

Review of preliminary alternatives for further evaluation

PRELIMINARY ALTERNATIVES

Preliminary Alternatives - Alternatives Categories

- No Action (Alternative 1)
- Dam Removal (Alternative 2)
- Dredge and Place (Alternative 3)
- Storage Expansion (Alternative 4)
- Sediment Management (Alternative 5)



Preliminary Alternatives - No Action (Alternative 1)

- Reservoir allowed to continue to accumulate sediment

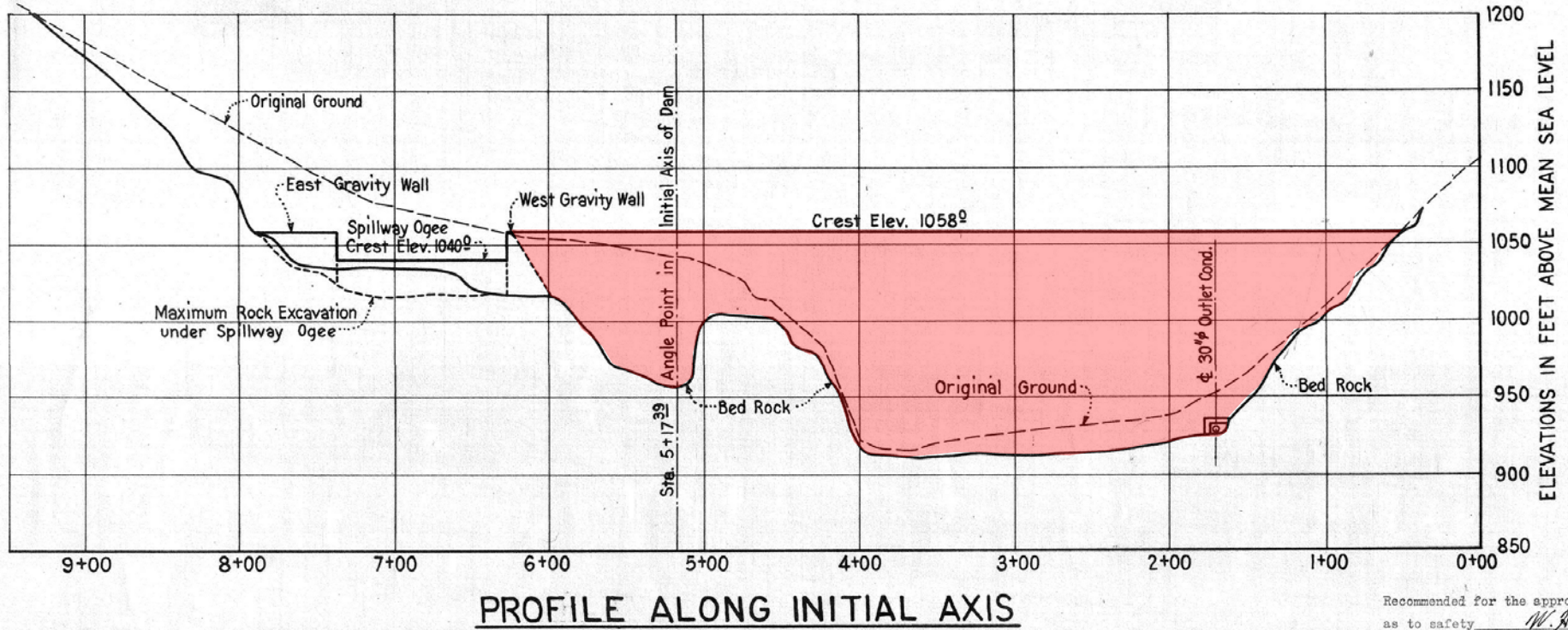


Preliminary Alternatives - Dam Removal (Alternative 2)

- Phased (multi-year) removal by elevation not feasible
 - Requires an operating spillway, which is not feasible
- Full or partial embankment removal feasible
- Embankment volume of 463,130 CY (DSOD)
 - Permanent storage vs. storage that could eventually be accessed by high storm flows

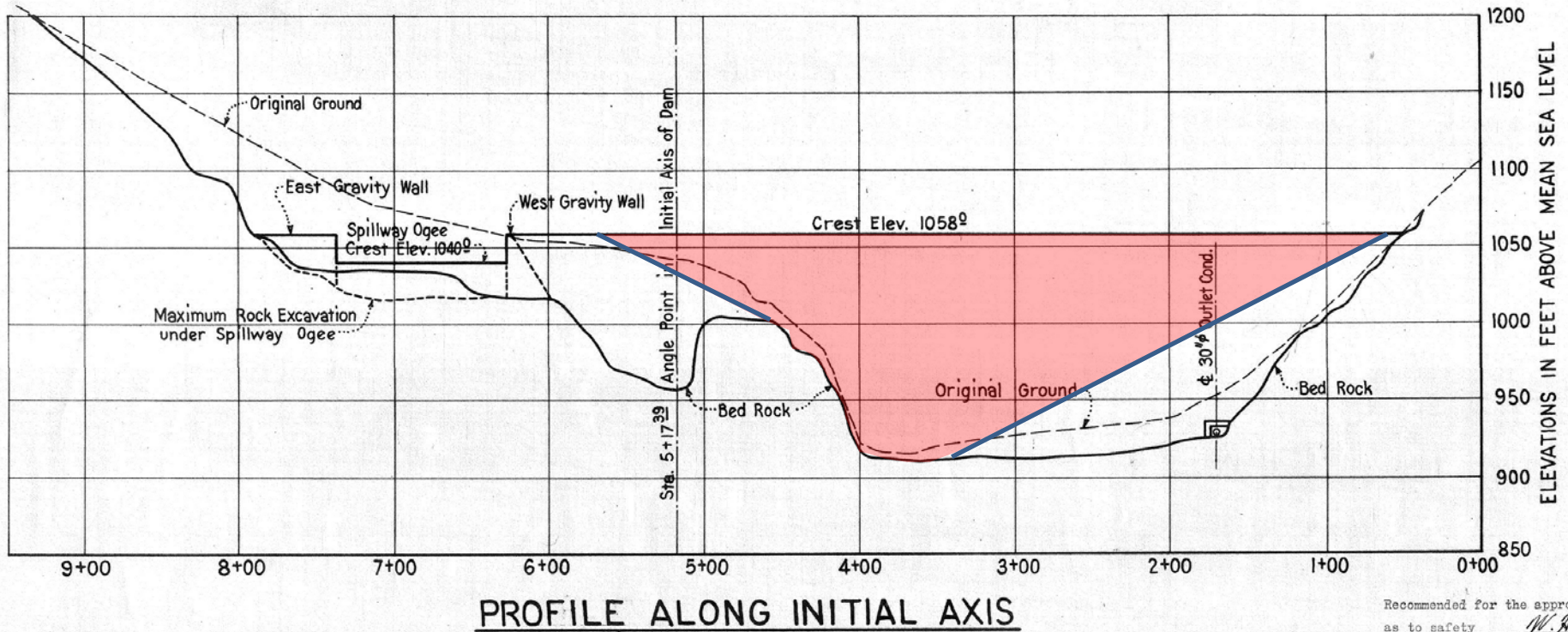


Preliminary Alternatives - Full Dam Removal



Recommended for the approval
as to safety *W. R.*
Princ

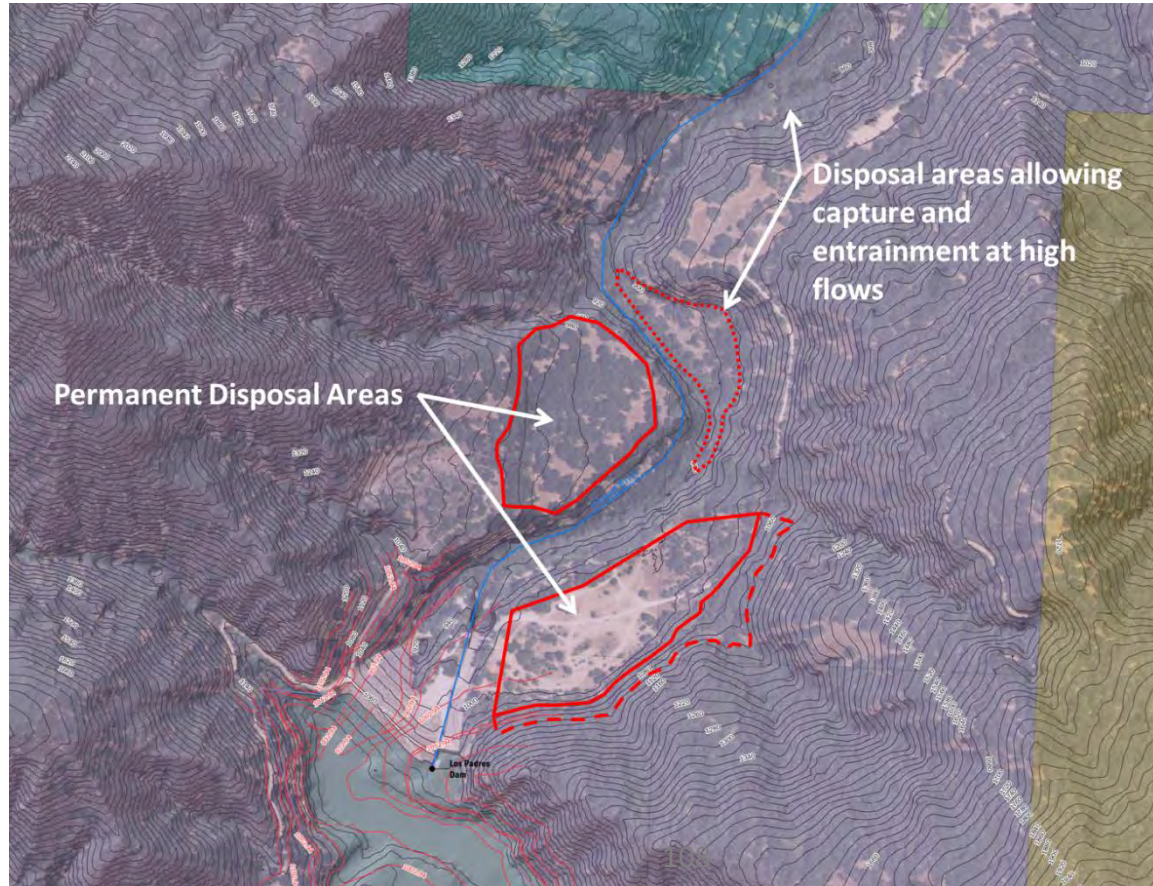
Preliminary Alternatives - Partial Dam Removal



Recommended for the approve
as to safety *W. H.*
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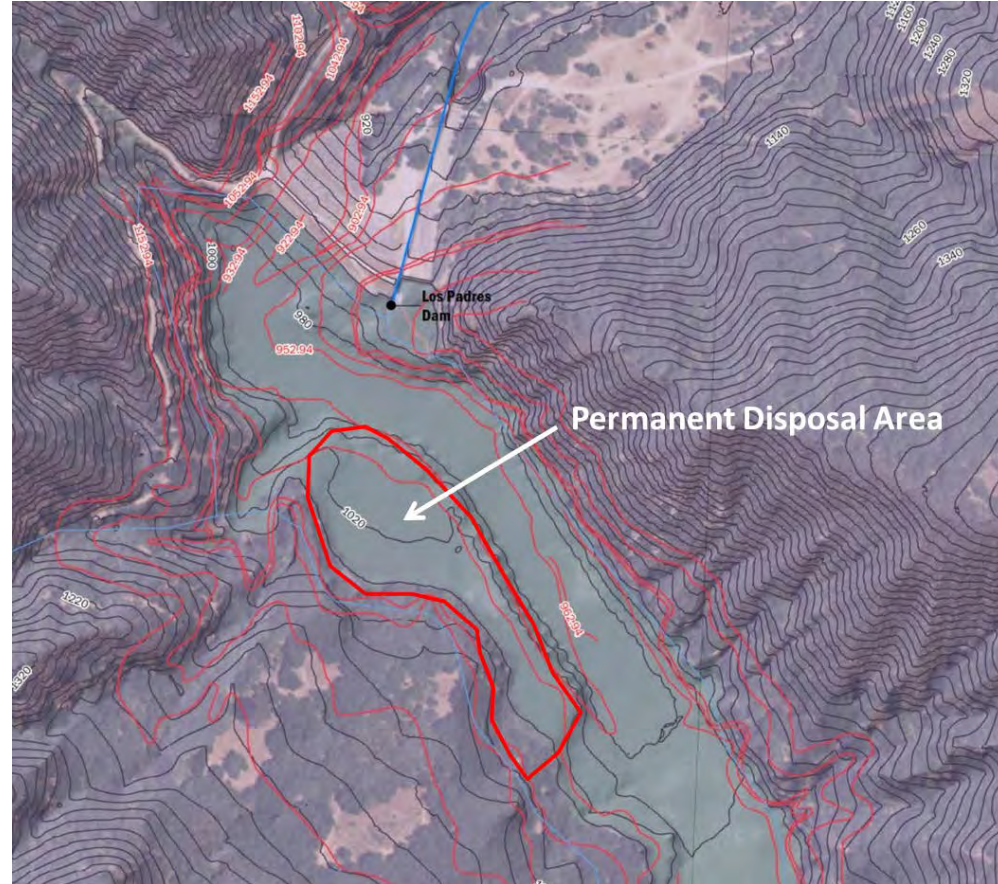
Preliminary Alternatives - Dam Removal

- Sediment disposal
 - Permanent disposal areas
 - Disposal areas allowing capture and entrainment at high flows



Preliminary Alternatives - Dam Removal

- Sediment disposal
 - Permanent disposal within reservoir footprint

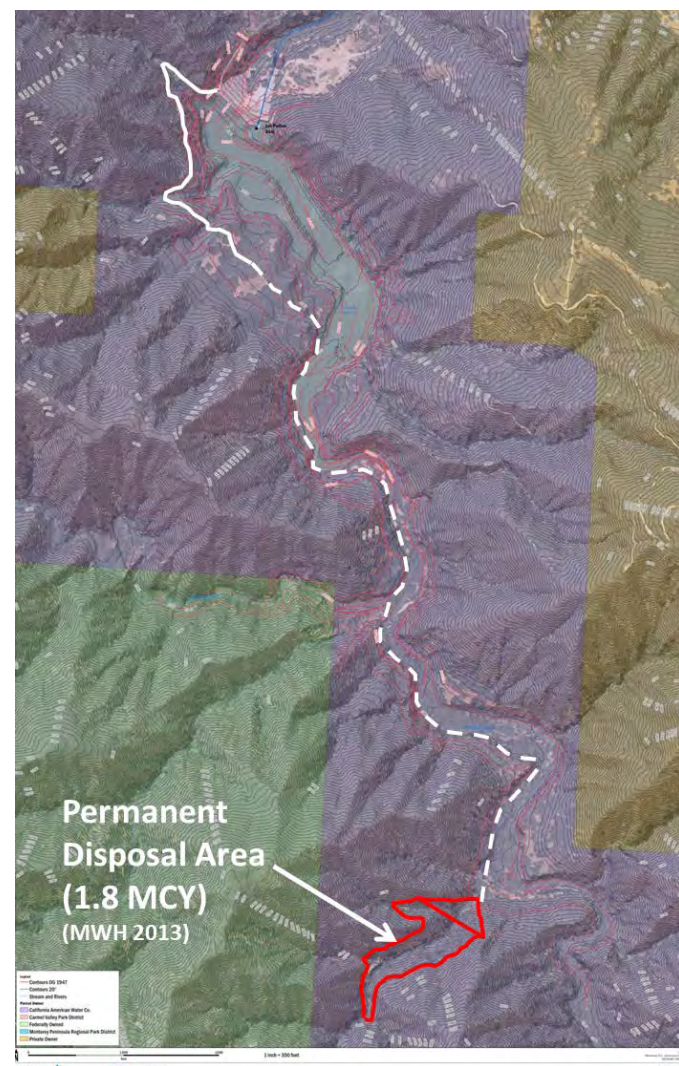


Preliminary Alternatives - Dredge and Place (Alternative 3)

- Alternative 3a – Place on Cal-Am Property
 - builds on MWH 2013 study
- Alternative 3b - Place off Cal-Am Property
 - Have not identified any reasonable locations as of yet
- Reservoir Sediment
 - 2.1 MCY in reservoir (MWH 2013)
 - 16,000 – 34,000 CY/year (MWH 2013)
- Dredging methods
 - Slurry dredging of fines likely not feasible due to inadequate volume of water
 - Fines most likely dredged using clamshell
 - Coarse sediment removed using conventional earthmoving equipment

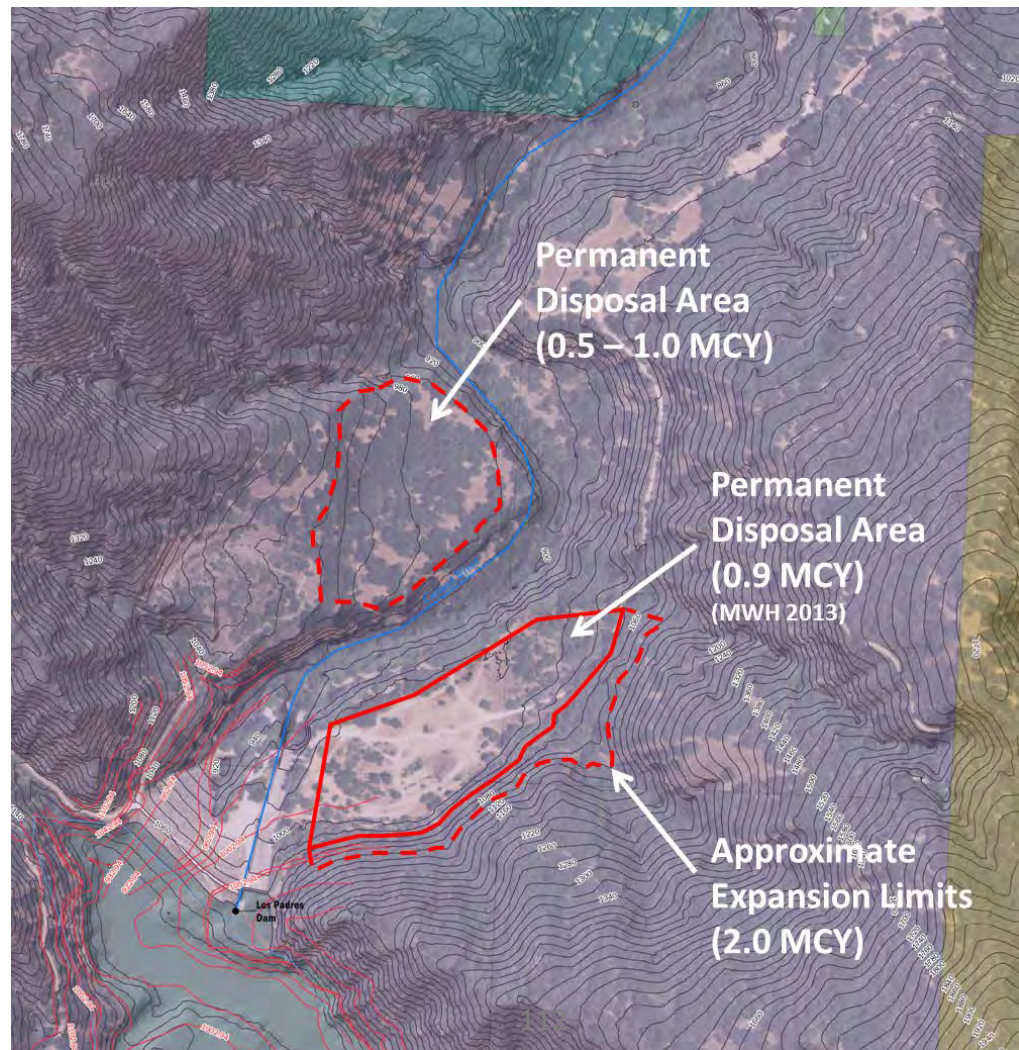
Preliminary Alternatives - Dredge and Place Upstream on Cal-Am Property (Alternative 3a)

- Requires access road along left side of reservoir and channel
 - Improve approx. 0.5 miles of existing road
 - New road approx. 1.3 miles in length
- Disposal area is 320 feet high
 - Not really feasible for equipment to place with narrow valley



Preliminary Alternatives - Dredge and Place Downstream on Cal-Am Property (Alternative 3b)

- Feasible
- Left side of channel would require an access road improvements



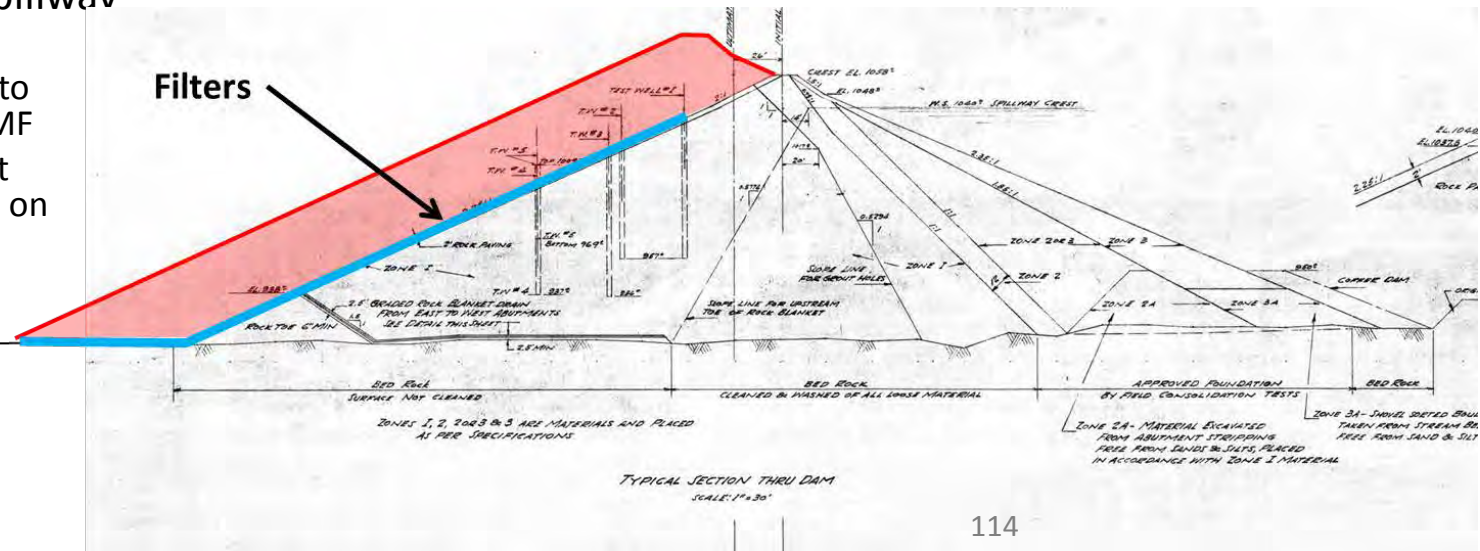
Preliminary Alternatives - Storage Expansion (Alternative 4)

- Four alternatives
 - Alternative 4a - Expand with Dam Raise
 - Alternative 4b - Expand with Rubber Dam
 - Alternative 4c - New Dam Downstream
 - Alternative 4d - Combination
- Maximum normal water elevation for raise is 1,055.5 feet
 - 12.6-foot raise over current spillway crest
 - Limited by boundary of Ventana Wilderness at Danish Creek (El. 1,060 ft)
 - Allows for 100-year flood (4.5 feet above spillway crest) to pass spillway without flooding wilderness
- Current storage estimated at 1,810 AF at spillway crest (1,042.9 ft)

Preliminary Alternatives - Expand with Dam Raise

(Alternative 4a)

- 12.6 foot raise (of spillway crest)
 - Could require 32.1 feet of freeboard (crest el. 1084 or 23 to 24-foot raise)
- Increase of 736 AF to bring storage up to 2,546 AF
- Updated stability and seismic deformation analysis required
 - Could result in need to add filters on downstream side
- Would require spillway modification
 - Passage of up to HMR 58/59 PMF
 - New dam crest would depend on how spillway modified
- Would require outlet modification



Preliminary Alternatives - Expand with Rubber Dam in Spillway Crest (Alternative 4b)

- 12.6 foot raise
- Increase of 736 AF, bringing storage up to 2,546 AF
- Potential for this to require spillway mod for up to HMR 58/59 PMF
- Would require raising dam crest (maybe 10 feet)
- Updated stability and seismic deformation analysis likely
- Could result in need to add filters on downstream side



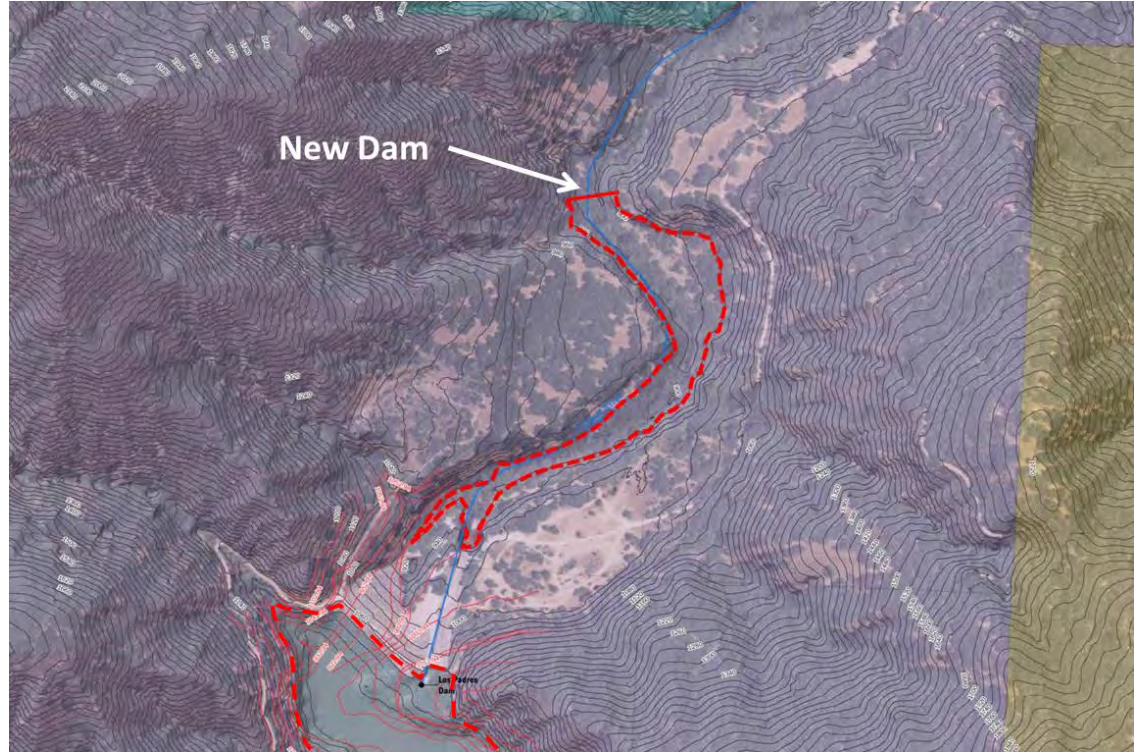
Preliminary Alternatives - New Dam Downstream (Alternative 4c)

- Spillway crest elevation 1,055.6 feet (12.6 feet above existing spillway crest)
- Increase of 6,329 AF to bring total storage up to 8,139 AF
- Dam Type
 - Roller Compacted Concrete
 - Earthfill with possible reuse of some existing LPD materials



Preliminary Alternatives – Combination (Alternative 4d)

- 12.6 foot raise (either dam raise or rubber dam in spillway) + 40-foot-high downstream dam
- Increase of 946 AF to bring total storage up to 2,756 AF
- Would have the same considerations as Alternatives 4a and 4b
- Downstream dam would have very shallow pool that would result in increased water temperatures



Preliminary Alternatives - Sediment Management (Alternative 5)

- Would be considered for alternatives:
 - Retaining existing dam
 - Expanding storage
- Five alternatives
 - Alt 5a - Periodic dredging and on site disposal
 - Alt 5b - Periodic dredging and placement downstream for entrainment during high flows
 - Alt 5c - Constructing a sediment capture area in reservoir
 - Alt 5d - Sluicing fine sediment during high flows
 - Alt 5e - Constructing a bypass tunnel for incoming sediment
- 16,000 – 34,000 CY/year (MWH 2013)