DRAFT

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WHITE PAPER ON NORTH DELTA IMPROVEMENTS
CALFED BAY-DELTA PROGRAM

July 2000

CALFED Bay-Delta Program

I. Introduction:

The CALFED Bay-Delta Program (CALFED) has identified North Delta improvements as a Stage I action of the CALFED Implementation Plan. The "Lower Sacramento River, North Delta Region Bundle" or "North Delta Regional Plan" consists of four actions to address flood control, ecosystem, water quality, fisheries, and water supply reliability concerns in the North Delta area including the Cosumnes River from Highway 16 to the confluence with the Mokelumne River, the Mokelumne River from Commanche Reservoir to the San Joaquin River, and the Morrison Creek Stream Group. These actions include:

1. implementing various potential flood control improvements, such as dredging and setback levees, along the north and south forks of the Mokelumne River;

2. undertaking actions on McCormack-Williamson Tract to provide flood control and habitat restoration benefits;

3. restoring habitat along Georgiana Slough to create wildlife and fisheries habitat; and

4. conducting a study of modifying operating rules for the Delta Cross Channel (DCC), and a study of the feasibility of constructing a 0- to 4,000-cfs screened diversion on the Sacramento River.

The first three actions will be implemented as a single project and analyzed in a project-level EIR/EIS tiered from the CALFED Programmatic EIR/EIS. The fourth action will be addressed in a feasibility study.

CALFED staff has convened a study group (the North Delta Improvements Group) with a focus on identifying flood control solution alternatives that are compatible with local land uses, regional flood control plans, and CALFED ecosystem restoration goals. The Group focus includes the first three actions of the North Delta Regional Plan, with emphasis on the first action or flood control improvements. In addition to the CALFED actions, numerous local, state, and federal agencies are developing or implementing projects or programs that address similar concerns in the North Delta area. CALFED staff is coordinating with these programs and performing research to identify technically and politically acceptable solutions. An overview of the North Delta area showing the general project area of CALFED North Delta improvements and some of the

regional efforts that are discussed in the "North Delta Area Projects" section is provided in Figure 1.

This White Paper will serve to put into perspective the complex history and mix of ongoing actions in the North Delta area and to document the results of this preliminary research to guide further efforts such as the Environmental Impact Report/Environmental Impact Statement (EIR/EIS) for the first three actions of the North Delta Regional Plan identified above. This White Paper will be refined as study continues. Although the CALFED actions focus on the geographic area described above, CALFED acknowledges that a North Delta solution should address flood issues from a larger watershed perspective and is coordinating with other watershed interests to achieve an integrated solution.

CALFED staff proposes to initiate a formal EIR/EIS process in early fall 2000. Prior to initiation of a formal EIR/EIS process, staff will continue to evaluate possible solution scenarios, develop solution criteria, and identify strengths and weaknesses associated with different scenarios. Public outreach is a key component of CALFED. Staff is receiving input from Delta stakeholders in the field and has and will continue to receive input from the North Delta study group and the Levees and Channels Technical team. With the launching of a formal EIS/EIR effort, formal public scoping will be performed.

II. Background:

The major flood problem in the North Delta is a lack of river channel capacity to safely convey flows from Sierra Nevada watersheds through the North Delta to the San Joaquin River. This lack of capacity is historic. Low channel capacity along the Mokelumne River and Lost Slough is the main reason that the large volume of water entering the North Delta channel system is not able to flow down the existing channels. Water flowing down the Mokelumne River backs up into a broad floodplain north of New Hope Tract. The limited capacity of the Mokelumne River also causes water to back up Snodgrass Slough to the north towards Lambert Road. Water also backs up against the east side of the McCormack-Williamson Tract levees and if the event is large enough, this levee fails. The tract rapidly fills. The levee along the south end of the tract eventually fails and sends a surge of water down the North and South Forks of the Mokelumne River. The capacity of the North and South Forks is not enough to safely convey the surge, and additional levee failures are likely as in 1986. As well, the surge may knock boats loose, as occurred at the New Hope Marina in 1997. This led to additional stress on the system as boats stacked up at the New Hope Bridge, creating a hydraulic dam.

The North Delta area has been a focus for planning efforts for many years. In 1987, DWR launched the planning and environmental documentation process for the

North Delta Program. This effort lead to release of a draft EIR/EIS in 1990 for the North Delta Program. Goals of the 1990 effort included: alleviate flooding in the North Delta, reduce reverse flows in the lower San Joaquin River, improve water quality, reduce fishery impacts, and improve State Water Project flexibility and water supply reliability. In 1995, DWR suspended North Delta planning efforts in deference to the CALFED Bay-Delta Program. Goals of the 1990 North Delta EIR/EIS have been absorbed into the CALFED Bay-Delta Program.

The preferred alternative at the time of the release of the 1990 draft EIR/EIS for the North Delta Program had a cost of $290 million and included the following:

- Dredge the main stem and South Fork Mokelumne River.
- Enlarge the main stem and North Fork Mokelumne River with levee setbacks and channel dredging.
- Enlarge the Delta Cross Channel gate structure.
- Acquire the necessary state and federal permits, and
- Test mitigation collector wells and fish screens.

Also under consideration were numerous alternatives combining these components in different ways as well as the idea of creating an island floodway.

Many events have changed the planning thought process since the release of the 1990 draft EIR/EIS. Numerous entities are developing or implementing closely related projects or programs in the North Delta Region. Coordination with these efforts is essential for a successful North Delta solution. As well, the consideration of cumulative impacts of these projects will be included in any future CALFED EIR/EIS document.

III. North Delta Area Projects

There are numerous recent and ongoing studies and planning efforts in the North Delta. Many of these efforts have received funding in full or in part from the CALFED Cat III Early Ecosystem Implementation Program. The list includes:

Sacramento County Alternative 11F - Sacramento County has developed a conceptual plan for improvements to increase flood protection for the residents of the Point Pleasant area and Franklin Pond areas. Public property also protected within the plan includes Interstate I-5, the Rio Cosumnes Correctional Center and the Union Pacific Railroad. The Sacramento County preferred plan, referred to commonly as 11F, includes a raised Lambert road and elevation and certification of Glanville Tract levees. However, construction of the 11F improvements will increase water levels in the North Delta area during peak floods, and as a result, implementation of this project is on hold pending identification of feasible mitigation measures. Sacramento County continues to collect impact fees from development activities in the upper watershed, which could be applied toward a permanent solution to flooding in the Point Pleasant area. Figure 1 shows the general project area.

San Joaquin River Basin South Sacramento County Streams Investigation - The U. S. Army Corps of Engineers (USACE) performed a feasibility study in this area known as the San Joaquin River Basin South Sacramento County Streams Investigation. This investigation addressed flood problems in the Morrison Creek stream group and Beach Stone Lakes basins and led to the South Sacramento County Streams Project discussed below.

South Sacramento County Streams Project - The Sacramento Area Flood Control Agency (SAFCA) is currently teamed with USACE to implement the South Sacramento County Streams Project, a flood improvement project on Morrison Creek, Florin Creek, Elder Creek, Unionhouse Creek and the North Beach-Stone lakes area. This project will allow safe passage of floodwaters from the upstream area through the City of Sacramento and into the North Beach-Stone Lakes area. SAFCA has determined that as a result of this project, peak flood stages could increase in the Point Pleasant and downstream areas. As part of mitigating the effects of the project on downstream properties, SAFCA has pledged to contribute $2 million toward a permanent solution to the flooding in Point Pleasant. SAFCA will be requesting the Reclamation Board to become the non-Federal sponsor of this project, with SAFCA becoming the local sponsor. Figure 1 shows the general project area.

McCormack-Williamson Tract - There have been several groups with an interest in the McCormack-Williamson Tract. Sacramento County and city have previously explored using the Tract as a floodway. A North Delta Flood Control scenarios document was prepared in August 1998 by Ensign and Buckley under the direction of CALFED staff and in coordination with Sacramento County and SAFCA. That document presents modeling analysis of six different flood scenarios, five of which included a flooded McCormack-Williamson Tract. (The sixth scenario includes breaching a downstream levee only, allowing for only partial flooding of the Tract and creation of tidal marsh habitat). This study was motivated in part by a renewed interest in the McCormack-Williamson Tract due to a proposal by environmental interests to purchase the tract and convert it to fisheries and wildlife habitats. Modeling results indicated that using the tract as a floodway would decrease stages upstream but would increase peak flows and stages downstream of the tract under certain flood scenarios.

The Nature Conservancy (TNC) has purchased the tract for conversion to fisheries and wildlife habitat with funding through a CALFED Category III grant. Although plans for McCormack-Williamson tract have not been finalized, possible alternatives for its conversion include: tidal habitat in the lower end with controlled breaches and farming in the northeast section; setback levees with shallow water habitat; weir and floodway; or combination of the above. Proposals for McCormack-Williamson Tract Restoration planning, design and monitoring were recommended for Bay-Delta Act funding in November 1999 and are expected to have funds made available in summer 2000. The current farming lease expires at the end of 2000 and may or may not be renewed.

Cosumnes River Feasibility Study - TNC has teamed with USACE to assess, identify, and implement ecosystem restoration and non-traditional flood control improvements along the lower Cosumnes River from the vicinity of Highway 16 to the confluence with the Mokelumne River. This effort received partial funding through a CALFED Category III grant.

Mokelumne River Feasibility Study - East Bay Municipal Utility District (EBMUD) has teamed with USACE to assess, identify, and implement ecological restoration and non-traditional flood control along the Mokelumne River from Camanche Dam to the San Joaquin River. This effort received partial funding through a CALFED Category III grant.

The Lower Mokelumne River Restoration Project - This project is sponsored by the Woodbridge Irrigation District and the City of Lodi to remove barriers to anadromous fish migration, support riparian restoration efforts, minimize ecological stressors, and restore spawning grounds. This effort received partial funding through a CALFED Category III grant.

Cosumnes River Task Force - The Cosumnes River Task Force was formed in 1997 as a result of the flooding along the Cosumnes River during the winter of 1997. Sacramento County is providing staff and acting as lead agency on the Task Force, a joint venture of Sacramento County, Lower Cosumnes Resource Conservation District (RCD), Sloughhouse RCD, Florin RCD, and Amador RCD.

Joint Settlement Agreement for the Mokelumne River - This is a joint effort by EBMUD, the Federal Energy Regulatory Commission, California Department of Fish and Game, and U.S. Fish and Wildlife Service (USFWS) to enhance the anadromous fishery and ecosystem of the lower Mokelumne River, including flow enhancement, riparian restoration, aquatic habitat restoration, and reduction and eradication of invasive non-native vegetation from riparian corridors.

The Lower Mokelumne River Stewardship Program – This program is sponsored by the Woodbridge Irrigation District and the City of Lodi. The goal of the program is to develop a watershed stewardship plan and implement watershed stewardship efforts within the lower Mokelumne River from Camanche Reservoir to the confluence with the Cosumnes River. Implement an Environmental Farm Plan encouraging voluntary assessment and reduction of non-point source pollutants and conduct biological monitoring. This effort received partial funding through a CALFED Category III grant.

The San Joaquin County Multi-Species Habitat Conservation and Open Space Plan Program - This program sponsored by the San Joaquin County Council of Governments (SJCOG) is to provide a mechanism to coordinate County Habitat Conservation Plan mitigation, enhancement and compensation for impacts to threatened and endangered species.

The Cosumnes Consortium Research and Monitoring Program – University of California, Davis Center for Integrated Watershed Science and Management is sponsoring this program to conduct fluviogeomorphic-ecological studies of the Cosumnes and Mokelumne River. This effort received funding through a CALFED Category III grant.

Delta Dredging and Reuse Strategy – Sediment Toxicity Study **–** The Delta Protection Commission has teamed with the Department of Fish and Game and the State Water Resources Control Board to develop General Order – Waste Discharge Requirements for dredging in the Delta. The General Order- Waste Discharge Requirements will facilitate potential actions associated with a North Delta solution including lower Mokelumne River channels dredging and limited levee setbacks, and levee improvements in selected reaches. This effort received funding through a CALFED Category III grant.

Assessment of Ecological and Human Health Impacts of Mercury in the Bay-Delta Watershed – The Department of Fish and Game is sponsoring this study in cooperation with the University of California, Davis Department of Environmental Science and Policy to provide information that will lead to reduction of mercury in resident fish levels throughout the Delta, including the Mokelumne and Cosumnes River inflow areas. The potential to create conditions for the methylization of mercury has been identified as a significant issue of concern in North Delta area planning efforts. This effort received partial funding through a CALFED Category III grant.

Canal Ranch Habitat Restoration Planning – The Department of Fish and Game is sponsoring this effort for planning restoration of seasonal wetlands, riparian and shaded riverine aquatic habitats and enhancement of ag management for fish and wildlife on 3,070 acres in the Northeast Delta. This effort receives funding through a CALFED Category III grant.

Mokelumne-Cosumnes Watershed Alliance - There has been widespread acknowledgement that there is much to be gained from coordination between these various efforts. Previously, the SJCOG took an initiative towards such coordination through a CALFED Category III proposal outlining a coordination effort for the Mokelumne–Cosumnes watershed. Also, SAFCA produced a "White Paper on Proposed North Delta Coordination and Integration Committee" outlining a similar effort. Subsequently, CALFED has teamed up with these and other interested parties to form the Mokelumne-Cosumnes Watershed Alliance (MCWA), building on the efforts initiated by the SJCOG and SAFCA. The MCWA aims to support communication, partnership, and integration of the numerous on-going and proposed projects in the Mokelumne-Cosumnes watershed area which includes the CALFED Ecosystem Restoration Program East Delta habitat corridor, North Delta, and Southern Sacramento County. Activities of the MCWA include development and management of a stakeholder database and creation of a Webpage to disseminate project and other pertinent information. Additionally, formation of focused sub-groups will allow the participants to maximize resources by sharing information and data on hydraulic and hydrologic modeling and geographic

information systems (GIS). CALFED has taken administrative lead of the MCWA, however, the Alliance has agreed that funding or in-kind service provisions for the effort will be shared among the participating entities. The full scope of the Mokelumne-Cosumnes Watershed Alliance effort is described in the "Mokelumne-Cosumnes Watershed Alliance Coordination Program Project Description" which is attached as Appendix A. More information on the Mokelumne-Cosumnes Watershed Alliance effort can be found on the MCWA webpage at www.mcwatershed.org which went online in March, 2000.

In addition to coordination with outside efforts, CALFED staff involved in the North Delta Improvements is coordinating with other related CALFED efforts and programs. For instance, one CALFED Levee Program goal is improvement of Delta levees to the PL84-99 standard. The Levee Program will provide funding for these improvements which will be a key component of a North Delta solution. As well, the CALFED Program has identified study of the feasibility of a 0-4K cfs Sacramento River Diversion as a Stage I action. Although a North Delta solution can be pursued independent of a Sacramento River diversion, these efforts are closely related and will be coordinated.

IV. North Delta Hydrologic and Hydraulic Background

The purpose of this section is to characterize the hydrologic and hydraulic issues that challenge the North Delta area.

Flood issues in the North Delta are numerous and complex. Watercourses that contribute to flooding in the area include the Mokelumne and Cosumnes Rivers and the Morrison Creek stream group. Figure 2 shows the hydrographs for the Mokelumne and Cosumnes Rivers, and Morrison Creek for the 100-year Delta specific storm. The 100-year Delta specific storm is the storm used for modeling scenarios presented in the "Recent Modeling Studies" section.

In addition to the magnitude of peak flows, it is important to consider flow patterns over time. Because of the topography and hydraulic dynamics, flow patterns change over the course of the flood event. For instance, the Point Pleasant/Beach Stone Lakes area contributes to downstream flows early in a storm event. During major events, this outflow is blocked by the Cosumnes/Mokelumne River stage which reverses flow and causes it to overtop the Lambert Road flood control structure. The Point Pleasant/Beach Stone Lakes area then becomes a flood "retardation" basin for both the Cosumnes/Mokelumne watershed and the upstream Morrison Creek watershed. This causes a significant flood hazard to the Beach Stone Lakes area. Figures 3a-3d show a time series of flows for the 1986 flood event that illustrates this dynamic. The County has proposed a project to alleviate the flooding in the Beach Stone Lakes area that will also result in raising levels downstream and require mitigation. (Flooding in this area is compounded by other local issues that are covered more fully in Sacramento County's

documentation of Alternative 11F). For purposes of analysis, modeling with and without 11F hydrology was performed and is presented in the "Recent Modeling Studies" section.

In addition to the Point Pleasant area, areas that have been vulnerable to flooding in the North Delta area include McCormack-Williamson Tract, Dead Horse Island, Staten Island, Tyler Island, New Hope Tract, Brack and Canal Ranch Tracts and what is known as the Franklin Pond area. Figures 4a and 4b present a photo-mosaic of the 1986 flood event and the approximate bounds of the 100-yr. floodplain in the North Delta region respectively. These figures illustrate the extensive nature of flood issues in the area.

A lack of channel capacity in order to safely pass the 100-year peak flows from the Mokelumne and Cosumnes Rivers and the Morrison Creek stream group is the central flood control challenge. The lack of channel capacity is well explained in the 1990 DWR Draft North Delta Program EIR/EIS, as well as in the North Delta Flood Control Scenarios (Ensign & Buckley, 1998). Current channel areas are too small to pass this amount of water without levee failures. As well, in actual flood events, situations have occurred to further constrict the channels at vulnerable areas. For example, boats from local marinas stacked up at the New Hope bridge and Miller Ferry in the 1997 event. This created hydraulic dams that further stressed that system and caused nearby levees to breach. Constriction areas of concern are illustrated in Figure 5.

Part of the channel capacity issue is a baseline issue. Part is due to an inability to perform maintenance dredging because of regulatory constraints. Current channel capacities are approximately 26,600 cfs for the North Fork of the Mokelumne River (based on current Network model estimates) and 13,300 cfs for the South Fork of the Mokelumne for an approximate combined capacity of 40,000 cfs. The channel capacity that would be required to safely convey flows from the 100-yr flood event (based on the Delta Specific Storm for the 1986 flow pattern) would be approximately 90,000 cfs. Inclusion of hydrology from 11F would necessitate a 100,000 cfs capacity to safely convey 100-yr flood flows.

Channels in the North Delta range from about 3,000 to 16,000 sq. ft. in cross sectional area. Channel areas along the Mokelumne River from the I-5 Bridge to New Hope Landing are reduced to nearly 3,000 sq. ft. Along the North Fork, the channel area at the Miller Ferry Bridge is restricted to about 5,750 sq. ft. Figure 6 shows a North Mokelumne River cross section in the vicinity of the Miller Ferry Bridge. The North Fork channel is generally restricted to approximately 6,000 sq. ft.

Channels along the South Fork are generally smaller than those along the North Fork. The bridge at New Hope is about 6,000-sq ft. in area. Figure 7 shows a South Mokelumne River cross section in the vicinity of the New Hope Landing Bridge. For 5 miles or so downstream of the New Hope Landing Bridge, channel areas generally range from 4,000 to 6,000 sq. ft. The channel areas between North and South Fork (south of Walnut Grove Road) differ in their most restricted areas by about 20%.

The difference in channel areas is reflected in channel velocities at peak flow. In the base condition, channel velocities are shown to increase in smaller channel areas as might be expected. The modeled velocities along the North Fork peak in the area near and just downstream of the Miller Ferry Bridge. This area has experienced levee overtopping and failure in 1986 and 1997. Along the South Fork, velocities are the highest again near and just downstream of the New Hope Bridge. Appendix B presents graphs of channel areas and channel velocities along the North and South Forks of the Mokelumne.

Sedimentation is an issue of concern in the system, particularly in the South Fork of the Mokelumne as obtaining permits for dredging in this area is very difficult due to environmental regulations. In the North Fork of the Mokelumne, sedimentation has not been as much of an issue as flow velocities are such that they keep the channels scoured.

North Delta levees have failed in numerous flood events over the years. The following briefly characterizes levees in the North Delta vicinity:

Levee Configurations - All survey elevations are referenced to NGVD (National Geodetic Vertical Datum). Levee crown elevations in the study area range from about 25 feet in the Glanville Tract area to about 10 feet on the southern tip of Staten Island. Levee slopes vary from 2:1 slopes on the waterside, 2:1 to 5:1 on the land facing side. Levees on McCormack-Williamson Tract and Dead Horse Island frequently overtop in large events. Levees along New Hope, Canal Ranch, and Brack Tracts as well as those along Staten, Tyler, and Bouldin Islands, will be eligible for funding to upgrade to the PL84-99 standard upgrade under the CALFED Levee Program.

Levee Integrity - In 1986 and 1997, levees in the North Delta were stressed to the point of failure. In 1986, levees near Thornton failed structurally, while levees on Tyler Island were overtopped. In 1997, levees near New Hope Landing and Miller Ferry Bridge were sandbagged. A structural levee failure on the Staten Island Levee was quickly repaired, and island inundation prevented. There is a significant historical pattern of stressing the levee system with high peak flows and subsequent overtopping and failure.

PL84-99 - Most of the non-Federal project levees in the North Delta area will be eligible for funding to upgrade to the Federal PL84-99 Standard with implementation of the CALFED Levee Program. This upgrade is detailed in the 1999 CALFED Long Term Levee Protection Plan. North Delta Levees have recently been mapped by private contractors, and upgrade quantities calculated. Meeting this standard would bring the levees up to Federal requirements and provide the additional levee height needed in low places.

V. Recent Modeling Studies

This section documents recent modeling of flood management scenarios in the North Delta area.

The current modeling effort builds on that presented in the August 1998 Ensign and Buckley report North Delta Flood Control Scenarios (Ensign & Buckley, 1998). Six scenarios were detailed in that report. Two additional scenarios have been developed and modeled for analysis. This includes a modified dredging scenario with and without the Sacramento County 11F project.

Scenarios 4C and 11F (11E) - To increase channel capacity, Scenario 4 from Ensign and Buckley, 1998 has been modified. The original Scenario 4 includes breaching the up and downstream levees of McCormack-Williamson Tract and dredging the North and South Forks of the Mokelumne River from Snodgrass Slough to the San Joaquin River. Scenario 4C is the same as Scenario 4, only with reduced dredging. Figure 11 shows the limits of potential dredging.

To address flood protection for the Point Pleasant and much of the Franklin Pond area, Sacramento County has recommended a conceptual plan referred to as 11F. In order for Sacramento County to implement scenario 11F, Sacramento County has acknowledged that implementation of a regional flood control plan to address the hydraulic impacts of 11F will be required. CALFED has included scenario 11F in recent modeling efforts for purposes of analysis. However, this inclusion should not be taken as an endorsement of Alternative 11F. CALFED is committed to achieving a regional flood control solution consistent with its Program objectives, but is non-committal towards providing the mitigation that Alternative 11F would necessitate. Due to modeling constraints, a slightly modified Scenario 11F referred to as Scenario 11E, has been used for modeling purposes. For the uses of this modeling analysis, Scenario 11F is very similar to Scenario 11E, and goes by that name. Scenario 11E consists of levee raising, and flow routing as shown on Figure 8.

Hydraulic Model Flows - NETWORK model runs of Scenario 4C and 4C with 11E have been made on the assumption of levee upgrade to the highest water surface elevations predicted by the model and that levees do not fail in the model. Scenarios 4C and 11E were modeled using a 100-year Delta Specific Storm event. The Delta Specific Storm Flow was also used to calculate a base flood flow and stage. Model results for scenarios 4C and 11E were then compared to the base flood. Combined upstream Cosumnes and Mokelumne River flows are about 113,000 cfs for this event (compared to approximately 85,000 cfs for the 1986 flood event). The Morrison Creek Stream Group plus Beach Stone Lakes local inflow contributes about 19,800 cfs to the system. Not all of the above-mentioned inflows are translated to areas south of Mokelumne/Lost Slough and Snodgrass/Lost Slough confluences as some flows are attenuated in the Beach Stone Lakes and Franklin Pond areas.

Modeling Results - Scenario 4C modeling results differ along the North and South Forks of the Mokelumne River. As shown in Figure 9, along the North Fork the model predicts that the differential of water surface elevations, between the 100-year flood event

and the base flood flow, vary from approximately 2 feet, in the vicinity of Lambert Road to a zero differential near the confluence of the North and South forks of the Mokelumne River. The modeling results for Scenario 4C with 11E predict a slight increase in peak water surface elevation over the base condition throughout much of the system. Water surface elevations become near or equal to the base condition in the vicinity of Dead Horse Island and remain so until the confluence with the South Fork of the Mokelumne River.

As shown in Figure 10, along the upstream main stem and South Fork of the Mokelumne, the model predicts that water surface elevations for Scenario 4C drop most below the base condition from just west of Dry Creek to the northeast end of the McCormack-Williamson Tract at Lost Slough. The water surface elevation increases slightly over that of the base condition near the southern end of McCormack-Williamson Tract since the tract is opened up to through flow in the model. The modeling results for Scenario 4C with 11E show water surface elevations lower than the base condition, though slightly greater than the 4C Scenario-only, from the vicinity of the Dry Creek confluence to just past Lost Slough. Water surface elevations for three scenarios are nearly equal from the vicinity of Sycamore Slough to the confluence with the North Fork of the Mokelumne.

Scenario 4C offers the chance to increase channel capacity through a program of dredging along the North and South Forks of the Mokelumne River. For example, model results for Scenario 4C show that, along the South Fork of the Mokelumne River, water surface elevations are lowered by roughly 2.5 feet from the base condition in the vicinity of the I-5 Bridge. Water surface elevations along the North Fork are lowered significantly by dredging almost all the way from Snodgrass Slough in the vicinity of the Lambert Road crossing to the confluence with the South Fork. On both the North and South Forks, dredging appears to have less effect on lowering water surface elevations as one approaches the confluence of the North and South Forks of the Mokelumne River.

Model Limitations - While the DWOPER model is adequate for planning purposes and gives a very good overview of the system operation, it may be limited in several respects:

1. Cross sections are too far apart in some critical channel areas, especially Snodgrass/Dead Horse/Staten area. This is close to where levee failures have occurred. There is about 4200 feet between cross sections in this area. In other areas, cross-sections may be a mile or more apart.

2. Geometry used in the model is dated 1990 and earlier. These cross sections are probably not accurate in terms of the channel bottom below normal low (fall season) water.

3. Bridges at New Hope and Miller Ferry are not in the model. These bridges restrict channel area to about 6,000 square feet (sq. ft.).

4. Several field surveys have shown that that there are conditions not reflected in the model. For example, there appears to be at least one not documented bridge just upstream of the Snodgrass Slough confluence; and there is a rather large floating marina on Snodgrass Slough not in the model

5. While the model has been calibrated to the 1986 flood event, it has not been calibrated to the 1997 event

VI. North Delta Scenarios Study:

There are two (2) objectives of this section. These objectives are summarized below and discussed in detail in the following sub-sections:

- The first objective is to identify possible scenarios to address flood control in the North Delta. In an attempt to reduce the amount of unwanted flooding, several scenarios have been examined. These scenarios are similar to some of those presented in the 1990 DWR North Delta Draft EIR/EIS, but have been modified and reduced in scope. There has been some preliminary local input on all of the scenarios presented.

- The second objective is to conduct a preliminary analysis of the strengths, weaknesses, and issues associated with the possible flood control scenarios and to provide suggested criteria for evaluation of the flood control scenarios.

This effort will guide and provide groundwork for public scoping and alternative development in the EIR/EIS process.

Possible Flood Control Scenarios

Alternative ND-1 - No Action - In the No Action measure, no project beyond the PL84-99 upgrade is developed to manage North Delta floodwaters and their effects. Study efforts would not lead to a constructed project or operational change. The CALFED Levee Program outlines the provisions for funding for levee improvements to PL84-99. These improvements will be locally driven.

Alternative ND-2 - Dredging and Levee Raising - One way to mitigate for channel aggradation and increase channel capacity is through dredging and levee raising operations. Dredging of the North and South forks of the Mokelumne River has been proposed as shown on Figure 11. Due to concerns over impacts to ecosystem habitats within the channels, the dredging was generally assumed to be limited to those portions of the channel which were between –10.0 msl and –20.0 msl feet elevation. A few sections were evaluated for dredging up to elevation –6.0 msl. Modeling results indicate that dredging south of Hog Slough has little benefit to a reduced water surface elevation.

Alternative ND-3 - Flood Bypass/Setback Levees - Another way to increase channel capacity is through the construction of setback levees creating a channel approximately 1,500 feet wide. The current channel width varies from about 200 to 1,000 feet. Setback levees could be constructed to create a flood bypass, which could be kept dry in non-flood times through a system of weirs. Interested stakeholders have proposed several bypass configurations.

Alternative ND-3.a – South Mokelumne River Bypass - Figure 12 shows the plan view for the first flood bypass scenario. Total length of the setback levees is approximately 46,000 feet. For comparison, in the 1990 DWR Draft EIR/EIS, a similar plan has a total setback levee length of 56,000 feet. In addition to construction of the setback levees, other key features include the construction of 12 overflow weirs, additional slope protection, and the elevation of Walnut Grove-Thornton Road.

Alternative ND-3.b – North Mokelumne River Bypass - The second bypass scenario is an attempt to simplify the bypass plan by making the required new embankment shorter, and by reducing the number of weirs required. Figure 13 shows the plan view. Total length of the setback levees is approximately 48,000 feet. In addition to construction of the setback levees, other key features include the construction of 2 weirs, internal levees to protect MT Ranch headquarters, additional slope protection, and the elevation of Walnut Grove-Thornton Road.

Alternative ND-3.c – Tyler Island Bypass - In the Tyler Island Scenario, a setback levee would be constructed on Tyler Island, as shown in Figure 14. The new levee length would be approximately 49,000 feet. There is an increasing depth of peat southward on Tyler Island. However, much of the new embankment would be constructed over an old railroad bed. Other key features include construction of 2 weirs, additional slope protection, and the elevation of Walnut Grove-Thornton Road.

Alternative ND-4 – Staten Island Floodway - Intentionally providing storage for peak flood flows to relieve peak flows elsewhere in the system is a potential means to address North Delta flood issues. One way to increase such storage would be to open up an island to intentional flooding. To evaluate this concept, the use of Staten Island for peak flow storage was considered. Figure 15 illustrates this scenario. In this scenario and in conjunction with use of McCormack-Williamson Track, Staten Island is overtopped at a designated weir providing peak storage. Staten Island could also act in part as a floodway as higher flows could exit through an outlet weir, however eventual pump-out of a large portion of the floodflows would be required. Potential key features of the alternative include construction of 3,800 feet of setback levee, 9,500 feet of interior levee to protect MT Ranch headquarters, an elevated section of Walnut Grove-Thornton Road, inlet and outlet weirs, additional slope protection, and acquisition of a floodway easement.

Alternative ND-5 – Staten Island Floodway & South Mokelumne River Setback Levees – This alternative is a hybrid of Alternative ND-3.a and ND-4, above. In this scenario Staten Island would be used, in conjunction with the McCormack-Williamson Track, as a floodway, Figure 16. The key scenario features are similar to that of Alternative ND-4. However, approximately 21,600 feet of setback levees would be constructed along the South Fork of the Mokelumne River in addition to the other key features of Alternative ND-4, above.

Preliminary Cost Estimates – Table 1 is a summary of the preliminary cost estimates for the various alternatives considered above. The cost estimates are limited to capital costs; operation and maintenance costs have not been included in these estimates. However, for Alternatives ND-4 and ND-5 present worth costs for pumping out Staten Island are noted in the comment section of Table 1.

TABLE 1 - ESTIMATED COSTS

ALTERNATIVE	ESTIMATED COSTS	COMMENTS
ND-1 – No Action	$ 15,000,000 + Incremental Cost of Levee Improvements	Annual costs of flooding and related cleanup of 1 main island (USACE). Impact of higher cost to achieve PL84-99 upgrade would need to be evaluated.
ND-2 - Dredging and Levee Raising	$ 55,000,000 + Cost of Levee Improvements	Maintenance dredging, to maintain channel capacity, not included.
ND-3.a – South Mokelumne Bypass	*330,000,000*	*Estimate not complete*
ND-3.b – North Mokelumne Bypass	270,000,000	
ND-3.c – Tyler Island Bypass	145,000,000	
ND-4 – Staten Island Floodway	100,000,000	Additional $ 1.6 million (Present Worth) necessary for island pump-out.
ND-5 – Staten Island Floodway & South Mokelumne River Setback Levees	*175,000,000*	*Estimate not complete* Additional $ 1.6 million (Present Worth) necessary for island pump-out.

Other Scenarios Considered

In addition to the above scenarios, the North Delta Improvements Group discussed possible alternative scenarios that were not further analyzed because they were considered to have significant potential drawbacks at the time they were discussed by the Group. These scenarios may be revisited in the public scoping portion of the EIR/EIS preparation process. These include damming the Cosumnes to solve flood control issues, which was set aside because of overwhelming environmental impacts. Installation of a flow barrier at Georgiana Slough {as mentioned in CVPIA Section 3406 (b)(14)} that could also potentially help alleviate some hydraulic pressure on the system was likewise set aside because of numerous environmental considerations.

Other Actions

In addition to the scenarios considered above, it is recommended that other actions be taken to increase flood capacity including:

- Because recent flood events have highlighted the potentially serious hazard of marina and other water structure damages (such as boats being knocked loose) during flood events that lead to further channel constrictions, it is recommended that modifications be pursued to decrease this hazard. Such modifications may include:
  Modifying existing structures to resist flood flows.
  Relocating large vessels prior to flood events or during a designated period of time when flooding is likely to occur.
  Marina management be contacted during the EIR/EIS process to incorporate such elements or other means to address potential hazards into a North Delta solution.

Other recommended actions include:

Identifying structures that may contribute to flooding risks, such as unauthorized houseboats, and developing appropriate solutions.

Better enforcement of navigation controls during flood events.

Better communication of proposed projects (for example, through broad circulation of application for Army Corps of Engineers permits) so that activities that may result in adverse impacts can be adequately addressed.

- Bridge modifications should be considered to increase channel capacity. For example, modifying the Miller Ferry Bridge to decrease the volume of concrete in the channel would increase channel capacity at a significant constriction point.

- It is recommended that recreation opportunities be incorporated into the North Delta solution where possible. The Delta Ad Hoc Committee on Recreation was formed to promote the incorporation of recreation opportunities and minimization of impacts to recreation into the CALFED Program actions. The Committee is coordinating with CALFED staff to identify potential recreation enhancements for inclusion in North Delta area actions which may include: restroom facilities, boat docks, hiking trails and picnic areas. A listing of specific recommendations of the Ad Hoc Committee on Recreation is included in the letter to Steve Ritchie of CALFED from the Ad Hoc committee dated March 29, 2000 and provided as Appendix C.

Scenario Analysis

The various possible flood control scenarios were evaluated against various criteria to evaluate each scenario's potential to address CALFED program objectives and to identify the strengths, weaknesses, and issues associated with each scenario. This evaluation is intended to be a course screening level evaluation of the various scenarios.

Figures 17 and 18 present a matrix for each baseline condition of without and with 11F hydrology respectively. The criterion included in the matrix were roughly applied for preliminary analysis of the scenarios presented in the White paper and are the suggested criterion for detailed analysis of scenarios during alternative development in the EIR/EIS process.

North Delta Improvements Group Scenarios Evaluation Matrix Evaluation Rationale

Ecosystem benefits: To what extent will the scenario provide ecosystem benefits? (To be further defined by CALFED ERP staff).

Flood control benefits: As all of the scenarios are to be designed to achieve the 100-yr level of flood protection, this category is neutral except for the No Action scenario.

Water Quality benefits: To what extent will the scenario provide better water quality for the environment and water supply?

Water supply reliability benefits: To what extent will the scenario provide more predictable or better quality water supply to in-Delta users and exporters?

Compatibility with CALFED ERP: To what extent are the elements of the scenario compatible with the goals and objectives of the CALFED ERP?

Compatibility with CALFED MSCS: To what extent are the elements of the scenario compatible with the goals and objectives of the CALFED MSCS?

Compatibility with CALFED Water Quality Program: To what extent are the elements of the scenario compatible with the goals and objectives of the CALFED Water Quality Program?

Compatibility with CALFED Water Conveyance: To what extent are the elements of the scenario compatible with the goals and objectives of CALFED concerning water conveyance?

Compatibility with MCWA Actions: To what extent are the elements of the scenario compatible with the actions of MCWA entities?

Compatibility with desirable Delta hydrodynamic patterns: To what extent are the elements of the scenario compatible with the goals and objectives of the CALFED ERP?

Regulatory Acceptability: To what extent are the elements of the scenario acceptable to the regulatory community?

Community/Local Government Buy-In: To what extent is the community and local government supportive of the elements of the scenario?

Reclamation District Buy-In: To what extent is the community and local government supportive of the elements of the scenario?

Fisheries impacts: To what extent does the scenario avoid negative impacts to fisheries?

Impacts to existing wildlife use: To what extent does the scenario avoid negative impacts to existing wildlife use? For example, the addition of 11F hydrology makes Alternatives ND-4 and ND-5 less attractive from a Sandhill Crane perspective as it threatens to cause more frequent flooding and damage existing Sandhill Crane habitat. Figure 19 shows land areas managed or potentially managed for conservation.

Taking of farmland out of production: To what extent does the scenario avoid/minimize the taking of farmland out of production?

Growth inducing impacts: To what extent does the scenario avoid growth impacts?

Economic impacts: To what extent does the scenario avoid creating negative economic impacts?

Upstream/Downstream Hydraulic Impacts: To what extent does the scenario avoid creating negative upstream or downstream hydraulic impacts?

Seepage concern-Impacts to farming activities: To what extent does the scenario avoid creating negative seepage impacts to farming activities?

Seepage concern-Impacts to levee integrity: To what extent does the scenario avoid creating negative seepage impacts to levee integrity?

Cost-Initial: How high is the initial cost of this scenario? A relatively high cost generates a lower rating and vice versa.

Cost-Maintenance: How high is the yearly maintenance cost of this scenario? A relatively high yearly maintenance cost generates a lower rating and vice versa.

Cost-sharing and funding resources: Are there current programs that would provide cost sharing for elements of this scenario? Availability of cost-sharing resources generates a higher rating.

Maintenance requirements: How difficult are the maintenance requirements to achieve? A high level of difficulty generates a lower rating and vice versa.

Individual Scenario Preliminary Analysis Comments

Alternative ND-1 - No Action – Islands in the Delta would continue to be threatened by levee failure, and in very high events, island inundation would be likely. As well, the Point Pleasant/Franklin Pond areas of Sacramento County would continue to flood from the backwaters of the Mokelumne and Cosumnes Rivers as well as the Morrison Creek watershed. The flood threat to the Rio Cosumnes Correctional Center, the Union Pacific railroad, and Interstate 5 would continue. The cost to achieve PL84-99 level protection in the Delta as provided for in the CALFED Levee Program would be greater.

Alternative ND-2 - Dredging and Levee Raising – Dredging is a maintenance intensive program and is invasive. Protection is less when Scenario 11E is considered as well. Dredging and levee raising does not offer full protection to all islands in the North Delta, especially when combined with Scenario 11E. As well, there are significant concerns about the viability of obtaining permits to dredge. (In 1986, channels were filled with about 30,000 cfs just before failure along Tyler Island. In current modeling, these areas are enlarged by up to about 1,500-sq. ft. by dredging. After enlargement, the

increase in modeled flow capacity almost doubles to about 58,000 cfs for scenario 4C plus 11E).

Alternative ND-3.a – South Mokelumne Bypass –

Alternative ND-3.b – North Mokelumne Bypass –

Alternative ND-3.c – Tyler Island Bypass – This option has the hydraulic advantage of placing water farther downstream than the other bypass scenarios.

Alternative ND-4 – Staten Island Floodway – This alternative has the advantage of reducing the channel constriction in the area where it is most needed, along the northern one-third of Staten Island. This alternative presents significant concerns regarding impacts to farming and ecosystem habitat if flooding exceeds approximately a one-in-ten year flood frequency.

Alternative ND-5 – Staten Island Floodway & South Mokelumne River Setback Levees – This alternative has the advantage of reducing the channel constriction in the area where it is most needed, along the northern one-third of Staten Island. Additionally, Alternative ND-5 provides additional opportunities to enhance ecosystem restoration efforts. This alternative presents significant concerns regarding impacts to farming and ecosystem habitat if flooding exceeds approximately a one-in-ten year flood frequency.

VI. Key Issues:

Several issues have emerged as the key points to consider and/or resolve in the formulation of a North Delta flood solution. Many have been long-standing issues in the North Delta area and some have surfaced as a result of the current physical and political climate. The study efforts of the group will focus around these issues. Key issues include:

- Early stakeholder input and buy-in is important.
- Coordination with ongoing North Delta programs and projects is essential.
- Early coordination with USFWS and other environmental Agencies is needed.
- The extent to which dredging is acceptable to regulators must be established.
- Consideration of new technologies, especially regarding slope protection methodologies, could enhance solution options.
- A flood control solution must be approached regionally.
- Future means to secure cost-sharing and funding should be considered.
- Solution should avoid or minimize the taking of farmland out of production.
- Liability issues associated with setback levees must be considered.
- Consideration of whether a North Delta solution will encourage further floodplain development must be addressed.
- More accurate modeling will be required when an EIR/EIS effort is launched.

- Seepage concerns must be addressed.
- Impacts to Mokelumne River fisheries must be considered.
- Local economic impacts must be considered.

VI. Summary:

CALFED staff will continue to identify and research North Delta solution ideas in anticipation of launching a formal EIR/EIS process. This will involve outreach to stakeholders and coordination with other ongoing efforts in the North Delta area. This will occur mainly through the meeting of the North Delta Improvements Group, through the North Delta reflector that has been set-up to facilitate communication, and through CALFED staff working closely with the MCWA. CALFED staff will continue to update and refine this White Paper to document research efforts and invites comment from agencies and stakeholders. Focus of North Delta study discussions will include the key issues listed above. It is intended that the North Delta Improvements Group will identify potential alternatives for consideration in the EIR/EIS for the North Delta Improvements. The Group recommends that these alternatives and any other alternatives that arise through the EIR/EIS public scoping and alternative development process be evaluated on the following criteria which are reflected in the evaluation matrices in Figures 17 and 18:

- Compatibility with ongoing North Delta programs and projects.
- Regulatory acceptability.
- Public acceptability.
- Environmental benefits.
- Flood control benefits.
- Water supply reliability benefits.
- Cost.
- Potential to secure cost-sharing and funding.
- Avoidance or minimization of the taking of farmland out of production.
- Ability to address growth inducing impacts.
- Ability to address seepage concerns.
- Ability to address fisheries impacts.
- Ability to address economic impacts.
- Maintenance requirements.
- Short-term effectiveness.
- Long-term effectiveness.
- Implementability.
- Protectiveness.