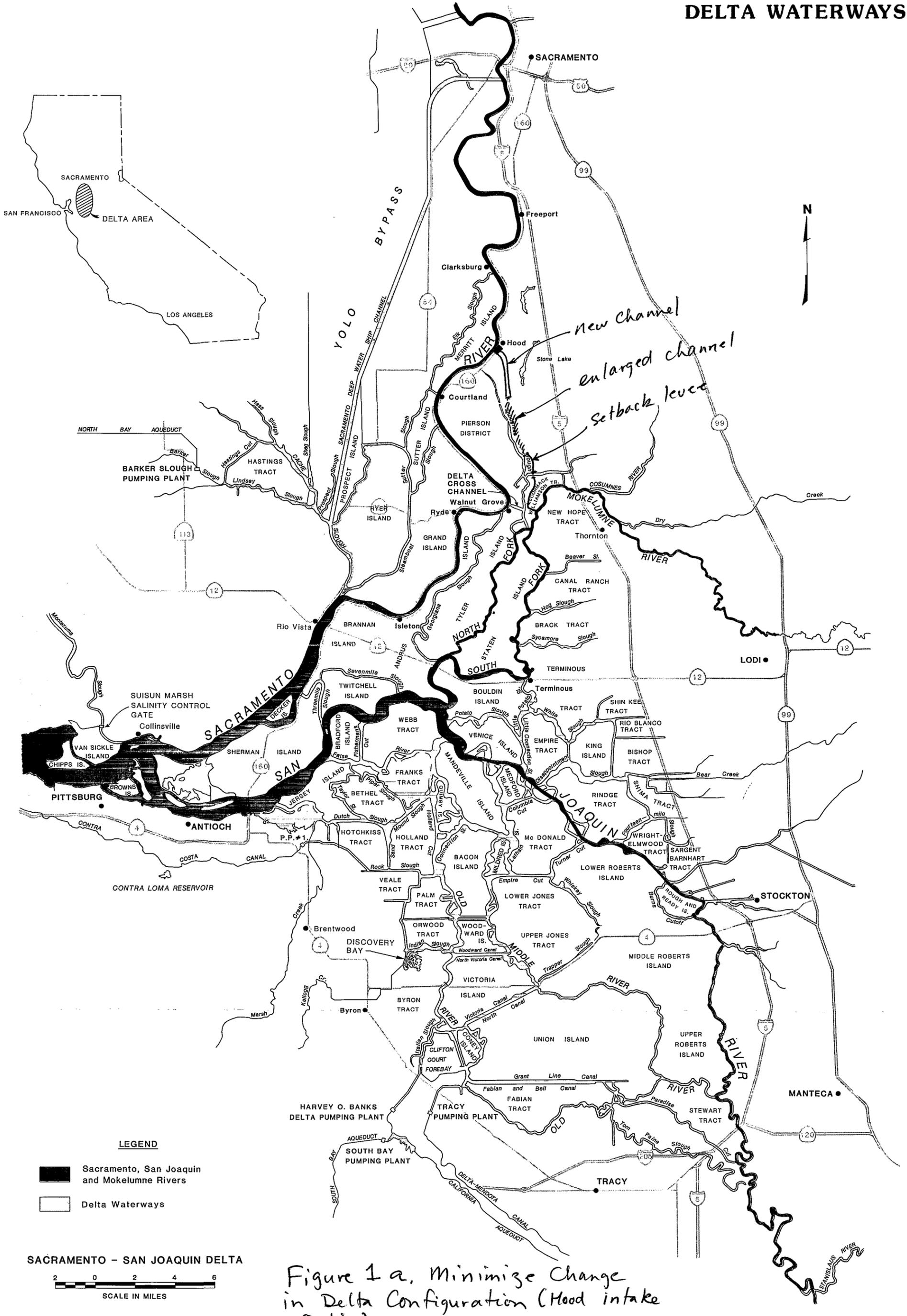
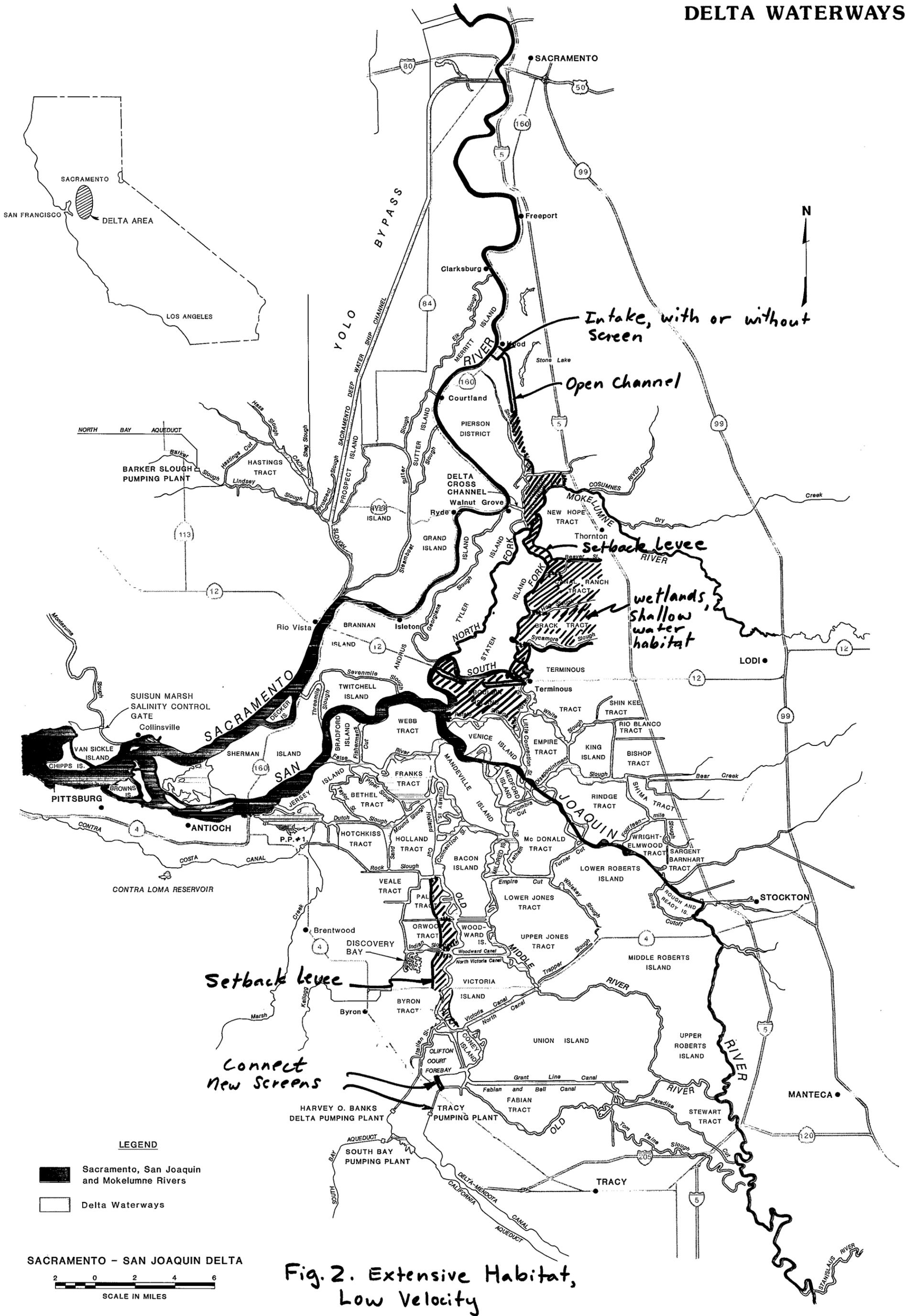


Figure 1a. Minimize Change in Delta Configuration (Hood intake Option)

DELTA WATERWAYS



LEGEND

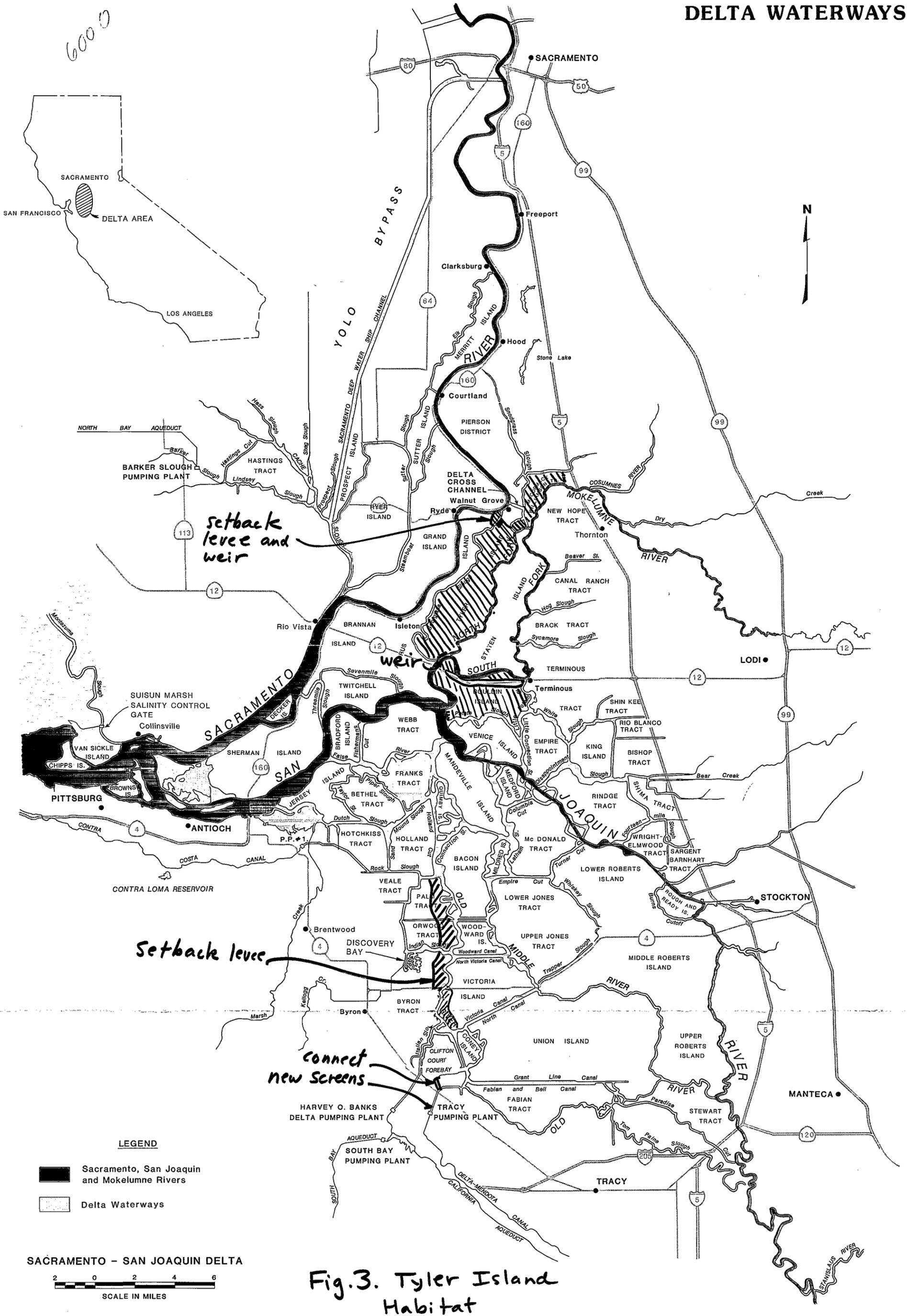
- Sacramento, San Joaquin and Mokelumne Rivers
- Delta Waterways

SACRAMENTO - SAN JOAQUIN DELTA

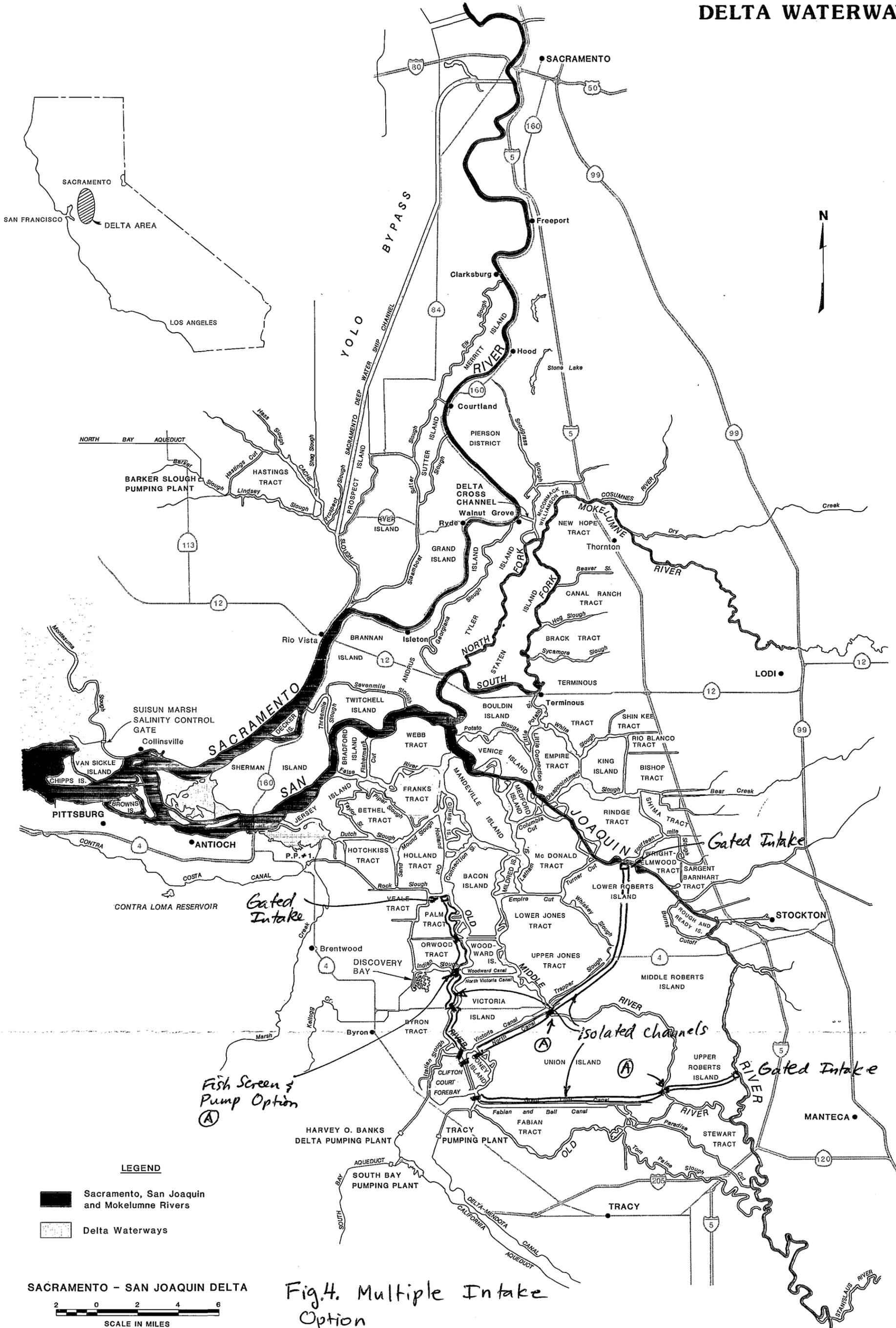


Fig. 2. Extensive Habitat, Low Velocity

DELTA WATERWAYS



DELTA WATERWAYS



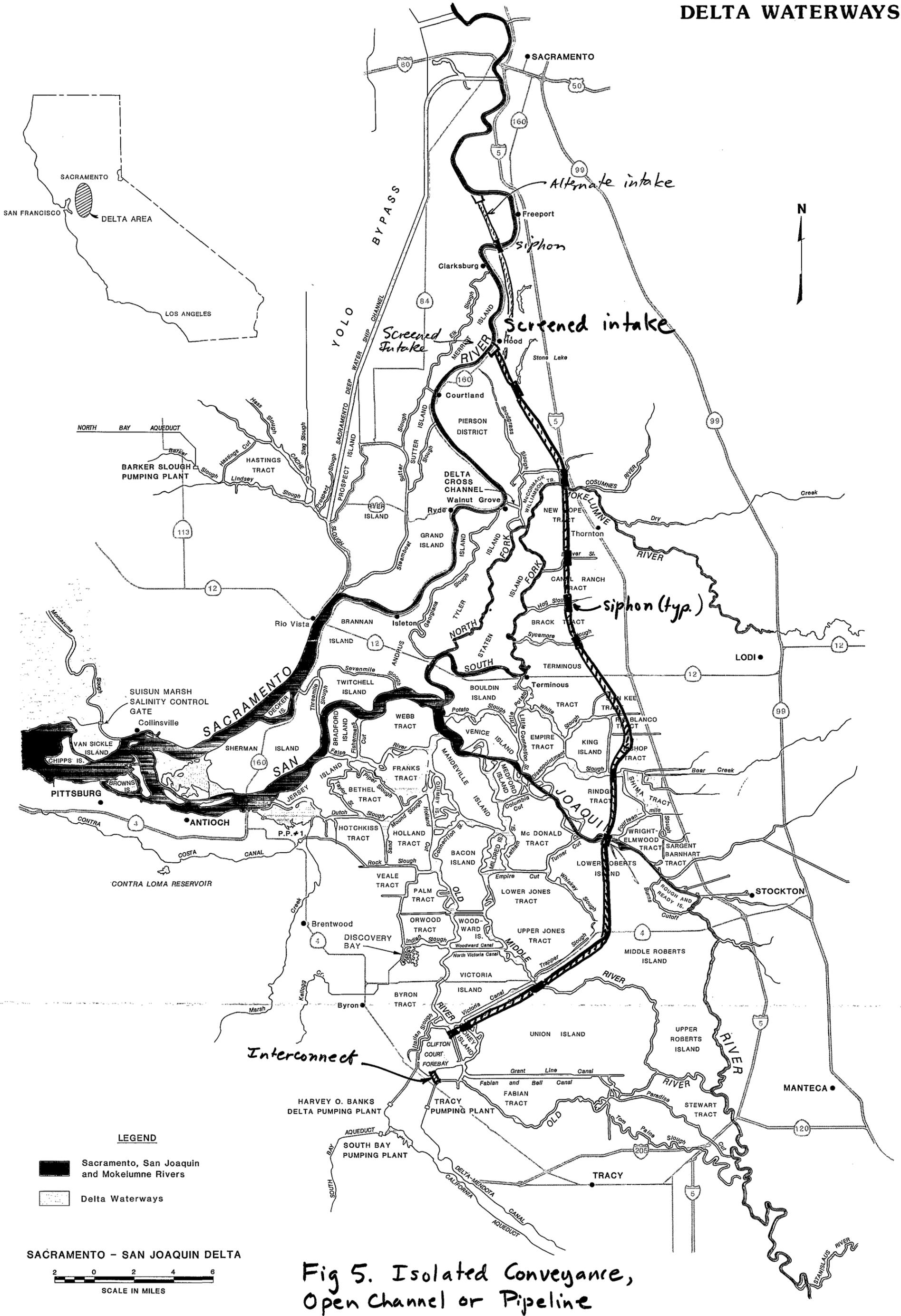
LEGEND

- Sacramento, San Joaquin and Mokelumne Rivers
- Delta Waterways

SACRAMENTO - SAN JOAQUIN DELTA
 2 0 2 4 6
 SCALE IN MILES

Fig.4. Multiple Intake Option

DELTA WATERWAYS



DELTA WATERWAYS

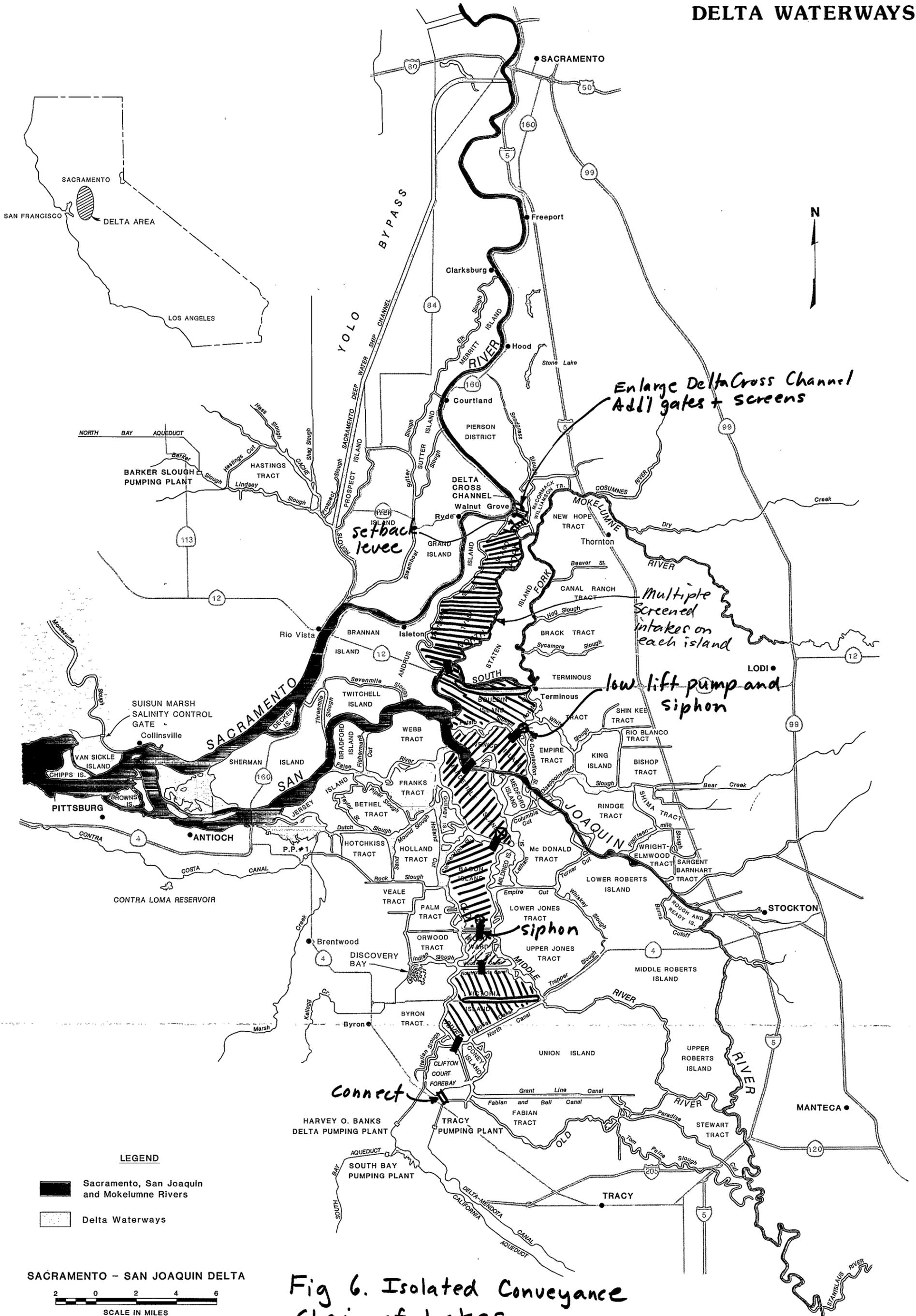


Fig 6. Isolated Conveyance Chain of Lakes

DELTA WATERWAYS

