

Bureau of Reclamation
Mid-Pacific Region
California Department
of Water Resources

Upper San Joaquin River Basin Storage Investigation

Workshop 6

August 27, 2003



Workshop Purpose and Objectives

- ◆ Review study status
- ◆ Present preliminary findings from recent work
- ◆ Discuss surface storage options being carried forward in the Feasibility Study
- ◆ Update on incorporation of conjunctive management into Investigation
- ◆ Discuss transition to Feasibility Study and anticipated milestones

Agenda

Workshop 6

Welcome and Introductions

Investigation Overview

Overview of Analyses

Surface Storage Options

Conjunctive Management Options

Next Steps

Participation Principles

- ◆ Participate – Attend the workshops
- ◆ Learn – Learn about resources, people, roles, and process
- ◆ Represent – Bring issues and interests forward from others whose interests you share
- ◆ Cooperate – Work with others in the workshops to share information and consider options
- ◆ Educate – Report back to others who share your interests

Workshop Ground Rules

- ♦ **Commit to Being Fully Present**
 - No cell phones, pagers, voicemail, etc.
 - Ask for what you need from the meeting process and participants
- ♦ **Honor Our Time Limits**
 - Keep comments and discussion concise
 - Stay focused on the topic – Use the parking lot for other issues
- ♦ **Respect Each Other**
 - Listen carefully to other participants
 - Respond to ideas and issues, not individuals
- ♦ **Support Constructive Discussion**
 - Suggest improvements and solutions
 - Build on others' ideas – Use “and” instead of “but”

Agenda

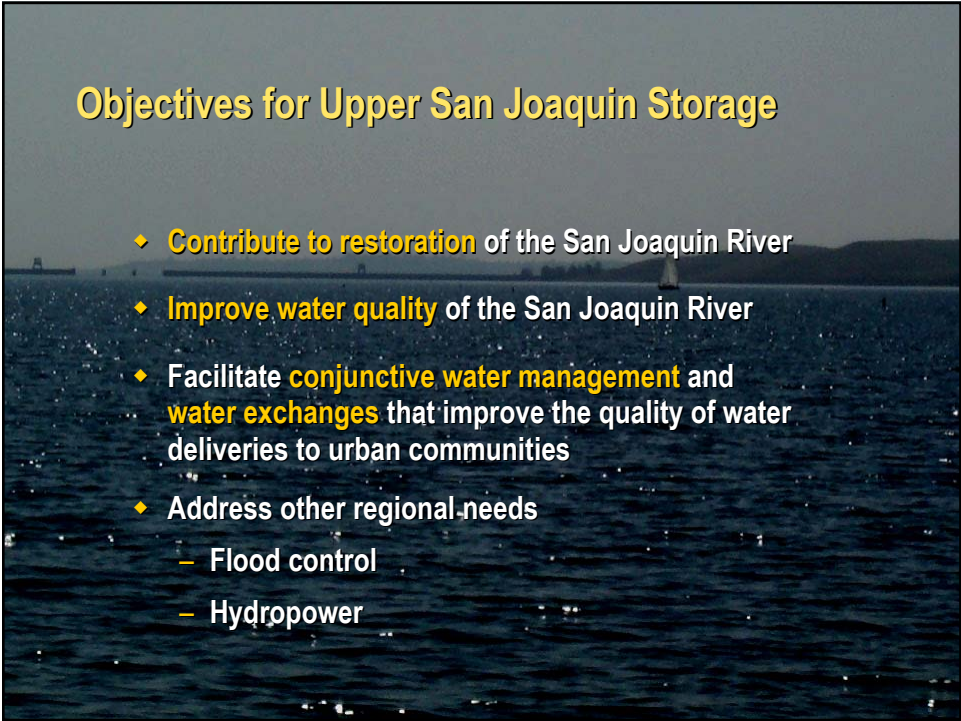
Workshop 6

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CALFED ROD Guidance

- ◆ Enlarge Millerton Lake by 250 to 700 TAF
OR
- ◆ Develop a functionally equivalent storage program
- ◆ Schedule
 - Initiate initial studies December 2000
 - Initiate Feasibility Study June 2001
 - Complete Feasibility Study June 2006



Objectives for Upper San Joaquin Storage

- ◆ **Contribute to restoration** of the San Joaquin River
- ◆ **Improve water quality** of the San Joaquin River
- ◆ Facilitate **conjunctive water management** and **water exchanges** that improve the quality of water deliveries to urban communities
- ◆ Address other regional needs
 - Flood control
 - Hydropower

Potential Extent of Primary Project Influence

- ◆ San Joaquin River
 - Friant to Merced River
- ◆ Eastern San Joaquin Valley
 - CVP Friant Division
 - Groundwater basin
- ◆ South of Delta Service Area



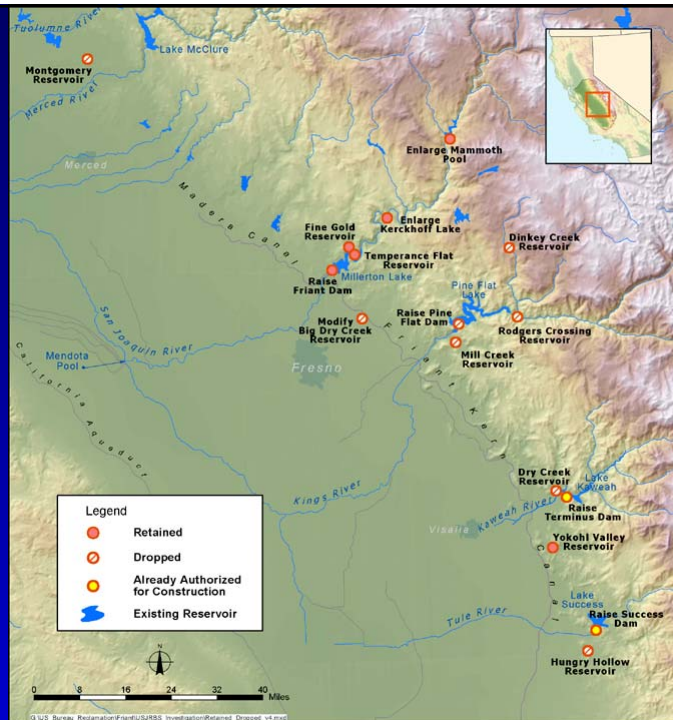
Opportunities to Store San Joaquin River Water

- ◆ Surface Water Storage
 - Enlarge existing facilities (raise dams)
 - New upstream facilities
 - Off-stream storage
 - Off-canal storage
- ◆ Groundwater Storage
 - Increase deliveries to recharge facilities
 - New recharge facilities
 - In-lieu recharge

Initial Screening

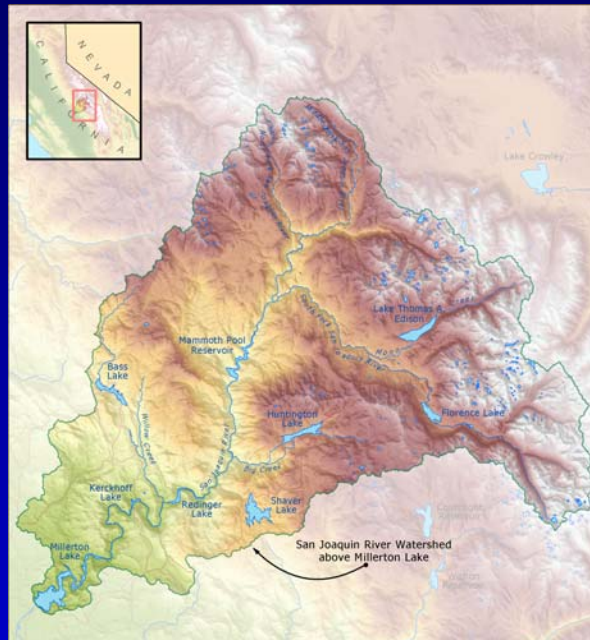
Surface Storage Options

- ◆ 16 sites identified
- ◆ 2 sites already authorized for construction
- ◆ 8 sites dropped
- ◆ 6 sites retained



Retained Surface Storage Options

- ◆ **San Joaquin River**
 - Raise Friant Dam
 - Temperance Flat
 - Enlarge Kerckhoff
 - Enlarge Mammoth
- **Off-stream**
 - Fine Gold Creek
 - Yokohl Valley



Groundwater Storage and Conjunctive Management

- ◆ Theoretical Analysis
 - Suggests additional conjunctive management is possible
- ◆ Stakeholder Interviews
 - Friant and non-Friant contractors
 - Interest in conjunctive management for regional benefits
 - No specific projects were identified for inclusion in the Investigation
 - Many stated that institutional barriers limit opportunities

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Overview of Surface Storage Options Analyses

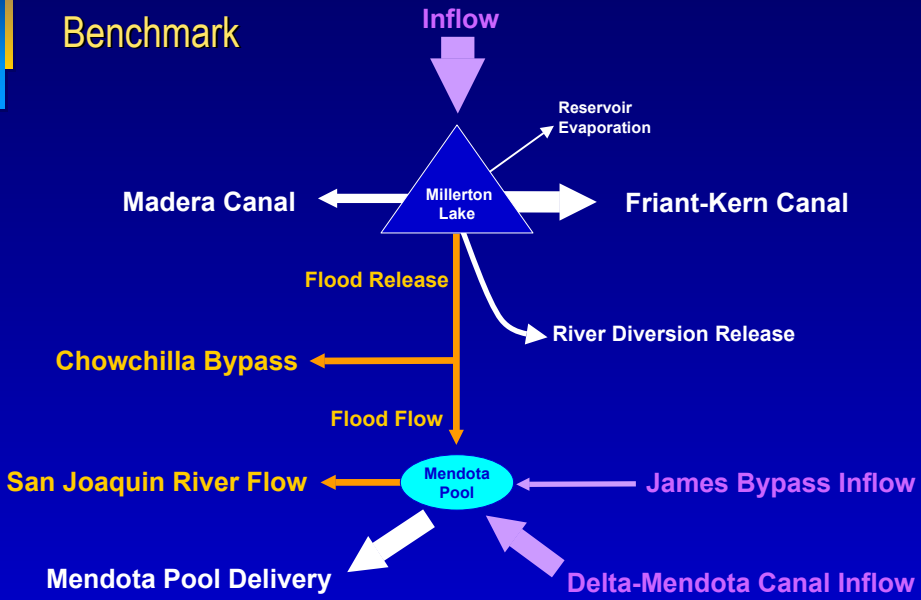
- ◆ Reservoir Operations Modeling
- ◆ Engineering and Geology
- ◆ Environmental Review
- ◆ Hydropower Generation and Impacts

Reservoir Operations Modeling

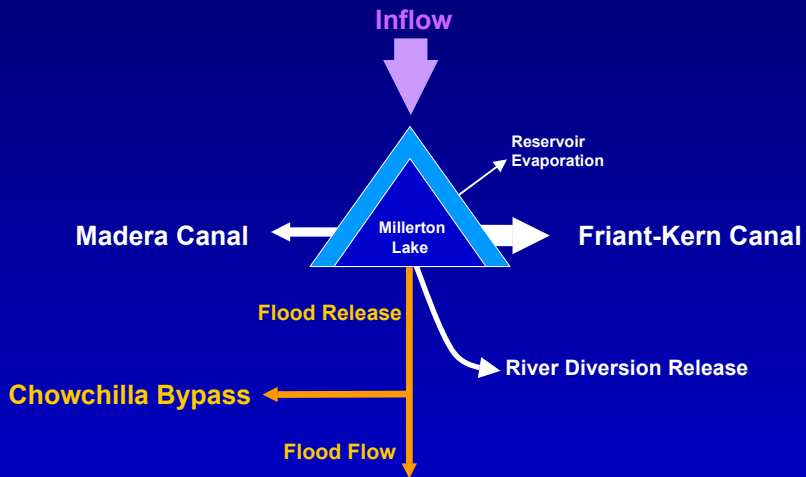
- ◆ CALSIM Friant module
 - Benchmark scenario
 - New storage options
- ◆ Single purpose analyses
 - Restoration flow
 - Water quality
 - Water supply reliability
- ◆ Sensitivity analysis
 - Annual vs. Multi-year operation



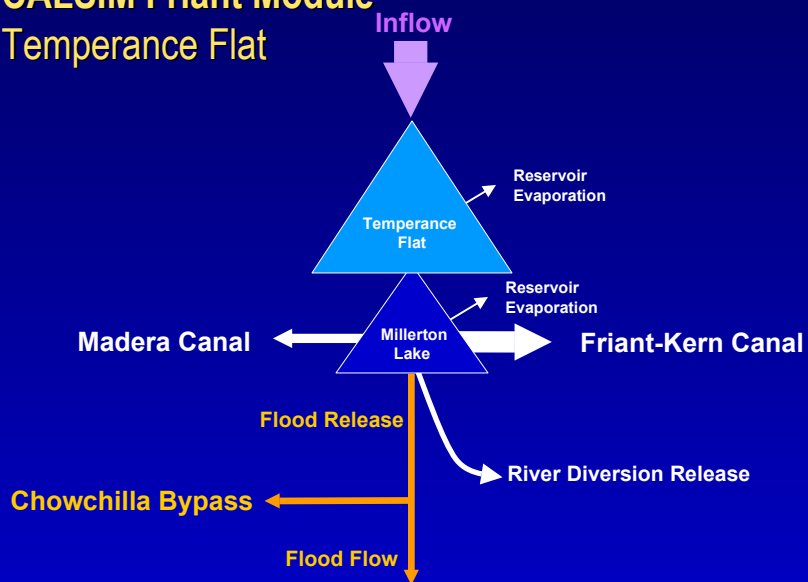
CALSIM Friant Module Benchmark



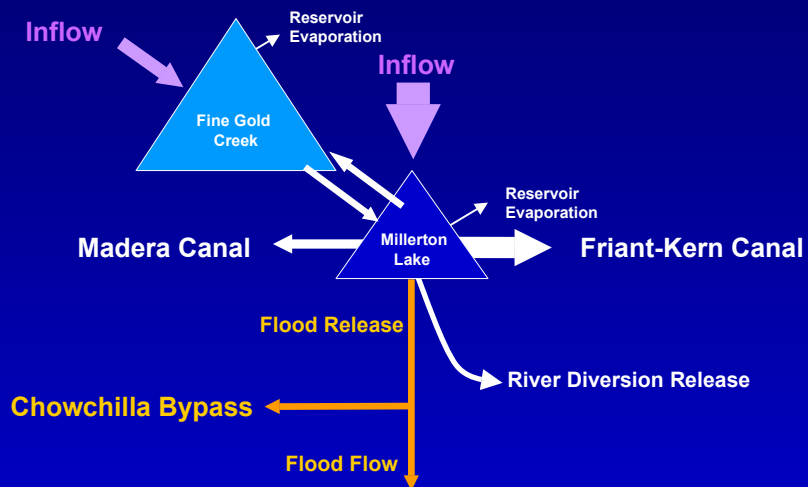
CALSIM Friant Module Enlarged Millerton



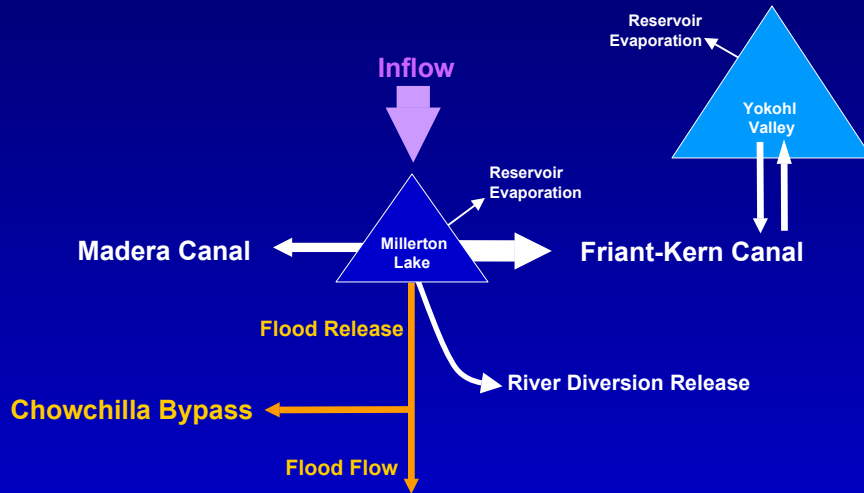
CALSIM Friant Module Temperance Flat



CALSIM Friant Module Fine Gold Creek



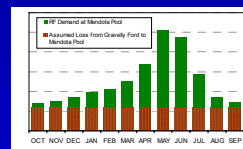
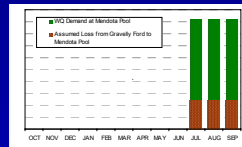
CALSIM Friant Module Yokohl Valley Reservoir



Single Purpose Analyses

Operate new storage for one purpose at a time

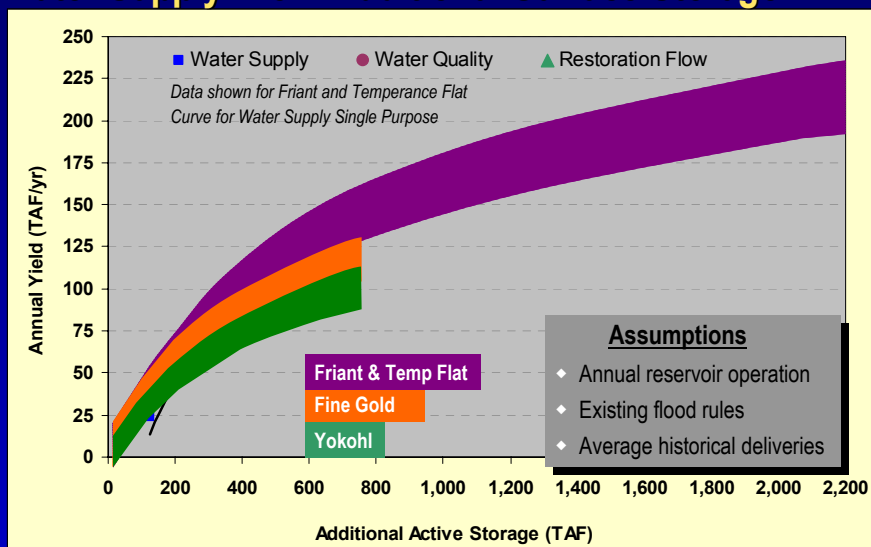
- ◆ **Water supply (WS)**
 - Delivery logic same as benchmark
- ◆ **Water quality (WQ)**
 - Late irrigation season releases
- ◆ **Restoration flow (RF)**
 - Follow natural monthly distribution



Single Purpose Analyses

- ◆ Same water allocation logic as benchmark
 - ◆ Class 1 and Class 2 contracts
 - ◆ Section 215 water
- ◆ Annual reservoir operation
 - ◆ Same end of year objectives as current project
- ◆ Existing conditions, laws, rules, and regulations

Water Supply From Additional Surface Storage



Single Purpose Analyses Findings

Annual Reservoir Operations

- ◆ Supply from new storage is similar for all three single purpose evaluations
- ◆ Difficult to support new river demands in critical years
 - Annual reservoir operation provides no carry-over
- ◆ System effects
 - Flood damage reduction below Friant and Mendota Pool
 - Same supply available for delivery at Mendota Pool, but different source mix

Overview of Surface Storage Options Analyses

- ◆ Hydrologic Modeling
- ◆ Engineering and Geology
- ◆ Environmental Review
- ◆ Hydropower Generation and Impacts

Engineering and Geology Site Review

Key activities in dam development

- ◆ Site selection
- ◆ Hydrologic studies
- ◆ Site characterization
- ◆ Foundation analysis
- ◆ Design
- ◆ Construction



We are
here

Engineering and Geology Site Review

Site Characterization Considerations

- ◆ **Site access**
 - Ease of access
 - Degree of potential impact
- ◆ **Staging area**
- ◆ **River diversion**
 - Cofferdam requirements
 - Dewatering or unwatering
- ◆ **Excavation requirements**
- ◆ **Material sources**
 - Borrow area
 - Quarry
 - Processing
 - Stockpiles

Overview of Surface Storage Options Analyses

- ◆ Hydrologic Modeling
- ◆ Engineering and Geology
- ◆ **Environmental Review**
- ◆ Hydropower Generation and Impacts

Environmental Review Data Sources

- ◆ Reconnaissance level of detail
- ◆ Field and aerial reconnaissance
- ◆ Prior studies, databases, aerial photography
- ◆ No field surveys

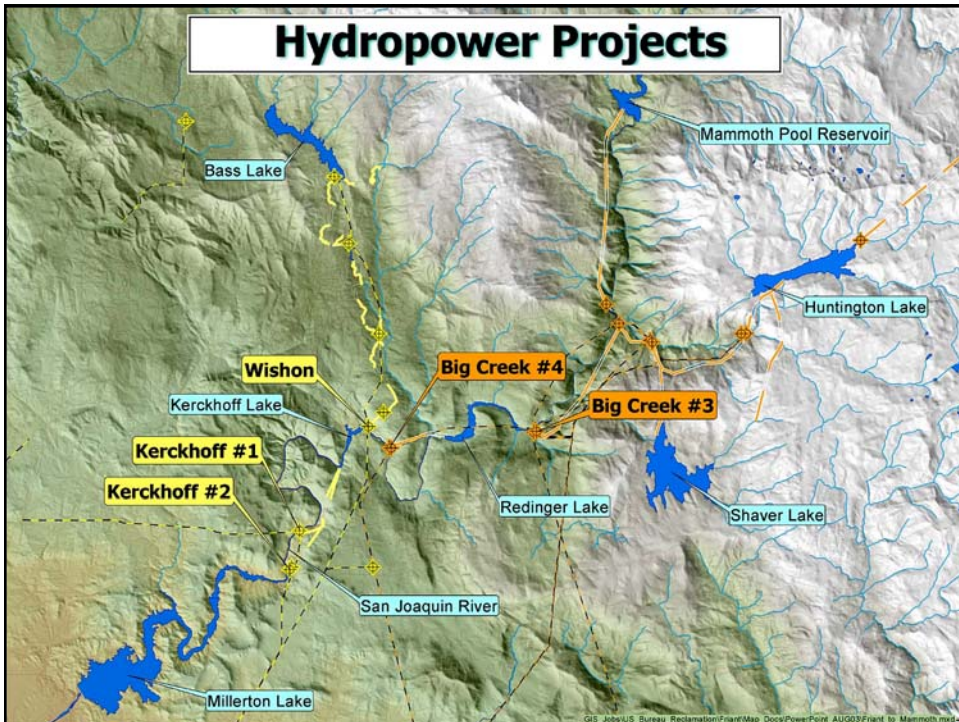
Environmental Review

Resources Examined

- ◆ Aquatic biology
- ◆ Botany
- ◆ Terrestrial wildlife
- ◆ Recreation
- ◆ Cultural resources
- ◆ Land use

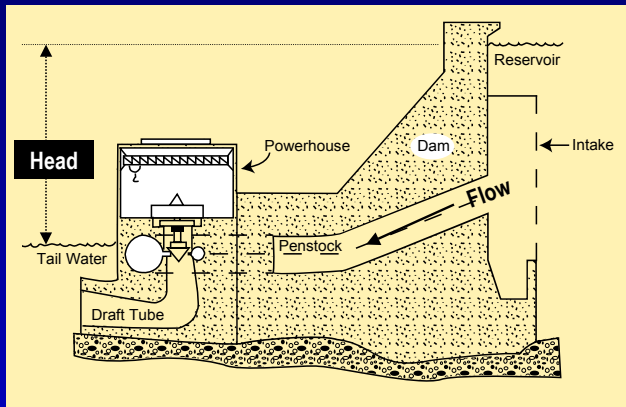
Overview of Surface Storage Options Analyses

- ◆ Hydrologic Modeling
- ◆ Engineering and Geology
- ◆ Environmental Review
- ◆ **Hydropower Generation and Impacts**



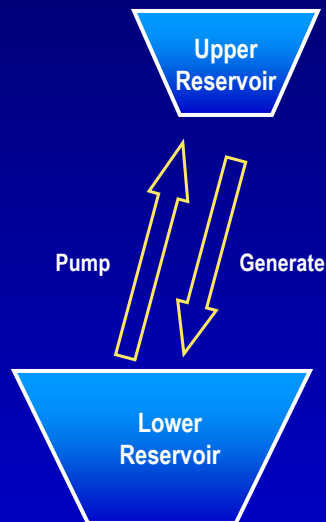
Hydropower Basics

- ◆ Generation potential affected by
 - Head
 - Flow
- ◆ Head depends on reservoir levels
- ◆ Flow depends upon operations of reservoirs



Common Hydropower Terms

- ◆ **Pump-back storage**
 - Long-term (seasonal)
 - Off-stream
 - Water supply emphasis
- ◆ **Pumped storage**
 - Short-term (daily)
 - On- or off-stream
 - Power emphasis



Hydropower Impacts and Generation

- ◆ **Focus**
 - Energy generation potential
 - Impacts to existing operations
- ◆ **Major Assumptions**
 - Analysis based on CALSIM output
- ◆ **Limitations**
 - Indicative only, dependent upon simplifying assumptions
 - Energy value not yet estimated
 - Potential impacts not analyzed in system context

Agenda

Workshop 6

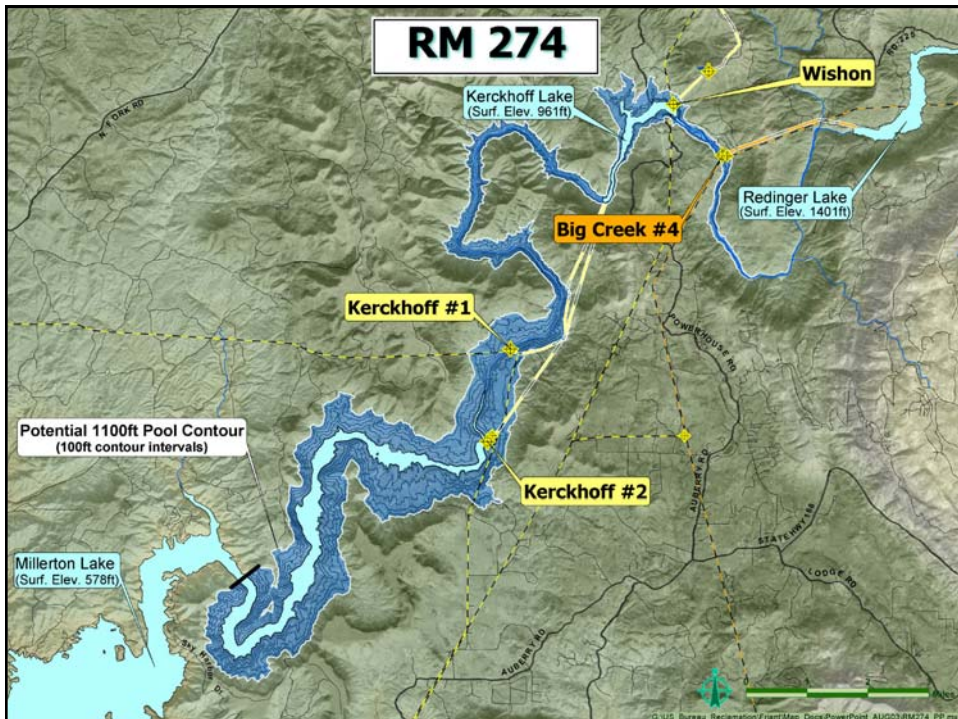
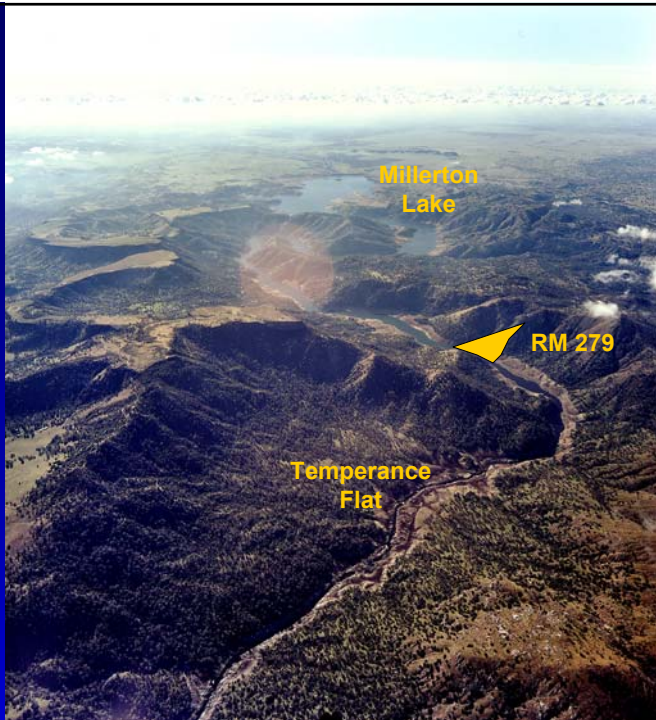
- Welcome and Introductions
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- Conjunctive Management Options
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Surface Storage Options Carried Forward to the Feasibility Study

- ◆ Temperance Flat Reservoir
- ◆ Friant Dam Enlargement
- ◆ Fine Gold Reservoir
- ◆ Yokohl Valley Reservoir

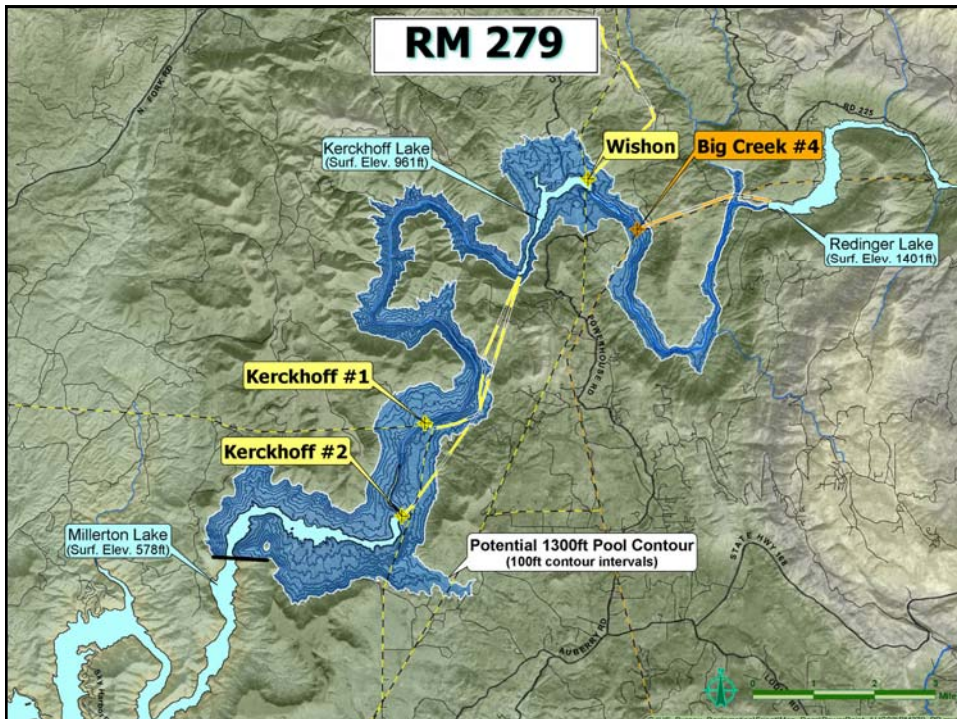
Temperance Flat Reservoir

- ◆ 3 Dam Sites
 - RM 274
 - RM 279
 - RM 286
- ◆ Key Concerns
 - Design and Construction
 - Environmental
 - Hydropower



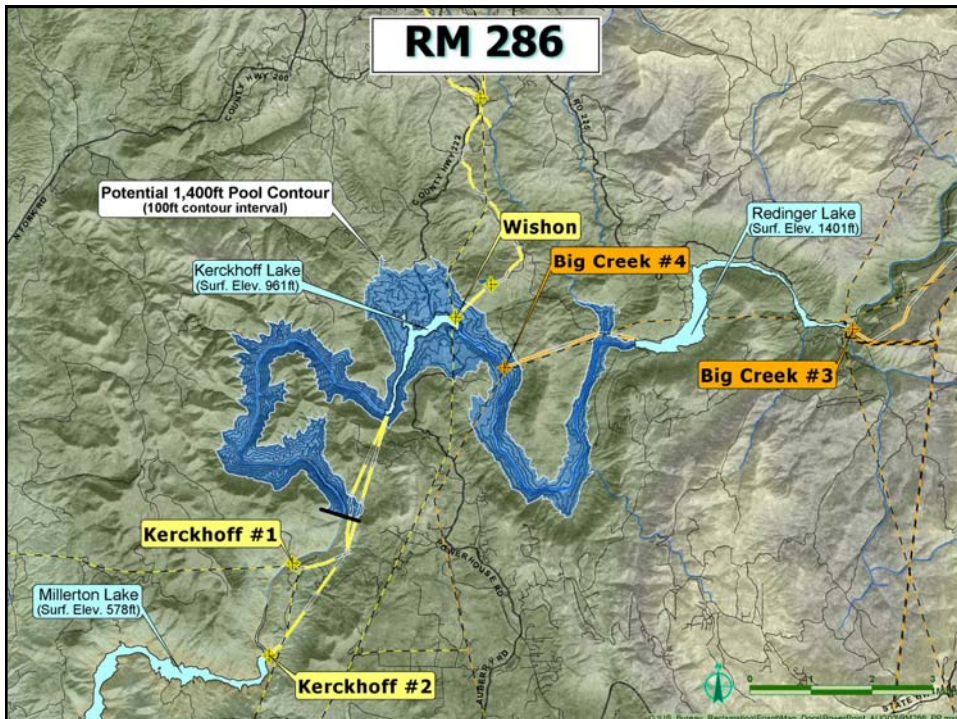
RM 274 Dam Site: Engineering & Geology

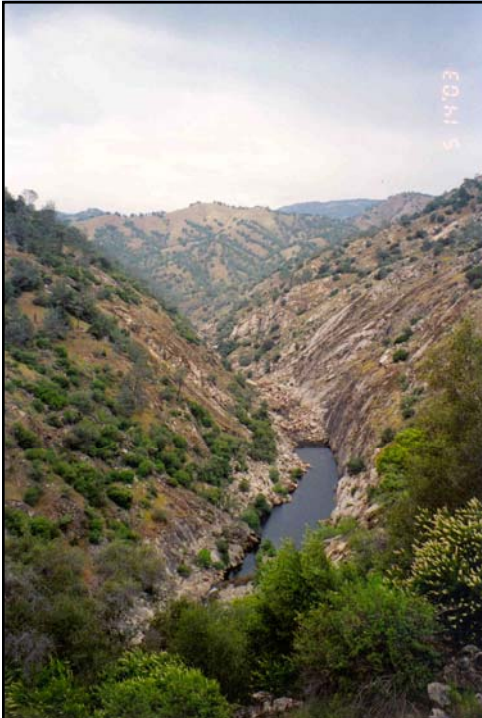
- ◆ Foundation
 - Hard, jointed granite
 - Steep to very steep abutments
- ◆ Availability of Materials
 - Hard, fresh granite for aggregate or rock fill
- ◆ Dam Types Considered
 - RCC, Concrete Gravity, and CFRF
- ◆ Construction Issues
 - Difficult access - near residential area
 - Construction in reservoir in +/-200 feet of water
 - Minimal staging area



RM 279 Dam Site: Engineering & Geology

- ◆ Foundation
 - Hard, jointed granite
 - Steep abutments
 - Narrow canyon cross section
- ◆ Availability of Materials
 - Hard, fresh granite for aggregate or rock fill
- ◆ Dam Types Considered
 - RCC, Concrete Gravity and CFRF
- ◆ Construction Issues
 - Difficult access
 - Construction in reservoir in +/-100 feet of water
 - Large staging area in Temperance Flat



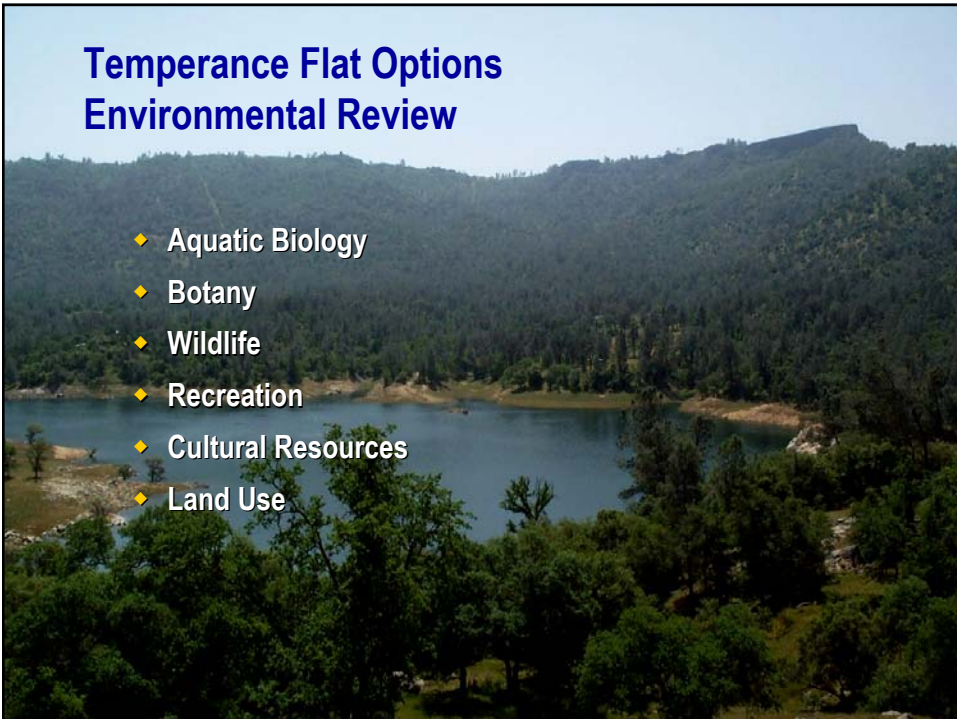


RM 286 Dam Site: Engineering & Geology

- ◆ Foundation
 - Hard, jointed granite
 - Very steep abutments
- ◆ Availability of Materials
 - Hard, fresh granite for crushed aggregate
- ◆ Dam Types Considered
 - Concrete Arch
- ◆ Construction Issues
 - Difficult access
 - Dry construction site
 - Minimal staging area

Temperance Flat Options Environmental Review

- ◆ Aquatic Biology
- ◆ Botany
- ◆ Wildlife
- ◆ Recreation
- ◆ Cultural Resources
- ◆ Land Use



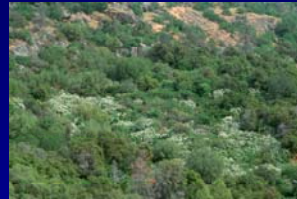
Temperance Flat Options

Environmental Review - Aquatic Biology

<i>Species</i>	<i>Status</i>	<i>Mitigation Potential</i>
Kern Brook Lamprey	State species of special concern	Determine if present Protect available habitat in areas not inundated
Hardhead	State species of special concern FWS sensitive	Operate to meet flow and temperature needs Improve native fish habitat elsewhere
American Shad	Not listed	Operate to meet flow and temperature needs
Black Bass	Not listed	Operate to stabilize water levels in Millerton Lake for game fish

Temperance Flat Options

Environmental Review - Botany



<i>Species</i>	<i>Status</i>	<i>Mitigation Potential</i>
Tree Anemone (Carpenteria)	State Listed	Coordinate with Backbone Creek Research Natural Area
Mariposa Pussypaws	Federal Listed	Not determined
Madera Linanthus	Not listed CNPS List 1B	Transplant

Temperance Flat Options Environmental Review - Wildlife

<i>Species</i>	<i>Status</i>	<i>Mitigation Potential</i>
Southwestern Willow Flycatcher	Federal Listed	Dedicated riparian habitat
Valley Elderberry Longhorn Beetle	Federal Listed	High replacement ratio
California Tiger Salamander	Candidate	Not determined
Western Pond Turtle	Not listed	Dedicated habitat with seasonal flow

Temperance Flat Options Environmental Review - Recreation

- ◆ **River rafting**
 - Patterson Run - below Kerckhoff Dam
 - Horseshoe Bend - above Kerckhoff Lake
- ◆ **Temperance Flat recreation**
- ◆ **San Joaquin River Gorge Management Area**



Temperance Flat Options

Environmental Review - Cultural Resources

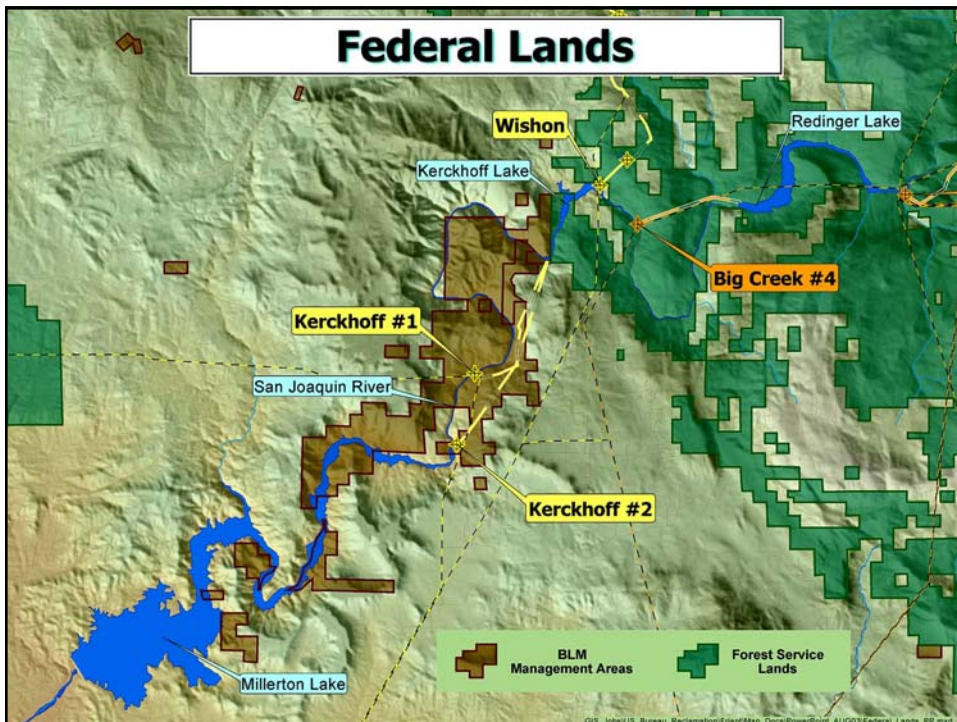
- ◆ **Potential for sites**
 - Native Americans
 - Homestead, mining, logging, hydropower, recreation
- ◆ **Known sites**
 - Proposed Cultural District
 - Chawanakee School near Redinger Lake
 - Patterson Mine

Temperance Flat Options

Environmental Review - Land Use

- ◆ **New or expanded roads for construction access**
- ◆ **Residences near Big Creek #3**
- ◆ **San Joaquin River bridges**
 - Footbridge - Kerckhoff #1
 - Road 222 - Kerckhoff Lake
 - Italian Bar - Redinger Lake
- ◆ **Changes of use for Federal Lands**

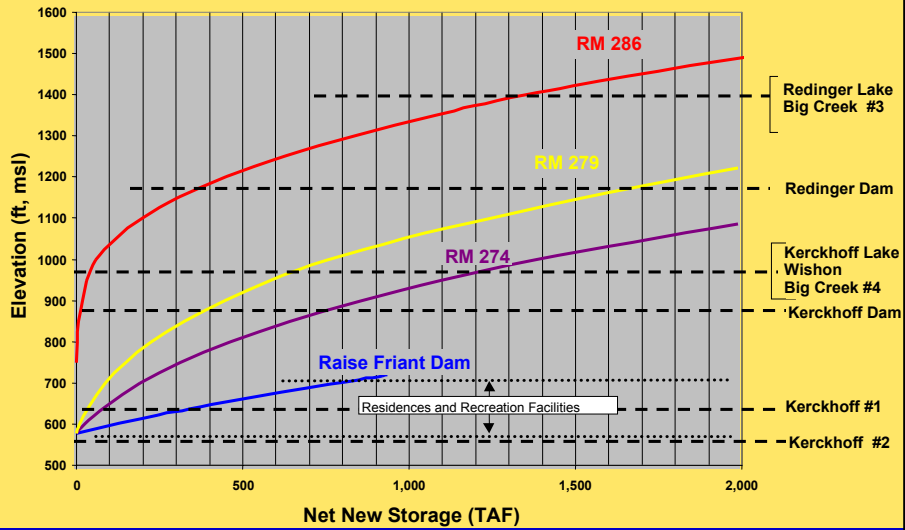




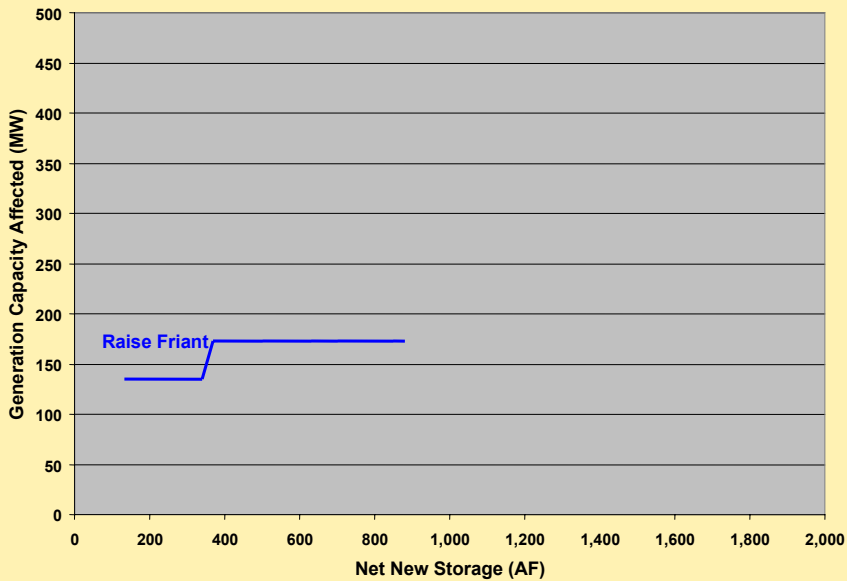
Temperance Flat Hydropower Analysis

- ◆ Beginning Hydropower study
- ◆ Identify potential extent of impacts or generation
- ◆ Similar level of detail with other Phase 1 studies
 - Determine if more detailed study is warranted

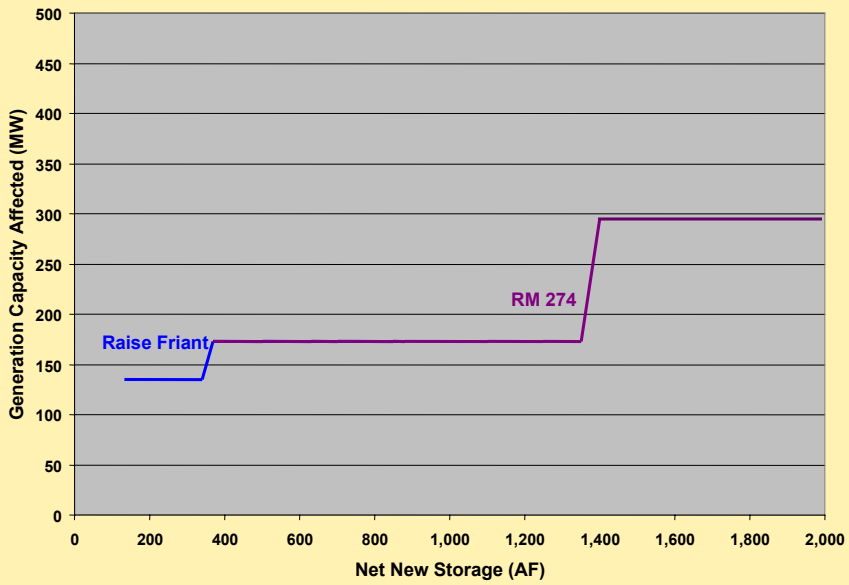
Potentially Affected Power Facilities



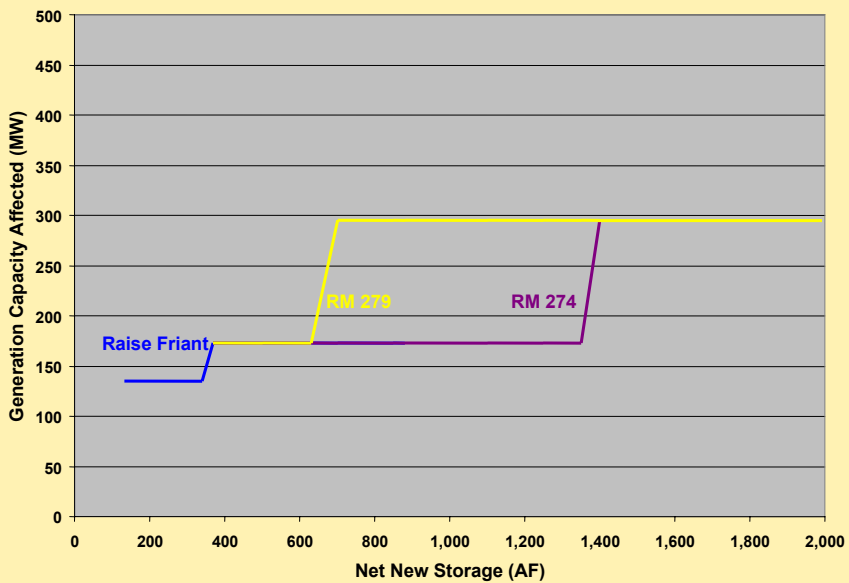
Generation Capacity Affected by Storage Options



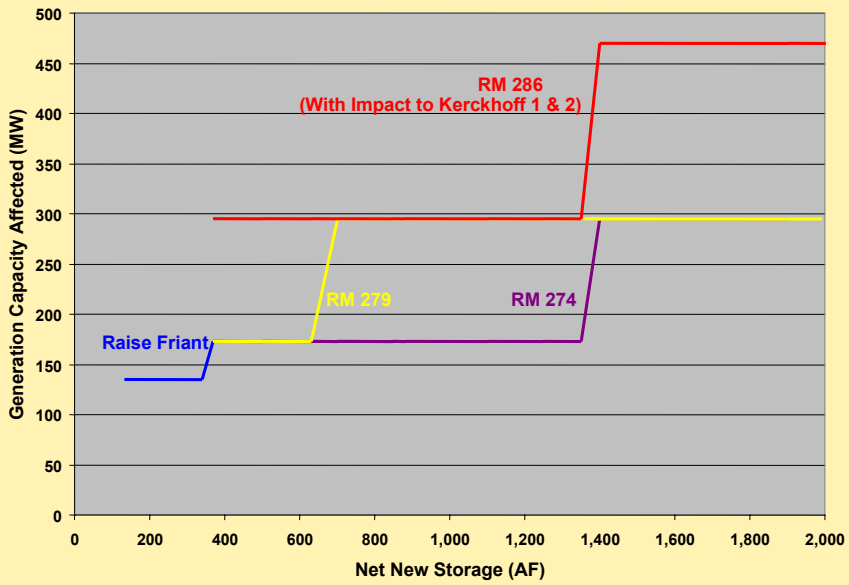
Generation Capacity Affected by Storage Options



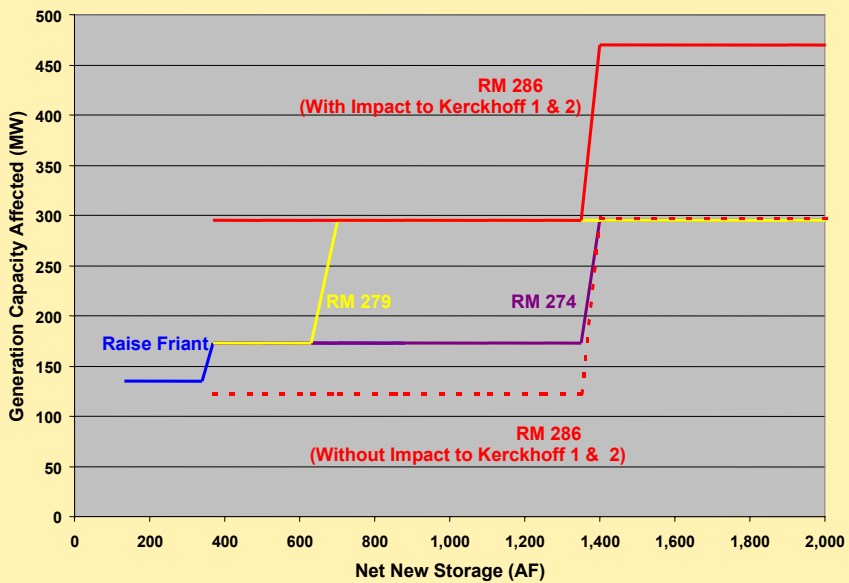
Generation Capacity Affected by Storage Options



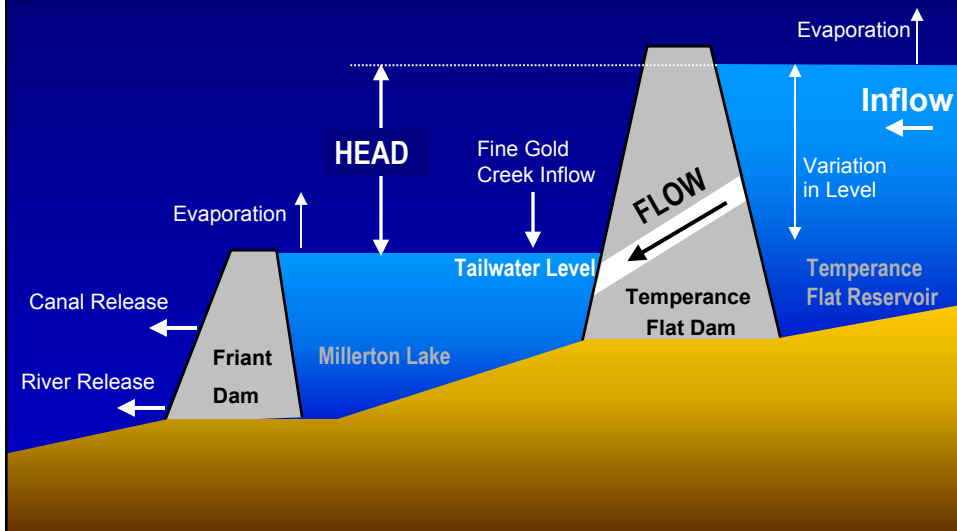
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Generation Capacity Affected by Storage Options

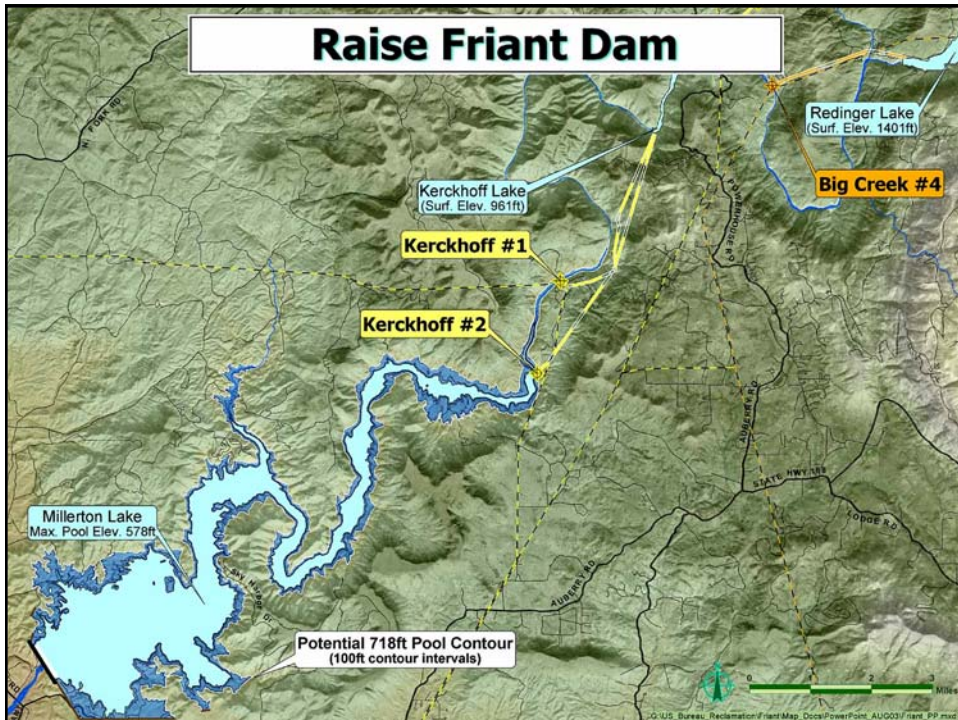


Temperance Flat Hydropower Variables



Temperance Flat Preliminary Hydropower Findings

- ◆ Existing hydropower generation will be affected
- ◆ A net increase in power generation is possible but may be limited
- ◆ Potential power generation is greatest at RM 286 due to higher head
- ◆ Additional generation at Friant powerhouses is possible



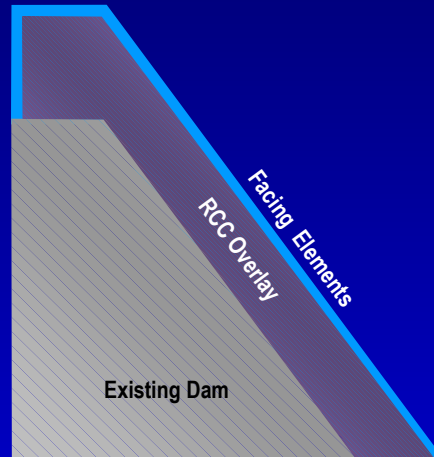
Friant Dam Enlargement Engineering and Geology

- ◆ Existing Concrete Dam
 - Competent concrete
 - Alkali aggregate reaction in some areas
- ◆ Foundation
 - Hard, jointed meta-sedimentary rock
 - 60 years of good performance
- Availability of Materials
 - Decomposed granite for earth fill
 - Hard, fresh granite & alluvium for aggregate



Friant Dam Enlargement Engineering and Geology

- ◆ Dam Types Considered
 - RCC overlay on main dam
 - Embankment for dike and saddle dam
- ◆ Construction Issues
 - Good access
 - No construction in reservoir
 - Large staging area
 - Millerton Lake residences



Friant Dam Enlargement Environmental Review


- ◆ Millerton Lake Recreation
- ◆ Spawning of American shad, striped bass
- ◆ Shallow water habitat
- ◆ Cultural resources
- ◆ Residences and former homesteads



Friant Dam Enlargement Hydropower Issues

- ◆ Impacts to existing upstream facilities
 - Any raise would affect Kerckhoff #2
 - Larger raises would affect Kerckhoff #1
- ◆ Unlikely that sufficient replacement power could be generated at Friant
- ◆ Kerckhoff project modifications have not been examined





Fine Gold Reservoir Engineering and Geology

- ◆ Hard, jointed granite & meta-granite Foundation
- ◆ Fresh granite available for aggregate and rock fill
- ◆ Dam Types Considered
 - Concrete Gravity, RCC and CFRF
- Construction Issues
 - Access on existing roads
 - Construction in the dry or in shallow water (+/-10 ft)
 - Limited staging area
 - Nearby residential area

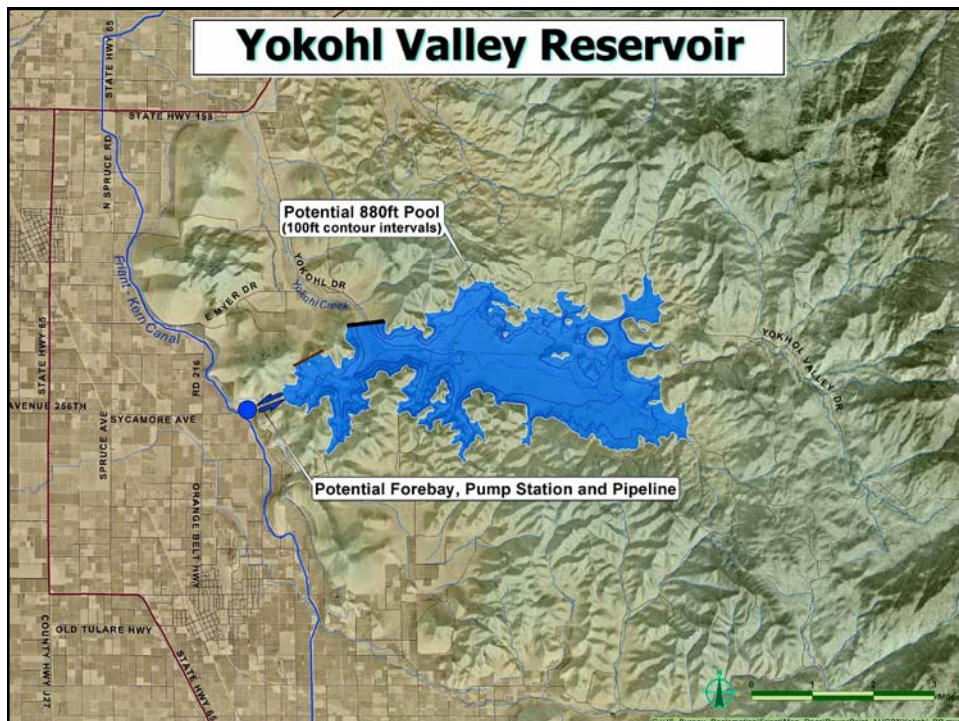


Fine Gold Reservoir Environmental Review

- ◆ Relatively pristine area would be inundated
- ◆ Wetland and riparian habitat
- ◆ Operations could affect fish in Millerton Lake
- ◆ Lake level fluctuations depend on operation

Fine Gold Reservoir Energy Requirements and Power Generation


- ◆ No impact to existing power generation
- ◆ Pumping head is greater than generation head
 - Fill Fine Gold while lowering Millerton
 - Lower Fine Gold while raising Millerton
- ◆ Net power user
- ◆ May need separate pump and generation equipment





Yokohl Valley Reservoir Engineering and Geology

- ◆ Foundation
 - Hard, some jointing and fractures
 - Excavation required in center of dam
- ◆ Pervious and impervious material nearby
- ◆ Zoned earth fill dam considered
- ◆ Construction Issues
 - Two saddle dams required
 - Staging areas both upstream and downstream
 - Access on existing road



Yokohl Valley Reservoir Environmental Review

- ◆ San Joaquin adobe sunburst (Tulare pseudobahia)
 - State listed as endangered
 - Federal listed as threatened
- ◆ Cultural resources
 - Prehistoric Native American sites
 - Former homesteads
 - Historically used trails

Yokohl Valley Reservoir

Energy Requirements and Power Generation

- ◆ Assumed storage capacity 800 TAF
- ◆ Pump-back facility
 - Operations from CALSIM
 - Pumping capacity
 - Forebay requirements
- ◆ Tie-in to transmission system
- ◆ Net energy user

Agenda

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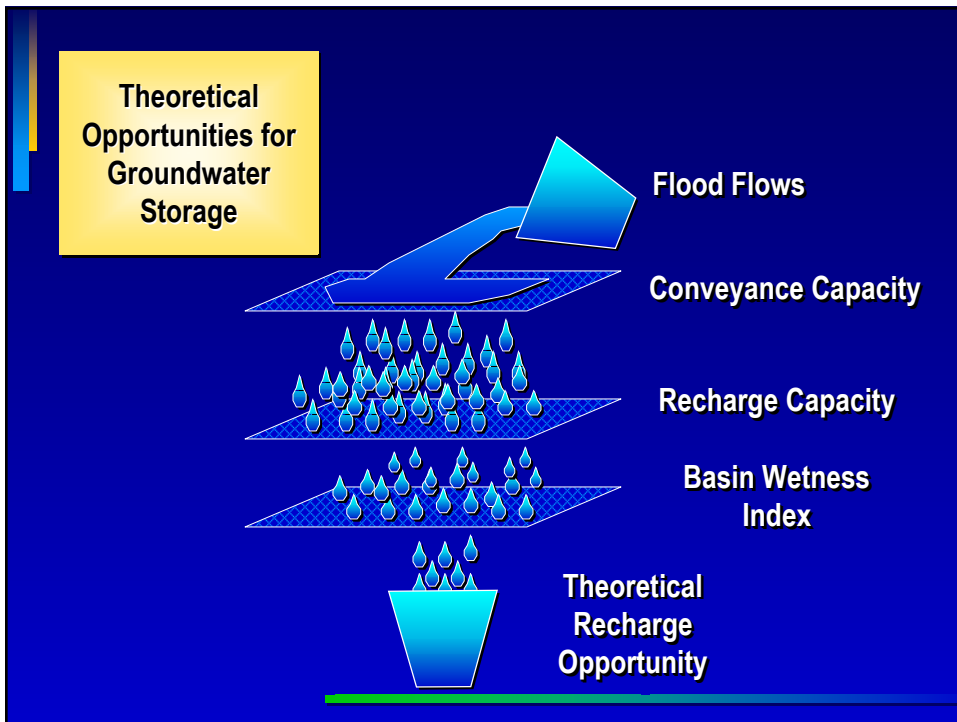
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Role of Conjunctive Management in the Investigation

- ◆ **Reasons to consider Conjunctive Management**
 - Historical project operations
 - Previous studies
 - CALFED ROD
 - Stakeholder input
- ◆ **Opportunity for off-stream storage**
 - Water and facilities are available
- ◆ **How can conjunctive management support Investigation objectives?**

Summary of Theoretical Analysis

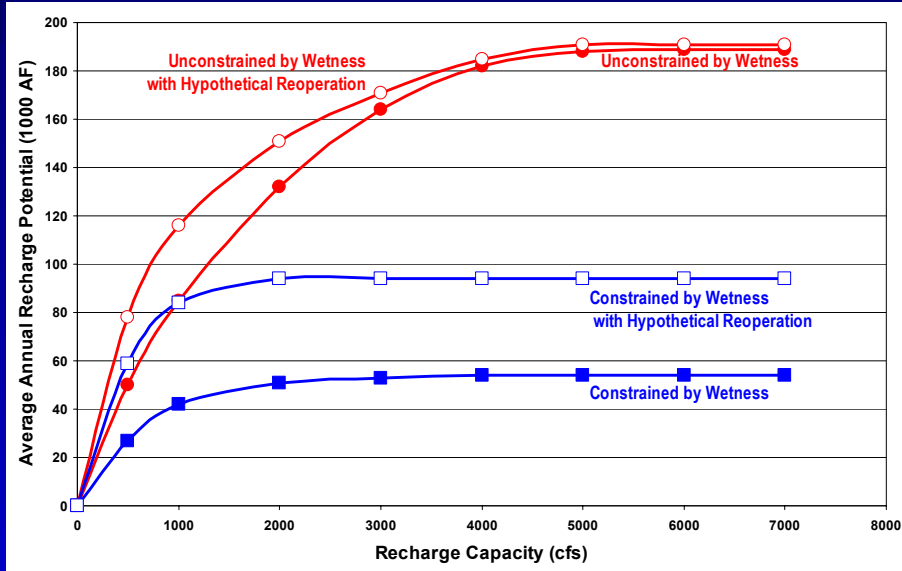
- ◆ **Estimate potential water supply available for recharge**
 - Reflects current operating practices
 - Honors current institutional constraints
- ◆ **Provides focus for further consideration**
 - Physical constraints
 - Institutional constraints



Wetness Index

- ◆ **Developed to reflect historical practices**
- ◆ **Influenced by hydrology**
 - Local supply availability
 - Availability of facility capacity
- ◆ **Influenced by institutional policies**
 - Flood control objectives
 - Cost of water
 - Place of use

Theoretical Groundwater Recharge Potential



Theoretical Recharge Analysis Findings

- ◆ Theoretical recharge capacity is limited by canal conveyance at high recharge rates
- ◆ Specific project details are needed for additional evaluation

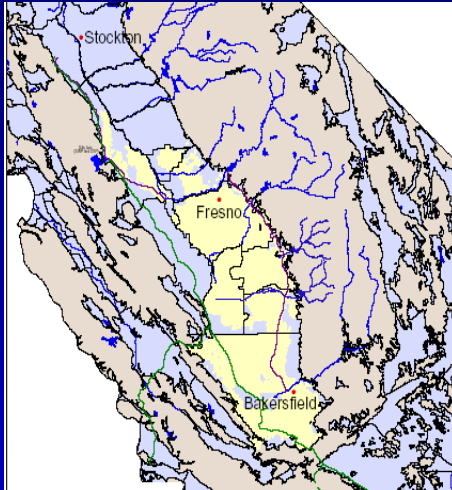
Stakeholder Coordination Summary

- ◆ Stakeholder Interviews - June 2003
 - Friant and non-Friant contractors
 - List from FWUA and DWR Conjunctive Management Program
 - Expressed interest in conjunctive management
- ◆ Initial Findings
 - Interest in conjunctive management for regional benefits
 - Many institutional barriers exist
 - Desire to meet local needs first

Conjunctive Management Approach

- ◆ DWR will work with potential implementing water agencies to identify conjunctive management opportunities
- ◆ Conjunctive Management projects and actions must:
 - Specifically address Investigation objectives
 - Be formulated with stakeholders who would be involved in management and implementation
 - Identify project facilities, operation and maintenance criteria, and institutional requirements

Interest in Conjunctive Management



Interest has been indicated by:

- Arvin-Edison WSD
- Chowchilla WD
- Fresno ID
- Friant Water Users Authority
- Kaweah and St. Johns Rivers Assoc.
- Kaweah Delta Water CD
- Kern County Water Agency
- Kings River Water Assoc.
- Kings River CD
- Lower Tule River ID
- Pixley ID
- SJRECWA
- Shafter-Wasco ID
- Tulare ID
- Tule River Assoc.

Objectives of Conjunctive Management Process

- ◆ Identify institutional barriers
- ◆ Develop project review criteria
- ◆ Identify potential policy actions
- ◆ Identify potential projects

Schedule for Conjunctive Management Process

- ◆ Work with water managers to identify opportunities - Sept 2003
- ◆ Present options to interested stakeholders - Oct / Nov 2003
- ◆ Identify specific actions and projects - March 2004
- ◆ Evaluate potential actions and projects - June 2004

Contact Information

- ◆ DWR
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Agenda

Workshop 6

Welcome and Introductions
Investigation Overview
Overview of Analyses
Surface Storage Options
Conjunctive Management Options
Next Steps

Next Steps

- ◆ Complete Phase 1 report
- ◆ Conjunctive Management working session
- ◆ Issue Notice of Intent / Notice to Prepare

Next Steps

- ◆ **Consider adding cooperating agencies**
 - Specific expertise for Investigation needs
- ◆ **Plan for Phase 2 of Investigation**
 - Further evaluate storage options
 - Define evaluation and comparison criteria
 - Develop initial set of alternatives
 - Identify set of final alternatives



Bureau of Reclamation
Mid-Pacific Region
California Department
of Water Resources

**Upper San Joaquin River Basin
Storage Investigation**

Workshop 6

August 27, 2003

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