North Delta Program and South Delta Water Management Program

Work Plan

Environmental Study of Dredged Material

November 1991

DIVISION OF PLANNING
Department of Water Resources
The Resources Agency
State of California

Work Plan
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and
South Delta Water Management Program
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Table of Contents

Tables

Figures

Appendices

I. PROGRAM DESCRIPTIONS

A. Purpose of This Report

The California Department of Water Resources (DWR) proposes to implement the North Delta Program (NDP) and South Delta Water Management Programs (SDWMP).

This report describes the work plan proposed for the testing of dredged sediment, surface soil , channel water and imported borrow material which could be used in the construction of either the NDP or the SDWMP. The testing and analysis proposed in this work plan is a portion of the work involved in obtaining an approved Section 404 permit from the U. S. Army Corps of Engineers and a certification or waiver of certification or waste discharge permit from the California Regional Water Quality Control Board, Central Valley Region (CRWQCB, CVR) stating that the proposed project will not violate state water quality objectives. The dredging and disposal operation portion of the project will require waste discharge requirements issued by the Central Valley Regional Board.

B. Program Background

1. Program Location and Description

The NDP and the SDWMP are two distinct programs located in the Sacramento-San Joaquin Delta (Figure 1).

The north Delta study area includes the islands and channels south of Sacramento, north of the San Joaquin River, east of Rio Vista and west of Thornton. The area contains about 170,000 acres of which 150,000 are used for irrigated agriculture. The remaining area consists of waterways, natural areas, and municipal uses.

The south Delta study area generally comprises the lands and channels of the Delta south-west of Stockton. Included in the study area is the South Delta Water Agency (SDWA) which comprises about 120,000 acres used for irrigated agriculture. Important features of the State Water Project (SWP) and the Central Valley Project (CVP) are also located in the study area.

2. Program Benefits

The NDP is designed to address problems related to flooding, reverse flow, water quality, fisheries impacts and water supply reliability. The February 1986 flood demonstrated the urgent need for new flood control work in the north Delta area. The 1986 flooding forced the evacuation of 1,600 people from small towns and various homes in the area, caused $20 million worth of direct damage, and flooded Interstate 5 and numerous local roads.

The NDP will also improve water quality by reducing reverse flow and allowing export water to flow in a direct path, avoiding ocean bromides and reducing trihalomethanes (THMs). Fisheries impacts will be reduced with creation of setback levees, which provide more shoreline. The NDP will also improve water supply reliability and efficiency of the SWP.

The main benefits of the SDWMP are to: improve and maintain water levels, circulation patterns and water quality in the south Delta area; improve the water quality for the Contra Costa Canal (CCC) and the SWP; improve overall efficiency of the SWP; improve SWP and CVP water supply reliability through enhanced capabilities for banking winter water supplies ; increase the operational flexibility to help reduce fishery impacts and improve fishery conditions; and, to improve navigation and flood protection in the south Delta area.

Project alternatives for the NDP and the SDWMP involve channel dredging and construction of setback levees (Tables 1 and 2 and Appendix B).

3. Description of Preferred Alternatives

A. North Delta Program

The preferred alternative for the NDP is called, "Alternative 5B." Alternative 5B consists of: dredging the South Fork Mokelumne River; enlarging the main stem and North Fork Mokelumne River with levee setbacks and channel dredging; and, enlarging the Delta Cross Channel gate structure (see Appendix A).

B. South Delta Water Management Program

The SDWMP preferred alternative, called "Preferred Alternative," will enlarge Clifton Court Forebay to about 5,000 surface acres with new intakes at Old River and Middle River at the west and east ends of North Victoria Canal; enlarge some existing south Delta channels to improve conveyance and circulation; construct up to four mitigation and enhancement barrier-type facilities in south Delta Channels to directly improve water level and circulation (Appendix A); and obtain US Army Corps of Engineer (USACE) permit to increase diversions at Harvey O. Banks Pumping Plant.

C. Construction Plans

1. Proposed Dredge and Setback Levee Plans

A. The North Delta Program

The NDP currently considers one alternative which will require constructing 15.5 miles of setback levees parallel to existing channels and/or dredging of channels. For the four alternatives considered for the NDP, 31 miles of channel will be studied and considered for possible dredging (see Appendix A for Project Alternative Maps). Dredging operations will remove material no deeper than -20.0 ft. mean sea level (msl).

B. The South Delta Water Management Program

The SDWMP also considers dredging. Dredging may be required in all four project alternatives, although the dredging required in the "Preferred Alternative" is minimal. This study will investigate approximately 17 miles of existing channel in the south Delta (see Appendix A for Project Alternative Maps). Dredging operations will remove material to a depth of no more than five feet below the existing invert of the channel. The estimated maximum depth of dredging for each channel in the SDWMP, based on existing engineered cross-sections is:

River/Canal	Feet Below Mean Sea Level
Middle River	17.0
Victoria/North Canals	19.0
Woodward/N. Victoria Canal	16.0
Old River, north of Coney Is.	20.0

Chemical analyses will also take place in locations where four barrier-type facilities and six potential sites for siphons and intake structures are located (depending on which alternative is chosen for construction).

2. Proposed Method of Dredging

Two types of dredging have been considered for these two projects: clamshell dredging and hydraulic dredging.

Clamshell dredging is the preferred form of dredging for both of these projects. Clamshell dredging will allow for quicker drying and placement of dredged material in the construction of setback levees, or enhancement of existing levees.

In hydraulic dredging, only between 12 to 18 percent solid particles are pumped. The dredged material is then deposited into ponds for sediment settlement. Once dredging is complete, the holding ponds are drained. It can then take over one year before the material can be recovered for levee construction. This could be too slow and costly for construction of these projects, since both projects will attempt to use dredged material for reinforcement of existing levees and in the construction of new setback levees. In addition, pond design for hydraulic dredge settlement will take a considerable amount of surrounding farm land out of production for up to two years until dredging is completed.

Transportation of dredge material is most commonly done by barge or split hull dump scows for clamshell operations, and by pipeline for hydraulic dredging operations. Neither project is considering disposal of dredged material in any existing channel; therefore, split hull dump scows may not be useful for this project. Barges will most likely be used to haul away dredged material which is not placed on levees adjacent to the dredging operation. Both programs

anticipate using all dredged material to either reinforce existing levees, or to help create water side berms in the newly constructed channel. Berms will create wildlife habitat.

It is estimated that over 10.8 million cubic yards of material will be dredged from the Mokelumne River if the preferred alternative for the NDP project is approved. Reconnaissance studies and evaluation of existing channels indicate very little (if any) dredging will be required for the SDWMP preferred alternative. Representative channel cross sections for the NDP and SDWMP are displayed in Appendix B. Also, *Figure 3. NDP Sediment and Water Sampling Locations*, and, *Figure 4. SDWMP Sediment and Water Sampling Locations*, show estimates of how much sediment will be dredged. Utilization of this material for both levee reinforcement and new levee construction will benefit these projects greatly. The quality of the sediments will be a determining factor in the utilization/disposal of dredged materials.

Because some channels are narrow, use of hydraulic dredge equipment in some places may be impossible.

3. Proposed Method of Disposal of Dredge Material

Once removed from the channel, the deposited sediment will be allowed to dewater by gravity and evaporation. When the materials moisture content is within acceptable engineering limits, the material will be incorporated into the work and compacted in place as directed by the project's engineering specifications.

The NDP and SDWMP proposes two uses for dredged material: 1) place material on the land side of existing levees; and, 2) use dredged material in the construction of new setback levees and waterside berms (this alternative is applicable only for construction of NDP Alternative 5B).

4. Potential Turbidity from Dredging Activity

Dredging activities will disturb channel bottom sediment with either clamshell or hydraulic dredging.

During construction, a short term problem associated with dredging of contaminated sediments is resuspension of the sediments and the resulting loss of volatiles and solubles to the water column. Resuspension occurs due to dredging action at the sediment-water interface, during transfer of the sediment to a transporting vessel, due to slop or leakage from the vessel, and during disposal.

Water contamination by volatiles is generally less with mechanical dredges which cut the sediments. Hydraulic dredges are less likely, however, to release solubles to the water column. Hydraulic dredging causes less turbidity and channel bed disturbance compared to mechanical dredging.

5. Use of Imported Material on NDP and SDWMP

In order to construct the setback levees for the projects, fill material will be imported to the project from borrow sites (see page 9 for partial listing of identified sites). In addition, the material excavated from the construction of the parallel channel will also be incorporated into the new setback levees. This imported material will be tested along with the indigenous sediment/soil material utilized in this project.

As mentioned earlier, reconnaissance studies and evaluation of existing channels in the south Delta area indicates that the SDWMP does not need to construct setback levees at this time.

D. Objectives of Environmental Study

The objectives of the NDP and SDWMP Environmental Study is to determine the impact of the dredging operation and the effects of the physical and chemical components of the dredged material to the environment. This study will also help determine the suitability of dredged material, imported (borrow) material for use in construction of these projects. This study will also document existing soil conditions in the program areas.

1. Results From Previous Analyses

Two separate analyses have been performed for the NDP in March, 1990 and November, 1990, respectively. The March, 1990 study sampled at seven sites in the NDP area. Channel sediment samples were analyzed for organotin, CAM metals (including mercury), an extractable organics analysis (EPA 8270) and a pesticides and PCB analysis (EPA Method 8080). In addition, water samples were taken for CAM metals at the seven sites. The only result of concern was that mercury was detected in the sediment samples. Concern over proper QA/ QC resulted in a retesting of the sediment in the same areas.

In November,1991, retesting took place to analyze mercury concentrations at one new site and at five of the seven original sites. Duplicates of of each of the sample locations were submitted for analysis as a means to test the precision of the analysis. Also, a reference sample of known concentration was submitted to test the accuracy of the laboratories. (For this analysis, results were submitted to three laboratories for an interlaboratory comparison). At the laboratories, care was taken to ensure a homogeneous sample. With the quality controls and assurances in place, results of the second analysis showed mercury levels less than 1 mg/kg (ppm).

To date, there have been no obvious impacts of channel dredging on vegetation, fish or wildlife, despite dredging for levee and channel maintenance over the past 100 years. However, construction impacts and more subtle long-term impacts of the proposed project need to be adequately investigated prior to project implementation. Accordingly, the proposed test plan will address the concerns raised toward dredging activities for these two programs.

2. Data Usage From Environmental Study

Data collected from this study will be used to better understand the existing project site conditions before project work begins.

USACE studies show that over 90 percent of the total volume of dredged material is considered acceptable for a wide range of management practices. To date, testing shows little evidence that major problems will be encountered on these programs.

The management strategy proposed for these projects is a tiered approach to effects-based testing, along with a decision-making framework. A tiered project structure provides a sound approach for testing, as well as being cost effective. This study will examine representative areas, including areas of potential environmental concern that are within the projects boundaries. Material to be imported to the project during construction will also be studied.

This Environmental Study is considered the first extensive tier of work for both NDP and SDWMP. Details on the Environmental Study Work Plan are discussed in *Section II. Design of Environmental Study.* If results from the first tier of analysis show no "reason to believe" that there is potential for unacceptable adverse effects, then analysis should end after this study. If there is a " reason to believe" there is potential for unacceptable adverse effects, then further testing will be undertaken.

3. Objectives

The proposed baseline testing will investigate:

1. The current conditions at the project areas with respect to chemical and physical properties of channel water, channel soil sediment, existing levee soil, levee foundation soil, soil excavated from new channel areas (to be used in levee construction) and imported (borrow) soil to be used in construction of the project (see *Figure 2. Environmental Study Cross Section*). The data gathered should be sufficient to determine if there are potential water quality impacts during the dredging and transport of sediments portions of the programs.

2. Appropriate management of the sediment at the levee/disposal site to minimize contaminant migration. Data should allow a determination of any potential long term adverse environmental impacts at the sediment deposition areas.

Upon the completion of environmental studies for the NDP and SDWMP, the data and results will be used to obtain necessary permits to begin construction of these projects.

II. DESIGN OF ENVIRONMENTAL STUDY

In addition to environmental (chemical) analysis of channel water quality, dredged channel sediment, excavated soil and imported soil, DWR will analyze and evaluate materials considered for this project for physical (engineering) properties including: particle size, moisture content, compaction density and other engineering tests. This study focuses on the environmental concerns of these materials.

A . Environmental Study

1. Areas of Sampling

Before any work begins, baseline information will be taken to determine the existing field conditions. Samples will be taken at representative areas at each project site. Chemical analysis sampling areas include the following (see *Figure 2. Baseline Study Cross Section*):

a. **Channel water** samples (Figure 2, Item 1) will be taken in the channels adjacent to the projects. Samples will be collected from a depth between 18 and 36 inches below the water surface.

b. Sediment samples will be taken in the channel to test **channel soil sediment** (Figure 2, Item 2). Both a chemical and physical analysis will be done. Samples will be taken to the lowest depth of dredging, or, to lowest depth of excavation in the vicinity of the SDWMP's proposed barriers, intake structures and siphons.

c. The **backside (land side) of existing levees** (Figure 2, Item 3) will be tested since dredge channel soil sediment will be placed on the backside of levees during construction. Both chemical and physical analysis will be performed.

d. The **land that will support new setback levees** (Figure 2, Item 4) will also be studied, since both import soil, excavated soil and dredge channel soil sediment will be used to construct new setback levees. Analysis will be for both physical and chemical properties for the soil.

e. As **sites for import material** (Figure 2, Item 5) are selected, the material will be tested for both physical and chemical properties.

f. **Excavated material** (Figure 2, Item 6) from proposed parallel channels (waterway between the setback levee and an existing levee) will be evaluated for possible use in construction of waterside berms. Material will be unearthed to a depth equal to the dredged depth of channel, described in *Section I.B.1. Proposed Dredge and Setback Levee Plan.* This material will also be analyzed for its chemical and physical properties.

2. General Description of Tests

The tests described below will be performed concurrently to enable better correlation of data.

a. Water Test and Sediment Test

i. Test Description and Test Parameters

Water Test Description

Water samples requiring filtration will be filtered through 0.45 micron Millipore membranes, using a plastic filtration apparatus. Both unfiltered and filtered samples of fluoride, chloride, hardness, electrical conductivity, total dissolved solids, pH and suspended solids samples will be collected and placed in one quart plastic containers. Total and dissolved metals are placed in acid washed plastic containers and preserved with nitric acid. Oil and grease samples will consist of unfiltered sample water, placed into a one quart glass jar, and preserved with sulfuric acid. Chromium VI is filtered through a 0.45 micron Millipore membrane and placed into a acid washed, plastic container. Samples will be taken from between 18 and 36 inches below the water surface.

The constituents to be sampled as well as the quantity (volume) of water required for each constituent sampled is listed in *Table 3, Parameters for Chemical Analysis of channel Water.*

Pesticide and aroclor (PCB) chemical analysis will occur using the procedures listed in EPA Method 608 (*Table 5. Pesticide and Aroclor (PCB) Analysis Using EPA Methods 608 and 8080*).

Sediment Test Description

Representative **channel soil sediment samples** will be taken using pontoon-mounted (or similar) sediment sampling rig. Each sample will be taken in composite form. One composite sample will be tested at each site, as shown in Figures 4 and 5.

Two samples will be taken from each test site: one for chemical analysis and one for physical (engineering) analysis. Each sample will be driven to a depth of - 20.0 msl.

The quantity (volume) of sediment required for each constituent sampled is listed in *Table 4, Parameters for Chemical Analysis of Sediment/ Soil*.

The quantity of sample required for each analysis are listed in *Table 4. Parameters for chemical Analysis of Sediment/Soil.*

The three samples with the highest metals concentrations in the NDP area and the three samples with the highest metals concentrations in the SDWMP area shall be additionally analyzed for by the Waste Extraction Test (WET) for soluble metals, as defined under Title 22 for hazardous wastes.

In addition, Acid Generation Potential Tests will be performed for each sediment sample and each fill (borrow) material sample, per EPA -600/2-78-054 (March 1978).

ii. Sites For Monitoring

NDP staff has selected 13 sites along the Mokelumne River for water and sediment analysis. Test sites were selected to give a good representation of all possible project dredge areas (covering all alternatives). Specific areas of concern including marinas, populated areas, towns, agricultural drainage areas and river junctions were identified as points of value for testing. The locations are shown in *Figure 3. NDP Sediment and Water Sampling Sites.* Explanations for each selected site are as follows:

Sample Site Station Per Table 4	Type of Site
South Fork Mokelumne (SFM) 0.5	At Pirate's Lair Marina
SFM 2.0	S/O Georgiana Slough Junction
North Fork Mokelumne (NFM) 0.0	Junction of NFM and SFM
SFM 7.5	Only dredge area on reach
SFM 8.75	Near Terminous/ Previous Test Site Nearby
SFM 11.0	SFM Junction with Sycamore Slough
SFM 12.0	Past Test Site downstream of Agricultural Drain
SFM 15.5	SFM Junction with Beaver Sl.
SFM 18.5	Near New Hope Lndg. / 0.2 mi s/o Walnut Grove Br./Past Test Site
NFM 4.5	Past Test Site Central to NFM
NFM 8.5	Near Walnut Grove Br./ Past Test Site
N/O Dead Horse Island	Upper end of Project/S/O Delta Cross Channel
SFM 21.0	Upper end of Project Area

SDWMP staff has selected 13 sites to monitor(F*igure 4. SDWMP Sediment and Water Sampling Sites*). Sites 1 through 4 were selected because they are areas where barrier-type facilities could be placed. Depending on the alternative being studied, four of the sites identified (sites 5 through 10) are for intake structures, inverted siphons. Locations 11 through 13 were

selected because they are in representative sites where dredging could (depending on the construction alternative selected) occur.

After the sediment tests are performed and the laboratory results are received, DWR will perform a statistical evaluation in accordance with EPA SW-846) and present the results to the CRWQCB. Analyses performed will also segregate samples taken from marina areas from non-marina areas.

iii. Sample Collection Frequency

The tests described above will be performed one time at each of the locations listed above.

b. Soil Tests

i. General Description of Tests

Chemical and physical analysis will be conducted for the following areas: soil on the back side of levees, soil in levee setback construction areas, excavated channel material, and imported soil from outside the project areas.

For soil on the back side of levees and soil in levee setback construction areas, composite samples will be collected for each sample site. Soil from the back side of levees and from levee setback construction areas will be removed from the existing surface to a depth of up to 12 inches below the ground surface. Samples will be taken using a stainless steel trowel. Up to three areas within a ten foot radius will be combined to make one composite, homogenized sample for testing.

Soil samples from excavated channel areas will be composite samples taken from the existing ground surface to -20.0 ft. msl (the proposed invert elevation for all proposed NDP channels is -20 ft msl). Reconnaissance studies indicate that new channel excavation will not be required for the SDWMP. For sites where a drill rig is required, only one core will be taken for each site.

Finally, for imported material, representative samples will be selected either from a representative stockpile, from excavation similar to methods described above, or from site specific methods which will insure that the samples taken will truly represent the soil to be used for this project. Samples will be collected as are described for soil on the back side of levees.

The volume of soil required for each test is listed in *Table 4, Parameters for Chemical Analysis of Water and Sediment for Baseline and Pilot Studies*, and, *Table 5. Pesticide and Aroclor (PC B) Chemical Analysis Using EPA Methods 608 and 8080.*

ii. Soil Analysis Parameters

Soil samples will be tested during the baseline phase of this project for parameters listed in *Table 4, Parameters for Chemical Analysis of Sediment/ Soil,* and, *Table 5. Pesticide and Aroclor (PCB) Chemical Analysis Reporting Limits Using EPA Methods 608 and 8080.*

The Acid Generation Potential Test will be performed on channel sediment samples only.

iii. Sites For Monitoring

Soil monitoring and testing will occur for different types of soil in different locations within project areas. Each project will analyze conditions for: soil on backside of levees that will be reinforced with dredge material, soil in areas where setback levee construction will occur, soil to be excavated for new channel and used for constructing new levees, and import soil that is to be trucked onto the project sites for use in constructing new setback levees (see Figures 2, 5, and 6).

1. Soil on Backside of Levees

For each project site, selected test sites will be used for baseline sampling. Existing boring logs indicate little soil homogeneity in the levee construction. Sites were selected that have differing soil types to allow analysis of a reasonable mixture of field conditions.

For the NDP, 19 sample sites have been selected. For the SDWMP, 11 sites have been selected. Sites were selected throughout the project area in an attempt to represent the entire project. Many sites correspond to the sites used for sediment sampling.

2. Levee Setback Construction Areas

A variety of field test sites will be used for baseline sampling. For the NDP, 10 test sites are located on both sides of the North Fork Mokelumne River have been selected. Reconnaissance studies indicate that levee setbacks not required for the SDWMP.

3. Channel Excavation Analysis

Sampling will occur where channel excavation is proposed for the NDP. Samples will be taken to the same depth as the proposed channel invert (-20.0 msl). Sampling will occur along the main stem and North Fork of the Mokelumne River on both sides of the channel.

Sample selection will be based on existing geologic data on or near the study areas. Ten samples will be taken for the NDP along 15 miles of channel.

4. Import Material

The siting of borrow sites is an ongoing study in the NDP and SDWMP. As sites are located, the analysis listed in this report for soil testing will be performed. To date, possible sources of import material include:

1. Allan Loam Pit-- 6 miles east of Hwy. 99 off Peltier Rd. (1,500,000 cubic yards available)
2. Asta Brannan/Andrus Island Site--located on Brannan/Andrus Islands (2 million cubic yards available)
3. Asta Rio Vista Pit--located near Rio Vista (600,000 cubic yards available).

As sites are located, at least two samples will be taken for each site. The material will be tested for both chemical and physical properties.

iv. Frequency and Collection of Samples

Soil tests will be performed one time for each site selected.

B. Schedule of Work

Table 6, Environmental Study Field Sampling and Laboratory Analysis Schedule, shows the testing frequency for each of the tests described in Section III.

III. QUALITY ASSURANCE/QUALITY CONTROL

A. Quality Control During Water Analysis

1. Field Quality Control

During the collection of water samples in the Baseline Study Phase, one duplicate will be collected for each ten samples collected. The duplicates will be analyzed along with the collected samples.

EPA methods for sample collection, preservation and handling will be followed.

2. Laboratory Quality Control For Water Sample Analysis

Laboratory quality control procedures listed in EPA methods will be followed. This will include the analysis of a procedural blank and a matrix spike along with every batch processed. The laboratory should analyze appropriate standard reference materials with the same frequency as the blanks and spiked matrix samples. Standard reference materials will be provided by the Department's Quality Assurance/Quality Control Program and submitted to the contract laboratory as an external check on performance. Reference material will be selected based on appropriate matrix.

B. Quality Control During Sediment Analysis/ Soil Analysis

1. Field Quality Control

As with the water samples, at least one duplicate sample will be collected for each ten samples collected. EPA methods for sample collection, preservation and handling of sediment material will be followed.

2. Laboratory Quality Control For Sediment/Soil Sample Analysis

The EPA methods for the analysis of priority pollutants include detailed quality control procedures which will be followed by the laboratory. As with the water analysis, standard reference material provided by the Department's Quality Assurance/Quality Control Program will be submitted to the contract laboratory to check on performance.

C. Reporting of Test Results

Reports will be submitted to interested agencies as follows:

Environmental Study Report	60 calendar days after lab analysis done.

Results of this study will also be included in the NDP Final EIR/ EIS and the SDWMP Final EIR/EIS.

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TABLES

Table 1. North Delta Program Alternatives

Alternative	Dredging	Setback Levee
2A, 2B	SFM 17 miles 3,527,000 cy	None
3B	NFM, SFM 27 miles 6,548,000 cy	None
5B **Preferred Alternative**	NFM,SFM 31 miles 10,831,000 cy	NFM 15.5 miles

Table 2. South Delta Water Management Program Alternatives

Alternative	Dredging	Setback Levee
North Intake Barrier Configuration A	MRV, ORNC,VC&NC 12 miles 1,800,000 cy	None
North Intake Barrier Configuration B	MRV, ORNC,VC&NC 12 miles 1,800,000 cy	None
Hwy. 4 Intake Barrier Configuration B	MRW, W&NV 10 miles 1,200,000 cy	None
Preferred Alternative	MRW 5 miles 600,000 cy	None

SFM-- South Fork Mokelumne R.
NFM-- North Fork Mokelumne R.
MRV-- Middle River East of Victoria
VC&NC-Victoria Canal and North Canal
ORNC- Old River N/O Coney Is.
MRW-- Middle River East of Woodward
W&NV-- Woodward and North Victoria Canal

Table 3. Parameters For Chemical Analysis of Channel Water

Constituent	Units	Reporting Limit*	Sample Type	Quantity of Sample Required (ml)	EPA Test Method
Fluoride	mg/l	0.1	Grab	200	340.2
Sulfate	mg/l	1.0	Grab	100	375.2
Chloride	mg/l	1.0	Grab	100	325.2
Oil and Grease	mg/l	5.0	Grab	1,500	413.1
Arsenic	mg/l	0.001	Grab	100	206.3
Cadmium	mg/l	0.005	Grab	100	213.2
Total Chromium	mg/l	0.005	Grab	100	218.2
Chromium VI	mg/l	0.010	Grab	100	218.5
Copper	mg/l	0,005	Grab	100	220.2
Lead	mg/l	0.005	Grab	100	239.2
Nickel	mg/l	0.005	Grab	100	249.2
Selenium	mg/l	0.001	Grab	100	270.2
Zinc	mg/l	0.005	Grab	100	289.2
Mercury	mg/l	0.001	Grab	100	245.1
Silver	mg/l	0.005	Grab	100	272.2
Tributyltin	ug/l	0.02	Grab	1,500	Per Lab
pH	Std. Units	--	Grab	100	150.1
Flow	gpd	--	Grab	--	
Suspended Solids	mg/l	1	Grab	100	160.2
TDS	mg/l	1	Grab	100	160.1
Hardness	mg/l as CaCO3	5	Grab	250	Calculated
Specific Conductance	umhos/cm	1	Grab	100	120.1

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Table 4. Parameters For Chemical Analysis of Sediment / Soil

Constituent	Units (wet)	Reporting Limit	Sample Type	Quantity of Sample Required	Test Method
Oil and Grease	mg/kg	50	Grab	500 g	9071
Arsenic	mg/kg	5	Grab	for	7060/7061
Total Chromium	mg/kg	2	Grab	parameters	6010
Copper	mg/kg	1	Grab	listed	6010
Lead	mg/kg	10	Grab		6010
Selenium	mg/kg	5	Grab		7740/7741
Zinc	mg/kg	2	Grab		6010
Mercury	mg/kg	0.02	Grab		7471
Silver	mg/kg	1	Grab		6010
Nickel	mg/kg	5	Grab		6010
Cadmium	mg/kg	1	Grab		7310
Tributyltin	ug/kg	2	Grab		Per Lab
pH	Std. Units	--	Grab		9045
Moisture Content per sample	percent	0.1	Grab		Per Lab

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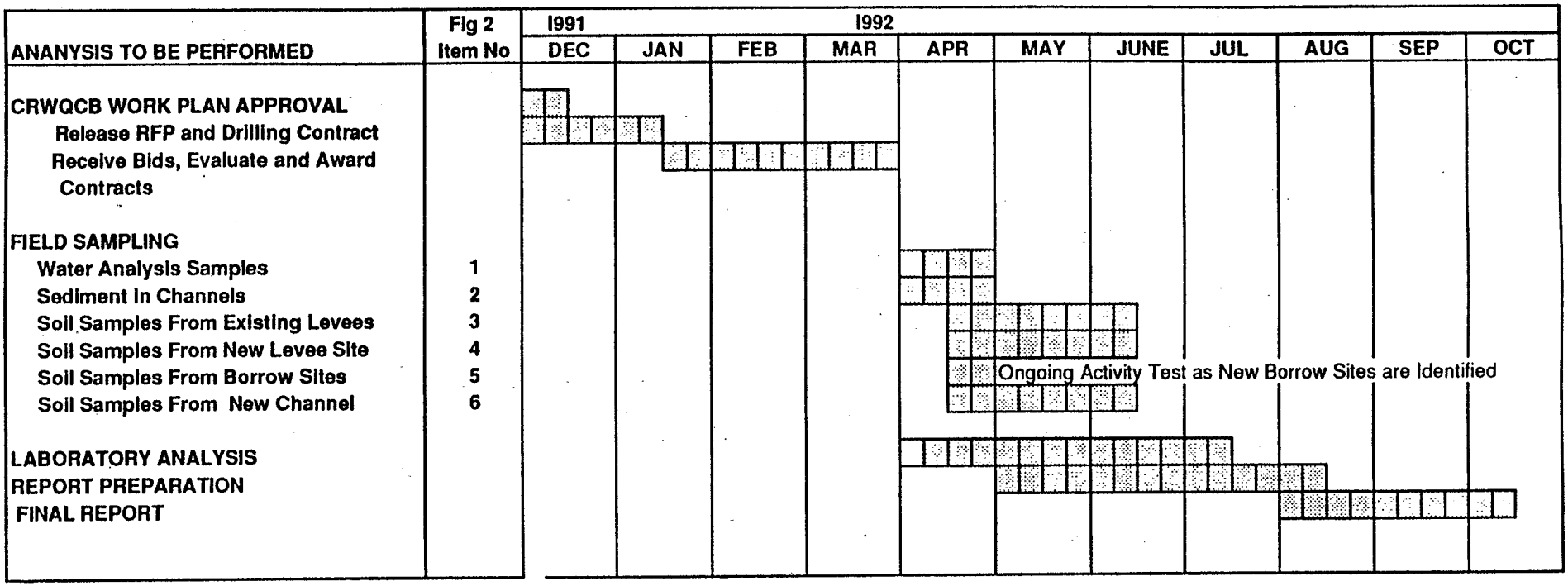
Table 5. Pesticide and Aroclor (PCB) Chemical Analysis Reporting Limits Using EPA Methods 608 and 8080.

Constituent	Units	Reporting Limits* (water/soil)	Sample Type
Arochlor-1016,	ug/L, ug/kg	2.0/ 70	Grab
Arochlor -1221	ug/L, ug/kg	2.0/ 70	Grab
Arochlor -1232	ug/L, ug/kg	2.0/ 70	Grab
Arochlor-1248	ug/L, ug/kg	2.0/ 70	Grab
Arochlor -1254	ug/L, ug/kg	1.0/ 30	Grab
Arochlor-1260	ug/L, ug/kg	1.0/ 30	Grab
Aldrin	ug/L, ug/kg	0.01/ 1.0	Grab
alpha-BHC	ug/L, ug/kg	0.01/ 1.0	Grab
beta -BHC	ug/L, ug/kg	0.03/ 1.0	Grab
delta- BHC	ug/L, ug/kg	0.01/ 1.0	Grab
Chlordane	ug/L, ug/kg	0.5/ 20	Grab
4,4-DDE	ug/L, ug/kg	0.01/ 2.0	Grab
4,4-DDD	ug/L, ug/kg	0.01/ 2.0	Grab
4,4-DDT	ug/L, ug/kg	0.02/ 2.0	Grab
endosulfan I	ug/L, ug/kg	0.01/ 1.0	Grab
Endosulfan II	ug/L, ug/kg	0.01/ 2.0	Grab
Endosulfan sulfate	ug/L, ug/kg	0.02/ 2.0	Grab
Endrin	ug/L, ug/kg	0.01/ 2.0	Grab
Endrin Aldehyde	ug/L, ug/kg	0.2/ 2.0	Grab
Heptachlor	ug/L, ug/kg	0.01/1.0	Grab
Heptachlor Epoxide	ug/L, ug/kg	0.01/1.0	Grab
Methoxychlor	ug/L, ug/kg	0.5/ 20	Grab
Toxaphene.	ug/L, ug/kg	0.8/ 30	Grab

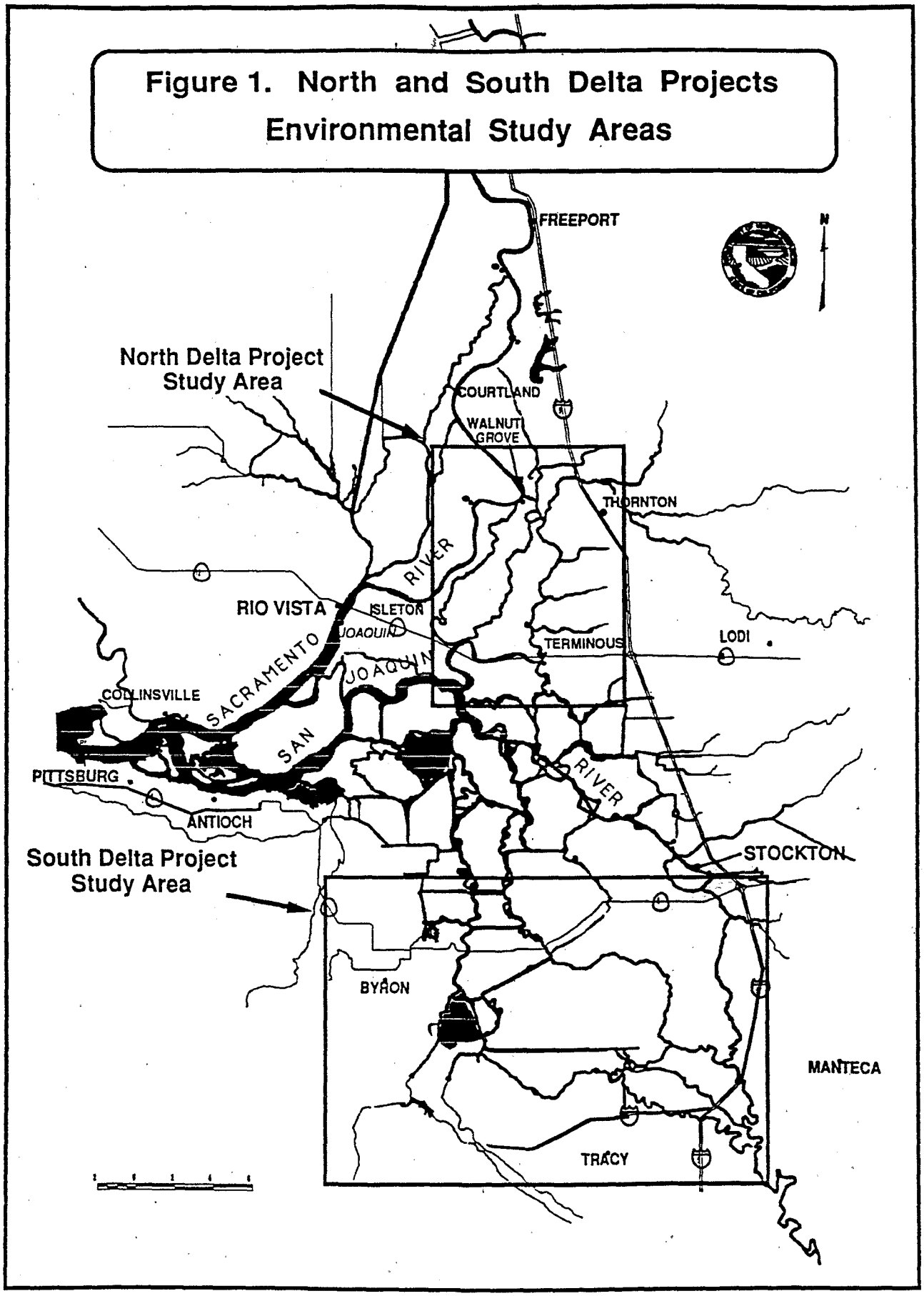
v

* Reporting Limits submitted to DWR by Pace Laboratories, Novato, CA. Limits may vary slightly, depending on capabilities of laboratory awarded contract to perform ananlysis.

Table 6. Environmental Study Field sampling and Laboratory Analysis Schedule



FIGURES



F-1

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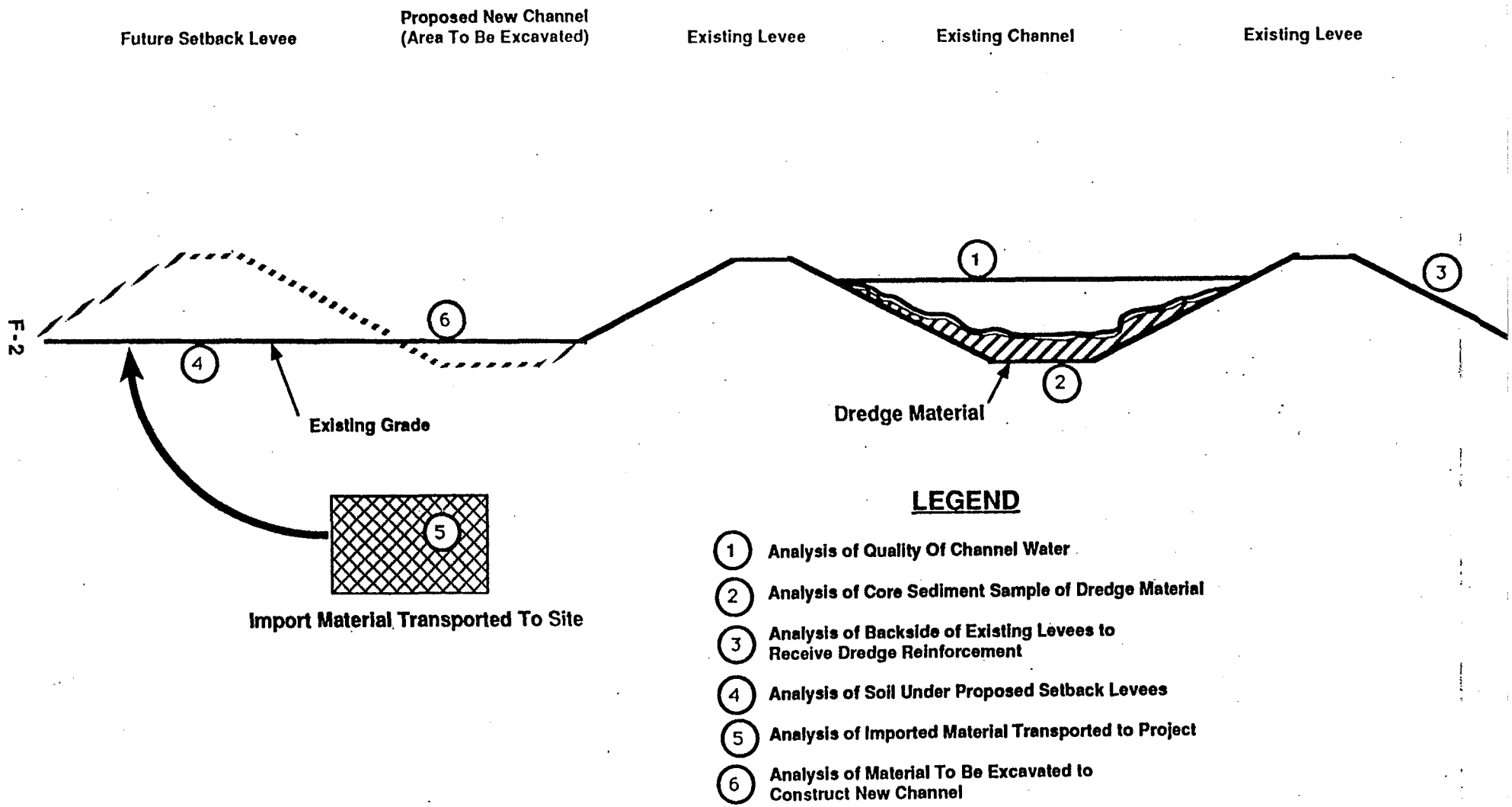
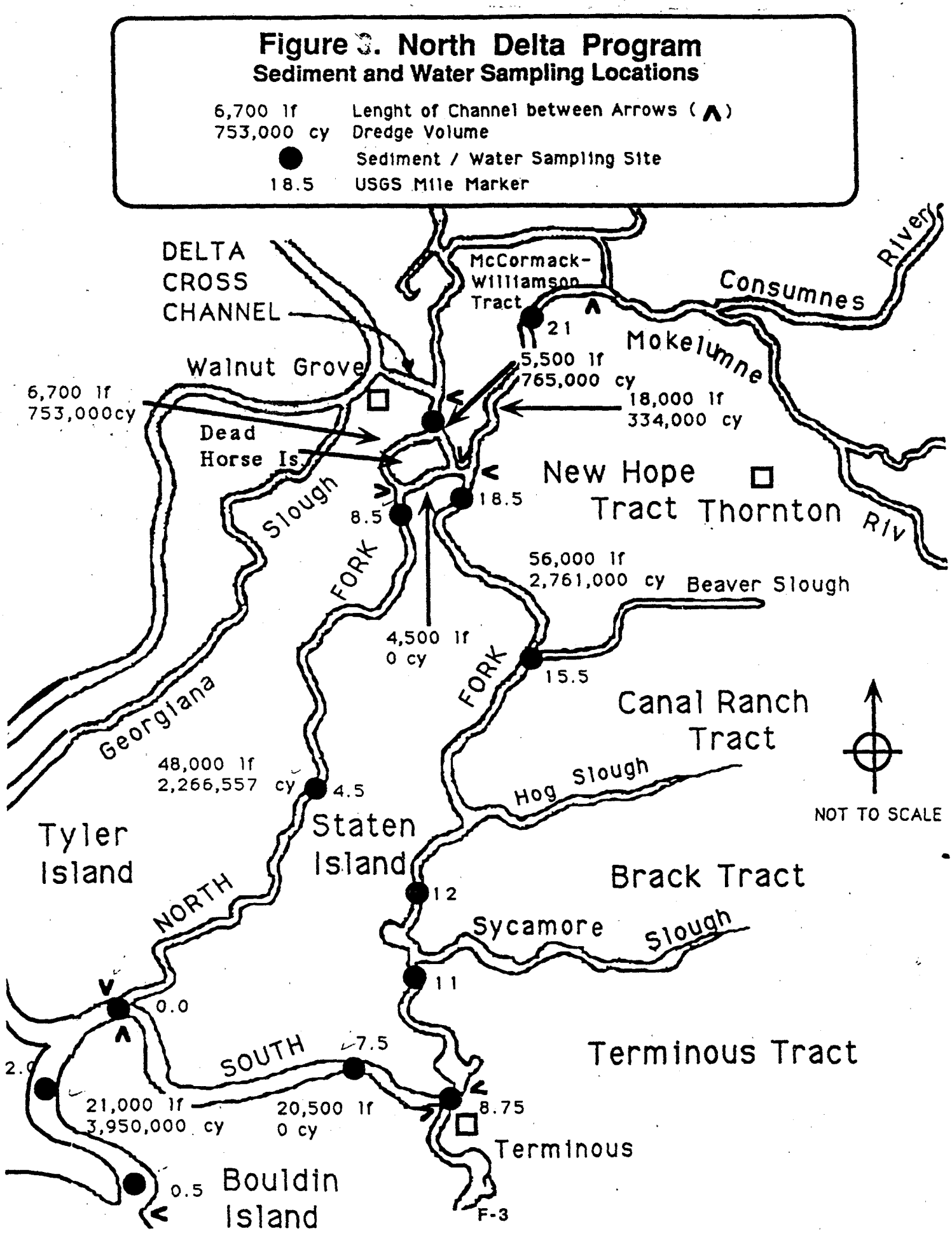
D-040345

Figure 2. Baseline Study Cross Section

Areas of Analysis





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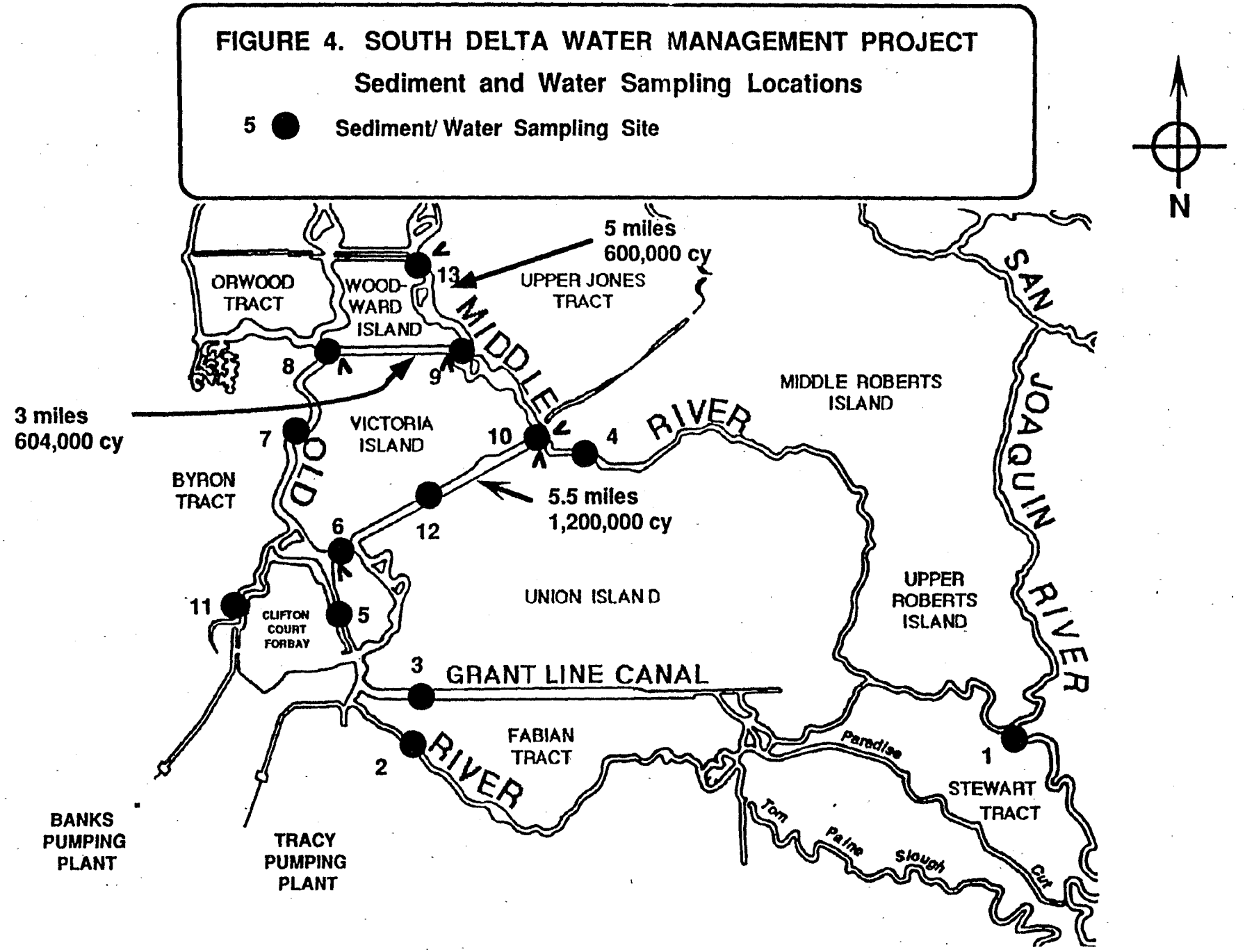
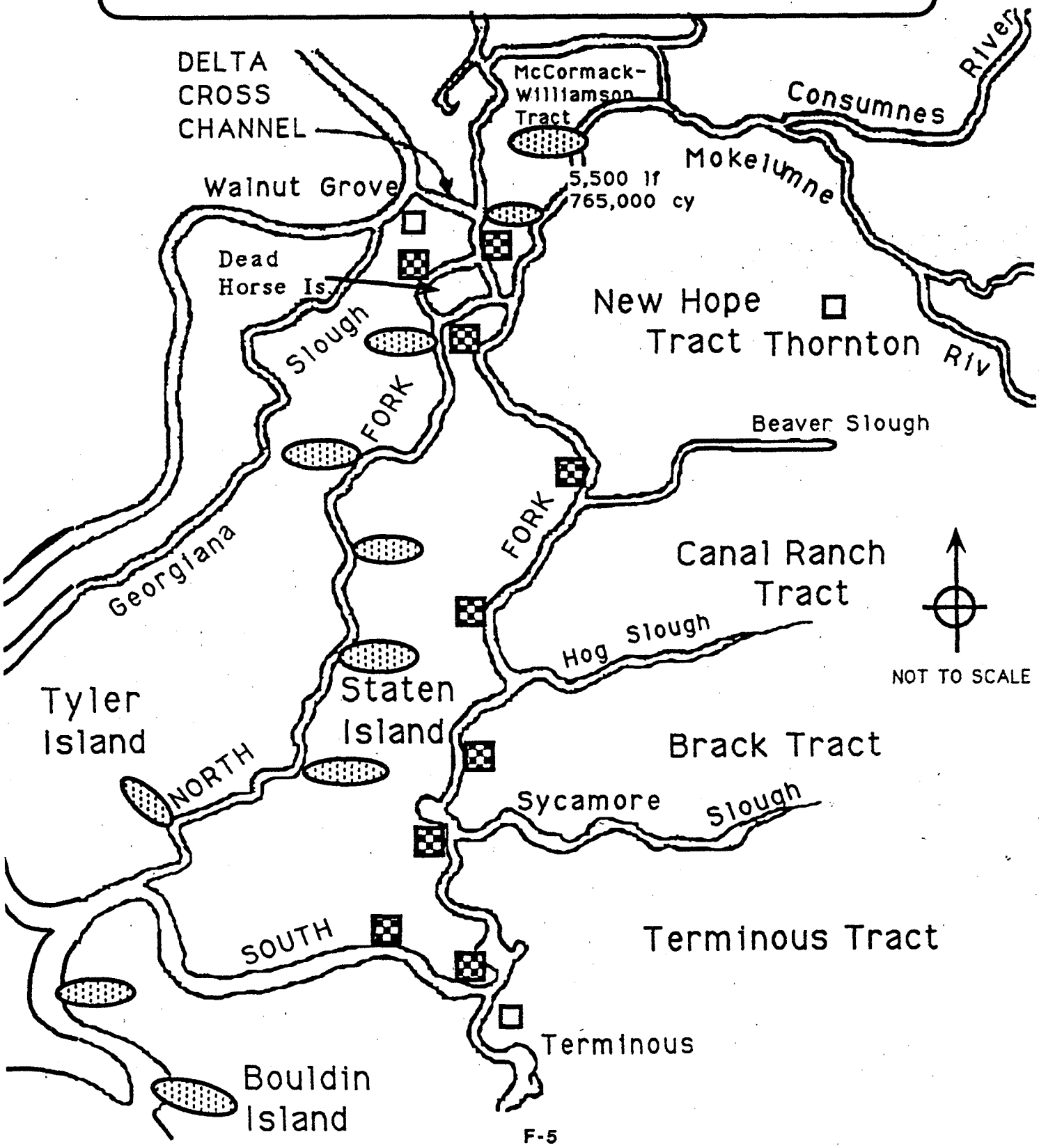


Figure 5. NORTH DELTA PROGRAM

Locations for Soil Sampling Within Project Boundaries

Test Site For Backside of Levees, Levee Setbacks, & Channel Excavation Analysis

Test Site For Backside of Levee Analysis Only



F-5

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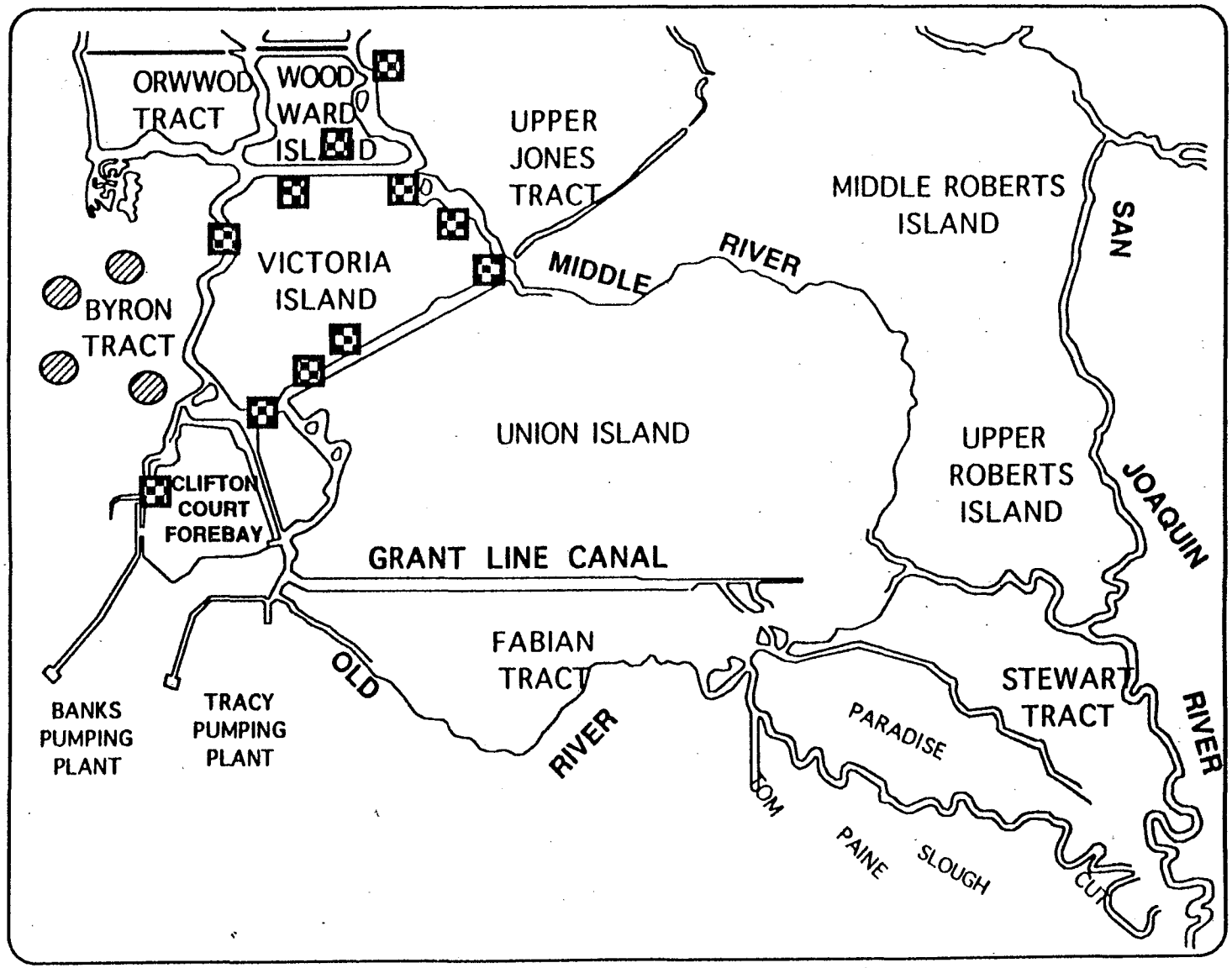
FIGURE 6. SOUTH DELTA WATER MANAGEMENT PROGRAM

Soil Sampling Sites Within Project Boundaries

Test Site on Backside of Levee

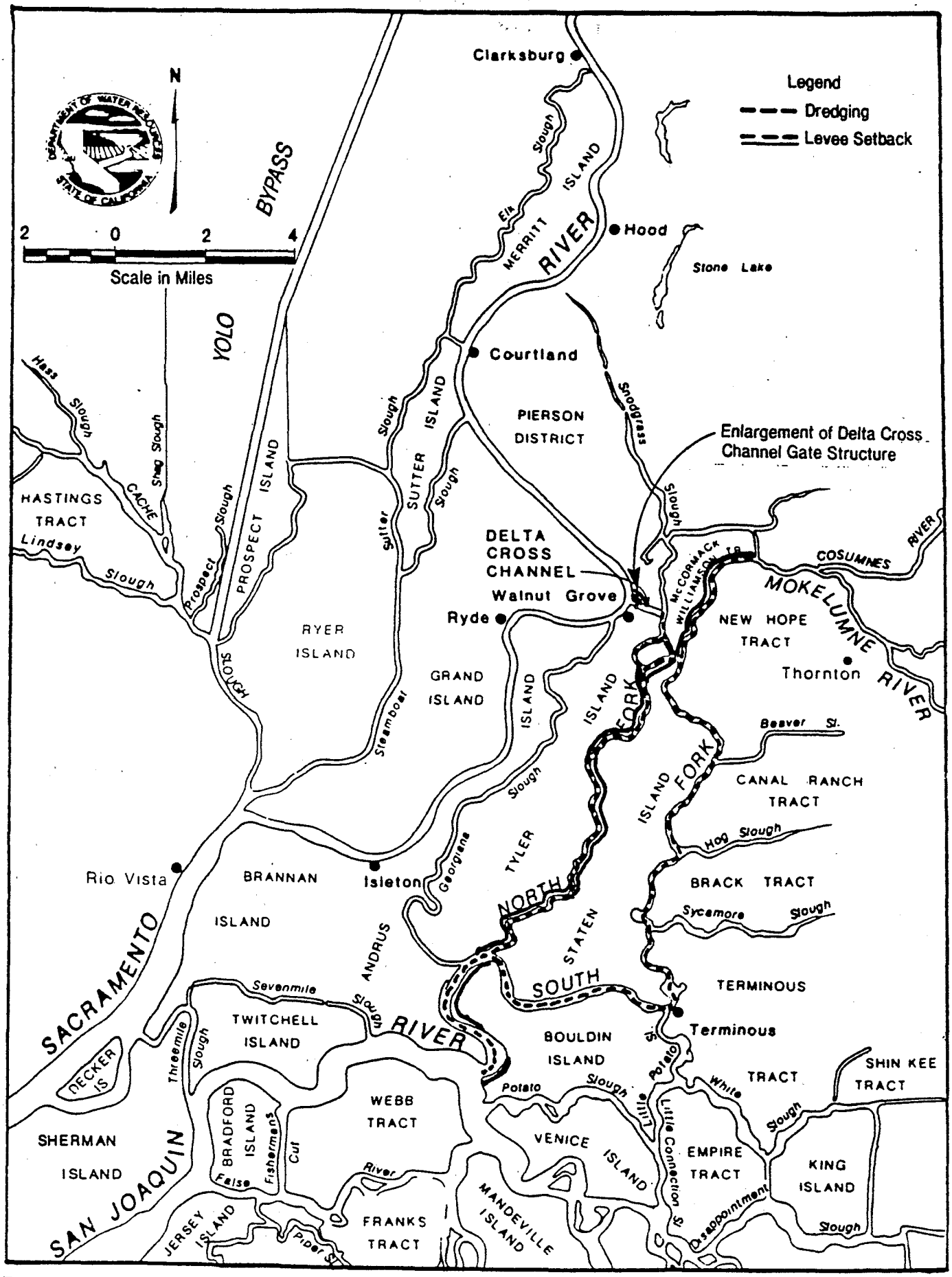
Test Site for Borrow Material



Appendix A

North Delta Program Alternatives
South Delta Water Management Program Alternatives

Alternative 5B (Preferred Alternative)



North Delta Program
A-1

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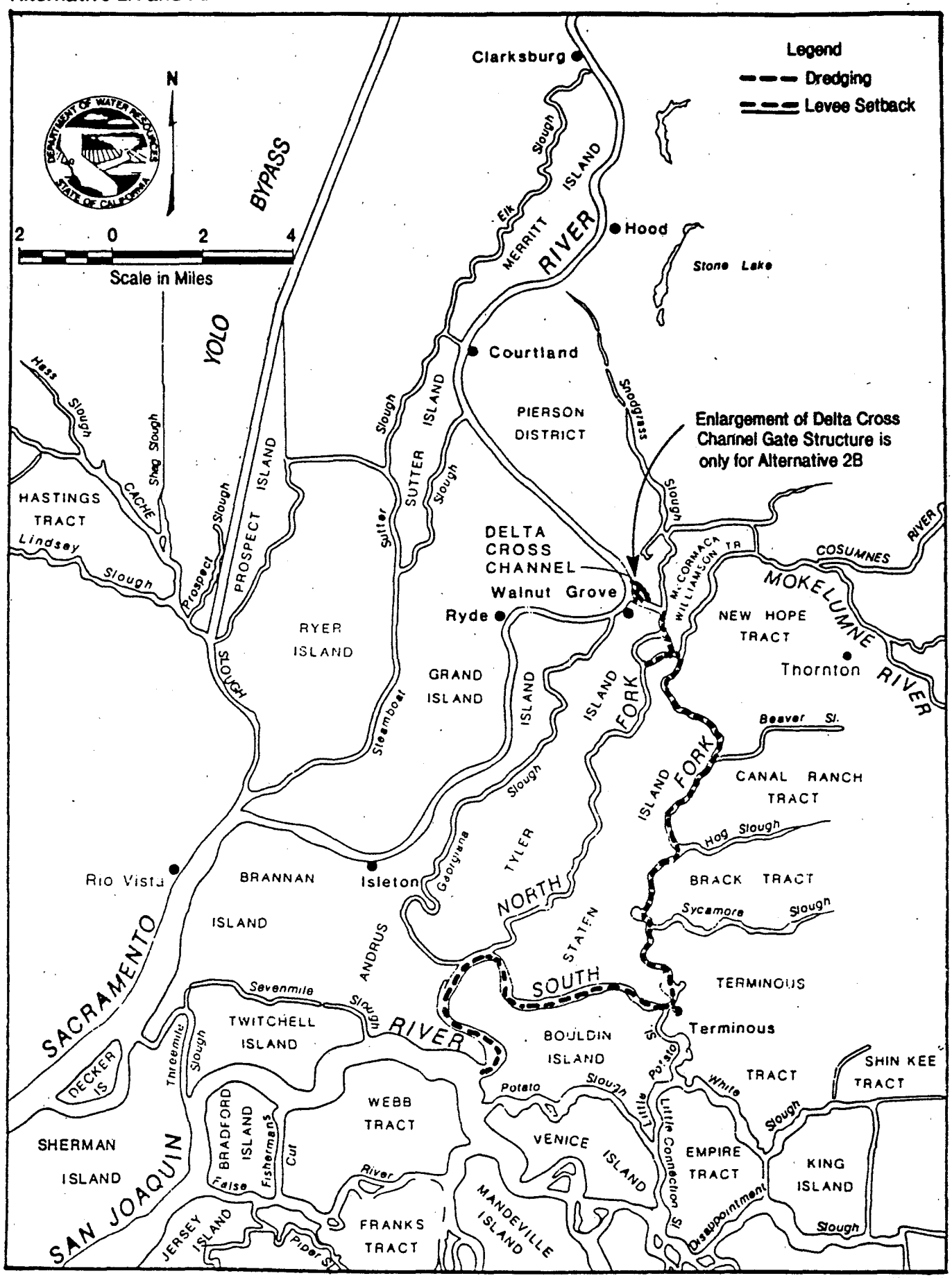
Alternative 2A and 2B



North Delta Program

A-2

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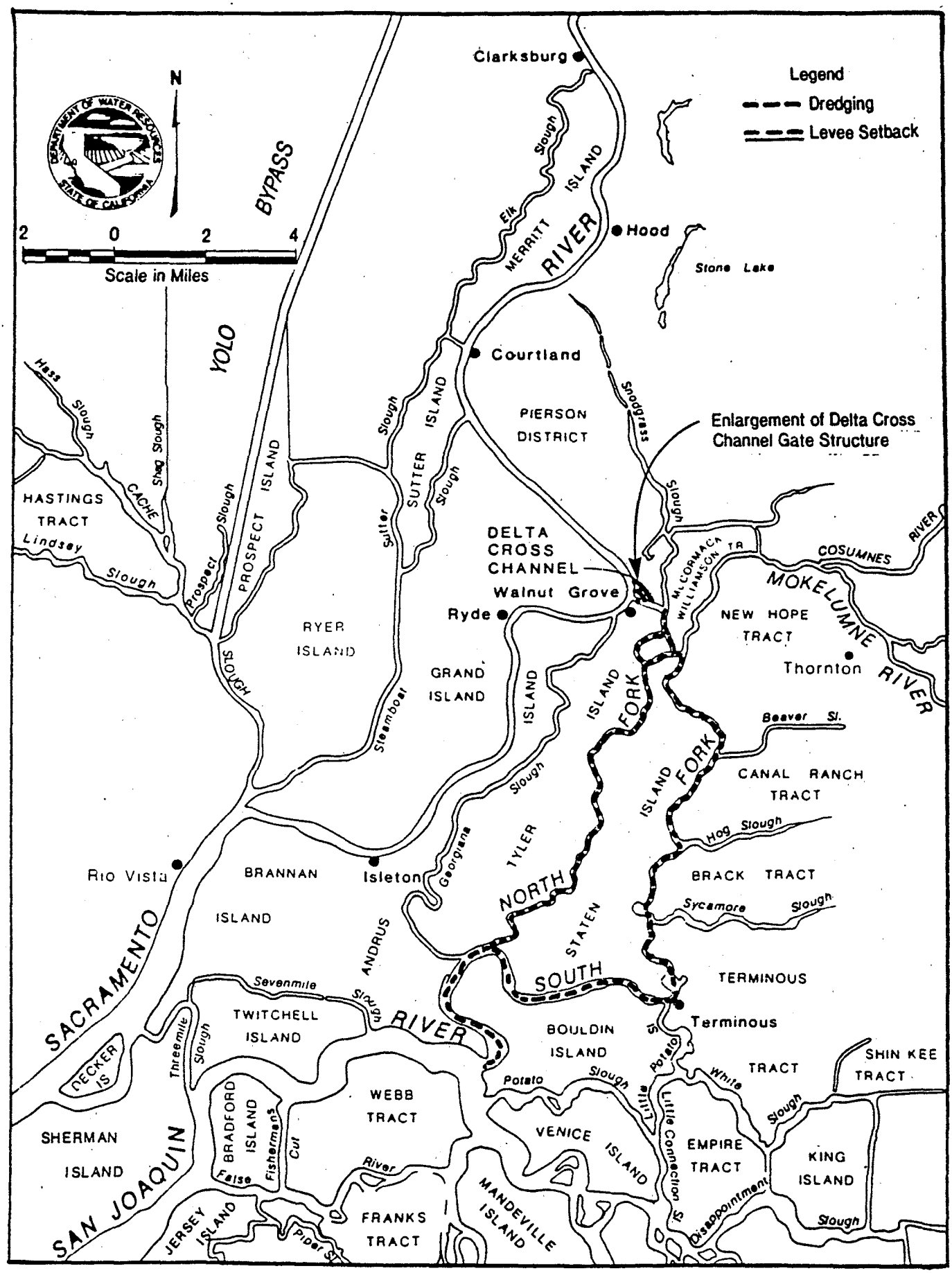
Alternative 3B



North Delta Program

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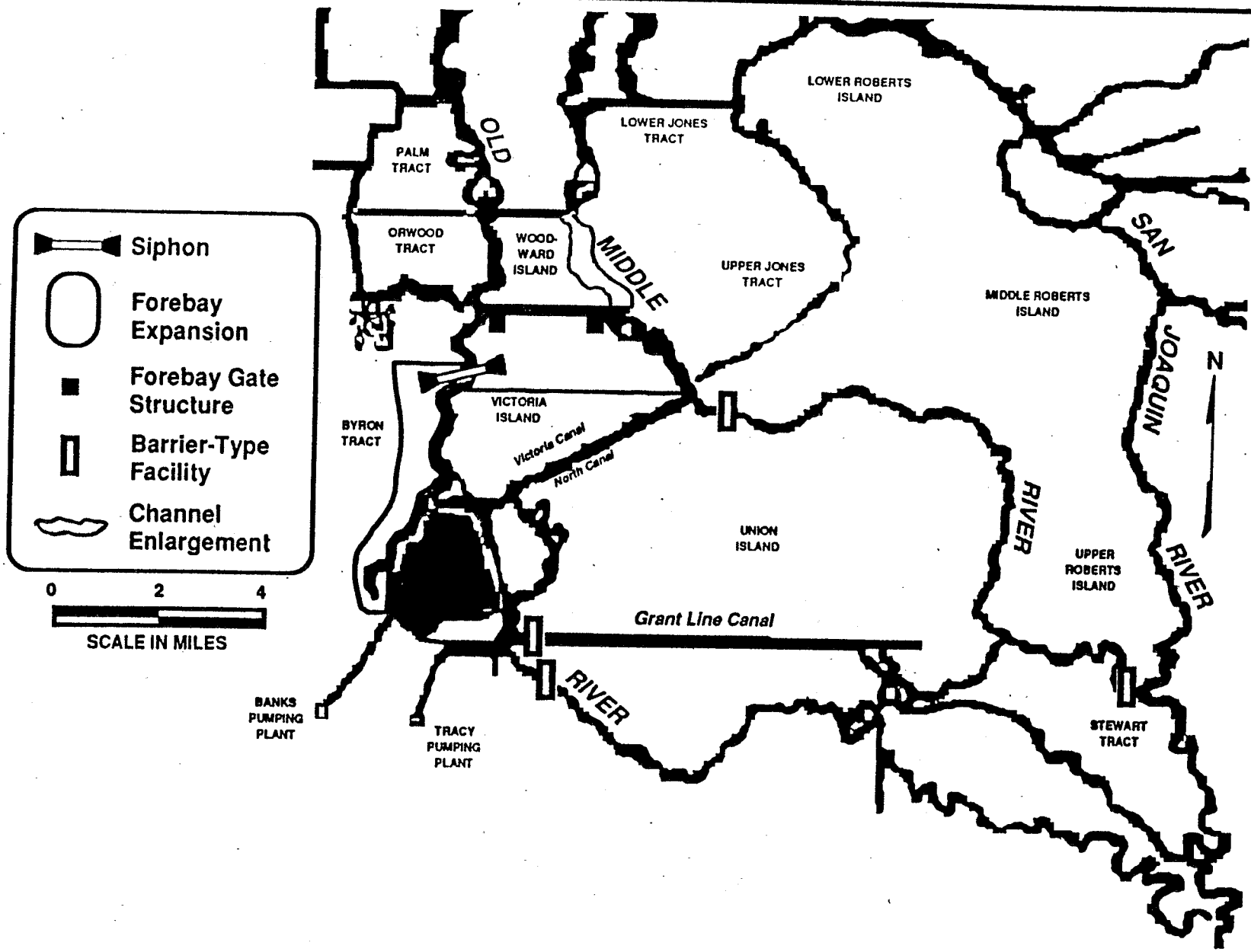
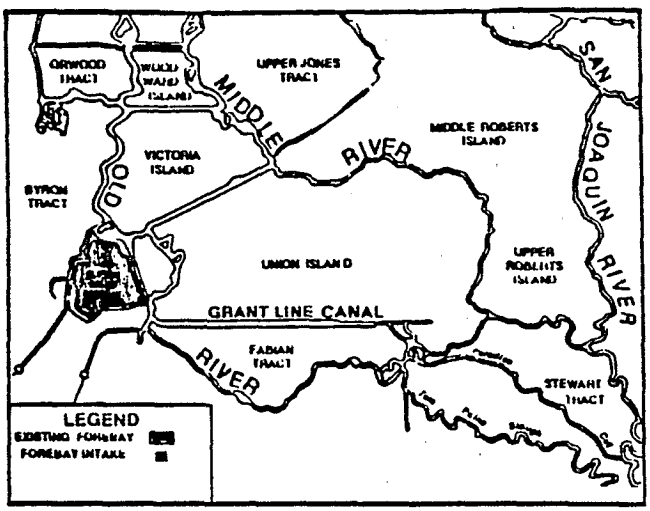
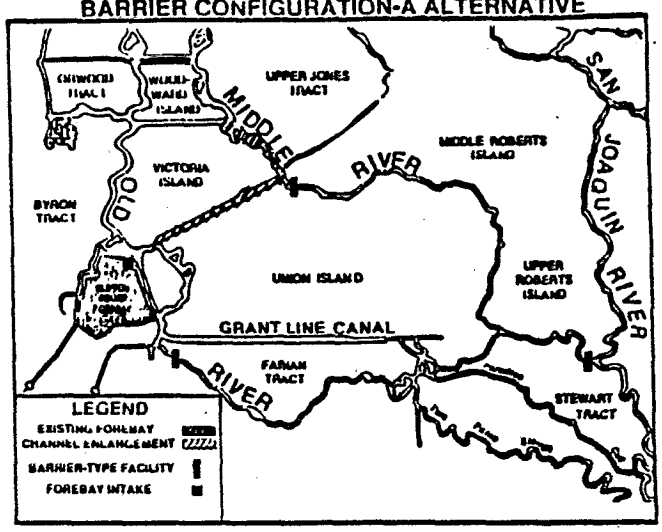
SOUTH DELTA WATER MANAGEMENT PROGRAM
PREFERRED ALTERNATIVE



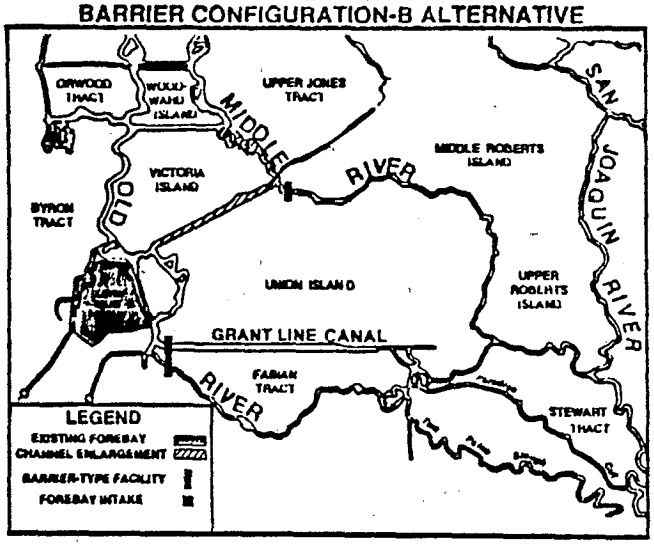
NO - ACTION ALTERNATIVE



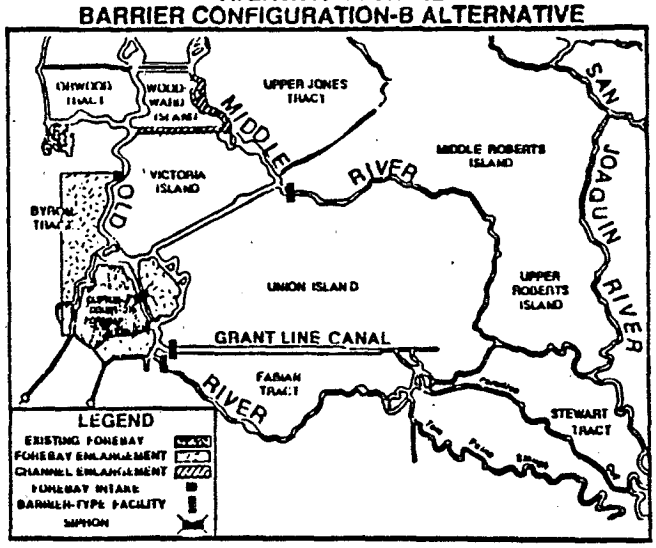
NORTHERN INTAKE
BARRIER CONFIGURATION-A ALTERNATIVE



NORTHERN INTAKE
BARRIER CONFIGURATION-B ALTERNATIVE



HIGHWAY 4 INTAKE
BARRIER CONFIGURATION-B ALTERNATIVE



South Delta Water Management Program Alternatives