

In-Delta Storage Program
February 2004 Public Workshop

Engineering Design &
Risk Analysis

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Presentation Outline

- Objectives
- Proposed Facilities
 - Embankment Design
 - Erosion & Piping Protection
 - Seepage Control
 - Integrated Facilities
- Project Cost & Construction Schedule
- Risk Analysis
- Summary

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Objectives of Engineering Design & Risk Analysis

- To determine the technical feasibility of the In-Delta Storage Project
- To ensure public safety and project reliability through...
 - Improved embankment design
 - Consolidation of inlet and outlet structures

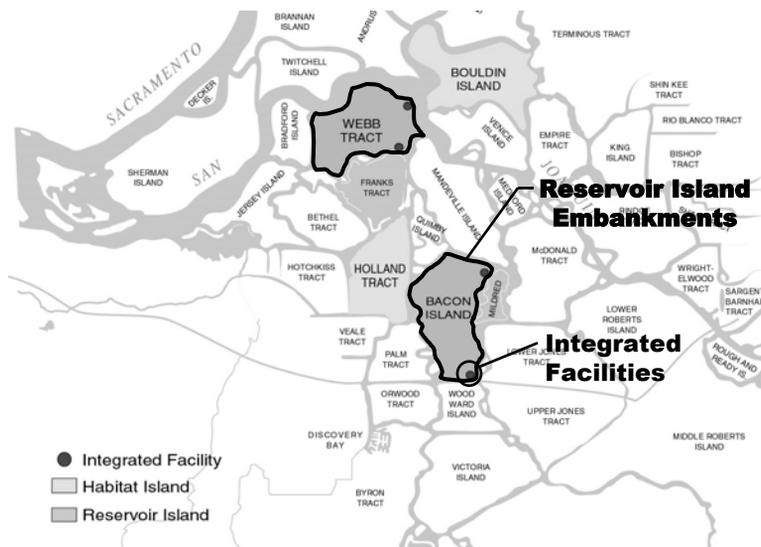
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Presentation Outline

- **Engineering Investigations**
- **Proposed Facilities**
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Proposed Facilities



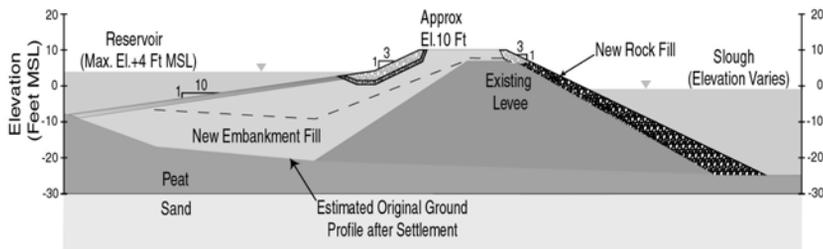
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Reservoir Embankment Design

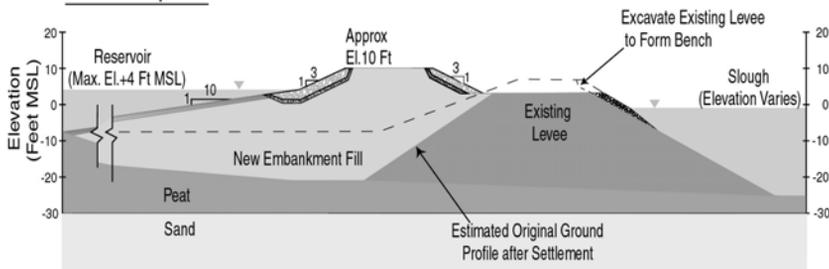
- “Rock Berm” Option
 - Construct new embankment on top of existing levee
 - 3H:1V Slough-side slope
 - Place Rock Fill on slough-side to meet stability criteria
- “Bench” Option
 - Bench created by removing a portion of existing levee to an elevation between 0 and 6 feet
 - Bench shifts new embankment towards reservoir
 - Erosion protection provided above bench elevation

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Rock Berm Option



Bench Option

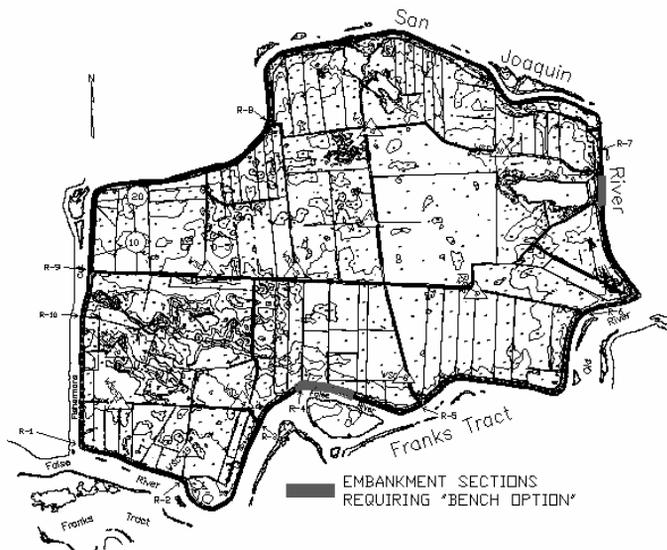


Recommended Embankment Design

- Recommended design includes both Options
 - “Rock Berm” used around majority (96%) of reservoir islands
 - “Bench” configuration used where:
 - Slough is deep
 - Existing slope too steep to place rock
 - Placement of rock would block portion of channel
- Design based on safety and risk analysis requirements established by DWR and Reclamation
- DWR’s Independent Board of Consultants reviewed and approved this design

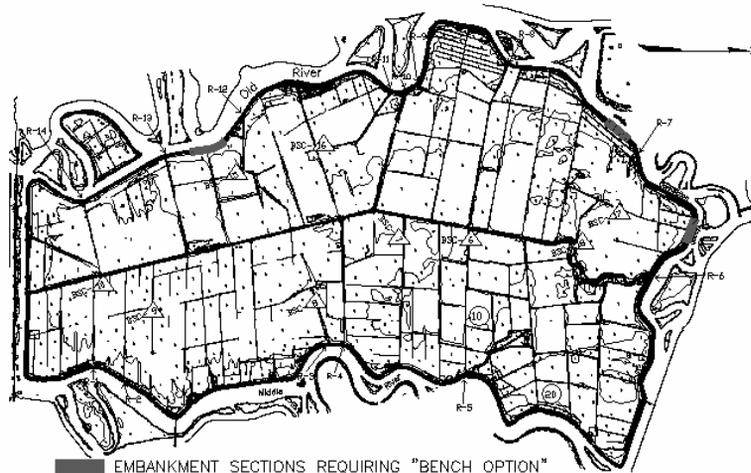
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Webb Tract - Bench Option Locations



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Bacon Island - Bench Option Locations



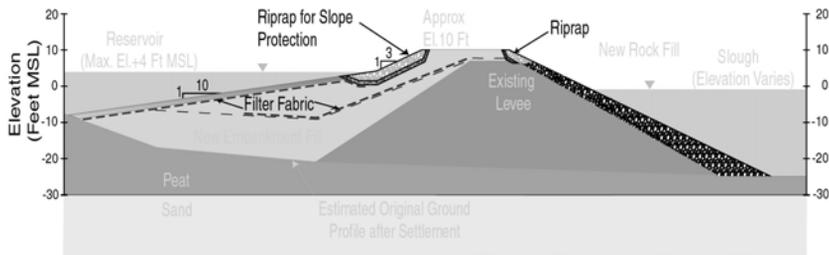
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Erosion & Piping Protection

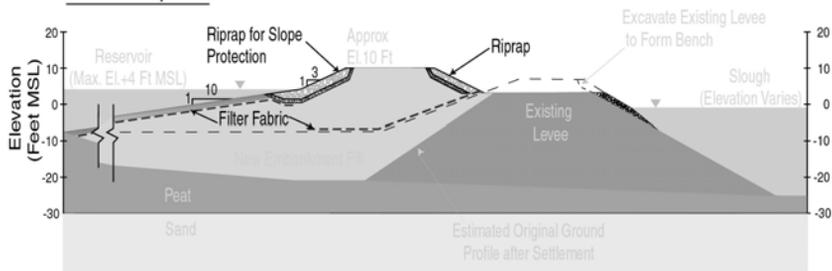
- Erosion Protection (from wind and wave action)
 - Riprap
 - upper portion of slough-side slope
 - reservoir-side slope from crest to elevation +3
 - Soil Cement
 - north and west facing 10:1 reservoir-side slopes (general prevailing wind and storm wind directions)
- Piping Protection
 - Geotextile Filter Fabric
 - reservoir-side slopes between existing levee and new embankment fill
 - 10:1 reservoir-side slopes

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Rock Berm Option



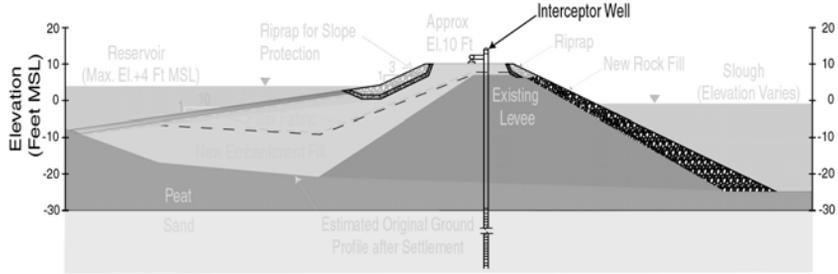
Bench Option



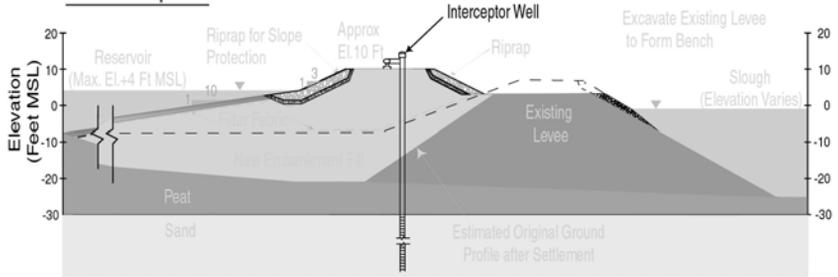
Seepage Control System

- Without Seepage Control
 - The proposed reservoir islands may increase seepage flows onto adjacent islands beyond the current rate
- With Seepage Control
 - Crop damage and increased pumping costs on adjacent islands will be prevented
- Proposed Seepage Control
 - Interceptor wells along reservoir embankment crest
 - Average Depth – 50 ft
 - Average Spacing – 160 to 200 ft apart
 - Average Pumping Rate – 6 to 8 gallons per minute

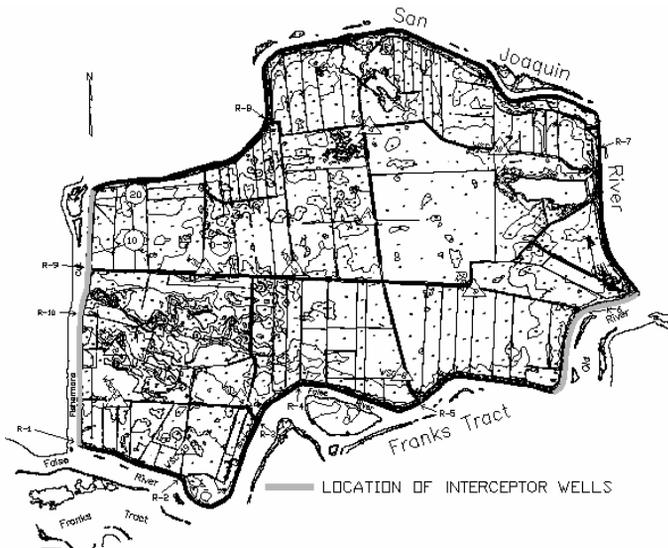
Rock Berm Option



Bench Option



Webb Tract Seepage Control Locations



Bacon Island Seepage Control Locations



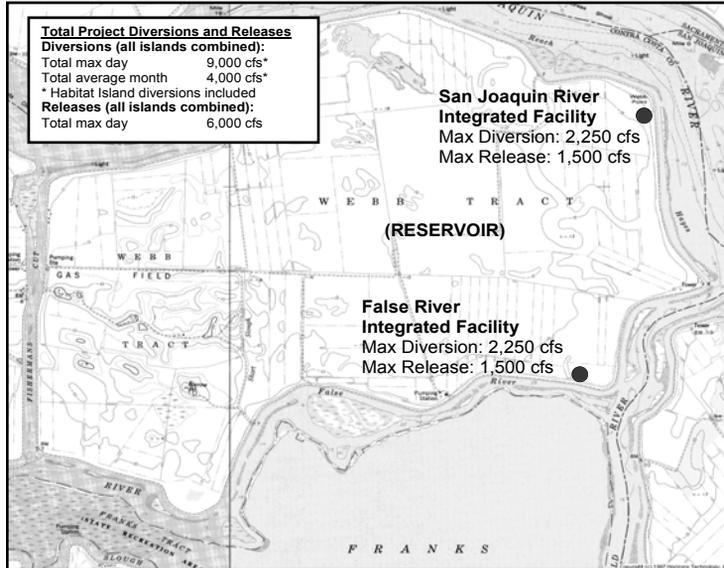
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Integrated Facilities (Diversion and Release Structures)

- Purpose of Integrated Facilities
 - To control diversions and releases from reservoirs
 - To combine all operational components into a single facility for more efficient operations
- Operational Strategy
 - To maximize gravity flow and minimize pumping to reduce operation and maintenance costs

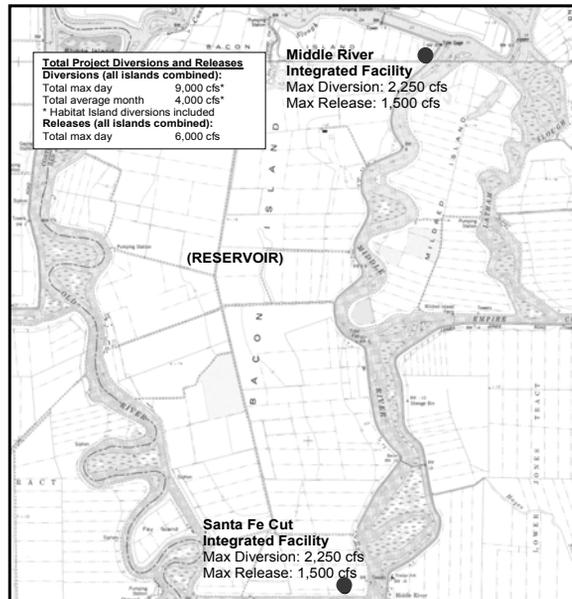
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Webb Tract Integrated Facilities



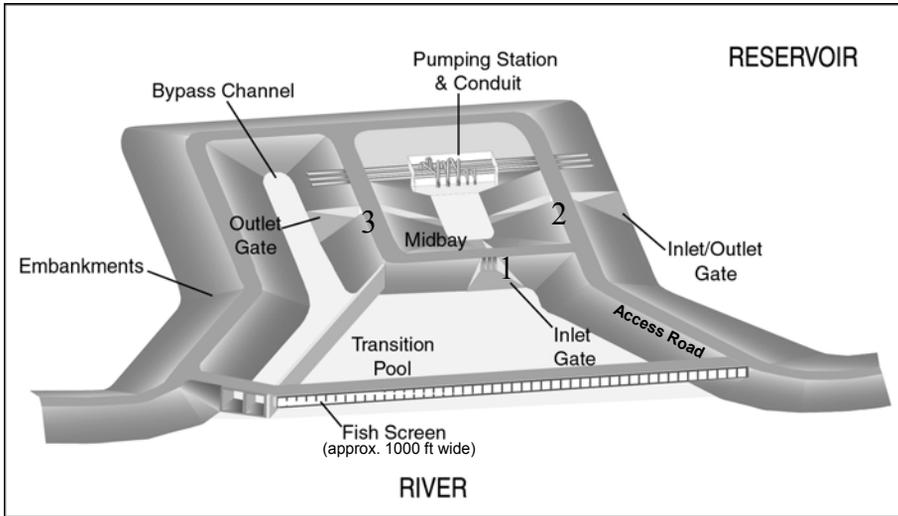
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Bacon Island Integrated Facilities



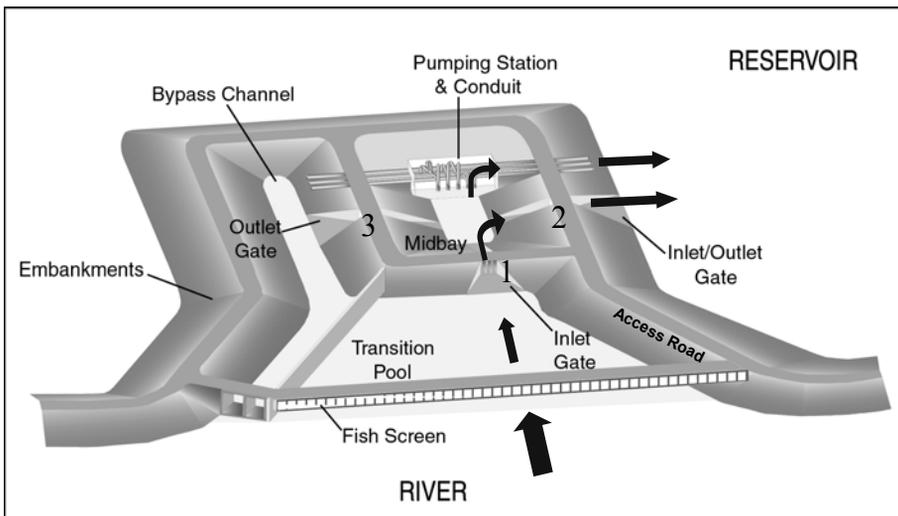
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Integrated Facility Components



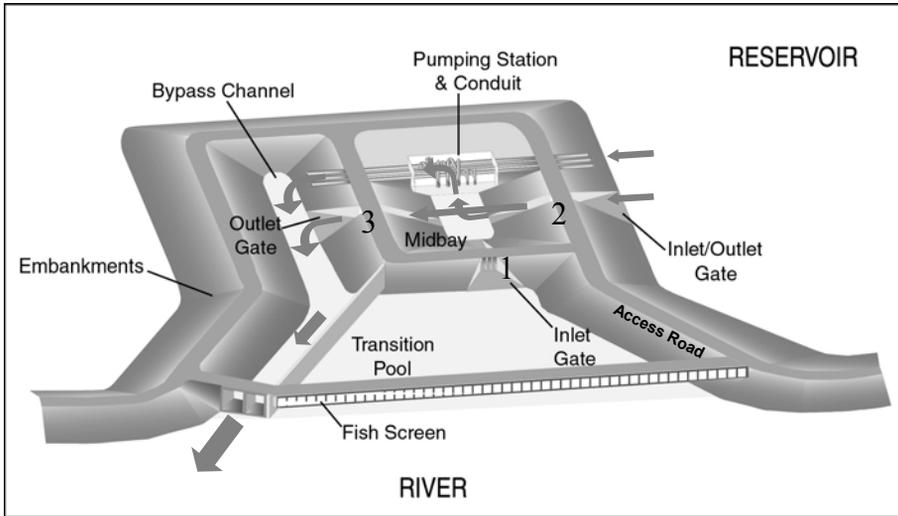
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Integrated Facility Diversion Flow Paths



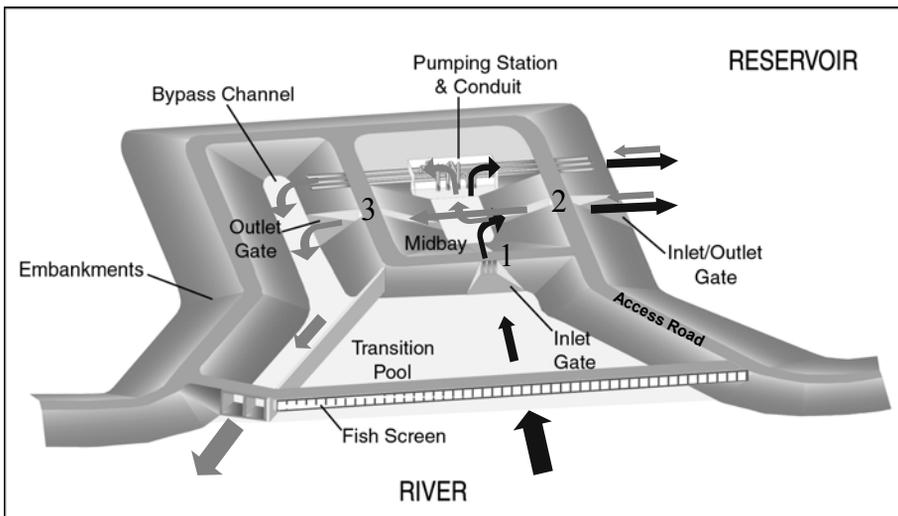
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Integrated Facility Release Flow Paths



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Integrated Facility Diversion & Release Flow Paths



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Key Features of Integrated Facility

- Integrated Facilities consolidate all controls for improved operation and maintenance
- Year-around diversions and releases are possible with gravity flow and pumping combinations
- State-of-the-Art Fish Screens similar to CCWD's Old River Intake
- Conceptual design approved by CVFFRT

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Project Cost Estimates

➤ Basis for Cost Estimates

- Material quantities
- Construction methods, task sequencing and construction duration
- Market research to obtain unit costs for materials and cost of labor and equipment
- Previous Investigations

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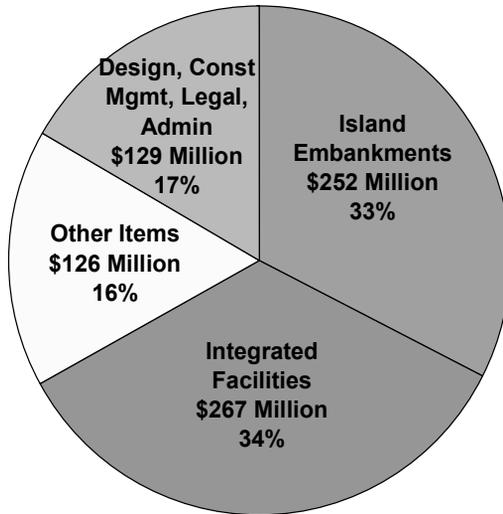
Project Cost

➤ Total Project Cost: \$774 Million

- Includes
 - Base Construction Costs
 - Land Acquisition, Mitigation, Demolition, Relocations and Permits
 - Contingencies
 - Engineering Design
 - Construction Management
 - Legal
 - Administration

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Project Cost Breakdown



- > Costs shown include contingencies where applicable
- > Other Items include:
Land Acquisition, Mitigation, Demolition, Relocations and Permits

Project Construction Schedule

Activity	Year								
	1	2	3	4	5	6	7	8	9
Engineering & Final Design	←→								
Bid & Award Process		↔							
Embankment Construction (Including Piping Protection & Erosion Control)			←→						
Seepage Control System							↔		
Integrated Facilities					←→				

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Risk Analysis

- Objective
 - To evaluate the ***risk*** (*probability and consequences of failure*) of the existing levees and IDS Project embankments and integrated facilities under all loading events
 - To assess public risk and potential economic losses that may result if a failure occurs

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Loading Events that could cause an Embankment Failure

- Flooding
 - Overtopping, piping / internal erosion
- Seismic
 - Foundation liquefaction, slope instability due to deformation & cracking
- Operational
 - Slope failure, piping / internal erosion, operational problems

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Consequences of Embankment Failure

- Inward Breach
- Outward Breach
- Potential to Flood Neighboring Islands

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Risk Analysis Findings

Reservoir Island	Annual Failure Probability		Chance that 1 Person would become a Fatality During 50-Year Project Life	
	Rock Berm	Bench	Rock Berm	Bench
Webb Tract	2.1%	2.3%	1 in 400	1 in 156
Bacon Island	2.1%	2.3%	1 in 400	1 in 137

- Risk from existing levees is 2 to 8 times higher than the risk from re-engineered embankments at Webb Tract and Bacon Island

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Summary

- The project design ensures public safety and project reliability
 - Safe embankment design recommended
 - Erosion & Piping protection provided
 - Seepage control measures (on project embankments) established to prevent increased pumping costs and crop damage on adjacent islands
 - Integrated Facilities provide flexibility in operations, improved operation and maintenance, and protection to fish
 - Overall risk lower than existing conditions
 - Cost of Project has been estimated
 - Project as designed is technically feasible
 - All work has been peer reviewed

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