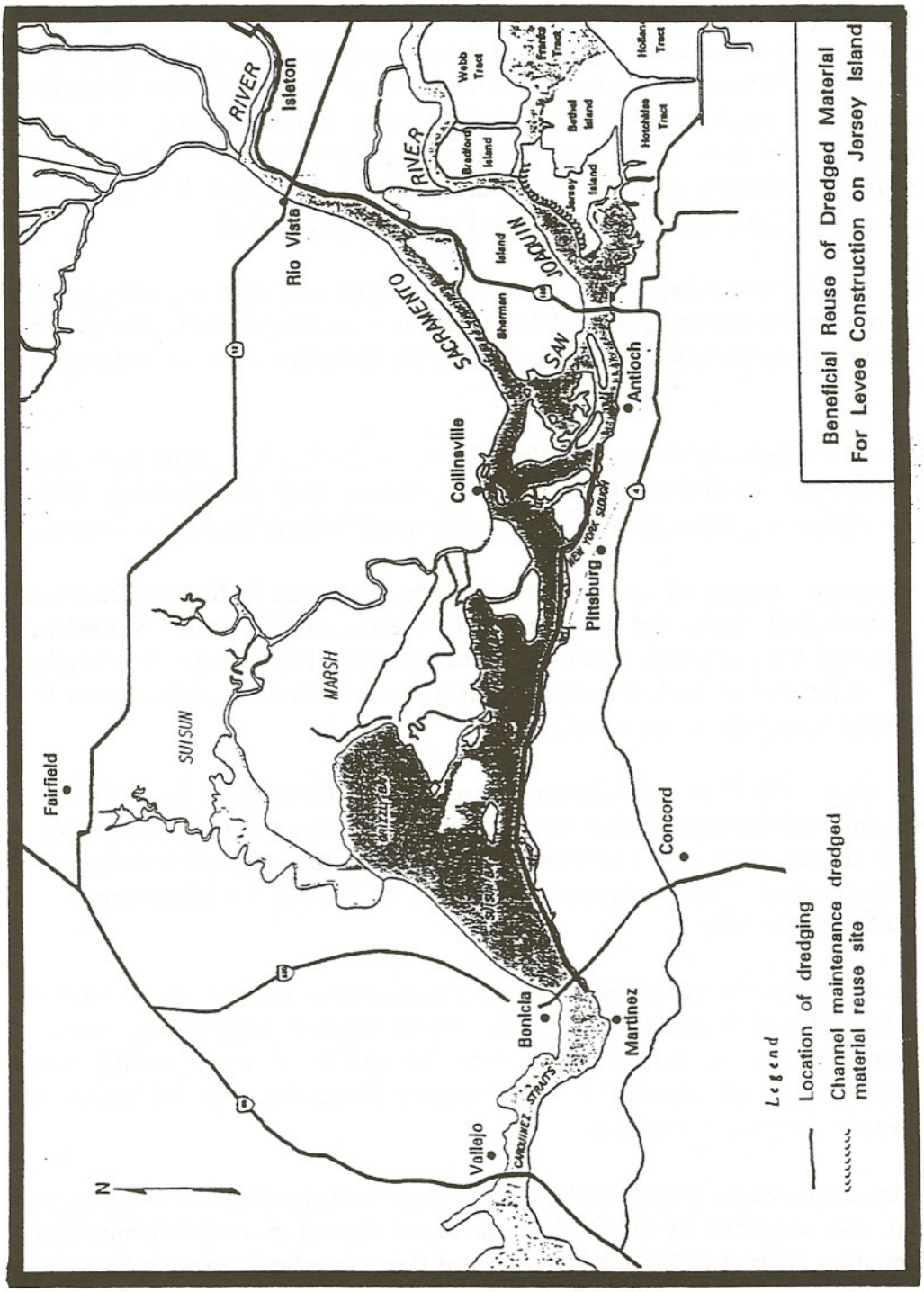
FIGURE 1



PROJECT LOCATION

The COE was challenged by the following: the federal navigation channels needed to be maintained for safe and efficient navigation yet there was no alternative upland dredged material disposal site. Also, there was lack of a participating local sponsor (Port of Stockton), since the Port was in the process of transferring that portion of their sponsorship to Contra Costa County. Currently, the transfer of local sponsorship from the Port of Stockton to Contra Costa County has yet to be completed. However, once the local sponsorship has been transferred, there will no longer be oversight duplication performed by both the COE's Sacramento and San Francisco Districts since Contra Costa County lies within San Francisco's jurisdiction.

In March 1988, the California Legislature passed the Delta Flood Protection Act (Senate Bill (SB) 34) which recognized the importance of the Sacramento-San Joaquin Delta Region. The bill legislated the intent to appropriate $12 million annually for Delta flood protection for ten years, ending in 1998.

SB 34 directs the California Department of Water Resources (DWR) to develop and implement flood protection projects on the eight western Delta islands. They are: Sherman, Twitchell, Bradford, Webb, Bethel and Jersey Islands; and Hotchkiss and Holland Tracts (See Figure 2).

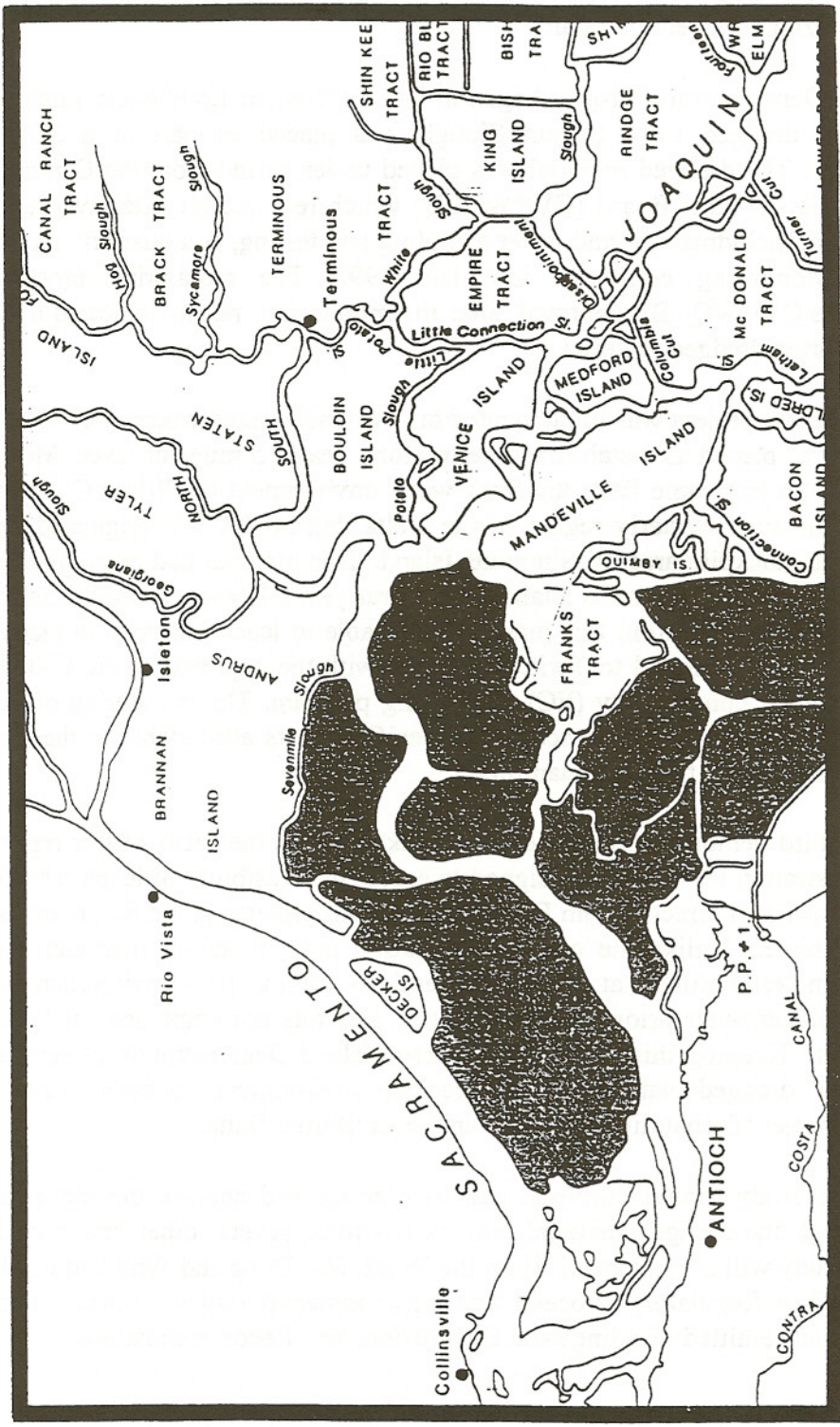
The primary purpose of the projects is to protect: the Delta system and its flow of fresh water to the Federal Central Valley Project and the State Water Project; public highways and roads; utility lines and conduits; private and public land uses; recreation; and wildlife habitat. To complete the work, the DWR is directed to seek cost-sharing opportunities with public entities and Federal agencies who have interests in flood protection.

Nearly 700,000 acres of land in the Delta are protected by 1,100 miles of levee. All of these levees require regular maintenance if they are to continue to provide the designed level of flood protection. Many of these same levees are in need of substantial improvements and upgrades just to provide the minimum protection required by the Federal Emergency Management Agency's (FEMA) Hazard Mitigation Plan.

Preliminary quantity estimates of material needed for maintenance and upgrade of Delta levees indicate a need in excess of 50 million cubic yards. For the Western Delta Islands, which are of particular concern because of their importance to the quality of water serving Southern California's population, it is estimated that at least eight million cubic yards will be needed to return these levees to reasonable standards.

Reclamation District No. 830, comprised of the Iron House Sanitation District which owns most of Jersey Island, was identified by the DWR as having an interest in levee rehabilitation. The Iron House Sanitation District (IHSD) plans to expand their secondary treatment facilities onto Jersey Island in order to accommodate the population increase in eastern Contra Costa County. The Island is presently used primarily for cattle grazing and wildlife habitat. In the future, IHSD plans to grow truck crops and graze cattle on Jersey Island. Reclamation District No. 830 (RD 830) has the responsibility for maintenance and improvement of the levees on Jersey Island.

FIGURE 2



WESTERN DELTA ISLANDS

As of this date, the DWR has conducted two other demonstration projects on Sherman and Twitchell Islands utilizing dredged material.

The Sherman Island Demonstration Project began in late 1990 when 1,600 cubic yards (CY) of fine-grained material dredged from Suisun Slough was placed as part of a 2,500 CY levee-stabilizing berm. The dredged material was placed under permit from the Central Valley Regional Water Quality Control Board (CVRWQCB) which required an extensive monitoring and reporting program, including soil and water sampling and testing, and quarterly reporting of analytical results. Monitoring continued into late 1992. The monitoring program was discontinued, with the CVRWQCB's approval, after the monitoring results indicated little to no impact from the imported dredged material.

The second demonstration project was implemented on Twitchell Island where over 500,000 CY of dredged material was placed as a stabilizing berm along nearly 5 miles of levee. Most of the material used for this project came from the fresh water environment of Clifton Court Forebay which is located in the southwesterly region of the Delta, but 50,000 CY originated from the COE dredged material stockpile area on Simmons Island. This material had been dredged from Suisun Channel and stored on Simmons Island for several years. However, unlike the material used at Jersey Island, the salts within this material were able to leach out prior to placing it at Twitchell. This material was moved to Twitchell Island with the approval of the CVRWQCB, who required an electrical conductivity (EC) monitoring program. The monitoring of this site continues. However, to date and as expected, no specific effects attributable to the Simmons Island material have been identified and quantified.

Jersey Island is the third demonstration project undertaken and is the focus of this report. The Jersey Island Demonstration Project was designed to assess the feasibility of levee rehabilitation using dredged material taken directly from Federal navigation projects in the San Francisco Bay Estuary on a larger scale. Unlike the two demonstration projects at Sherman and Twitchell Islands, the dredged material utilized at Jersey came entirely from a saline environment; was not allowed to leach with rainwater prior to its placement; and was not combined (or "cut") with clean non-saline soils. Keeping this in mind, the Jersey Island Demonstration project is really the first time "in-situ" dredged material from a brackish environment has been studied at this magnitude for the purpose of rehabilitating levees in the California Delta.

Although one of this study's main purposes was to monitor and analyze the movement and impact of salts through the dredged material into its environs, several other important lessons were learned. This study will also examine: How the Work Was Done and Who Did It; The Cost of Doing Business; The Regulatory Process; and Environmental Issues. Finally, this study concludes with sections entitled: Findings and Conclusions and Recommendations.

2.0 HOW THE WORK WAS DONE AND WHO DID IT

The first step in proceeding with a project of this scope involved identification of the necessary tasks and who would perform each function. In this case, the involved agencies and the local sponsor were proactive and wanted the project to succeed. If this were not the case, this project would have never been possible. The second, and probably most important, step is to identify the source(s) of funding. Had the agencies and local sponsor been unwilling to finance such an ambitious project, the plan would have remained on the "shelf." At their first meeting, held in March 1994, the agencies decided what would be done and who would do it. The following is a chronological compendium of what occurred:

Initially, the San Francisco District Engineer promised to deliver approximately 65,000 CYS of sandy dredged material from both the Suisun Bay Channel and New York Slough navigation projects based on the pre-condition hydrographic survey of 40,000 CYS and 25,000 CU, respectively. However, by the time the dredging actually took place in December 1994, the quantity had increased and the COE dredged approximately 40,000 cubic yards from Suisun Bay Channel and 32,719 cubic yards from New York Slough.

Prior to the actual dredging, sediment testing was necessary to determine the suitability of the material for upland disposal. Grain size analysis, chemical characterization and Waste Extraction Tests were conducted by the COE.

The sediment samples were analyzed for constituent concentrations to determine whether the proposed sediments could be classified as "inert waste" as defined in Section 2524 of Chapter 15, Title 23 of the California Code of Regulations.

The sediments were analyzed for the following constituents: Trace Metals, Pesticides, PCBs, Semi-Volatile Organic Constituents, Tributyl Tin, and Total Recoverable Petroleum Hydrocarbons.

Predredge sediment sampling and analyses demonstrated that the sediments would meet the classification of "inert waste" in all aspects except for salinity. The COE's sediment testing indicated that the salinity of the dredged materials was between 10,000 to 17,000 mg/l in Suisun Bay Channel and between 3,000 and 4,000 mg/l in New York Slough.

The next step in the process entailed preparation of the project description. DWR and BCDC assisted RD 830 in preparation of a project description and monitoring plans for the project. Both plans were submitted to the CVRWQCB with the request to approve and grant a Waste Discharge Order.

Concurrently, the COE prepared the Environmental Assessment pursuant to the National Environmental Policy Act and DWR prepared the Negative Declaration required under the

California Environmental Quality Act. With the environmental permits and the Waste Discharge Order completed by mid-September 1994, the cost sharing arrangement was left to be negotiated prior to letting the construction contract. Funding came from the COE's Operations and Maintenance funds, DWR Subvention Funds and RD 830. The cost sharing agreement between DWR and RD 830 was 75% and 25%, respectively.

The COE, Port of Stockton, and the DWR entered into a cost sharing arrangement under the 1982 Local Cooperative Agreement (LCA) between the Government and the Port of Stockton (technically the local sponsor). The financial arrangement was based on the amount of yardage shown on the pre-condition survey initially conducted in March 1994, which at that time was 40,000 cubic yards in the Suisun Bay Channel and 25,000 cubic yards in the New York Slough Channel.

Under the LCA, the Government was completely responsible for dredging, transporting, and off-loading the material for the New York Slough portion of the project; and only responsible for dredging the material for the Suisun Bay Channel portion of the project. Historical in-bay disposal is the responsibility of the Government, while the transportation and off-loading of the Suisun Bay Channel material onto Jersey Island was the responsibility of the Port of Stockton. DWR agreed to provide the monitoring and assessment of the project during the pre-project, dredging, material placement, and post-project periods; they also agreed to take lead responsibility for initiating and completing corrective actions to mitigate unreasonable impacts to waters of the State pursuant to the Waste Discharge Order, if required. Prior to the delivery of the dredged material to the Island, DWR sampled the baseline background water quality levels (See Environmental Issues Section for results). Once this task was finished a qualified contractor was sought to perform the work.

Nine firms were issued solicitations for bid, however, only one responded with a proposal. On September 30, 1994 a contract between the United States of America and Manson Construction Company was awarded in the amount of $1.153 million (See The Cost for Doing Business Section for further discussion). The Notice to Proceed was received and acknowledged on October 20, 1994 by Manson Construction.

For the Suisun Bay Channel material the Contractor worked 7 days a week, with 1 barge load per day in up to 12 hours of operation. At New York Slough they worked up to 24 hours in two shifts. The contract specifications required clamshell dredging with the material to be transported by barge. Two each, 2,100-2,500 ton flat barges (approximate draft for theses barges fully loaded is about 10 feet) were used with a 5 cubic yard bucket attached to a 190 foot long floating boom (the draft for this boom was approximately 6.5 feet deep).

Dredged material was barged to Jersey Island on flat barges with open sides where it was unloaded by clamshell to the land side of the levee. Excess water generated during dredging was discharged back into the Bay at the dredge sites prior to transportation; however, a staff member from the CVRWQCB reported that the material at the delivery site appeared to be wetter than the

water content specifications outlined within the Waste Discharge Order.

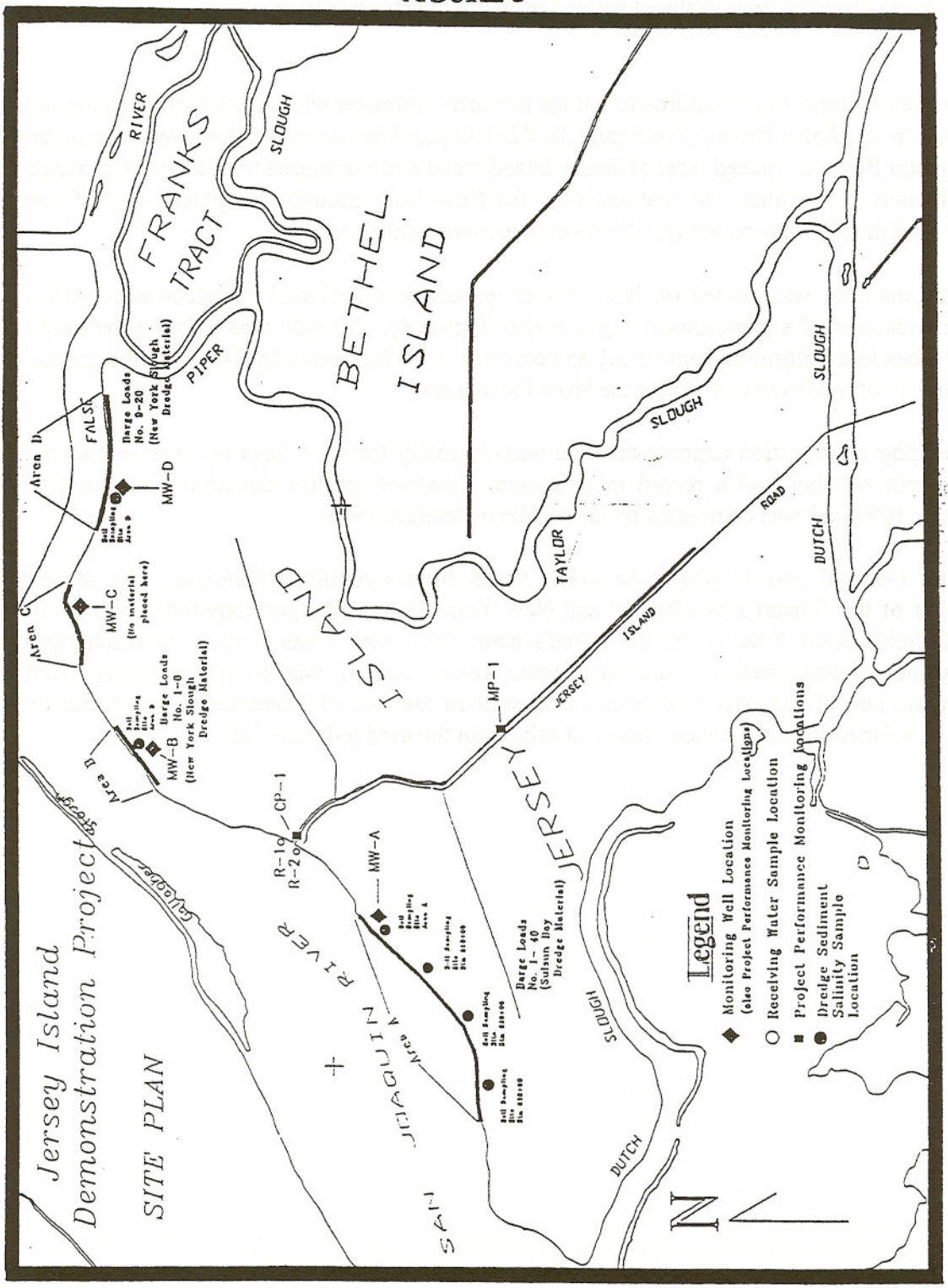
The dredged material was "windrowed" at the northern perimeter of Jersey Island adjacent to the San Joaquin and False Rivers (See Figure 3). RD 830 provided access to the levee. The material from Suisun Bay was placed west of Jersey Island Road and continued to the east, a distance of approximately 2 ½ miles. The material from the New York Slough was placed east of Jersey Island Road in segments covering a distance of approximately 1 mile.

Once the material was placed on land, it was spread by a bulldozer in accordance with the recommendations of a geotechnical engineer (See Figure 4). The plan was to bring the landside of the levees to a minimum slope of 3:1 and construct a 40 foot-wide by 3-foot high berm along the landslide of the levee to stabilize the levee foundation.

The dredging construction contract duration was originally for sixty days but was extended due to inclement weather and a record rainy season. However, project construction started mid-December 1994 and was completed by the middle of January 1995.

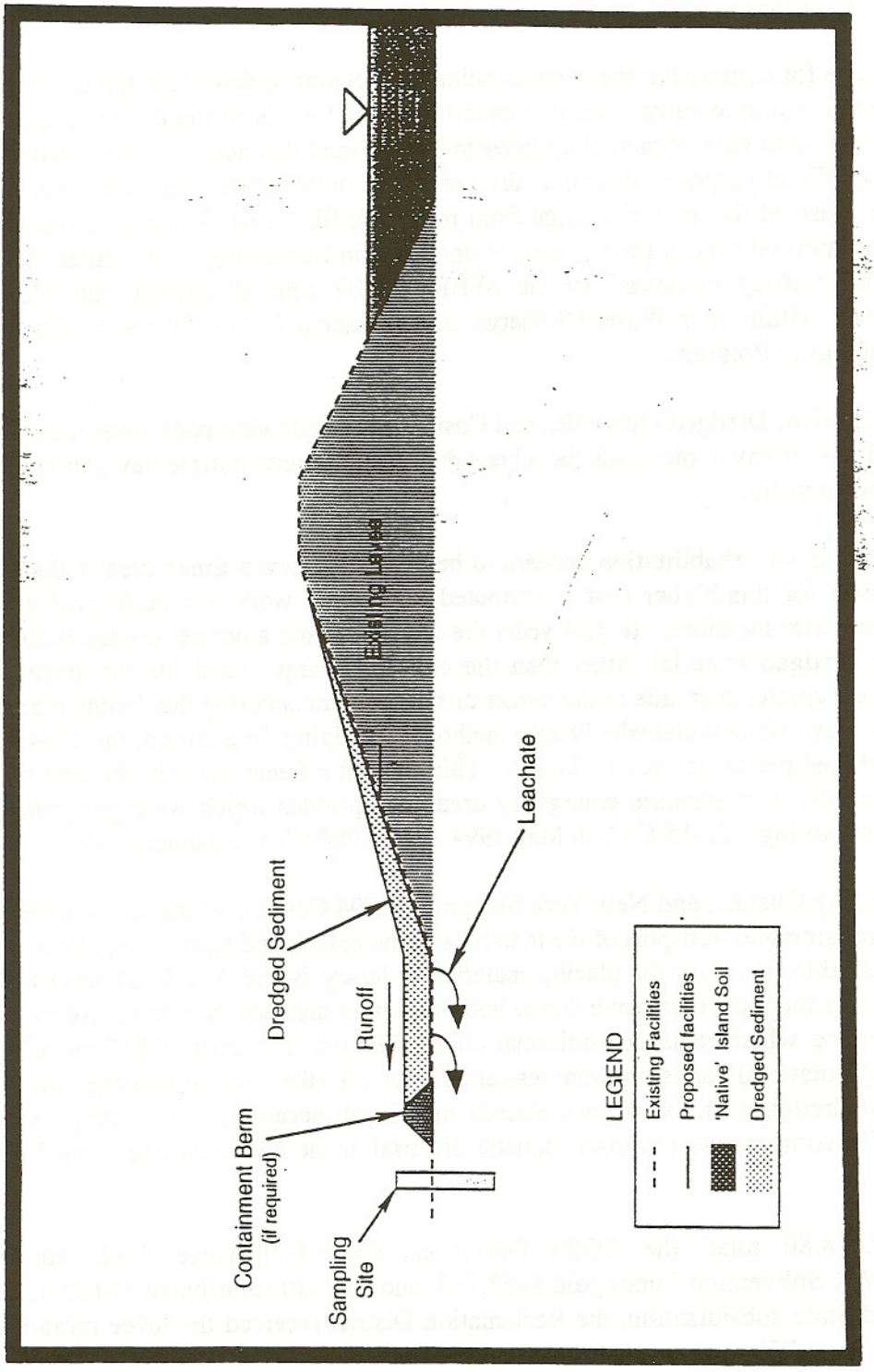
Once the material was in place, the DWR began their monthly monitoring. The areas for placement of the Suisun Bay Channel and New York Slough dredged materials are served by separate field drains bisected by the Island's main drain which has a pump to discharge the Island's interior water back into the San Joaquin River. Thus, it was possible to independently monitor the rate of salt loss from each fill as well as the rate of movement through the drain system as a function of the concentration of salinity in the dredged material.

FIGURE 3



SITE PLAN

FIGURE 4



LEVEE CROSS SECTION

3.0 THE COST OF DOING BUSINESS

One of the reasons for conducting the demonstration project was to determine the present cost of levee rehabilitation using localized dredged material. It has long been the desire of the BCDC, SFBRWQCB, and other environmental agencies to use the sand dredged from the Suisun Bay for some type of beneficial purpose rather than disposing of a potential resource back into the Bay. Other ideas for reuse of this material range from providing fill for development projects and/or for the local commercial sand miners presently operating in Suisun Bay. The latter idea is the subject of another study requested by the SFBRWQCB's Special Studies and Monitoring condition outlined within their Waste Discharge Order Number 95-040 for the COE's 1995-96 Maintenance Dredging Program.

Table A, the Historical Dredged Quantities and Costs on the following page illustrates what has been spent, and how many cubic yards have been dredged to maintain these navigation channels for the last eighteen years.

The 1994 cost for levee rehabilitation appears to be more than seven times greater than in past years. The reason for this higher cost is attributed to how the work was performed given the change in disposal site locations. In past years the COE has used a hopper dredge with aquatic disposal of the dredged material rather than the clamshell/barge used for the Jersey Island project. There is a greater cost due to the longer distance for transporting the dredge material for disposal and the less efficient clamshell/barge method of dredging. In addition, the 1994 amount indicates a total cost per cubic yard of $14.80. This amount reflects not only the cost for levee rehabilitation but also two separate emergency dredging episodes which were performed via a hopper dredge removing 42,515 CYS in May 1994 and 16,000 CYS in January 1995.

Table B, Suisun Bay Channel and New York Slough FY 1994 Cost Comparison, summarizes the costs for both dredging and transport of the materials to the upland and aquatic locations. Referencing this table, the cost for placing material at Jersey Island was $1,259,618.80. The Suisun material was the most expensive due to both its further distance from the delivery site and its irregular shoaling which required additional plant operation at a cost of $17 per CY. The New York Slough material cost somewhat less at $12 per CY (the overrun yardage was slightly cheaper since the dredging equipment was already mobilized) because of its closer proximity to Jersey Island. For comparative purposes, aquatic disposal at the historical site costs $3.50 per CY.

Of the $1,259,618.80 total, the COE's Operations and Maintenance funds contributed $719,618.80, DWR Subvention Funds paid $458,750 and RD 830 contributed $81,250. Due to both Federal and State subsidization, the Reclamation District received the levee reinforcement material for $1.12 per CY.

The above construction cost does not include other external costs such as sediment testing ($55,497), mitigation monitoring (estimated at $450,000), and the additional staff time required

for plan coordination at the COE, CVRWQCB, and the RD 830.

Table A, Historical Dredged Quantities and Costs for Suisun Bay Channel and New York Slough

FISCAL YEAR	DREDGING DATES	AMOUNT DREDGED (CYS)	TOTAL COST ($)	COST PER CUBIC YARD	CONTRACT COMPANY
1977	30 NOV - 04 DEC 76	85,000	60,257	0.71	GOV
1978	26 APR - 04 MAY 78	130,000	97,307	0.75	GOV
1979	02 JAN - 12 JAN 79	233,000	153,522	0.66	GOV
1980	15 FEB - 03 MAR 80	285,000	244,525	0.86	GOV
1981	17 FEB - 03 MAR 81	166,000	220,495	1.33	GOV
1983	29 SEP - 04 NOV 82	177,000	667,905	3.77	GOV
1984	10 SEP - 09 NOV 84	119,545	281,272	2.33	MANSON
1985	01 APR - 02 APR 85 25 APR - 27 APR 85	4,100 34,500	16,242 97,408	3.96 2.86	GOV
1987	24 MAR - 26 MAR 87	28,300	112,309	3.97	GOV
1988	03 OCT - 05 DEC 87	46,846	56,707	1.21	NORTH AMERICAN TRAILING
1990	17 AUG - 22 SEP 90	91,395	178,557	1.95	DUTRA
1991	18 SEP - 12 OCT 91	13,370	33,059	2.47	NATCO
1992	01 AUG - 28 AUG 92	54,418	291,336	5.35	MANSON
1993	19 JUL - 25 SEP 93	22,711	41,442	1..82	MANSON
1994	07 MAY - 08 MAY 94 20 OCT - 20 JAN 95	42,515 89,000	70,542 1,316,777	1.66 1.48	GOV MANSON

Table B, Suisun Bay Channel and New York Slough FY 1994 Cost Comparison

DESCRIPTION	QUANTITY	AMOUNT	UNIT PRICE
MOB/DEMOB	1 JOB	$173,000.00	LUMPSUM
SUISUN/JERSEY	40,000 CYS	$680,000.00	$17 PER CY
NY/JERSEY	25,000 CYS	$300,000.00	$12 PER CY
SUISUN/IN-BAY	16,331 CYS	$57,158.50	$3.50 PER CY
NY/JERSEY OVERRUN	7,519 CYS	$86,618.88	$11.52 PER CY
OVERRUN MOB/DEMOB	1 JOB	$20,000.00	LUMPSUM
TOTAL*	72,719 CYS	$1,259,618.80	

* This denotes the amount of dredged material placed only at Jersey Island and the cost.

4.0 THE REGULATORY PROCESS

One of the lessons learned is the complexity of Federal-State-Local inter-agency coordination. Coordination with multiple agencies can be complex and can discourage private interests who might otherwise consider participating in such projects.

Planning complexities were compounded since dredging and disposal of the material occurred in two separate jurisdictions of the COE and RWQCB. Both Suisun Bay Channel and New York Slough dredging is the responsibility of the San Francisco District COE while the disposal of the dredged material at Jersey Island is within the Sacramento District COE's jurisdiction. The same is true for the SFBRWQCB and the Central Valley RWQCB, respectively.

The BCDC's jurisdictional boundary lies within the dredging and aquatic disposal areas pursuant to the Coastal Zone Management Act. The Consistency Determination (CD) concurrence between the SFCOE and the BCDC stipulated upland disposal for the New York Slough material, and strongly recommended the same for the Suisun Bay Channel material, supporting the requirements of the two year Waste Discharge Order between the SFCOE and the SFBRWQCB. However, as agreed upon within the CD and Waste Discharge Order, if no such upland site existed by the time dredging took place then disposal would need to continue at the historically used Suisun Bay Disposal Site. Thus, the BCDC had the incentive to locate an upland site, becoming a major force in identifying a local interest for both channel's dredged material, in this case a State water development agency, the Department of Water Resources.

The 1986 Water Resources Development Act requires the local sponsor to provide all necessary lands, easements, right of ways, and disposal sites. The Port of Stockton is technically the responsible local sponsor, however at the time of the Jersey Island Demonstration Project negotiations were underway to transfer this responsibility to Contra Costa County. Although the Suisun Bay Channel is bisected lengthwise and part lies within Solono County, the primary industrial benefactors of this ship channel are located within Contra Costa County, making it the logical county to accept local sponsorship. Currently, COE headquarters in Washington D.C. is working on a new Project Cooperative Agreement which will transfer local sponsorship from the Port of Stockton to Contra Costa County. This will eliminate the COE Sacramento District's jurisdiction for this federal navigation channel which lies within the San Francisco District boundaries. However, should Contra Costa County chose an upland site in adjacent counties to the east, then the COE Sacramento District would need to be consulted.

Since transfer of local sponsorship is not yet completed, the DWR accepted full liability in order to proceed with the project. The DWR then cost shared its financial responsibility (75%) with the Reclamation District 830 (25%), who had to receive permission from the local land owners, who own approximately 20 % of the Island, and the Iron House Sanitation District, who owns and manages the remaining 80%, to go ahead with the project.

Perhaps the most difficult obstacle confronting planners is the "race against the clock". The Federal government operates on a Fiscal Year which extends from October 1st to September 30th. This time constraint has ramifications for both establishing the dredged material quantities to be delivered and the negotiations for construction financing.

The first survey, the pre-condition survey, which reveals the initial quantity estimate, took place in December 1993. At that time there was approximately 40,000 CYS at Suisun Bay Channel and 25,000 CYS at New York Slough. These were the quantities used for planning the design and cost estimates to finance the project. The first meeting of the various agencies to discuss project implementation occurred in March 1994, at which time the COE offered to conduct the sediment testing. Testing is necessary in order to screen the sediment as to its suitability for upland disposal. This was done by a contractor in April 1994. However, the sediment test results were not known until June 1994. The material proved to be acceptable. At that time the DWR/RD 830 prepared a project description and applied for a Waste Discharge Order from the CVRWQCB. The CVRWQCB worked closely with the applicants to expedite the project and were able to place the permit request on their August 1994 agenda. Formal approval was received by mid-September 1994. The environmental assessment was completed by the end of funding, September 1994; the DWR/RD 830 provided their portion of the funding and the COE advertised and let the bid by September 30th 1994.

Planning for the Jersey Island Demonstration Project was under an extremely tight time frame of approximately six months. However, since there was a great desire and willingness for the project to succeed, there was a concerted effort by the involved agencies to expedite the planning process.

Prior to the onset of dredging, the COE performs a condition hydrosurvey to establish any changes in quantity and shoal locations. This was done in December 1994, one year after the pre-condition, and the quantities were determined to have increased in both channels due to shoaling: Suisun Bay Channel had an estimated 56,331 cubic yards, for an additional 16,331 cubic yards, and New York Slough Channel, 32,519 cubic yards, representing an additional 7,519 cubic yards.

A Request for Proposal (RFP) was sent to the Contractor on December 8, 1994. The RFP asked the Contractor to provide price proposals to dredge the additional yardage and to place the additional New York Slough material on Jersey Island and the additional Suisun Bay material in-bay and, alternatively, on Jersey Island. This would have required an additional $216,000 of funding from the State if the Suisun material were to be placed onto Jersey Island. This amount was based on the bid amount of $17 per CYS for Jersey Island placement and $3.50 CYS for open water disposal at Suisun Bay. The difference of $13.50 per CYS applied to the 16,000 additional CYS of material then became the responsibility of the State.

The State declined to pay for the extra yardage and so the COE disposed of the material aquatically at the Suisun Bay Disposal Site. The COE is required by law to conduct its operations in the most cost effective manner. In addition, the COE budgets two years in advance of the

current fiscal year. Therefore, additional funding is not appropriated and available for projects that cost more than originally budgeted. Lastly, due to the additional time required for planning and developing the project, and because project implementation occurred at a later date than usual, the COE was contacted twice by the San Francisco Bar Pilots Association regarding the formation of dangerous shoals within the Suisun Bay Channel (both in May and August 1994). Normally, this channel is dredged annually by June of the FY. For each emergency dredging event equipment had to be mobilized and the dredged material disposed of aquatically. This resulted in a greater inefficiency and additional cost to the public and the local sponsor who depends on a safe, navigable waterway to conduct commerce.

5.0 ENVIRONMENTAL ISSUES

Conspicuously excluded from the Regulatory Process Section is a discussion on environmental regulations. Compliance with environmental statutes protecting endangered/threatened species and water quality is mandatory and the explanation of each warrants a separate section in this report.

The primary reason for implementing the demonstration project is to maintain the levees at full function. If any of the levees on these eight islands fail, the brackish tidal prism would expand and return to its former extension further east, endangering both State and local water supplies given the intake location to the State Water Project.

A secondary reason for the pilot project is to investigate whether water quality impacts would result from the placement of saline dredged material onto Island levees. The concern with placement of these sediments at a location such as Jersey Island is the introduction of salts into the freshwater portions of the Delta. This residual salinity could have the potential for causing or contributing to an exceedance of State water quality objectives at the compliance point and in the receiving waters, thereby degrading fresh water quality. The Jersey Island Demonstration Project is a part of the continuing DWR effort to demonstrate the feasibility of using material dredged from the Bay-Delta Estuary for levee improvement and maintenance. Also, there was a joint interest as the COE was investigating beneficial reuse of dredged material.

Another component of the regulatory process was the need to interact with the United States Fish and Wildlife Service, National Marine Fisheries Service and the California Department of Fish and Game pursuant to Federal and State laws.

In order for the project to qualify for State SB 34 subvention and Federal O & M program funds, the above agencies needed to determine that the proposed action would not "result in a net long-term loss of riparian, fisheries, or wildlife habitat." There could also be no adverse impact to any listed or proposed listed endangered and threatened species.

For these reasons, the northern portion of Jersey Island, an approximate 300 foot-wide swath, adjacent to the San Joaquin and False Rivers, was surveyed on June 24 and 28, 1994 by the COE's staff ecologist, botanist and biologist. The purpose of these site visits was to map the existing emergent wetland vegetative communities and to verify the existence of any protected species. In order for the CDFG to find that there would be "no net loss" to these resources, the COE prepared two reports entitled Jersey Island Dredge Material Reuse Project, Project Impacts on Wetlands; Endangered and Rare Plant Species; and Riparian Habitats and Jersey Island Beneficial Reuse Demonstration Project, General Habitat Assessment. These reports were submitted to the CDFG in August 1994 and approved, with conditions (i.e., requirement to "flag" dredged material placement sites prior to construction), by September 1994.

Wetland habitat is recognized as having intrinsic value to wildlife and its identification is

important in order to protect this resource from filling with dredged material. Once identified, the dredged material was placed in those areas that were completely devoid of emergent wetland vegetation. In order to ensure that sensitive areas were completely and adequately avoided, staff from both the COE and the CDFG defined the areas for dredged material placement prior to construction. In addition, construction personnel were instructed where to place the dredged material.

As it turned out, the regions that were "flagged" for dredged material placement (devoid of wetland vegetation) were areas that had been recently, probably within the last five years, reinforced with sandy material . If a wetland were found it would have been under the jurisdiction of the Sacramento District COE and a wetland delineation inspection and permit would have been necessary pursuant to the Clean Water Act. This permit process would take, at a minimum, four months and mitigation measures (i.e., replacement in kind) would have been required. Since the "tight" project schedule was unable to accommodate this process, a unilateral decision to avoid any wetlands was made by the San Francisco COE. This is the reason for the project's segmented configuration.

Endangered/Threatened Species

The United States Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) are Federal agencies (part of the Departments of the Interior and Commerce, respectively) that have the responsibility for implementing the provisions of the Endangered Species Act; influencing decisions on proposals which have the potential to impact fish and wildlife habitat.

Coordination with the FWS and the NMFS was necessary in order to research the possible existence of endangered, threatened, candidate species that are protected under both the Endangered Species and Marine Mammal Protection Acts and which may have been impacted by the project.

Consultation with the FWS, the NMFS and the California Department of Fish and Game (CDFG) was conducted either in writing and/or via telephone regarding the presence of endangered, threatened, or candidate species.

The FWS and NMFS indicated the possible existence of the following species in the project area: the endangered winter-run Chinook salmon (*Oncorhynchus tshawytscha*), the threatened delta smelt (*Hypomesus transpacificus*), the proposed for listing Sacramento splittail (*Pogonichthys macrolepidotus*); and the threatened giant garter snake (*Thamnophis gigas*).

The California Natural Diversity Data Base (CNDDB) provides listings of observed sightings of special status species (i.e., endangered or threatened plants and animals) by location. A CNDDB search was conducted by the California Department of Fish and Game with the result that no special status species (i.e., the giant garter snake and rare plants) were reported on the project

site.

The FWS indicated that the threatened Delta smelt and the proposed listed Sacramento splittail existed within the proposed project dredge area. These species generally spawn from mid-December to July for the smelt and March to July for the splittail. The NMFS indicated that the endangered winter-run Chinook salmon were also present. Both agencies agreed with the COE's determination that these species would not be adversely affected. In fact, these three species would be exposed to less impacts since dredged material disposal would be upland rather than in an aquatic environment.

Water Quality

The surface water from the project area flows to the island's lateral drains and then to the main drain (See Figure 3, Jersey Island Demonstration Project Site Plan). This water is then pumped into the San Joaquin River. The sections for dredged material placement are served by separate field drains. This permitted independent monitoring of the rate of salt loss from each different source of dredged material, and the rate of movement through the drain system as a function of the concentration of salinity in those dredged materials.

The dredged material criteria and receiving water criteria were developed to protect the domestic water supply and to prevent violations of water quality objectives. The criteria was developed based on testing done by the COE which indicated the sediment's quality. The DWR estimated and calculated saline discharge concentrations and analyzed the receiving water's ability for diluting these concentrations to acceptable drinking water standards.

The COE contracted with ToxScan Incorporated to conduct the necessary field studies of the material to be dredged. The sediment chemistry results are published within the final report entitled, Chemical Analysis of Sediments at Suisun Bay Channel and New York Slough for 1994 Maintenance Dredging, June 1994.

The grain size analysis classified the material as moderate to fine sand. The sediment chemistry indicated that the salinity of dredged material is 10,000 to 17,000 milligrams per liter (mg/l) from Suisun Bay and 3,000 to 4,000 mg/l from New York Slough. In addition, the sediment testing included extensive chemical analyses, gas chromatography studies, and waste extraction tests (WET) using both deionized water (modified or DI) and a weak acid (non-modified or citrate).

The results from the modified WET were used for the comparison since water would be the dissolvant affecting the placed dredged material.

The Monitoring and Reporting Program (MRP) required post project compliance monitoring

until constituent concentrations returned to background levels (See Appendix for the Waste Discharge Requirements and complete monitoring results). Past short term monitoring efforts at other demonstration sites did not specifically analyze the impact of saline dredged material on receiving waters.

The MRP addressed the monitoring of constituents from island drainage water; receiving water at the San Joaquin River; Island soils; and the dredged material at the project site. A monitoring program was implemented to ensure compliance with the appropriate water and soil quality criteria. The DWR Water Quality Assessment staff conducted the ongoing sampling and monitoring of the soil and water at the site.

The predredge assessment results from the three sediment sample composites collected from the Suisun Bay Channel were: the total metals were less than the Waste Discharge Requirement (WDR) limits; the soluble metals (citrate WET test) were greater than WDR limits, however the soluble metals from the DI WET test were below WDR limits; pesticides, PCBs, TPHs, and TBTs were below detection limits; oil and grease were 20 mg/kg; total phthalates were between 70-92 mg/kg; 3 PAHs were greater than the Low Effect Levels (LEL) but were below Severe Effect Levels (SEL) (Canada); the grain size analysis showed 98-98.2% sand; and this material had 10-17 parts per thousand interstitial salinity.

The predredge assessment results from the two sediment sample composites taken from New York Slough were: the total metals were less than the WDR limits; the soluble metals (citrate WET test) were greater than WDR limits, however the soluble metals from the DI water WET test were below WDR limits; pesticides, PCBs, PAHs, TPHs, and TBTs were below detection limits; oil and grease were also below detection limits; total phthalates were between 150-270 mg/kg; the grain size analysis indicated 92.8-97.5% sand; and this material had 3-4 parts per thousand interstitial salinity.

Figure 3, illustrates the dredged material placement locations; the monitoring well locations (used for both background field monitoring and project performance monitoring); the main drain performance monitoring locations; and the receiving water sample locations.

For the receiving water monitoring locations, Site R-1 was placed 200 feet upstream of the discharge site and Site R-2 was placed 250 feet downstream. Background monitoring levels indicated that dissolved metals were below detection levels except for arsenic which was 0.002 mg/l at both monitoring sites.

As for the monitoring of the Island's main drain, CP-1 indicates the compliance point at the pump station and MP-1 was placed 100 feet upstream from the lateral drains intersection with the main drain. Background results showed that dissolved metals were less than detection limits except for arsenic and zinc. CP-1's arsenic level was measured at 0.002 mg/l and MP-1's was 0.005 mg/l (the same for zinc). Total dissolved solids (TDS) exceeded WDRs at both locations. Electroconductivity (EC) at CP-1 ranged from 1,400-2,600 between April through August 1994.

The DWR installed four shallow wells ranging from 1/2 foot to 2 feet deep: MW-A for the Suisun material, MW-B and MW-D for the New York Slough material, and MW-C was a control where no dredged material was placed. The pre-project soil assessments at these areas indicated that total metals were below WDR limits and that soluble metals (DI WET) were below detection limits, wherefore, the deposited dredged material was within the limits defined in the WDR.

6.0 FINDINGS AND CONCLUSIONS

The findings and conclusions of this study are listed by their appropriate report topics:

How the Work Was Done and Who Did It

1. Contractor competition was non-existent since only one company submitted a construction proposal. The quick turn-around for project implementation may have been a factor.

2. There needs to be very close construction inspection to ensure compliance with contract specifications. On this project the contractor made a unilateral decision to switch the placement areas for Suisun Bay Channel and New York Slough materials. Another contract specification required the dredged material to be decanted at the dredge sites. Excess water generated during dredging was leached and discharged back into the Bay at the dredge sites; however, a staff member from the CVRWQCB reported that the material appeared to be wetter than the water content specifications outlined within the Waste Discharge Order for the delivery site.

3. The draft of the crane and barge was about 6.5 feet. Levees located adjacent to water areas less than this depth may not be able to receive dredged material, using the same type of equipment. A longer crane arm or other mechanical modifications may resolve accessibility constraints. These modifications may result in increased costs for future dredge disposal projects.

The Cost of Doing Business

4. Overall, the Jersey Island Demonstration Project resulted in beneficial results that improved the environmental and economic well being at the local, regional and statewide levels. At the local level, the design standard of the Jersey Island levees were increased and the risk of flooding reduced. There was a direct benefit to the 3,470 acres of agricultural land and wildlife habitat on Jersey Island. The project also demonstrated the economic and environmental feasibility of the reuse of dredged material from a brackish water environment for Delta levee improvement.

5. Contra Costa, Alameda, and Santa Clara Counties benefited from improved security of the Delta water delivered for use in these counties. This same water quality security accrued to the

large areas of the State that are served from the Delta by the Central Valley Project and the State Water Project.

6. The costs are $17 CY for Suisun Bay Channel, $12 CY for New York Slough, and $3.50 CY for Suisun Bay Channel Aquatic Disposal Site.

7. There is a need to identify the closest levees from the dredge site needing rehabilitation in order to minimize costs associated with transporting dredged material long distances.

8. Projects of this nature will continue to be feasible only as long as political and financial support continues.

9. The higher cost of dredging for this project is mainly attributed to: a) the decision to use a clamshell dredge versus a hopper dredge due to the undesirability of brackish water being introduced onto the Island. The clamshell method is less efficient than the hopper. Since the shoals were both scattered over long distances and thinly deposited, the clamshell had to move and set up more often than a hopper would have, thus slowing the dredging process and increasing the cost b) only one contractor (Manson) submitted a bid. According to the other probable contractor (Dutra), a bid package was never received. Having only one bid may have resulted in a higher cost, and c) the transportation distance of the material from the Suisun Bay Channel to the Island is much further than the historically used aquatic disposal site. The COE believes that the costs could have been significantly reduced, if there was more and continuous (rather than intermittent) shoaling and if there had been competitive bidding.

The Regulatory Process

10. There is a desire among certain agencies to implement a larger pilot project and to ultimately dispose of this O & M dredged material upland on a regular basis. However this may be difficult to achieve since the quantities (See Table A) are variable and available funding is uncertain.

11. Jersey Island required nine months to plan and coordinate, from December 1993-September 1994. A minimum of one full year would be necessary for a similar project. A more ambitious project should have a two year planning period.

12. It has become increasingly difficult to provide upland dredged material disposal sites due to the lack of local funding.

13. The COE is constrained in how it does its contractual business. Federal law states that dredging and disposal of the material must be performed in the most cost effective manner. As long as aquatic disposal is permitted it will remain the most cost effective disposal method.

14. The Sacramento District COE conducted a General Investigation reconnaissance study entitled The Sacramento-San Joaquin Delta, Western Delta Islands, California, May 1995 which

focused on Section 1135 environmental restoration at Webb Tract, Jersey, and Twitchell Islands. Webb Tract was not feasible due to the owner's desire to impound fresh water for later resale. Jersey Island was also not feasible since its landowners have plans to expand its sewage treatment facilities at this location. However, they still are interested in future levee rehabilitation. Twitchell Island, which is owned by the DWR (80%) and Chevron (20%) did pass the reconnaissance level study phase and has entered into the feasibility level study phase. This feasibility report is expected to be completed in 1998.

Environmental Issues

15. At Jersey Island, dredged material was placed on areas that had been recently improved and thus were devoid of any wetland vegetation. This is the reason for the segmented configuration.

Endangered/Threatened Species

16. Consultation with both the FWS and NMFS must be started as early in the process as possible since it is becoming increasingly difficult to arrive at project consensus regarding impacts and mitigation plans.

17. Any type of dredging and disposal plan will necessitate informal/formal consultation with the FWS regarding the Delta Smelt since the whole of Suisun Bay is designated critical habitat pursuant to the Draft Delta Native Fishes Recovery Plan. The final report is due by end of 1995. Since real time monitoring (the species actual location within the Delta at a given time of year) indicates this species current distribution, sampling would be necessary (Bob Pine, FWS). Use of "windows" to avoid impacts no longer apply. Distribution for real time monitoring can be found by calling the Fish and Game Delta Office at (209) 948-7800.

Water Quality

18. Dissolved arsenic was found in all monitoring wells at low levels except for MW-B which had 0.010 mg/l. MW-B zinc level was also above the WDR limit at 0.018 mg/l.

19. MW-A and MW-B were in mineral type soils. MW-C and MW-D were placed in organic type soils. No material was placed in MW-C. MW-A and MW-B had higher EC, TDS, chlorine and bromide. MW-B had the highest EC, TDS, and bromine. The chlorine was highest in MW-A. Dissolved arsenic exceeded the drinking water standard or Maximum Contaminant Level (MCL) at MW-B.

20. The groundwater was at its highest in January-February 1995 and declined steadily over time.

There was no apparent direct relationship between groundwater and the river's flow and/or tidal surge. However, the direction of groundwater flow remains unknown.

21. Post project receiving water results indicated: pH, dissolved oxygen (DO), and temperatures were all within WDR limits; very little change in EC, TDS, chloride and bromide between R-1 and R-2, however they were greatly affected by flow and tidal changes; dissolved metals remained below detection limits except for arsenic and zinc; and EC/TDS correlation equaled 1.0.

22. Post project well monitoring indicated that the pH was within WDR limits; the salt loading from the main drain into the river did not appear to be significant; dissolved metals were below detection limits except for arsenic, copper, nickel, and zinc; the EC/TDS correlation were .70 at MP-1 and .94 at CP-1. The TDS at CP-1 exceeded WDR limits seven times and MP-1 exceeded CP-1 seven times; average TDS increased 3.8% from MP-1 to CP-1; and there were no past or present main drain pumping records.

23. Receiving water salt loading at R-1 and R-2 did not appear to be significant.

24. The DWR estimated the salt load from the Suisun Bay Channel material to Area A on Figure 3 at 137,065 pounds or 68.5 metric tons. The salt load to Areas B & D from the New York Slough was calculated to be 43,904 pounds or 22 metric tons (however this used the 25,000 CY estimate, not the 32,719 actually placed). Therefore, the total salt introduction is estimated to be 194,491 pounds.

25. Due to an extremely wet rainy season and because of the low porosity and high permeability of sandy material, the salt impacts were relatively short term (only about one month, refer to Appendix A for detailed results).

26. As of the date of this report the DWR has concluded the water quality is at background levels, however, they are continuing long-term monitoring.

27. There are issues regarding the placement of the receiving water detection locations (upstream versus downstream). Since tidal flow influences the direction of the San Joaquin River in both directions, background levels differ depending on a flood or ebb cycle.

28. Additional EC monitoring is needed at several lateral drains and upstream of MP-1.

29. The DWR, BCDC, COE, and the RWQCB believe the small sized demonstration project identifies a successful use of a resource (dredged material), previously underutilized.

7.0 SUGGESTIONS FOR FUTURE DREDGING PROJECTS

The following suggestion may facilitate the implementation of future dredged material disposal projects:

* In March 1988, the California Legislature passed the Delta Flood Protection Act (Senate Bill 34) which recognized the importance of the Sacramento-San Joaquin Delta Region. The bill legislated the intent to appropriate $12 million annually for Delta flood protection for ten years, ending in 1998. SB 34 directs the California Department of Water Resources (DWR) to develop and implement flood protection projects on the eight western Delta islands. This funding source should be used before it expires and planning for the next project should start immediately.

* There should be an attempt to locate dredged material upland disposal sites closer to the Suisun Bay Channel and within the same Federal and State jurisdictions, if possible. Contra Costa County should share this leadership with the DWR.

* Federal General Investigation studies could be performed for the Islands closest to the dredged material locations per request of the local sponsor. Congressional authority for future study could also come from Section 1135 Environmental Restoration and/or Section 204 Beneficial Use of Dredged Material. Islands to be considered for projects could include Sherman, Seal, Roe, Ryer, Chipps, Browns, Van Sickle, Winter, Kimball and West. See Figure 1 (Project Location) and Figure 2 (Western Delta Islands) for further information. These are all located near the dredge sites and dredged material stockpiling facilities, levee rehabilitation, and wetland restoration could be the focus for future studies.

* Additional pilot projects could be performed for the Islands closest to the dredged material locations.

* A channel of communication between responsible agencies would improve coordination for: a more thorough pre-project analysis of previous salinity monitoring programs, refine contract specifications to meet WDR and/or other background monitoring plans; and the development of a comprehensive plan for the implementation of future dredge disposal projects.

* Complete the unreinforced segments on Jersey Island's northern perimeter.

* Ground water standards and the RWQCB's application of those requirements need to be redefined for areas that do not draw groundwater for drinking. Also, direction of groundwater flows should be studied.

* Prepare an environmental master plan on islands needing levee repair, wetland restoration and mitigation banking sites for future long-term projects. This master plan would identify environmentally sensitive areas and potential mitigation sites. A programmatic EIS/EIR for such

projects might be the most efficient approach. The implementation of the planning document should be coordinated between agencies to identify all available information and relevant data.

* Contra Costa County could investigate the possibility of establishing an assessment district to raise funds from the users of the navigation channels. A separate account could be set aside to provide upland disposal sites and to promote other beneficial uses within the County. This would require coordination with the local planning and public works departments to identify possible funding mechanisms.

* In order to create a "turn key" operation for the Corps' yearly O & M activities, it may be advisable to prepare an interagency Memorandum of Understanding (MOU). The purpose of the MOU would be to incorporate the findings and recommendations of this demonstration project into a procedural document which may streamline the implementation process of future O & M dredge disposal activities.

APPENDIX A

SUMMARY OF WASTE DISCHARGE REQUIREMENTS AND MONITORING RESULTS FROM THE DEPARTMENT OF WATER RESOURCES[1]

1 DWR should be contacted for a complete listing of waste discharge requirements.

WASTE DISCHARGE REQUIREMENTS

RECEIVING WATER

Turbidity not to increase more than 10 percent over background levels.

Dissolved oxygen concentrations not to fall below 7.0 mg/L (October 1 - June 30) and 5.0 mg/L (July 1 - September 30).

Temperature not to increase above 56 degrees Fahrenheit (13.3 degrees Celcius) or river background temperatures (October 1 - June 30), whichever is greater; and not to increase more than 5 degrees Fahrenheit (2.8 degrees Celcius) over river background temperatures (July 1 - September 30).

pH not to fall below 6.5 or exceed 8.5.

AGRICULTURAL DRAIN

pH not to fall below 6.5 or exceed 8.5.

Total Dissolved Solids concentrations at the main drain not to exceed 10 percent or a maximum of 150 mg/L, whichever is less, over the TDS concentrations 100 feet upgradient of the point where dredged sediment drainage enters the main drain.

GROUND WATER

Electrical conductivity not to exceed an annual average incremental increase of 400 umhos/cm, or a maximum of 2,600 umhos/cm, whichever is less.

Not to contain chemicals, heavy metals, or trace elements in concentrations that adversely effect beneficial uses or exceed drinking water maximum contaminant levels (MCLs).

DREDGED SEDIMENT

Not to exceed specified concentrations for the following constituents: arsenic, cadmium, chromium, copper, lead. Mercury, nickel, thallium, and zinc.

Not to contain waste classified as "hazardous" or "designated".

RECEIVING WATER (R-1 and R-2)
Background Data (in mg/L except as noted)
Sampling Date: 11/3/94

Constituent	R-1	R-2
Turbidity (NTUs)	-	-
Dissolved Oxygen	-	-
Temperature (degrees Celcius)	-	-
pH (pH units)	7.8	7.8
Electrical Conductivity (umhos/cm)	1890	2200
Total Dissolved Solids	968	1140
Suspended Solids	14	12
Hardness (as CaCO3)	237	253
Total Organic Carbon	2.3	2.2
Total Alkalinity	65	66
Chlorides	499	591
Bromides	1.85	2.24
Total Sulfides	-	-
Dissolved Sulfides	<0.5	<0.5
Sulfate	76	86
Fluoride	0.1	0.1
Sodium	270	336
Magnesium	43	48
Potassium	-	-
Calcium	24	22
Boron	0.2	0.2

Dissolved Metals: All concentrations below detection limits except for arsenic, which was 0.002 mg/L at R-1 and R-2.

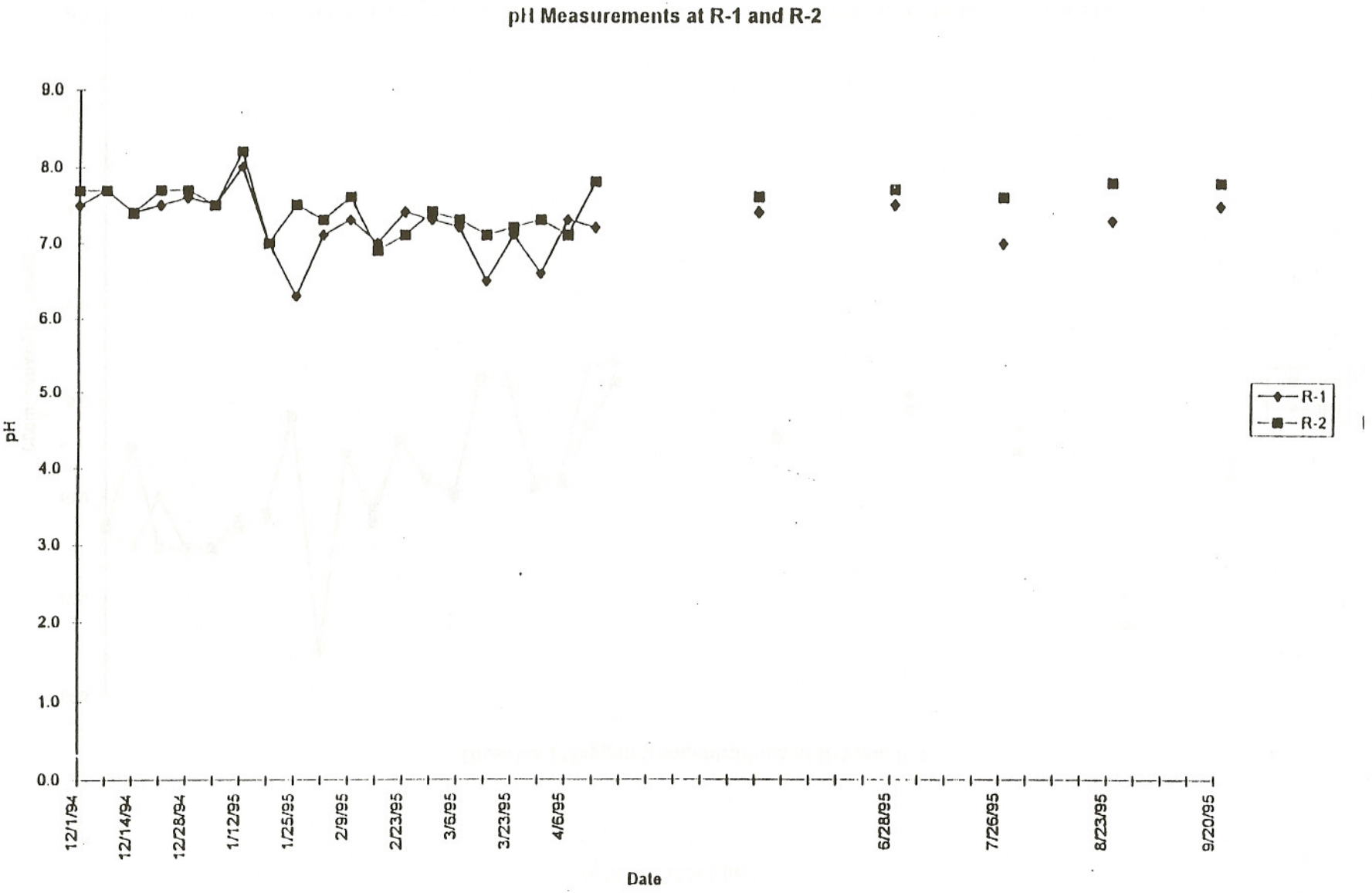
RECEIVING WATER (R-1 and R-2)
Monitoring (in mg/L except as noted)
Minerals and General Water Parameters

Constituent	Monitoring Period	R-1	R-2
Turbidity (NTUs)	12/1/94 - 9/20/95	6.4 - 90	5.0 - 90
Dissolved Oxygen	12/1/94 - 9/20/95	7.2 - 13.1	7.5 - 13.0
Temperature (degrees Celcius)	12/1/94 - 9/20/95	9.1 - 24.5	9.2 - 23.7
pH (pH units)	12/1/94 - 9/20/95	6.3 - 8.0	6.9 - 8.2
Electrical Conductivity (umhos/cm)	12/1/94 - 9/20/95	121 - 2,910	77 - 2,950
Total Dissolved Solids	12/1/94 - 7/26/95	82 - 1,550	78 - 1,540
Suspended Solids	12/1/94 - 8/23/95	2 - 50	3 - 54
Hardness (as CaCO3)	12/1/94 - 7/26/95	36 - 368	36 - 377
Total Organic Carbon	12/1/94 - 8/23/95	2.0 - 7.6	1.8 - 8.0
Total Alkalinity	12/1/94 - 7/26/95	34 - 76	32 - 78
Color	3/16/95 - 8/23/95	7 - 150	25 - 200
Chlorides	12/1/94 - 7/26/95	8 - 790	8 - 797
Bromides	12/1/94 - 8/23/95	0.03 - 2.68	0.02 - 2.65
Total Sulfides	12/1/94 - 8/23/95	<1 - 7.2	<1 - 7.7
Dissolved Sulfides	12/1/94 - 8/23/95	<0.5 - 7.0	<0.5 - 9.0
Sulfate	12/1/94 - 7/26/95	9 - 112	9 - 116
Fluoride	12/1/94 - 7/26/95	<0.1 - 0.1	<0.1 - 0.1
Sodium	12/1/94 - 7/26/95	8 - 455	9 - 447
Magnesium	12/1/94 - 7/26/95	4 - 68	4 - 69
Potassium	12/1/94 - 7/26/95	1.0 - 4.4	1.0 - 4.0
Calcium	12/1/94 - 7/26/95	8 - 35	8 - 37
Boron	12/1/94 - 7/26/95	<0.1 - 0.3	<0.1 - 0.3

RECEIVING WATER (R-1 and R-2)
Monitoring (in mg/L)
Dissolved Trace Metals

Trace Metal	Monitoring Period	R-1	R-2
Arsenic	12/1/94 - 8/23/95	0.001 - 0.002	0.001 - 0.002
Cadmium	12/1/94 - 8/23/95	<0.005	<0.005
Chromium	12/1/94 - 8/23/95	<0.005	<0.005
Copper	12/1/94 - 8/23/95	<0.005	<0.005 - 0.005
Lead	12/1/94 - 8/23/95	<0.002	<0.002
Mercury	12/1/94 - 8/23/95	<0.001	<0.001
Nickel	12/1/94 - 8/23/95	<0.005	<0.005
Selenium	12/1/94 - 8/23/95	<0.001	<0.001
Silver	12/1/94 - 8/23/95	<0.005	<0.005
Thallium	12/1/94 - 8/23/95	<0.002	<0.002
Zinc	12/1/94 - 8/23/95	<0.005 - 0.046	<0.005 - 0.030

RWPHMON Chart 1



RWOXYGEN Chart 1