A Watershed Approach to Fish Passage Feasibility (Calaveras Dam Case Study)

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Agenda

- Introduction
- Setting
- Fish Passage Studies
  - Calaveras Dam
  - Natural Barriers
  - Alameda Creek Diversion Dam
- Project Permits
- Conclusions
Introduction

- Evaluation of need for fish passage can be triggered by project CDFW Stream Alteration Agreement (F&G Code) and Federal ESA consultation
- Much water infrastructure developed prior to implementation of environmental laws
- Modifications or repairs may trigger need for environmental permits
Introduction

- Several interrelated steelhead passage studies
- Studies would support Calaveras Dam permitting and public review
- Ongoing, watershed-wide restoration effort would benefit from information from feasibility analyses
Calaveras Dam

- 220-foot-tall earthen dam
- Alameda and Calaveras Creeks, and Arroyo Hondo
- Arroyo Hondo Basin is 50,000 acres
Central California Coast Steelhead DPS

- Alameda Creek Watershed is 10% of DPS
- Steelhead anadromous life history
- Watershed-wide efforts to restore run of steelhead underway

Central California Coast (CCC) Steelhead Distinct Population Segment (DPS) and Alameda Creek Watershed
Habitat Upstream of Calaveras Dam

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<th>Sub-Watershed</th>
<th>Basin</th>
<th>Acreage</th>
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Fish Passage Studies

- Feasibility of Fish Passage at Calaveras Dam
- Feasibility of Fish Passage at Alameda Creek Diversion Dam
- Assessment of Fish Upstream Migration at Natural Barriers in the Upper Alameda Creek Sub-Watershed
- Assessment of Fish Migration at Riffles in the Sunol Valley Quarry Reach of Alameda Creek
Focus Of Analysis

Technological and Biological Feasibility

Tier 1
Potential Fish Passage Design Components

Tier 2
Technologically/Biologically Feasible Design Components

Tier 3
Specific Fish Passage Options

Annualized Cost
(Capital and O&M, including Water)

Biological Benefit
(Habitat Availability and Potential for Sustainability)

Findings
Evaluation Factors

**Tier 1 Focus**
- Biological Feasibility
  - Migratory needs
  - Avoiding injury
- Technological Feasibility
  - Engineering solutions available

**Tier 2 Focus**
- Annualized cost
  - Capital Cost
  - Water Cost
  - O&M Cost

**Tier 3 Focus**
- Biological benefit
  - Habitat availability
  - Potential for sustainability
  - Typical goals of fish passage
Fish Ladder at Calaveras Dam

Tier 1 – Technologically and Biological Feasibility
Preliminary Findings

- Fish ladder
  - 290 vertical feet
  - 70 feet of reservoir forebay fluctuation
- No volitional upstream or downstream passage options identified
- Trap and haul only feasible option for passage at Calaveras
Natural Barriers Study

- Evaluated in-stream features considered potential barriers
- Methods from Powers and Orsborn (1985)
- Provides context for Calaveras Dam
  - 12-foot waterfall 200 feet downstream
  - 17-foot waterfall 1.8 miles upstream
Arroyo Hondo Landslide – 17-foot Waterfall

February 23, 2006 (17 cfs)

March 3, 2009 (590 cfs)

Blocks upstream migration to majority of habitat above Calaveras Reservoir
Figure 3-6: Christian Landslide

- Ancient and Active Landslide
- Recently Eroded Landslide Toe
- 15-foot Waterfall
- Ownership Boundary
- Approximate Boundary of Landslide
- Stream
- Topographic Contour, 100-foot Interval

FEET
Findings

- Alternative measures for steelhead recovery with greater benefit-to-cost ratio should be investigated
  
  - Trap and haul would provide access to limited amount of habitat
  
  - Passage would be non-volitional
  
  - Cost would be relatively high
Alameda Creek Diversion Dam and Tunnel

- 31 foot high dam
- 650 cfs capacity diversion
- 1.8 mile tunnel to Calaveras Reservoir
Complete Barrier to Upstream Migration

- Unscreened diversion may take fish from Alameda Creek to Calaveras Reservoir
- Suitable steelhead habitat present upstream
- SFPUC studied feasibility of passage and screens concurrent with Calaveras Dam
Feasibility Cost Estimation

- **Capital Investment**
  - Design Fees
  - Materials and Labor
  - Construction Management

- **Other Annual Costs**
  - Operation and Maintenance
  - Annual Equipment/Repair/Replacement

- **Lost Water Opportunity**
  - Replacement of water not diverted

- **Presented as Annualized Cost Over an Assumed 30-Year Project Life**
Water Cost due to Reduced Diversion Capacity
Water Cost due to Screen and Ladder Operations
Findings

- Effort to establish steelhead above the diversion dam would have reasonable probability of success
- Fish ladder technologically feasible
- If Little Yosemite limits immigration to a ladder, trap and haul could provide passage
Project Permits

- Passage studies provided essential information needed for completion of permitting by answering key questions
  - Findings helped focus attention on feasible solutions
  - Facilitated approval of key environmental permits
Project Permits

- Included passage at the Diversion Dam and not at Calaveras Dam, & minor passage improvements downstream

- Decision based on:
  - Non-volitional, high cost/benefit of passage at Calaveras
  - Likelihood of greater success at Diversion Dam

![Diagram of proposed site plan showing power and control facilities, fish ladder, Alameda Creek, and conveyance pipes.](image-url)
Conclusions

➢ Early initiation of focused and coordinated fish passage studies provided several benefits:

- Provided rational, technical foundation for decisions
- Removed from consideration costly recommendations to modify dam replacement project
- Results incorporated into final CEQA document and permit applications
- Reduced potential permit delays
- Resulted in feasible permit terms and conditions
Acknowledgements

- SFPUC
- HDR
- Resource Agencies
  - CDFW
  - NMFS
  - USFWS
Questions?

Friant Power Authority, Friant Dam Hydroelectric Facility Expansion Investigation, Design, FERC Licensing, and Permitting


Nevada City, Deer Creek Environs Wildfire Mitigation Project, Federal Environmental Compliance