Reclamation District 799

Five Year Capital Improvement Plan

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1.0 Executive Summary

The Five Year Plan (Plan) has been defined in the Delta Levee Special Flood Control Projects Final Interim Guidelines for Providing Funding to Local Public Agencies (Interim Guidelines) as a document that describes, in detail, a District's integrated work plan to repair and improve flood protection infrastructure for the next five years. The requirements of the Plan are set forth in Attachment A of the Interim Guidelines (see **Appendix A**) and include:

- assessment of the status of existing levee systems and future goals,
- strategy to meet desired level of protection,
- identification of need for improvements to alleviate or minimize existing hazards,
- identification of the risks for current land use based on the existing assets,
- identification of opportunities for multi-objective project,
- habitat mitigation and enhancement, and
- compliance with CEQA and obtaining required permits.

The contents of the Plan are based on the requirements included in the Interim Guidelines. The Plan contains a detailed accounting of all technical information available, and the information is presented and analyzed for the purpose of determining potential levee stability issues. Stability issues are reviewed with regard to the District's five year level of protection goal, and projects to enhance stability or to gather additional technical information as required are proposed in order of priority. The objective of the Five Year Plan is to identify improvement projects to the Hotchkiss Tract levee system that will protect public facilities and provide public benefits for a five year period. Improved levees minimize the threat of levee failure, protect Delta water quality and protect the reliability of the State Water Project, Contra Costa Canal, Central Valley Project, and other local and non-local assets. The Five Year Plan provides a strategic approach to rehabilitation of the levees and identifies habitat mitigation possibilities to facilitate implementation of the levee improvement projects. It is intended that with the Plan in place, feasible projects will be identified and ready to implement as funding becomes available.

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2.0 Brief History of Hotchkiss Tract

2.1 Location

Hotchkiss Tract is located about 2 miles northeast of Oakley, California and bounded by Dutch Slough to the north, Sandmound Slough to the east, Rock Slough and the Contra Costa Canal to the south and west, and Little Dutch Slough to the northwest (see Figure 1). Reclamation District 799 (RD 799) is responsible for the care, upkeep and maintenance of six levee segments protecting Hotchkiss Tract, which are described below.

Dutch Slough runs along the north boundary of the levee district. A large portion of this reach of levee has some public access with many residences on the landward side as well as private docks on the water side. The remaining portion is adjacent to agricultural and grazing lands. The waterside levee slope is armored with riprap. Waterside levee slopes are often steep, and landside slopes have a variety of retaining structures where residences abut the levee.

Sandmound Slough runs along the east boundary of the levee district. A large portion of this reach of levee has some public access with many residences on the landward side as well as private docks on the water side. The waterside levee slope is composed mainly of grass slopes with intermittent bulkheads, and some riprap. Waterside levee slopes are often steep, and landside slopes have a variety of retaining structures where residences abut the levee. The RD 799 Maintenance Yard is located at roughly Station 135+00, on the west side of Sandmound Boulevard, off the levee landside toe.

Rock Slough runs along the southern boundary of the levee district. This reach of levee is not accessible by the public. It is mainly used as an access road for local ranchers to access grazing land adjacent to the levee. The waterside levee slope is well armored with riprap and some broken concrete. The landside levee slope is composed mainly of dirt with sparse vegetation and a few trees. The relative height of the levee is low on the west end, increasing in the easterly direction.

Contra Costa Canal runs along the southwest boundary of the levee district. This reach is not accessible by the public. It is mainly used as an access road for local ranchers to access grazing land adjacent to the levee. The waterside levee slope is generally composed of dirt and some vegetation with sporadic armoring of riprap or broken concrete; the levee is fully armored with rock at the new Fish Screen Project. The landside levee slope is mainly composed of dirt with sparse vegetation and a few trees. The levee is relatively low in height.

Little Dutch Slough runs along the western boundary of the levee district. This reach of levee is not accessible by the public. It is mainly used as an access road for local ranchers to access grazing land adjacent to the levee. The waterside levee slope is well armored with riprap and some broken concrete. The landside levee slope is composed of dirt with vegetation and trees. Some portions along this reach of levee have excessive vegetation and trees on the landside levee toe.

South Summer Lake Levee is an internal ring levee constructed by Shea Homes as flood protection for a new residential subdivision. This ring levee is located in the southeast corner of the RD 799 boundary and is approximately 17,000 Linear Feet. The levee slopes are covered with sparse seasonal grasses, with no riprap, and the crown is paved with a 12' wide asphaltic concrete access road.

2.2 Geomorphic Evolution

Hotchkiss Tract is located on the western side of the Sacramento Valley. This valley has been filled with a sequence of sedimentary soil deposits 25,000 feet thick overlying bedrock. The near-surface deposits and the potential for seismic shaking are of primary importance to the stability of the Hotchkiss levees.

The type and character of the surficial deposits of Hotchkiss Tract have been strongly influenced by sea level fluctuation within the last 80,000 years. During this time period, the sea level started at about its current level, dropped as much as 365 feet below the current level, and then rose again. This sequence affected both the environment of deposition and the types of sediments deposited in the Delta. The general environments of deposition on Hotchkiss Tract included; a fluvial (river) system which deposited predominantly finer-grained overbank silts from the San Joaquin and Sacramento River and which underlie most of Hotchkiss Tract; alluvial fan deposits spreading from nearby higher ground and consisting of a mixture of clayey distal fan deposits and some coarser-grained sediments from the distributary channels; dune sand deposits consisting of poorly graded sands blown off the river flood plains during periods of low runoff; and organic peat deposits formed when sea level rose and flooded the existing topography at the end of the last Ice Age.

These environments and their characteristic deposits apply variably across the surface of Hotchkiss Tract. Gently sloping sediments of the alluvial fans are present on the surface in the southwestern portion of the Tract, extending eastward of the Contra Costa Canal. They are overlaid by windblown sands in the north and eastern areas, with sand dunes forming the high points of the Tract, rising up to 17 feet above sea level. Subsequent rise in sea level flooded these deposits along the north and east margins of Hotchkiss Tract, depositing fine-grained overbank deposits and peat layers. These organic deposits are thickest in the northeast area and are the most peaty in nature in the southeast area.

Construction of perimeter levees, followed by the draining of the islands and crop cultivation, have subjected the surface organic soils to oxidation. Comparison of old topographic maps with more recent ones, thus indicates that the sand dunes on Hotchkiss Tract have become more pronounced surface features as oxidation and removal of overlying organic-rich soils has occurred.

Figure 1 – Reclamation District 799 Levee Location

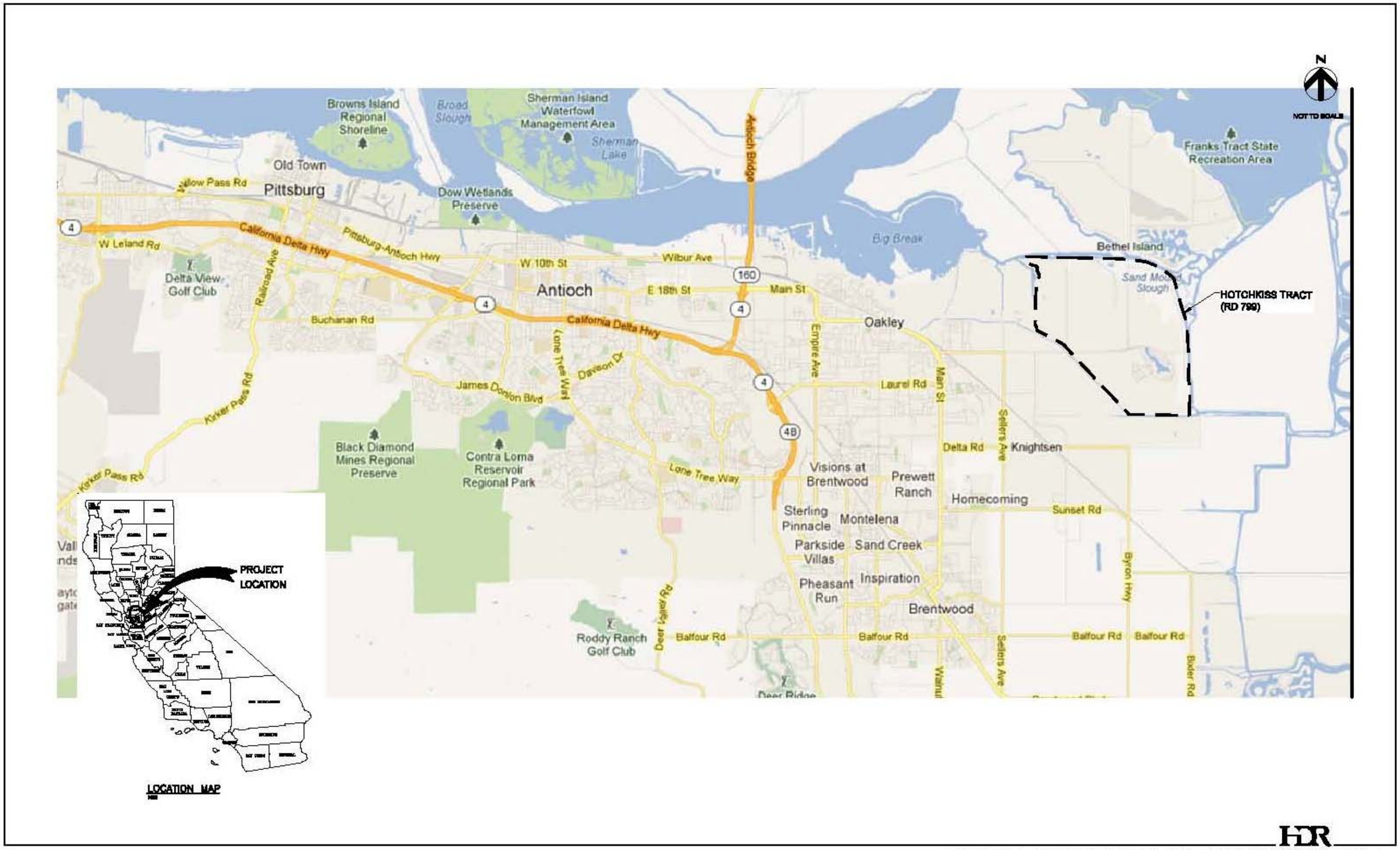

FIGURE 1 - RECLAMATION DISTRICT 799 (HOTCHKISS TRACT) LOCATION MAP

2.3 Historical Flood Events

There are no records of flooding events having taken place on Hotchkiss Tract. Although there have been no recorded historical flood events on Hotchkiss Tract, several nearby islands and tracts have previously experienced flood events. Measures have been taken, and will continue to be taken to make sure Hotchkiss Tract levees are providing adequate levels of protection.

2.3.1 Existing level of protection

According to a letter from the District to the U.S. Army Corps of Engineers, dated January 27, 2006, the existing Hotchkiss Tract levee system does not provide 100-year level of protection, although the levee geometry does meet FEMA Hazard Mitigation Protection (HMP) standard.

Future studies are needed in order to identify the levee segments that are at PL 84-99 levels, and what portions of the levees need to be upgraded to meet the PL 84-99 standards. PL 84-99 standards are defined by levees having the following characteristics:

- Maximum Waterside Slope 2H:1V
- Maximum Landside Slope (Varies with Peat thickness and levee height) 2H:1V to 5H:1V
- Minimum Crest Width 16 feet
- Minimum 1.5 feet of freeboard above 100-year flood stage

3.0 Identification of Need for Improvements to Alleviate or Minimize Existing Hazards

3.1 Local Assets

Today, Hotchkiss Tract is protected by approximately 9.0-miles of levee which encompass approximately 3,100 acres of land, according to the 1995 Sacramento Delta San Joaquin Atlas. All 9.0 miles of levee are non-project (non-federal) levees and are maintained by RD 799. RD 799 maintains and operates four modern pumping stations on Hotchkiss Tract. See Figure 2 (Contra Costa County Community Development Department, 2009) for details of the drainage system including location of the canals and pumps. Irrigation and canal ditch capacities are not available at this time. According to the 2000 census, the Island has a population of 968 people, with 489 dwelling units. The District is updating an emergency response plan in the event a dangerous condition could significantly compromise the levee system. Crop acreage on Hotchkiss Tract as reported in the Delta Risk Management Strategy (DRMS) Risk Analysis Report dated July 16, 2008 is shown in Table 1 below.

Table 1 – Crop Acreage on Hotchkiss Tract

Crop	Acreage
Alfalfa	1,587
Field Crops	3
Orchard	16
Truck*	75
Vineyard	28
* Truck crops include all other melon and vegetable crops	

In addition to agricultural uses, several recreational vehicle parks and marinas for local and public use are located on Hotchkiss Tract. In total, there are 9 small marinas and 1 medium sized marina, for a total of 306 marina berths.

The DRMS July 16, 2008 Risk Analysis Report indicates that the Hotchkiss Tract levee system protects approximately $128,000,000 in local assets. The following provides a list of the type of local assets for which the District can levy assessments:

- Land Use
- Agricultural
- Agricultural-Irrigated from District Facilities
- Marina-Recreation
- Urban

- Commercial
- Utilities and Utility Easements

The local assets listed above include recreational facilities, easements for infrastructure and local infrastructure. Although the assets listed above are local assets against which the District can levee assessment for flood protection, the levees also protect non-local assets which provide a public benefit.

3.2 Non-local Assets and Public Benefit

The Hotchkiss Tract levee system protects non-local assets which provide a public benefit, including infrastructure, utilities, water quality and water supply reliability. Below is a list of the non-local assets protected by the levee system:

3.2.1 Water Delivery System

- State Water Project
- Federal Central Valley Project
- Contra Costa Canal

3.2.2 Infrastructure

- Hotchkiss Tract provides emergency routes from Bethel Island and other islands/tracts via Jersey Island Road, East Cypress Road, and Bethel Island Road.
- Rock Slough Dam
- No major State-owned roads, or bridges are located within Hotchkiss Tract

3.2.3 Utilities

- Major 500 Kilovolts (kV) Transmission Lines
  - WAPA California Oregon Transmission Project
  - PG&E Table Mountain-Tesla line
  - PG&E Vaca Dixon-Tesla line
- Natural Gas Resources
  - Natural gas pipeline from Canada
  - Natural gas storage area
- Telecommunication and fiber optic lines

Figure 2 – Hotchkiss Tract Levee and Pumping Station Locations

FIGURE 2 - RECLAMATION DISTRICT 799 (HOTCHKISS TRACT) LEVEE AND PUMP STATION LOCATION MAP

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4.0 Consequences of Levee Failure or Breach

Consequences of Hotchkiss Tract levee failure or breach for local and non-local assets described in the previous chapter are described below. A more comprehensive discussion of risk and possible consequences of asset loss can be found in The Risk Analysis Report of the Delta Risk Management Strategy, dated July 16, 2008.

In addition to the costs incurred to repair or replace the assets destroyed by Hotchkiss Tract levee failure, an immediate cost would be pumping out the Island. The 2004 failure of the Upper Jones Tract, an Island of 6,259 acres which cost approximately $120 million to restore was used for to estimate the cost of restoring Hotchkiss Tract. This equates to about $19,100 per acre, and assuming inflation of 4% a year, would be about $26,100 in 2012. Accordingly it would cost approximately $81 million to pump out and restore Hotchkiss Tract (3,100 acres X $26,100 per/acre = $81 million). This estimate is conservative in that it does not account for the elevations on the interior of Hotchkiss, which can be more than 10 feet below sea level.

4.1 Transmission Lines

Three major electric transmission lines (greater then 500kV) cross Hotchkiss Tract: the California Oregon Transmission Project, operated by the Western Area Power Administration, the Pacific Gas and Electric Company (PG&E) Table Mountain-Tesla line, and the PG&E Vaca-Dixon-Tesla line. These lines work mainly to interconnect California loads and generation with loads and generation in the Pacific Northwest. The three lines through the Delta are operated as a coordinated grouping, with maximum imports or exports limited to provide some joint redundancy to help ensure reliability.

The combined load on these three lines is typically around 4,000 Megawatt (MW), though under some circumstances it can be as high as 4,800 MW (Mirzadeh 2006). This is approximately ten percent of statewide summer loads, which is less than the required planning reserve margin of 15 percent. However, other outages may occur at the same time as this disruption, so under some circumstances the loss of all three lines due to the failure of the Hotchkiss Tract levee system could cause operating problems.

PG&E also operates two other lines with less than 500kV capacity to provide local service to Hotchkiss Tract and nearby Delta Islands. Failure of the Hotchkiss Tract levee system would impact the ability of PG&E to serve the local delta community.

The DRMS report estimates the cost of a two month outage of two 500 kV lines to be $42,000,000. For additional information, please refer to the DRMS report.

4.2 Natural Gas Resources

According to the California Department of Conservation, Hotchkiss Tract has 9 active or idle natural gas and oil wells, and approximately 2,880 acres of gas and oil production fields.

Failure of the Hotchkiss Tract levee system would interrupt gas service and gas production occurring on Hotchkiss Tract.

4.3 Impacts to Water Quality

Hotchkiss Tract levees provide a public benefit by maintaining water quality and water supply reliability for cities and farms in the San Francisco Bay area, San Joaquin Valley, and Southern California. Hotchkiss Tract is situated where fresh river water and salty bay water meet and mix. Under typical summer salinity conditions in the lower Sacramento River, salinity rises sharply in the area of Hotchkiss Tract. Consequently, the levees are critical to controlling salinity intrusion to the interior Delta. A levee break would increase the rate and area of mixing and would allow the saline bay water to move further upstream, jeopardizing the fresh water supply taken from the Delta for the Central Valley Project water supply, the State Water Project and the Contra Costa intake. An artificial balance is maintained in the water exchanged between the Delta and the San Francisco Bay. Freshwater inflows regulated by upstream dams and diversions supply water to the Delta ecosystems and to farms and cities in central and southern California. Failure of Hotchkiss Tract levees would tip the water exchange balance in favor of more saltwater intrusion, which can ruin the water for agriculture and domestic uses supplied by the State Water Project and the Central Valley Water Project. Any reductions in the supply of imported Delta water could force water purveyors in many parts of the State to meet water demand with groundwater supplies. This, in turn, could renew land subsidence in the Santa Clara and San Joaquin Valleys and exacerbate subsidence in Antelope Valley and other areas that currently are reliant on imported Delta water supplies and prone to aquifer-system compaction.

The presence of the western Delta islands, is believed to effectively inhibit the inland migration of the salinity interface between the Bay and Delta. If Hotchkiss Tract were to become permanently inundated with saline water, the water available to the massive pumping facilities near the Clifton Court Forebay might become too saline to use. The timing of levee breaks and flooding is critical in this regard. Fortunately, most flooding occurs in winter and spring, when major saltwater intrusion is less likely. However, there are occasional levee failures under low-flow conditions. These failures can cause major short-term water-quality problems, even if the flooded areas are later reclaimed. Reducing increased salinity levels hinges on repairing the levee breaks, flushing the Delta with upstream reservoir releases, and pumping out salt water in the south Delta (DWR, 1982). Failure to repair the levees in a timely manner not only perpetuates elevated salinity levels in the Delta but also increases the damage to remaining portions of the levee systems. While the islands are inundated, the interior face of the levee is subject to wind generated wave erosion. The combination of several large levee breaches and waves rapidly eroding the levees from the interior increases the amount of time and material necessary to repair the levees, and subsequently, the amount of time to reduce salinity levels to acceptable levels. If emergency response teams are unable to repair all the levee breaches and pump water off the islands, it is conceivable that salinity levels will remain elevated and terminate an entire year or more of water exports. If a levee were to break and not be repaired, the situation would continue, resulting in long-term degradation of Delta water quality that would adversely affect several beneficial uses, including fish and wildlife, municipal and industrial, and agricultural uses.

The quality of water supplies derived from the Delta depends to a great extent on the path the water takes through the Delta to the export facilities. Permanent flooding of Hotchkiss Tract would worsen water quality and would require modifications in project operations involving releases of upstream storage to help offset the chloride levels. The water supply relied upon by the Central Valley Water Project, State Water Project and miscellaneous diversions directly from the Delta, and the regions they serve would be negatively impacted should water quality fall below acceptable standards due to a salinity increase caused by failure of Hotchkiss Tract levees. For additional information on the estimate of the cost to urban water uses which would result from a water shortage, please refer to the DRMS report.

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5.0 Strategy to Meet Desired Level of Protection

5.1 Description of the desired level of protection as a goal to achieve in the next five years

With all levees above the HMP Standard, but not at PL 84-99 levels, RD 799 has developed the following goals to be achieved in the next five years in order to reduce the risk of levee failure and loss of assets.

Goal 1: Improve District levees to reduce risk of levee failure and impacts to water quality, water supply reliability, other non-local assets and local assets

- Goal 1a: Improve all non-project levees to meet minimum PL 84-99 height and width standards
- Goal 1b: Gather additional information as required to determine extent of levee repair work necessary
- Goal 1c: Reduce the potential for wind and wave erosion

Goal 2: Ecosystem restoration and habitat enhancement

- Goal 2a: Identify mitigation opportunities
- Goal 2b: Increase habitat value by restoring larger, contiguous areas rather than several small areas that cannot support large populations and have less resiliency to outside forces.

5.2 Recommended Projects Needed to Achieve the Five Year Goal

The strategy to meet the desired level of protection, including phasing of the work, estimated cost of the work and schedule of the work is described in Exhibit A. The District anticipates that the projects will be funded through the Special Projects program, since assessments are insufficient for the District to cost share the levee rehabilitation projects.

In accordance with the requirements for the Five Year Plan (Appendix A), RD 799 has not explicitly identified projects which have a levee improvement component in addition to a habitat enhancement component. Most improvement projects will have a habitat enhancement component or mitigation requirements that will be formally developed as the improvement project is being developed. AB 360 mandates that all habitat impacts associated with levee improvements be mitigated, and requires that DWR's actions result in long-term net habitat improvement. Mitigation for levee improvement impacts frequently requires the creation of terrestrial, tidal or freshwater habitats. The multi objective studies, investigations, and projects are described below. Please see Figure 3 for a map of the specific locations for each of the design and construction projects.

5.2.1 Studies and Investigations

Study 1:	Levee Standards Development
Project Description:	Develop standards for each levee segment RD 799 is responsible for.
Goals:	Goal 1a and Goal 1b.
Required CEQA:	exempt
Permits:	None required
Mitigation:	None required

Study 2:	Emergency Action Plan
Project Description:	Develop an Emergency Action Plan for RD 799.
Goals:	Goal 1b
Required CEQA:	exempt
Permits:	None required
Mitigation:	None required

Study 3:	Survey of Levee System
Project Description:	Conduct survey of levee system to document the profile and cross section.
Goals:	Goal 1b
Required CEQA:	exempt
Permits:	None required
Mitigation:	None required

Study 4:	Operations and Maintenance Manual
Project Description:	Develop an Operations and Maintenance Manual to guide maintenance practices and activities, and assure continuity over the long term.
Goals:	Goal 1b
Required CEQA:	exempt
Permits:	None required
Mitigation:	None required

Study 5:	Geotechnical Investigation (PIR)
Project Description:	Conduct geotechnical investigation of RD 799 levees.
Goals:	Goal 1b
Required CEQA:	exempt
Permits:	None required
Mitigation:	None required

<u>Study 6:</u>	Phase 2 Magnetic Anomaly Study
Project Description:	Conduct study understand the results of the Magnetic Anomaly Tests performed several years ago to determine whether anomalies are pipes or a change in soil types.
Goals:	Goal 1b
Required CEQA:	exempt
Permits:	None required
Mitigation:	None required

<u>Study 7:</u>	Right of Way Study
Project Description:	Conduct study to determine district right of way. Findings may potentially lead to the determination that some ditches and other features may encroach upon district right of way.
Goals:	Goal 1b
Required CEQA:	exempt
Permits:	None required
Mitigation:	None required

<u>Study 8:</u>	Detailed Encroachment Study
Project Description:	Conduct study to identify encroachments in all RD 799 levees. Look specifically at retaining walls detailed in the Deferred Improvement Plan developed in Summer 2012.
Goals:	Goal 1b
Required CEQA:	exempt
Permits:	None required
Mitigation:	None required

5.2.2 Design and Construction Projects

Project 1:	Riprap Slope Protection
Project Description:	Add riprap to water side of levees for: • Dutch Slough for 2000 feet (From bridge) • Rock Slough from Sta 210+00 to Sta 211+00 • Contra Costa Canal for the entire length.
Goals:	Goal 1a, 1b, and 1c
Required CEQA:	Initial Study, Mitigated Negative Declaration
Permits:	USACE 404 permit, RWQCB 401 permit, DFG 1603
Mitigation:	To be determined
Project 2:	Additional Aggregate Base
Project Description:	Add additional aggregate base on Dutch Slough for approximately 1,000 feet (near Sta 80+00)
Goals:	Goal 1a
Required CEQA:	exempt
Permits:	None required
Mitigation:	None required
Project 3:	Little Dutch Slough Levee Widening
Project Description:	Widen levee on Dutch Slough from 1,000 feet East of Jersey Road to Little Dutch Slough
Goals:	Goal 1a, 1c
Required CEQA:	Initial Study, Mitigated Negative Declaration
Permits:	USACE 404 permit, RWQCB 401 permit, DFG 1603
Mitigation:	To be determined
Project 4:	Increase Levee Crowns
Project Description:	On Sandmound Slough and Little Dutch Slough, widen levee crowns to existing standards
Goals:	Goal 1a
Required CEQA:	Initial Study, Mitigated Negative Declaration
Permits:	USACE 404 permit, RWQCB 401 permit, DFG 1603
Mitigation:	To be determined

Project 5:	Slope Flattening
Project Description:	Flatten the levee slopes along: • Dutch Slough for 3,000 feet (near Sta 40+00; Sta 80+00) • Sandmound Slough for 1,000 feet (near Sta 250+00) • Contra Costa Canal – entire length • Little Dutch Slough (near Sta 450+00)
Goals:	Goal 1a, 1c
Required CEQA:	Initial Study, Mitigated Negative Declaration
Permits:	USACE 404 permit, RWQCB 401 permit, DFG 1603
Mitigation:	To be determined
Project 6:	Ice Plant Removal
Project Description:	On land side of levees along Dutch Slough, remove ice plant prohibiting visual inspection of levee (at Sta 05+00; Sta 40+00; Sta 80+00 approximately).
Goals:	Goal 1a
Required CEQA:	exempt
Permits:	None required
Mitigation:	To be determined
Project 7:	Vegetation Control
Project Description:	Maintain overgrown vegetation on Sandmound Slough (near Sta 200+00)
Goals:	Goal 1a
Required CEQA:	exempt
Permits:	None required
Mitigation:	None required
Project 8:	Wetland Design Project
Project Description:	Design Wetland area on Sandmound Slough (near Sta 180+00)
Goals:	Goal 1a, 2a, 2b
Required CEQA:	exempt
Permits:	None required
Mitigation:	None required

Project 9:	Cypress Road Roadway Raise
Project Description:	Raise Cypress Road at Contra Costa Canal above the levee elevation.
Goals:	Goal 1a
Required CEQA:	Initial Study, Mitigated Negative Declaration
Permits:	USACE 404 permit, RWQCB 401 permit, DFG 1603
Mitigation:	To be determined

Project 10:	Bulkhead Repair
Project Description:	Repair the bulkhead at the marina on Dutch Slough (STA 70+00)
Goals:	Goal 1c
Required CEQA:	Initial Study, Mitigated Negative Declaration
Permits:	USACE 404 permit, RWQCB 401 permit, DFG 1603
Mitigation:	To be determined

Project 11:	Slope Flattening (Land Side)
Project Description:	Flatten the land side levee slopes along: • Sandmound Slough for 500 feet (near Sta 110+00)
Goals:	Goal 1a, 1c
Required CEQA:	Initial Study, Mitigated Negative Declaration
Permits:	USACE 404 permit, RWQCB 401 permit, DFG 1603
Mitigation:	To be determined

Figure 3 – Reclamation District 799 (Hotchkiss Tract) Design and Construction Projects

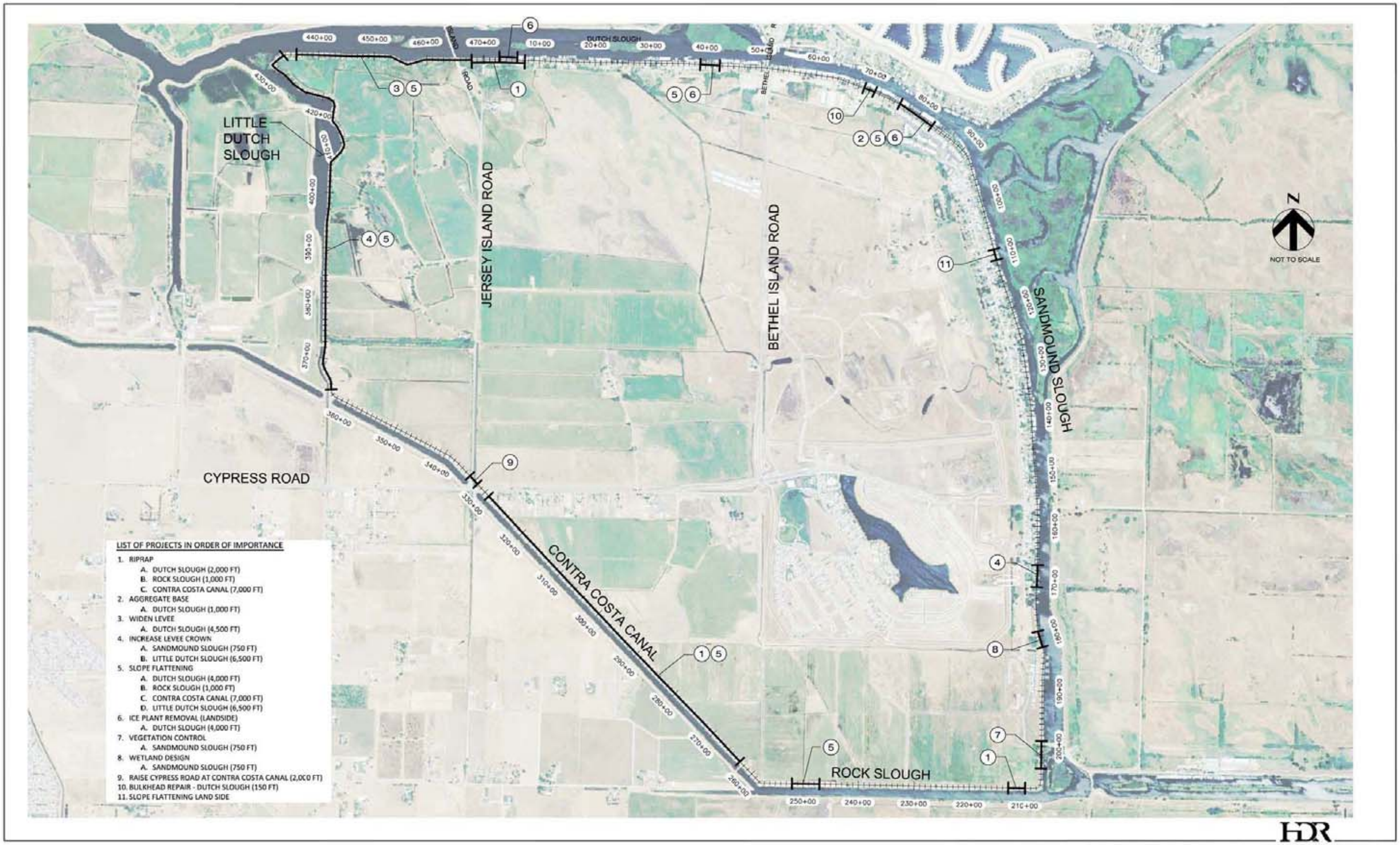

FIGURE 3 - RECLAMATION DISTRICT 799 (HOTCHKISS TRACT)
DESIGN AND CONSTRUCTION PROJECTS

5.3 Potential Obstacles to Meet the Desired Goal

Constraints most likely to affect RD 799 in meeting their desired goals include endangered species and associated permitting issues, lack of feasible mitigation sites on Hotchkiss Tract, and unreliable funding.

Endangered species most likely to be impacted by the projects proposed include, but are not limited to, giant garter snake, delta smelt, green sturgeon, and Chinook salmon. Potential impacts will be determined on an individual project basis through the environmental review process and may result in consultation with various regulatory agencies as required under Section 7 of the Endangered Species Act. RD 799 will try to avoid or minimize impacts using measures such as the timing of construction and employing environmental monitors during construction.

Waterside habitat enhancement along portions of the RD 799 levee system is difficult due to steep banks and surrounding property ownership.

The most challenging obstacle RD 799 faces with regards to achieving its goals is the lack of necessary funding. RD 799 is assuming that the projects described will be accomplished as a series of Special Projects funded through Project Funding Agreements between RD 799 and the Delta Suisun Marsh office.

6.0 Identification of the Risks for Current Land Use Based on the Existing Assets

Through discussion of the visual inspections, the District Board members and District engineer have determined that Hotchkiss Tract levees are most vulnerable to failure cause by flooding or earthquake damage. Failure from flooding could be caused by any one of the following:

- Overtopping
- Erosion
- Slope instability
- Burrowing animals

Areas of the existing levee system most susceptible to overtopping are those which do not meet the PL 84-99 height standard.

Areas of the existing levee system most susceptible to failure due to flooding resulting from erosion are those areas with inadequate riprap protection. The existing rip rap protection lacks the required coverage of the waterside slope to protect the levee from wind generated waves. The limited amount of rip rap below the high tide level exposes the unprotected levee embankment material to wind generated erosion damage. High winds originating from the north during periods of high tide and/or high storm runoff will seriously erode the unprotected levee slope. Accordingly, RD 799 feels that the lack of riprap slope protection is a critical issue which could affect the stability of the levee, should erosion damage occur.

Finally, failure of t he Hotchkiss Tract levees due to flooding could be triggered by slope instability. Areas prone to instability often crack as the levee shifts.

In addition to levee failure caused by overtopping, erosion or slope instability, levee failure caused by an earthquake event is a serious concern to RD 799. The Hotchkiss Tract levees are susceptible to earthquake-induced breaching from dynamic slope failure, inertially-driven cracking, levee liquefaction, and bearing capacity failure in liquefied native soils. Soils susceptible to liquefaction are present both beneath and within many levees. Liquefaction of sands down to about 50 feet can cause significant surface effects. Thus, the distribution of liquefiable sands buried beneath the peat is a critical objective of any subsurface mapping investigation. In the Delta, Atwater (1982) has shown that alluvial fans, sand dunes, abandoned distributary river channels, and floodplains are the primary geologic environments responsible for buried sand layers in the Delta. Appendix D contains a map showing the faults across Hotchkiss Tract.

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7.0 Data Collection and Monitoring

Due to the public benefit provided by Hotchkiss Tract levees and the valuable assets they protect, RD 799 has gathered some technical information for analysis and use in assessing the status of the levee system. In January 2012, RD 799 conducted a levee observation and evaluation. The purpose of the observation was to identify surface features that are considered evidence of changing physical condition that may result in a compromised levee integrity if not corrected. During the evaluation, seepage, boils, and voids were not identified, but the recommendations from the study encouraged additional detailed studies of the levee system.

Additional data gathering that is necessary to aid the assessment of the status of the levee system includes the following:

- levee surveys,
- groundwater quality monitoring,
- inclinometer monitoring,
- settlement plate monitoring, piezometer monitoring and
- boring logs.
- a LIDAR survey,
- Levee crown and cross section surveys,
- a bathymetric survey and
- an electromagnetic anomaly survey.

The District surveys the levee crest elevation and levee cross section every five years; the most recently completed survey dates from July, 2005.

Survey data is available from the DWR from LIDAR flights of the Sacramento-San Joaquin Delta conducted during late January and February of 2007. The work was conducted under contract issued by California Department of Water Resources to URS Corporation and had a vertical accuracy of 95% at 0.6’ and 90% at 0.5’ and a horizontal accuracy of 1.0 foot. Comparison of the 2005 ground survey and subsequent surveys undertaken at the completion of construction projects around the Island with the LIDAR data revealed discrepancies in levee crest elevations.

7.1 Bathymetric Data

A bathymetric survey of the Hotchkiss Tract levees can help identify areas of potential concern on the waterside levee slopes. One of RD 799’s five year goals is to improve levee stability, and a bathymetric survey can help identify the waterside levee areas which are potentially unstable. Once areas are identified, RD 799 can further investigate to determine if repair work is required (see Exhibit A for phasing of proposed additional study).

7.2 Groundwater Monitoring Wells

Groundwater quality monitoring is should be done in accordance with the terms and conditions of the Central Regional Water Quality Control Board General Order Waste Discharge Requirements to monitor changes in groundwater quality as a result of placement of dredge material. A series of deep and shallow wells were installed, and water samples taken from the wells and treated prior to, during and after placement of dredge material. Results of the monitoring program are available from the District or the Department upon request.

7.3 Vibrating Wire Piezometers

Additional data can be obtained by installing vibrating wire pressure piezometers to help determine the most appropriate rate of fill placement during construction by monitoring the pressure readings. Piezometers measure the pore-water pressure of the soil matrix by converting water pressure to a frequency signal via a diaphragm, a tension steel wire and an electromagnetic coil. At steady-state conditions, the pore-water pressure is equivalent to the hydrostatic water pressure at that depth. As fill material is placed on the ground surface over and adjacent to the piezometer, the pore-water pressures increase. In a well drained soil matrix, the increase in pressure dissipates relatively quickly as the excess water is "pushed out" to the adjacent lower-pressure areas as the soil material consolidates. "Lifts" of material can be placed at a rate and depth such that the pressures do not increase beyond a specified level and/or pressures return to or near the pre-project level (or other specified level) prior to placement of additional material. Piezometers data is primarily used during construction; however information obtained subsequent to construction provides an insight to sub-surface activity, which is a useful tool for identifying long-term solutions to levee instability.

7.4 Inclinometers

Inclinometers are used to measure the horizontal deflections of the levee embankment. An inclinometer is physically two separate components. One component is a PVC pipe with engineered grooves on the pipe interior which is installed in the ground via a bore-hole. The base of the pipe is located in a stiff, relatively stable material which will not move as a result of construction work or general levee movement. In order to locate this stiff, stable material, the pipe must extend down from the levee surface typically 60 to 100 feet. Only when the pipe is located in the stable material is the inclinometer useful for engineering evaluation purposes. The second component of an inclinometer is the inclinometer probe. The inclinometer probe is a stainless steel rod with wheels located at the top and bottom of the rod which run along the engineered grooves of the PVC pipe.

Located inside the stainless steel probe are sensitive tiltmeters. During an inclinometer reading, the inclinometer probe is inserted into the PVC pipe and the inclination of the probe is measured and recorded at two-foot interval stations from the bottom of the inclinometer pipe to the ground surface. The inclinometer software uses the probe tiltmeter measurements to determine the position of the inclinometer pipe at the time of reading and by comparing the pipe positions between a prior or baseline reading to the current reading, the deflection / movement of the pipe is determined.

7.5 Settlement Plates

Settlement plates provide an additional component to the levee stability monitoring, and may be used during construction of landside setback levees. On a weekly basis, a surveyor under the direction of the Engineer measured the elevations of each of the settlement plates.

7.6 Boring Logs

Boring logs can help provide an indication of the subsurface conditions at the boring location. These can be used for determining areas likely to liquefy during a seismic event, or to identify areas which can be used as borrow site for future levee repairs.

7.7 Electro-Magnetic Anomaly Survey

To meet Department of Water Resources' (DWR) monitoring records, a baseline electromagnetic (EM) survey is necessary for locating, identifying, and ranking potential deficiencies in levee integrity. The baseline data is developed in an ArcGIS format in order to be updated to reflect seasonal and yearly impacts on levee stability due to increases in hydraulic gradients.

The Survey is organized in two phases:

- Phase I - Data Collection and Overview Analysis, and
- Phase II - In-Depth Analysis and Evaluation.

Phase I was completed in September 2008 and consisted of the mobile EM survey to identify and report magnetic anomalies as well as provide a scoping for Phase II. Minimal analyses were conducted of the data except for the location of possible trouble areas.

The purpose of Phase II is to discover detail. Phase II will include further analyses of the EM data to identify subtle linear and focal features, and data modeling of specific locations as necessary to determine feature process, e.g., water infiltration. Phase II may include subsurface exploration.

Under the direction of the RD 799's Engineer, the Phase II: In-Depth Analysis and Evaluation shall:

- Identify the details of magnetic anomalies which are suspected to be large rodent burrows and dens within the levee (while they cannot be detected directly using these EM methods, they may be identified in contrast to their surroundings);
- Further define the location, scope, and extent of anomalies such as:

- Linear: these anomalies include pipes, cables, fissures (voids), etc.
- Focal: these anomalies include debris, e.g., concrete blocks, wood, rock, etc.; dry or water-filled rodent burrows and dens (voids), and the potential source points of water infiltration.
- Areal: these features include discontinuities in levee structure (fill types and repair areas, peat, sand, clay strata, etc.) and water infiltration routes; these data are useful in determining levee structure;
- Further analyze the data to determine, if possible, the cause of the anomaly and to define the location, scope, and extent;
- Collect further EM data using different configurations and methodologies as necessary;
- Collect further data using other geophysical tools as necessary to define the anomalies;
- Ground-truth (as necessary) the anomalies to investigate, further define, and/or verify the results;
- Document the findings in a format appropriate for ease of understanding of the anomaly and any associated processes;

Submit the data, metadata, and results of Phase II to DWR in georeferenced ArcGIS format with metadata, where appropriate.

7.8 Additional Information Available

In addition to the data available in Appendix B, the District and Department have produced a variety of reports, primarily geotechnical analyses, for use in evaluating the stability of the levee system. See Appendix C for a list of the technical analyses available. Also available are a variety of reports produced by other entities such as CALFED and the Delta Blue Ribbon Task Force which focus on Delta-wide issues such as subsidence reversal and the repercussions of a seismic event. While the Delta-wide reports are not extensively discussed herein, such information is an important resource available to decision makers as many of the reports address Hotchkiss Tract specifically, due to the public benefit provided by the tract.

8.0 References

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"Delta Risk Management Strategy Phase 1 – Draft Economic Consequences Technical Memorandum", Draft Report to DWR, March (URS 2007).

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Johnson, Blake. "Levee Observation and Evaluation', Reclamation District 799. January 24, 2012.

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Exhibit A

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Exhibit A

Strategy to Meet the Desired Level of Protection

		Estimated Funding Required	2012	2013	2014	2015	2016	Accumulated Total
Studies/Investigations								
Study 1 - Levee Standards	$	60,000						$ 60,000
Study 2 - Emergency Action Plan	$	15,000						$ 75,000
Study 3 - Levee Survey	$	25,200						$ 100,200
Study 4 - O&M Manual	$	24,000						$ 124,200
Study 5 - Geotechnical Investigation (PIR)	$	790,500						$ 914,700
Study 6 - Phase 2 Magnetic Anomaly Study	$	360,000						$ 1,274,700
Study 7 - Right of Way Study (irrigation ditch near levees)	$	36,000						$ 1,310,700
Study 8 - Detailed Encroachment Study	$	492,000						$ 1,802,700
Design/Construction								
Project 1 - Riprap	$	168,798						$ 1,971,498
Dutch Slough – 2000 feet (From bridge)								
Rock Slough – (Sta 210+00 to Sta 211+00)								
Contra Costa Canal – entire length								
Project 2 - Add Aggregate Base	$	67,665						$ 2,039,163
Dutch Slough – 1000 feet (~ Sta 80+00)								
Project 3 - Widen Levee on Dutch Slough from 1,000 feet East of Jersey Road to Little Dutch Slough	$	7,346,359						$ 9,385,522
Project 4 - Increase Levee Crown	$	1,696,148						$ 11,081,670
Sandmound Slough								
Little Dutch Slough								
Project 5 - Slope Flattening	$	6,651,180						$ 17,732,850
Dutch Slough – 2,000 + 1,000 = 3,000 feet (~Sta 40+00; Sta 80+00)								
Rock Slough – 1,000 feet (~ Sta 250+00)								
Contra Costa Canal – entire length								
Little Dutch Slough (~Sta 450+00)								
Project 6 - Ice Plant Removal from Land Side of Levee	$	127,964						$ 17,860,814
Dutch Slough – 500 + 3,000 + 500 = 4,000 feet (~Sta 05+00; Sta 40+00; Sta 80+00)								
Project 7 - Vegetation Control	$	25,463						$ 17,886,277
Sandmound Slough – 750 feet (~ Sta 200+00)								
Project 8 - Wetland Design	$	891,115						$ 18,777,392
Sandmound Slough – 750 feet (~ 180+00)								
Project 9 - Raise Cypress Road at Contra Costa Canal	$	2,027,575						$ 20,804,967
Project 10 - Bulkhead Repair	$	37,763						$ 20,842,729
Dutch Slough – (~ Sta 70+00)								
Project 11 - Levee Slope Flattening (Landside)	$	437,654						$ 21,280,383
Sandmound Slough – (~ Sta 110+00)								

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Appendices

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Appendix A
Five Year Plan Requirements

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Requirements for the Five-Year Plan

1. <u>Assessment of the status of existing levee system and future goals</u>

The Plan should provide a clear description of the following:

a. Describe historical flood problems, including:

- ◊ *Dates of events*
- ◊ *Estimated flood frequencies of events*
- ◊ *Levee performance during these events,*
- ◊ *Consequences of events*

b. What is the existing level of protection provided by the levee system? Include the source of this information. Specifically,

- ◊ *What portion of the levee is below or at HMP Standard?*
- ◊ *What portion of the levee is at PL84-99?*
- ◊ *What portion of the levee is above PL84-99?*

c. What level of protection is expected to be achieved at the end of the five years? Provide justifications in support of the anticipated outcomes.

2. <u>Strategy to meet desired level of protection</u>

The Plan should elaborate on the desired level of protection at the end of five years (item "c" above) and discuss the following:

a. A complete description of the desired level of protection as a goal to achieve in the next five years.

b. Phasing of the work, including a description of recommended projects needed to achieve the five year goal

c. Total estimated cost of the work and its distribution on a project-by-project basis over the five years

d. Potential cost sharing with other partners

e. *Schedule of work*

f. *Discussion of potential obstacles to meet the desired goal*

3<u>. Identification of need for improvements to alleviate or minimize existing hazards</u>

The Plan should provide an inventory of the local and non-local assets/critical infrastructures, both public and private, being protected by the levees. Local assets are those for which the

Local Agency can levy assessments for flood protection; non-local assets are those the Local Agency cannot levy assessments. The Local Agency should identify public benefits where applicable, such as:

◊ *Water quality*

◊ *Recreation*

◊ *Navigation*

◊ *Fish and wildlife*

◊ *Protection of State Infrastructure*

◊ *Other*

4. <u>Identification of the risks for current land use based on the existing assets</u>

The Plan needs to discuss risks associated with levee failure. In particular:

◊ *Consequences of levee failure or breach*

◊ *Existing deficiencies in the system, including existing seepage, boils, or voids under the levee*

◊ *Urgency of repair work*

5. <u>Identification of opportunities for multi-objective projects</u>

The Plan should, at a minimum, describe opportunities and significant constraints for achieving the following objectives:

◊ *Ecosystem restoration and habitat enhancement component*

◊ *Reversing land subsidence.*

◊ *Ensuring adequate and effective emergency response plans*

◊ *Benefitting water quality*

◊ *Improving water supply reliability*

6. <u>Habitat Mitigation and Enhancement</u>

The plan should describe how work to be carried out under the plan will meet the requirements of Water Code Sections 12314 which requires no net loss of habitat and consistency with net habitat improvement. The plan should describe the following:

a. Baseline habitat conditions prior to the plan

b. The anticipated impact to habitats and anticipated extent of the impact based on the identified needs for levee repair and other work outlined in the plan

c. How the requirements for no net loss of habitat, and net habitat enhancement will be met.

7. Compliance with CEQA and obtaining required permits

The Plan should describe all of the following:

a. Types of permits and environmental compliance documents required

b. Status of the environmental documentation

c. Status of the permit process

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Appendix B
Available Data

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List of Available Data

The following is a list of available data that RD 799 has collected:

1. Phase I Electro-Magnetic Anomaly Survey - Data Collection and Overview Analysis, September 2008.

2. Levee Observation and Evaluation, January 2012.

3. Seepage Analysis for Rock Slough Fish Screen East Setback Levee. March 2010.

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Appendix C
Available Technical Reports

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List of Technical Reports

The following is a list of available Technical Reports that RD 799 has produced:

1. Reclamation District No. 799, Hotchkiss Tract, Sheet Pile Feasibility Study. 2004.
2. Geotechnical Evaluation, Hotchkiss Tract Levees. September 1994
3. Levee Upgrading Study, Hotchkiss Tract. February 1993.
4. Phase II Encroachment Study, Hotchkiss Tract. May 1991.

Appendix D
Hotchkiss Tract Fault Map

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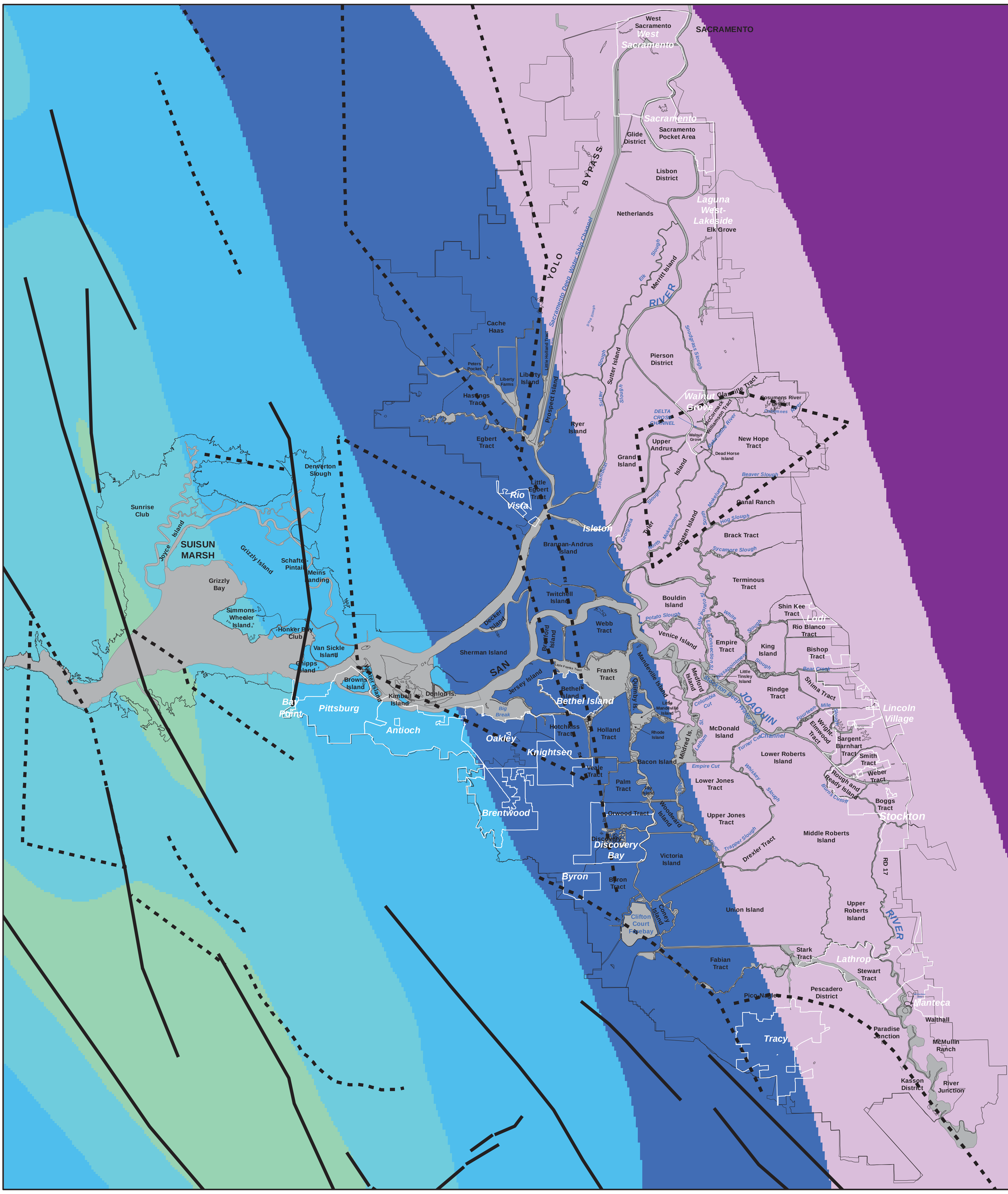

Legend

Mapped Faults

Surficial faults used in the hazard analysis

Blind Faults

Blind faults used in the hazard analysis

Legal Delta and Suisun Marsh Boundary

PGA, 100 Year Return Period

- 0.00 - 0.10
- 0.11 - 0.15
- 0.16 - 0.20
- 0.21 - 0.25
- 0.26 - 0.30
- 0.31 - 0.35
- 0.36 - 0.40
- 0.41 - 0.45
- 0.46 - 0.50
- 0.51 - 0.55
- 0.56 - 0.60
- 0.61 - 0.65
- 0.66 - 0.70

0 5 10 Miles

N

URS	DRMS 26815431	PGA Hazard for a 100-Year Return Period	FIGURE 6-19

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