Reinforced Earth Wall Raise

The reinforced earth wall would consist of a concrete-formed box section constructed adjacent to the upstream and downstream crests of the dikes or wing dams. The walls would be tied together and then backfilled with soil. The whole feature would be keyed into the existing embankment, with a water-stopping element integrated into the embankment core. Concrete for the walls would be mixed at a portable batch plant from cement and aggregate hauled to the site, and then poured into forms at the construction sites. Figure 2-10 illustrates the concept of a reinforced earth wall.

Reinforced Concrete Retaining Wall Raise

A reinforced concrete retaining wall (also termed a parapet wall) with footing embedded in the earthfill of the embankment (See Figure 2-11) would be constructed along the embankment crest to the required height. This would require excavating a portion of the dam or dike crest to place the footing and to replace the embankment fill along with a drainage element to control pore pressures.

Dual Parapet Concrete Wall

This feature would be similar to the concrete retaining wall except the elevated wall would be constructed along the upstream edge of the dam or dike. A second lower wall would be constructed along the downstream edge to provide edge protection. The parapet wall would be constructed by excavating a portion of the dam or dike crest to place the footing and then replace the material to the proposed earthen material height. Figure 2-12 shows the concept of a dual parapet wall.

Combination Earthen Raise and Concrete Wall

Engineering options involving the raising of the earthen structures could involve the use of both earthen materials and a parapet wall. For example, a 7-ft raise could be accomplished through an initial raise of 3.5 ft using earthen material and a 3.5-ft parapet wall constructed on top of the earthen raise element. Combining the two options reduces the amount of borrow material to be processed and transported and accomplishes the same hydrologic control needed to protect public safety.

2.2.4.8 Filters and Drains

Filters

The existing earthen structures (RWD, LWD, MIAD, and 8 dikes) were constructed of a dense earthen core as the primary feature containing the reservoir, with outer shells protecting the core. However, the shell material for Dikes 1 to 8 is essentially the same as the core material, so these embankments can be considered homogenous dikes. To better control seepage and piping (movement of water through the core that carries soil material), processed material (processed material and gravel) filters are proposed to be constructed within downstream portions of the earthen structures. The filters would be constructed by first excavating and stockpiling a portion of the outer

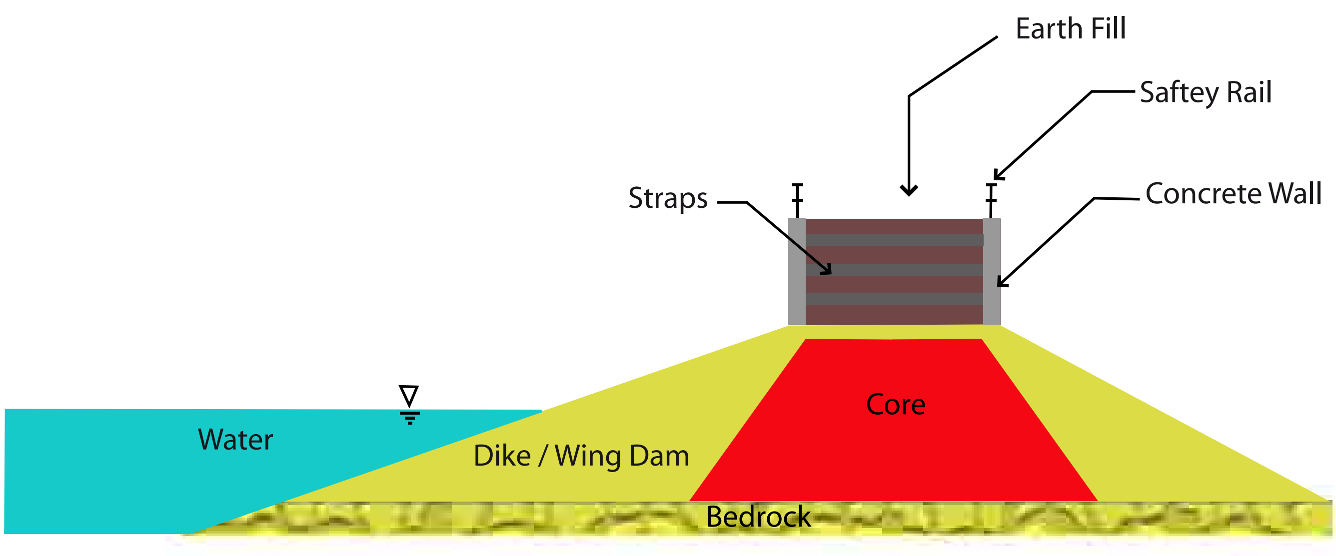

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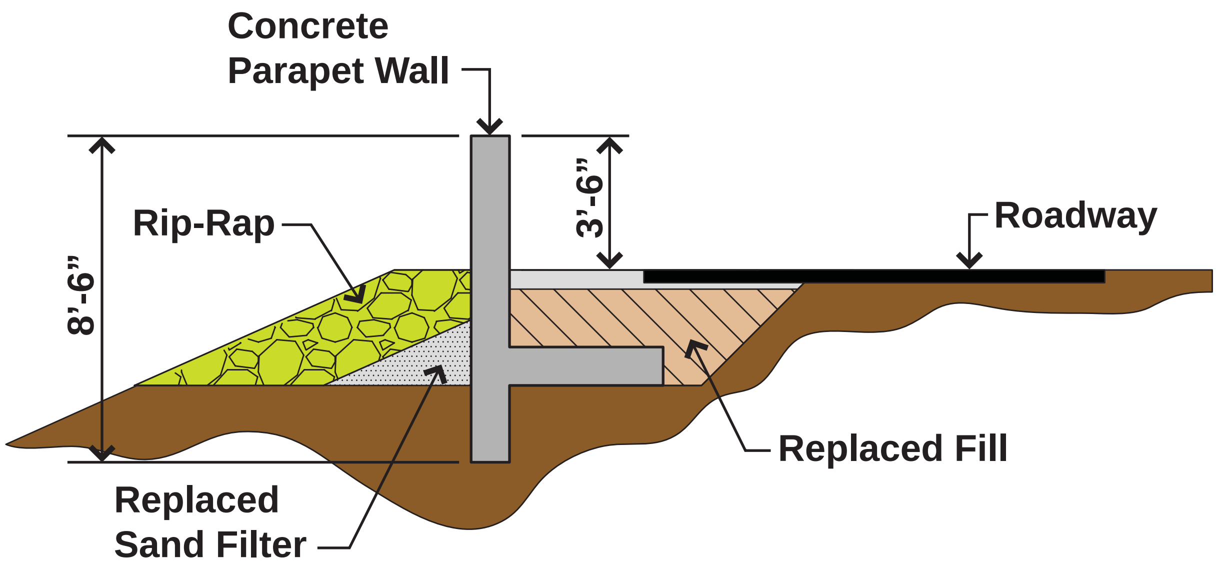
Figure 2-10
Reinforced Earth Wall



CDM

Figure 2-11
3.5 foot Raised Flood Wall

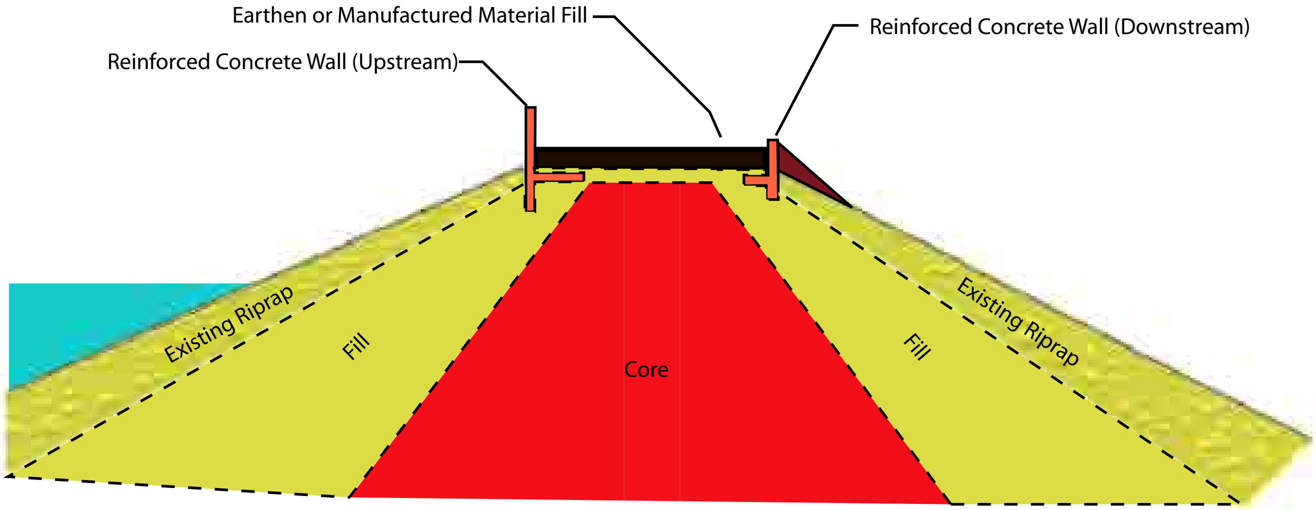


Figure 2-12
Dual Parapet Wall

CDM

shell, placing a layer of processed material with a specific gradation over the exposed slope of the earthen structure, and then replacing the outer shell. Processed material for construction of the filters would either come from a local (Sacramento area) commercial source or it would be manufactured on site using granitic material taken from borrow sites. Competent granite rock at Beal's Point and Granite Bay has shown promise as a processed material source for filter material.

Any water collected by the filter would be carried to the toe of the earthen structure for discharge away from the dam through the toe drain. The processed material filters would reduce the risk of failure of the embankments by piping.

Two alternatives for types of filters are being considered for the downstream face. The full-height filter would extend upward from the downstream toe of the facility to the crest of the dam or dike. The half-height filter would extend from the downstream toe to half the vertical distance to elevation 466 ft.

Due to concerns about piping along the embankment interface with the concrete dam, filter zones are required along these contacts. This would be accomplished by excavating a portion of the outer zones of the LWD and RWD so that filter material could be placed against the core materials of these dams. The filter zones would provide protection against both static and seismic loading conditions.

Crest Filters and Toe Drains

At the LWD and RWD, filter zones are required only in the upper portion of the dams. Processed material filter zones would be constructed from the crest to an elevation approximately 20 to 40-ft below the dam crest. This filter zone would be constructed by excavating a 20 to 40-ft portion of the downstream shell and placing the filter material against the core. The filter zone would then be covered by a layer of excavated shell material. This filter zone would exit into the downstream shell material of the embankment.

2.2.4.9 MIAD Seismic Fixes

Part of MIAD is constructed over an historic river channel, Blue Ravine. This portion of the dam, towards the left end of the dam, is at risk of significant deformations should the foundation of the dam liquefy during a severe earthquake event. Two design alternatives, in conjunction with a downstream overlay, are being considered to prevent these deformations from occurring. The alternatives to address the downstream lower zones of liquefiable foundation material are jet grouting and excavation and replacement of the material at the downstream toe. Another alternative to be constructed in conjunction with one of the downstream alternatives is the construction of a downstream overlay to address the upstream liquefiable foundation material. Figure 2-13 shows the cross section of the dam with the unstable liquefiable zones proposed for treatment.

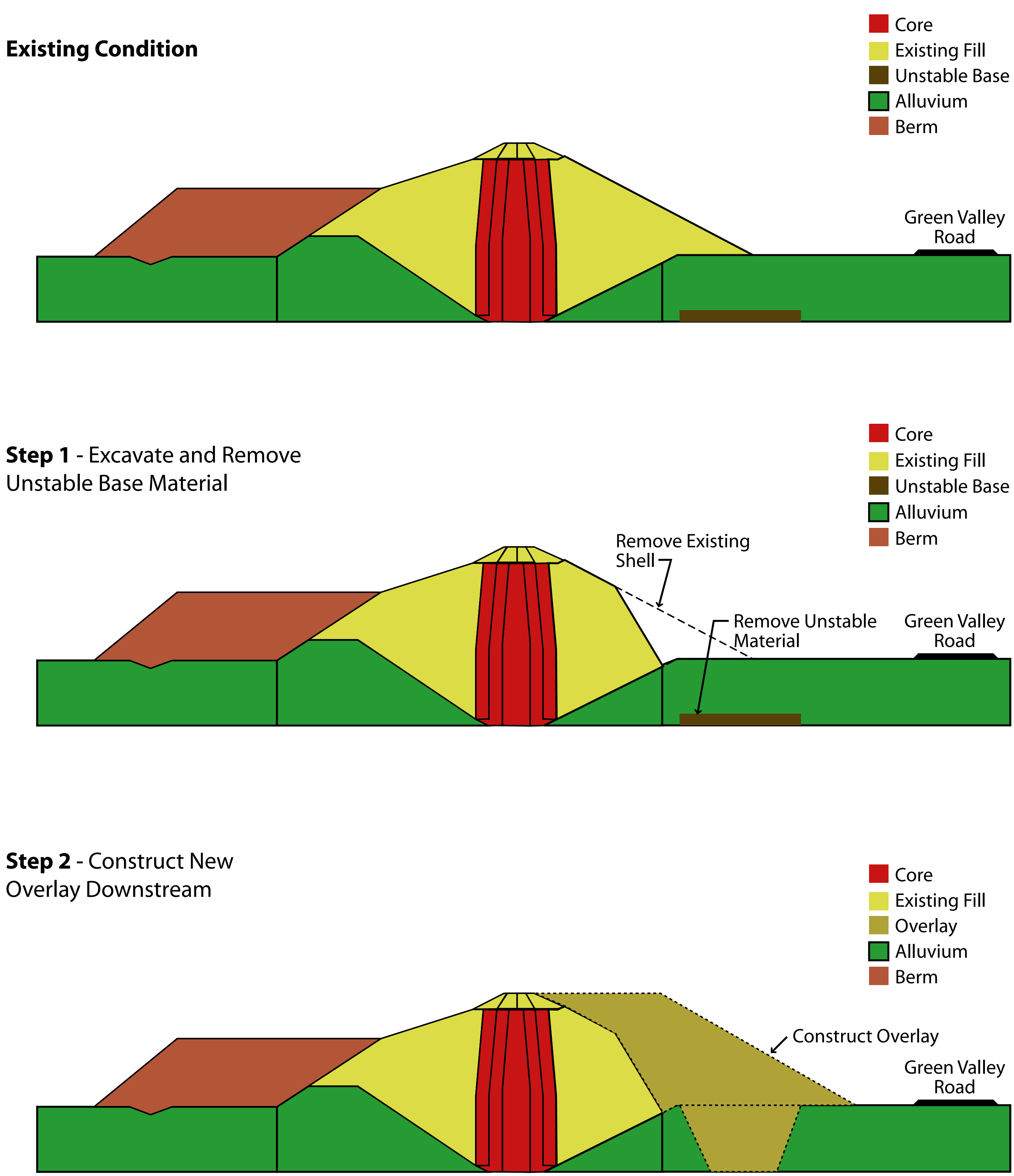


Figure 2-13
Mormon Island Auxiliary Dam Excavate and Replace Concept

Jet Grouting

Jet grouting is a method of increasing the strength of weak or loose materials in the foundation of structures or dams. In the case of MIAD, significant densification of the downstream foundation has previously been accomplished with the use of stone columns. The jet grouting would be used to increase the shear strength of the lower foundation that is still susceptible to liquefaction. Jet grouting consists of drilling to the lower zone to be strengthened, and injecting a grout mixture through a rotary nozzle that once sets up, solidifies the material to the foundation. It is anticipated that the grout would be mixed at the site of MIAD. The cement and other components for the grout would be transported to the site from local suppliers in the Sacramento area. Figure 2-14 provides conceptual illustrations of jet grouting. Upon completion of the Jet grouting the downstream overlay would be constructed.

Excavate and Replace

The second option to address MIAD downstream foundation seismic issues is the removal and replacement foundation material. This would involve the removal of the downstream outer dam shell materials and excavation of the downstream foundation alluvium at the toe of the embankment down to the rock foundation contact. These materials would be stockpiled, processed, and supplemented, as required prior to compacted replacement into the foundation.

The unsuitable structural (liquefiable) material would be removed down to the rock foundation and replaced with high strength material (Figure 2-13). This would include cement-modified soil to provide the high strength. Suitable materials excavated as part of the foundation removal would be stockpiled locally for reuse in rebuilding the foundation and shell. Non-suitable soils would be disposed of within the boundaries of Folsom Reservoir. Compacted soils would be placed on top of the high strength material prior to reconstructing the shell. Following foundation replacement, the outer shell of the dam would be reconstructed. As part of shell reconstruction, a full-height filter and a gravel drainage zone would be installed and integrated into the overlay construction.

Dewatering of the historic river channel would be necessary in order to excavate and replace the foundation materials. The water pumped from the foundation would be tested for turbidity, released to a settling pond, and discharged in accordance with the project’s water quality control permit.

Downstream Overlay

An additional component of the structural modifications proposed at MIAD would be to increase the mass of MIAD by placing an overlay over the downstream side (Figure 2-13). Although the upstream toe of MIAD was treated with dynamic compaction in the 1990s, the lower portion of MIAD was too deep to have been effectively treated by that procedure. Therefore there still is some risk for large

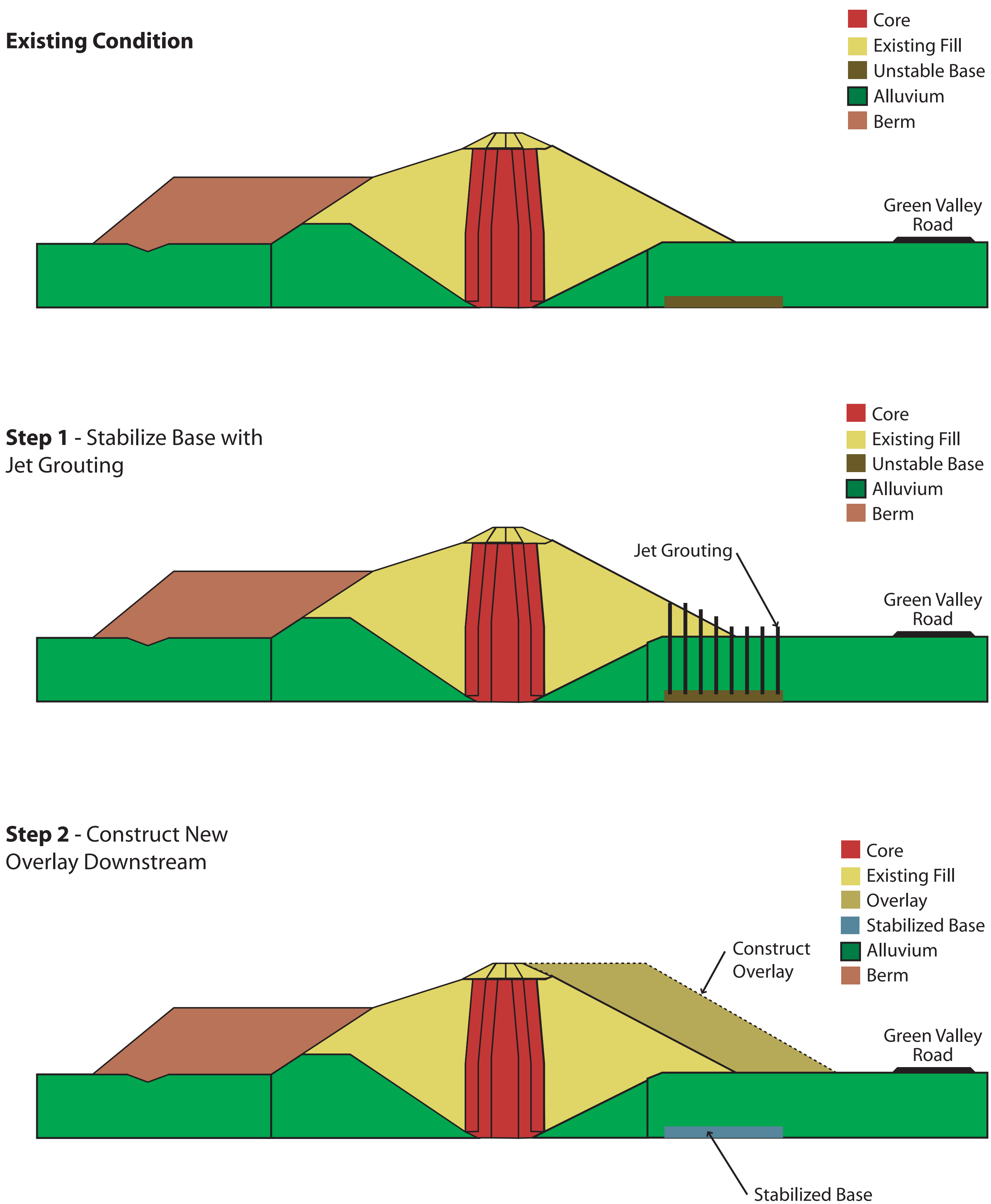


Figure 2-14
Mormon Island Auxiliary Dam Jet Grouting of Unstable Base Material Concept

sliding or deformation to occur due to upstream liquefaction. Because the presence of the reservoir makes it difficult to treat the upstream toe, a downstream overlay is being proposed. The downstream overlay would not prevent upstream sliding and deformation, but it would afford MIAD with adequate mass to withstand a seismic event.

The overlay would be accomplished following either jet grouting or replacement of the downstream foundation by widening the crest and downstream portion of the dam with large quantities of soil material. The most likely source of material would be that excavated from the site of the proposed Auxiliary Spillway. The material would be processed at a local facility, stockpiled, and then transported to MIAD for placement as the overlay. The material would be compacted as it is placed and would extend the downstream slope of MIAD to near Green Valley Road. The overlay would also incorporate the installation of a processed material filter zones. The purpose of the overlay is strictly for seismic and static concerns, and would not provide additional hydrologic control.

2.2.4.10 New Embankment/Dike Construction

All of the alternatives involving modifications of the existing flood storage pool elevations and/or raise of the Folsom Facility could result in a temporary increase in the reservoir water elevation over existing conditions during periods of maximum flood flows into the reservoir. These conditions are expected to occur at a frequency of hundreds to thousands of years. The actual level and duration of inundation is dependent on the modification alternative.

Increasing the reservoir flood storage pool would have the potential to flood property beyond the existing boundaries of Folsom Reservoir at locations with elevations that are below any potentially revised flood pool elevation.

A new embankment or other containment alternative, or obtaining flood easements, may be necessary in order to protect adjacent properties from flooding during these rare occurrences. The potential number of new embankments ranges from zero for the no-raise alternative, to an estimate of 45 new embankments around the lake perimeter under the 7-ft raise alternative. The potential number of new embankments required for raises above 7 ft has not been determined.

2.2.4.11 Miscellaneous Construction

Miscellaneous construction involves:

- Construction of staging, materials processing, and contractor work areas (See Figures 2-1 through 2-5)

    - Corps Main Concrete Dam Staging – The Corps would stage its project activities using the dam staging site developed under the Folsom Mods

Project authorization. This would include contractor's offices, parking, and storage of materials.

- Folsom Point – Folsom Point would be the main staging area along the reservoirs southern edge. Folsom Point would include contractor's offices, parking, staging of material, and processing and stockpiling of borrow materials, as well as other staging area-related activities. Borrow development from the MIAD, D1/D2, and Folsom Point areas would be staged at Folsom Point. The majority of the Folsom Point recreation area would most likely be used to support activities related to improvements planned for the LWD, Dikes 7 and 8, and MIAD.

- Beal's Point – Beal's Point would be the primary staging area along the western edge of the reservoir. Beal's point would include contractor's offices, parking, staging of material, processing and stockpiling of borrow materials, and concrete production, as well as other staging area-related activities. The southern portion of Beal's Point would be used as a staging area to support construction activities in the area. Beal's Point would support improvements to Dikes 4, 5, 6, and the RWD. Beal's Point could also support development of a borrow site. The Beal's Point staging area would be occupied during the period required to completion construction on the RWD; Dikes 4, 5, and 6.

- Granite Bay – The Granite Bay staging area would support the development of a borrow site at Granite Bay, as well as the construction at Dikes 1, 2, and 3. Activities at Granite Bay would include contractor's offices, parking, construction, materials storage, borrow material processing and stockpiling, as well as other staging area-related activities. Depending on the features of the alternative and the amount of processed material quantities required for filters, the utilization of the Granite Bay staging area could be minimal during the period of work on Dikes 1, 2, and 3. Under the earthen raise alternatives, the Granite Bay staging area would be occupied until adequate borrow and processed material was produced and transported to other project sites.

- MIAD – The MIAD staging area would support the jet grouting option as well as the excavate and replace option. It would include a contractor office, parking materials storage, and a portable concrete batch mixing plant. The MIAD staging area would be utilized through completion of the placement of the downstream overlay.

- Main Concrete Dam Overlook Parking Lot – The overlook parking lot staging area would include contractor offices and parking, materials storage, and a concrete mixing plant. This area is currently inaccessible to the public and would be occupied for the duration of the entire project.

- Development of borrow sites –Borrow sites could be developed, if required, Reclamation property upstream and downstream of the Folsom Facilities.

  The number and extent of borrow sites to be developed would be dependent on how much material the construction of the selected alternative requires, the types of material that can utilized from the Auxiliary Spillway excavation, the amount and types of earthen material available at each borrow site, proximity to proposed work, and the ability of local commercial suppliers to meet project needs. The projected amounts of borrow material available at each identified site is included in the descriptions below.

  - Auxiliary Spillway – Excavation at the Auxiliary Spillway site would produce between 2 and 4.2 million cubic yards of rock depending on the alternative. The majority of all on site borrow would be considered from this site and all other sites would be considered supplemental as needed. This material would be processed locally (screened and crushed) prior to transport to MIAD, D1/D2, or the Dike 7 stockpile site.

  - D2 – the D2 borrow site is within federal property outside of the reservoir, south of MIAD. This area contains one of the better sources for impermeable (clay-like soil) materials for raising and strengthening the cores of all earthen facilities. It could be developed to support construction of the MIAD downstream overlay. Staging, including a materials processing facility, could occur within the D2 borrow site area.

  - MIAD Right Abutment (Folsom Point) – This borrow site is adjacent to Folsom Point. Borrow at this location would be processed at Folsom Point (screened and crushed) prior to being stockpiled within the Folsom Point and Dike 7 areas.

  - Granite Bay – Borrow material development would occur along the low water shoreline north of the Granite Bay recreation site. The amount of material to be excavated varies by alternative but current estimates identify 913,000 cubic yards of earthen material available at the site. Excavated material would be processed at portable facility located at Granite Bay which would include screening for sizing and crushing to produce overlay material and processed material. Borrow material would be temporarily stored at the processing facility site prior to transport to project sites.

  - Beal's Point – Borrow material development would occur along the low water shoreline opposite the Beal's Point recreation area and to the north, along the shore line below Mooney Ridge. The amount of material to be excavated varies by alternative, with estimates identifying 1,250,000 cubic yards of earthen material available at this site. Excavated material would be processed locally including screening for sizing and crushing to produce overlay material and processed material. Processed material would be washed to remove fine-grained (silt-sized) material. Borrow material would then be temporarily stored at the processing facility site prior to transport to the various project sites.

- MIAD Left Abutment (Brown's Ravine) – This borrow site is located along the in reservoir shoreline north of MIAD. Borrow at this location would be transported to Folsom Point for processing.

- D1 – the D1 borrow site is within federal property outside of the reservoir, south of MIAD. This area would be developed to support construction of the MIAD downstream overlay. Staging, including a materials processing facility, would occur at D2.

- Filter Material Production – Filter material may be developed from excavated and processed granite or decomposed granite. The material would be crushed, ground, and screened in on-site, in mills to produce materials with the proper properties and gradations for filters. At the processing plant site, the material would be crushed, screened and washed repeatedly to remove over-sized particles until the proper sizing is achieved. The processed material would be transported via conveyor belt to a temporary stockpile location while the waste material would be dewatered under the proper conditions prior to transportation to a structure for placement, or a permanent stockpile. Filter material would be developed at the Beal's Point and Granite Bay material production sites.

- Development of stockpile sites – Stockpile sites for temporary storage of raw or processed borrow material would be established adjacent to each processing facility. The major exception would be the Dike 7 stockpile site, which could receive material from the Auxiliary Spillway excavation. In reservoir sites may require construction of a coffer dam within the reservoir, behind which stockpile material would be placed. In some instances, stockpiles would be temporarily used as processing site platforms. This is most likely to occur at Beal's Point, Folsom Point, Dike 7, and at the Overlook Parking lot. Following processing the borrow material would be removed for placement at the dikes, wing dams, and MIAD.

- Additional Explorations and Investigations – All areas identified within the project footprint as probable construction areas, contractor use areas, and borrow stockpile and/or disposal sites, may require additional geotechnical exploration or other investigation prior to construction to provide valuable information for final designs. This work could include drilling, test pits, trenches, test excavations, blasting, dewatering, unwatering, test constructions and expedited remediation activities.

- Disposal of excess materials – Depending on the alternative, the excavation of the Auxiliary Spillway site could result in between 1 and 2.5 million cubic yards of excess material not needed for dike reconstruction or the MIAD overlay. This material may be permanently disposed of at Beal's Point, Folsom Point, at Dike 7, at D1/D2, and/or on MIAD as additional overlay, or utilized to fill areas in-reservoir to create additional space for staging, stockpiling, and other construction activities.

  Dredging and excavation of approach chute – The length of the approach channel, or the approach chute varies from 300-ft to 900-ft, depending on the alternative. The majority of the construction required to excavate the approach channel would take place in the wet. It is assumed that the work would require a barge or floating platform to work from, a crane, dredging equipment, containment measures, and another barge or suitable method of transporting the excavated material.

  Material would be excavated from the lakebed mechanically until refusal. The substrate would be removed mechanically with a clamshell, suction dredge, or another suitable method. Once the material cannot be removed with a clamshell, or other means, the excavation would require controlled blasting. The majority of the blasting would take place under water. The material that is excavated by blasting would be placed on a barge or floating platform, with containment in place to reduce or eliminate sedimentation. All material excavated from the reservoir would be transported to a containment area onshore, where the material would dry. Once the material dries, it would either be processed, stockpiled for future use, or transported to a disposal area.

  Previous exploration by Reclamation has shown that there is a thin layer of sediment on top of weathered bedrock within the chute alignment. Reclamation and the Corps do not anticipate problems with water quality and sedimentation due to the minimal amount of sediment that would need to be removed. Construction methods would comply with all water quality regulations and would be fully permitted before construction starts. Best management practices and the employment of silt curtains, or other containment methods would reduce the impacts to less than significant.

  The sediments within the chute alignment are known to contain elemental mercury from historic mining operations, as well as other metals from historic activities or geology in the American River drainage. The screening level for mercury was obtained from the California Central Valley Regional Water Quality Control Board. This standard of 0.2 mg/kg is intended to define the fractional portion of the mercury that can easily be re-suspended and stay in suspension. Of the 18 samples that were collected by Reclamation in 2006, only two reached the threshold of 0.2 mg/kg hg The mean of all sites was 0.16 mg/kg

Of all the samples analyzed for metals, no results met or exceeded any of the sediment standards, and as a result would be suitable for unconfined aquatic disposal.

Sediment containing mercury would be temporarily suspended during construction, but the amount of material that would be suspending is assumed to be minimal. Reclamation and the Corps would be required to minimize the amount of material that is suspended in order to meet water quality standards. The majority of the material that would be suspended would drop out of suspension almost immediately. Unless releases are being made from the outlets, the majority of the rest of the material should fall out of suspension within Folsom Reservoir. Any material that stays suspended would be minor and would not represent a hazard or significantly impair water quality.

During construction, a detailed water quality monitoring plan would be implemented to ensure that the dredging would be conducted without adversely impacting the waters in the vicinity of the municipal water intake. Routine water samples would be taken at the start and completion of each dredging or controlled blasting period. If turbidity readings exceed predetermined values, corrective actions would begin immediately to correct any construction-related problems. If necessary, dredging operations would be shut down until values at the monitoring site return to acceptable levels.

<u>In-reservoir fill</u> – There are several locations within the reservoir that could be enhanced for construction purposes with the placement of material excavated from the Auxiliary Spillway site. In order to avoid the majority of recreation impact at the Beal's Point area, the area south of the parking lot would be elevated to the level of the parking lot. This area would be used for staging, stockpiling and potentially for processing materials. Fill material would also be used at Folsom Point for the same purposes.

Material would also be placed at the Observation Point area adjacent to the LWD to create more space for construction activities. A need has also been identified for material to be added to this area to reconfigure the topography in order to facilitate the eventual movement of water to the new Auxiliary Spillway.

The area upstream of Dike 7 would be used as a permanent stockpile area. Up to 400 cubic yards of material would be placed immediately upstream of the dike.

In order to avoid or eliminate water quality impacts during the placement of material within the reservoir, best management practices would be employed. If at all possible, material would be placed in the dry. Silt curtains or other physical methods would also be employed to reduce to eliminate water quality issues during construction.

- Development of internal roadways – To reduce construction traffic on city streets and to allow the use of oversized construction equipment, internal haul roads would be developed. The approximate routes of the construction roads are shown on Figure 2-15. The internal roadways would be sized to allow passage of oversized equipment. The crests of the wing dams and MIAD would be included as part the internal road network. Given the space limitations of the crests, one way traffic may be required. The internal haul roads routes being considered include:

  - Beal's Point to Granite Bay – This route would be used for construction at Dikes 4 and 5, access below Mooney Ridge, and Dikes 1, 2, and 3. The route would also allow transport of borrow material from Granite Bay to the RWD.

  - RWD – The RWD dam route would allow transport of material to the right abutment of the Main Concrete Dam.

  - Dam Staging to Folsom Point – A construction haul road would be constructed from the Auxiliary Spillway site to a Dike 7 stockpile site and then on to Folsom Point. This would allow for transportation of materials between these project facilities. The haul road would only be available when the reservoir was well below capacity. The use of this haul route would also necessitate re-initiation of consultation with the Service due to potential impacts that are not be accounted for in this document.

  - Folsom Point to Brown's Ravine – This haul route could involve use of the MIAD crest as a construction road. Material from the MIAD left abutment borrow site would be transported to Folsom Point for processing.

  - Folsom Point to D1/D2 Borrow sites – This haul route would transport materials to Folsom Point.

- External Haul Roads – Equipment, materials and supplies, and hauling of materials from the west to east side construction sites would be conducted on city streets. The primary proposed construction traffic routes are shown in Figure 2-16. Typical materials to be hauled on city streets include cement and aggregate, processed material, reinforcement steel, and general supplies.

- Construction Equipment – The following types of construction equipment would be used to excavate, haul, stockpile, and place earthen material and concrete.

  - Drill rigs – For installation of blasting agents for the excavation of the granitic rock foundation. Drill rigs would also be used for preconstruction geotechnical exploratory work by the Corps and Reclamation.

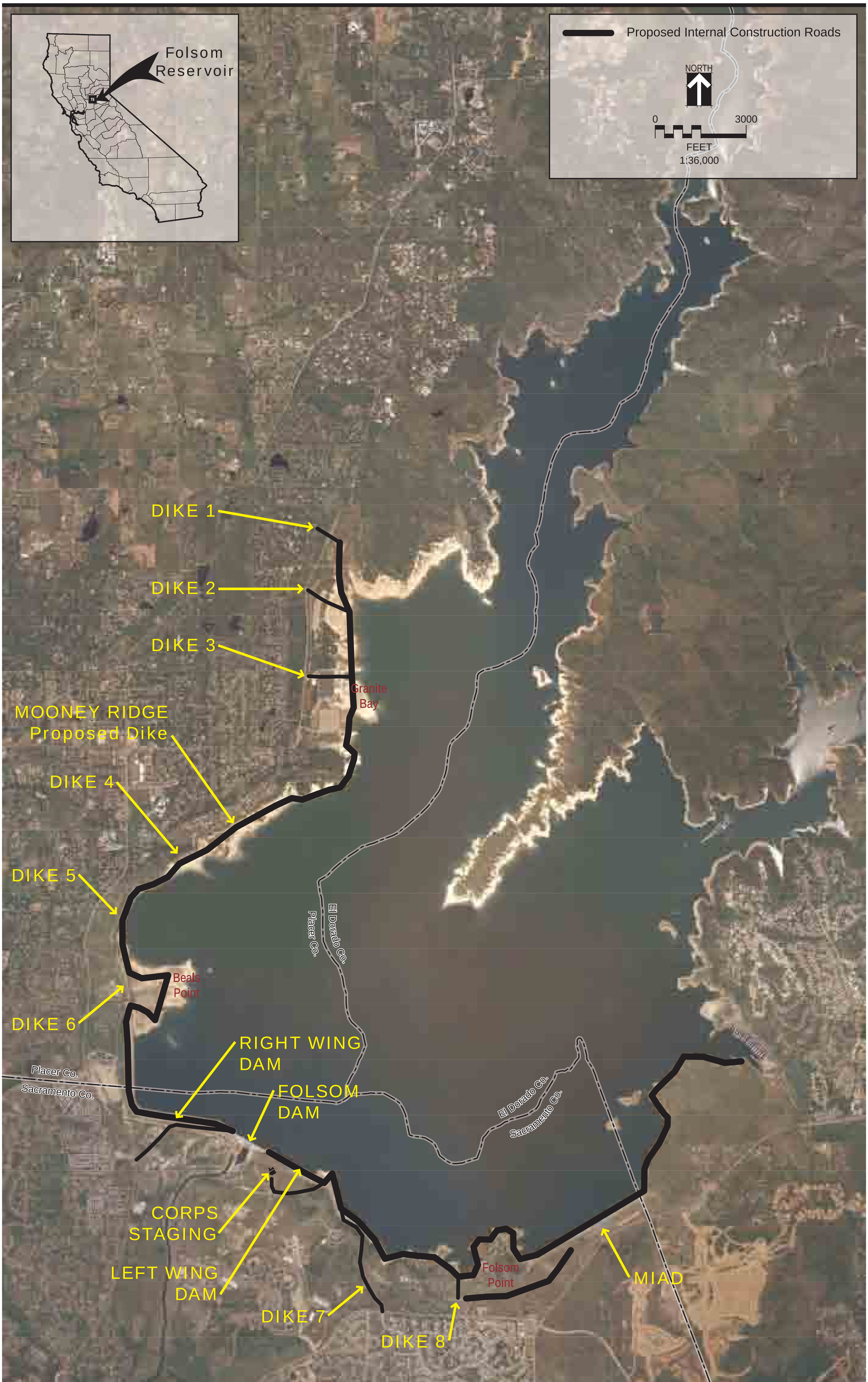


Figure 2-15
Folsom DS/FDR
Proposed Internal Construction Roads

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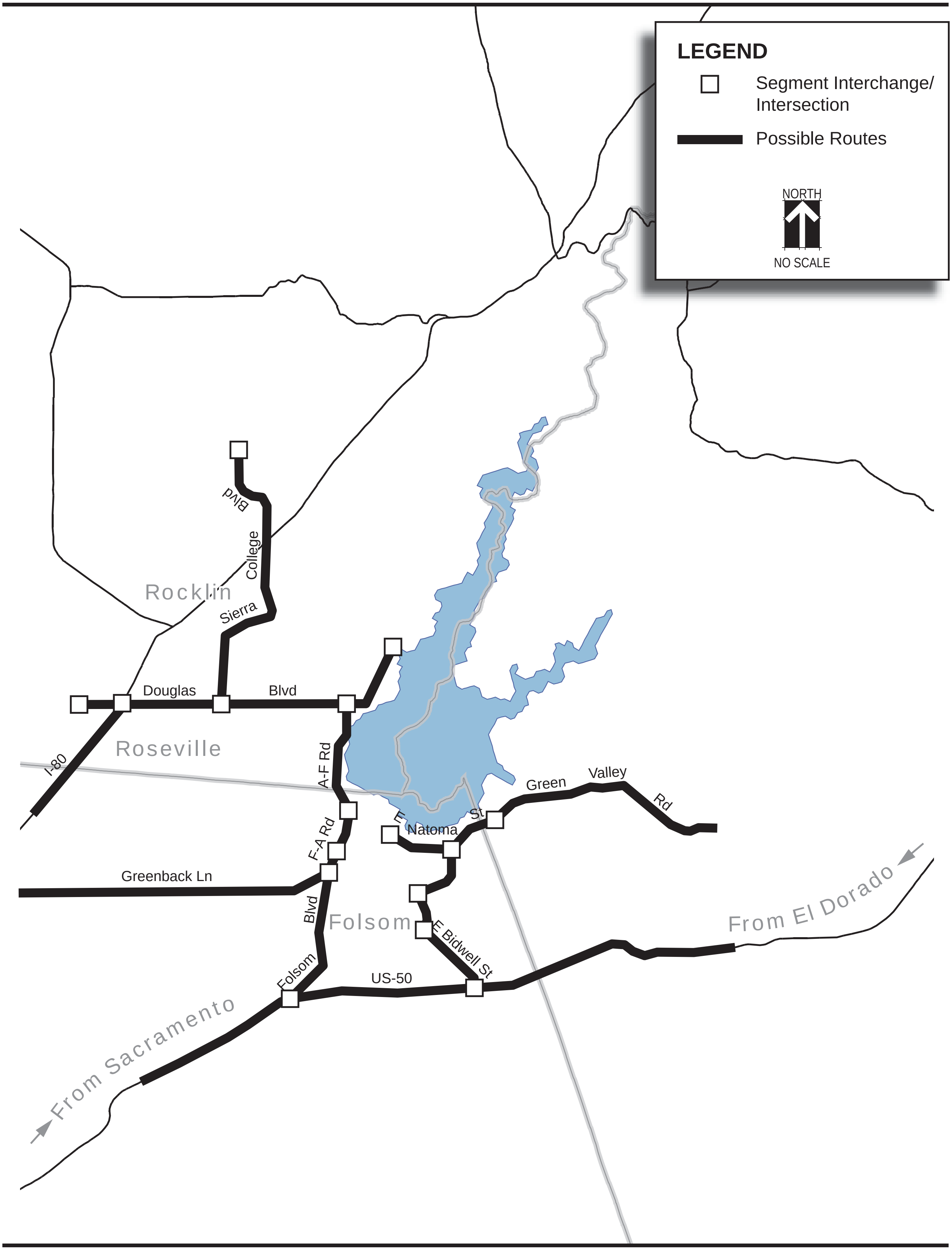

Figure 2-16
General Folsom DS/FDR Area Transportation Routes

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- Crawler tractors (bull dozers) – For earth movement and stockpiling, and pushing bottom excavators.

Bottom excavators – For excavation of ripped, stripped, or other loose material for transport to stockpiles.

- Rippers – For breaking up weathered rock foundation and blasted material in preparation for excavators.
- Excavators and Loaders – For excavation and truck loading of excavated materials.
- Graders – For haul road construction and maintenance, site restoration.
- 30-cy haul truck – For within reservoir hauling of excavated materials to processing plants and from processing plants to stockpile areas.
- 20-cy haul trucks – For hauling of materials on city streets and between Folsom processing, staging, and work sites.
- All terrain crane – For placement of forms, pre-cast walls, reinforcement steel, and other heavy materials.

2.2.4.12 Existing American River Operations

Congress authorized the Corps to construct major portions of the American River Division. The American River Basin Development Act of 1949 subsequently authorized it to be owned, operated and maintained by Reclamation and financially and operationally integrated into the Central Valley Project (CVP). The American River Division includes facilities that provide conservation of water in the American

River for flood control, fish and wildlife protection, recreation, protection of the Delta from intrusion of saline ocean water, irrigation and municipal and industrial (M&I) water supplies, and hydroelectric power generation. Initially authorized features of the American River Division included Folsom Dam, Lake, and Powerplant***;*** Nimbus Dam and Powerplant; and Lake Natoma.

Current flood control requirements and regulating criteria are specified by the Corps and described in the Folsom Dam and Lake, American River, California Water Control Manual (Corps, 1987). Flood control objectives for Folsom require that the dam and lake are operated to:

- Protect the City of Sacramento and other areas within the lower American River flood plain against reasonable probable rain floods.

- Control flows in the American River downstream from Folsom Dam to existing channel capacities, insofar as practicable, and to reduce flooding along the lower Sacramento River and in the Delta in conjunction with other CVP projects.

- Provide the maximum amount of water conservation storage without impairing the flood control functions of the reservoir.

- Provide the maximum amount of power practicable and be consistent with required flood control operations and the conservation functions of the reservoir.

From June 1 through September 30, no flood control storage restrictions exist. From October 1 through November 16 and from April 20 through May 31, reserving storage space for flood control is a function of the date only; with full flood reservation space required from November 17 through February 7 and is fixed at 400,000 acre-feet. Beginning February 8 and continuing through April 20, flood reservation space is a function of both date and current hydrologic conditions in the basin.

If the inflow into Folsom Reservoir causes the storage to encroach into the space reserved for flood control, releases from Nimbus Dam are increased. Flood control regulations prescribe the following releases when water is stored within the flood control reservation space:

- Maximum inflow (after the storage entered into the flood control reservation space) of as much as 115,000 cfs but not less than 20,000 cfs when inflows are increasing.

- Releases would not be increased more than 15,000 cfs or decreased more than 10,000 cfs during a 2-hour period.

- Flood control requirements override other operational considerations in the fall and winter period. Consequently, changes in river releases of short duration may occur.

In February 1986, the American River Basin experienced a significant flood event. Folsom Dam and Reservoir moderated the flood event and performed the flood control objectives, but with serious operational strains and concerns in the lower American River for the overall protection of the communities in the floodplain areas. A similar flood event occurred in January 1997. Since then, significant review and enhancement of lower American River flooding issues has occurred and continues to occur. A major element of those efforts has been the SAFCA sponsored Interim Flood Control Plan Diagram for Folsom Reservoir (Interim Flood Operations).

Since 1996, Reclamation has operated according to Interim Flood Operations criteria, which reserves a variable 400,000 to 670,000 acre-feet of flood control space in Folsom Reservoir and a combination of upstream reservoirs during the flood season. The Interim Flood Operations plan, which provides additional protection for the lower American River, is implemented through an agreement between Reclamation and SAFCA. The terms of the agreement allow some empty reservoir space in Hell Hole, Union Valley, and French Meadows to be treated as if it were available in Folsom. The interim operations plan release criteria are generally the same as the 1987 Corps plan, except the interim operations plan diagram may prescribe flood releases earlier than the Corps plan. The Interim Flood Operations plan diagram also relies on Folsom Dam outlet capacity to make the earlier flood releases with out restrictions. The outlet capacity at Folsom Dam is limited to up to 32,000 cfs based on lake elevation. In general, the interim operations plan provides flood protection from the 1 in 100 year design flood up from 1 in 80 year design flood protection realized by the existing Corps plan for communities in the American River floodplain.

Required flood control space under the Interim Flood Operations plan diagram would begin to decrease on March 1. Between March 1 and April 20, the rate of filling is a function of the date and available upstream space. As of April 21, the required flood reservation is about 225,000 acre-feet. From April 21 to June 1, the required flood reservation is a function of the date only, with Folsom storage permitted to fill completely on June 1.

The Interim Flood Operations agreement between SAFCA and Reclamation is set to expire in 2018 and was intended to provide a temporary interim flood damage reduction benefit until such time that the Corp's outlet modification project was completed.

<u>Without Project Conditions</u> – As described above, prior to 1995 authorized flood storage space was fixed at 400,000 acre-feet above the normal operational pool elevation of 466 feet. In 1995, Reclamation and SAFCA entered in to an 5 year Interim Agreement to provide a variable range of flood control storage space of 400,000 to 670,000 acre-feet, depending upon storage conditions in existing reservoirs upstream of Folsom Facility. Upon expiration, the agreement was extended for 2 one year periods to 2002. From 2002 until 2004 there was no agreement in place.

The Water Resources Development Act (WRDA) of 1996 directed Reclamation to continue the variable 400,000 to 670,000 acre-feet operation and enter into an agreement with SAFCA until a comprehensive flood damage reduction plan for the American River Watershed has been implemented. The current agreement to continue said variable operation was executed in December 2004 and is scheduled to expire in 2018, unless and until the Corps implements a new water control manual and associated new flood control diagram, which would provide the basis to define new operational requirements that would supersede and replace the existing agreement. Completion of a new flood control diagram and a water control manual is contingent upon completion of the appropriate level of environmental compliance, the requirements of WRDA 1996, and the reconciliation of potential conflicts with pre-existing authorities.

The Corps intended to implement a new water control manual and a new flood control diagram for the Folsom Dam Modification Project, or another relevant authorization associated with flood damage reduction at the Folsom Facilities. The Corps has not identified a plan to implement a new water control manual and flood control diagram based on the current status of the Folsom Dam Modification Authorization and/or other relevant authorizations. However, the Corps has initiated efforts to address a new flood control manual and water control plan for the current joint effort. The Corps has estimated that the new documentation to address the current dam safety and flood damage reduction action would be available in 2012. The new documentation would be in place well before the any new features would be fully constructed or operational.

Construction of any of the Folsom DS/FDR actions would not significantly alter current Folsom Facility operations. During construction and upon completion of structural modifications current operational parameters as summarized above and defined in appropriate agreements and authorities would remain in effect until the current flood operations agreement expires, or a new Flood Management Plan is developed and implemented, or if there are new Congressional authorizations, directives or mandates.

The Corps and Reclamation as directed by, and/or authorized by Congress, and under the appropriate agency authorities and agreements would update the existing Water Control Manual of 1987 or develop a new water plan and control manual. Upon selection of either a preferred joint Folsom DS/FDR alternative or stand-alone dam safety hydrologic risk reduction or flood damage reduction alternatives, the Corps as the lead agency, in cooperation with Reclamation, would determine the basis for the updated/new plan. Decisions would be based on existing authorizations, or reauthorizations, or new authorizations.

The updated/new plan would analyze weather, basin wetness, precipitation, upstream reservoir storage, and reservoir inflow forecasts to help determine appropriate comprehensive flood control operations procedures. The environmental impacts on all pertinent aspects of the human environment, and the natural environment would be evaluated in a separate environmental compliance document. The Water Control Manual would likely go through multiple revisions as the various structural modifications are completed at the Folsom Facility, but it is expected that a Final

Updated Flood Management Plan and Flood Control Manual would be completed before construction on the Folsom DS/FDR project is completed.

This Folsom DS/FDR EIS/EIR generally considers operations affected by proposed structural modifications; however, a detailed analysis of operational impacts cannot be determined at this time. Upon the selection of a preferred alternative(s), Reclamation, the Corps, SAFCA, and the DWR/Reclamation Board would fully coordinate and address relevant congressional directives to evaluate the existing requirements related to operations and consider possible changes as appropriate. The environmental impacts associated with proposed changes and operational impacts required for supplemental environmental compliance documentation. The required compliance documentation shall be completed in parallel with a Final Updated Flood Management Plan and Water Control Manual, and is anticipated to be completed in 2010.

Fish and Wildlife Requirements in the Lower American River - The minimum allowable flows in the lower American River are defined by the State Water Resources Control Board (SWRCB), and Decision 893 (D-893), which states that, in the interest of fish conservation, releases should not ordinarily fall below 250 cfs between January 1 and September 15 or below 500 cfs at other times. D-893 minimum flows are rarely the controlling objective of CVP operations at Nimbus Dam. Nimbus Dam releases are nearly always controlled during significant portions of a water year by either flood control requirements or are coordinated with other CVP and State Water Project (SWP) releases to meet downstream Sacramento-San Joaquin Delta Water Quality Control Plan requirements and CVP water supply objectives.

Power regulation and management needs occasionally control Nimbus Dam releases. Nimbus Dam releases are expected to exceed the D-893 minimum flows in all but the driest of conditions. Until such an action is presented to and adopted by the SWRCB, minimum flows would be limited by D-893. Releases of additional water are made pursuant to Section 3406 (b)(2) of the Central Valley Project Improvement Act (CVPIA).

Water temperature control operations in the lower American River are affected by many factors and operational tradeoffs. These include available cold water resources, Nimbus release schedules, annual hydrology, Folsom power penstock shutter management flexibility, Folsom Dam Urban Water Supply Temperature Control Device (TCD) management, and Nimbus Hatchery considerations. Shutter and TCD management provide the majority of operational flexibility used to control downstream temperatures.

During the late 1960s, Reclamation designed a modification to the trashrack structures to provide selective withdrawal capability at Folsom Dam. Folsom

Powerplant is located at the foot of Folsom Dam on the right abutment. Three 15-foot-diameter steel penstocks for delivering water to the turbines are embedded in the concrete section of the dam. The centerline of each penstock intake is at elevation 307.0 feet and the minimum power pool elevation is 328.5 feet. A reinforced concrete trashrack structure with steel trashracks protects each penstock intake.

The steel trashracks, located in five bays around each intake, extend the full height of the trashrack structure (between 281 and 428 feet). Steel guides were attached to the upstream side of the trashrack panels between elevation 281 and 401 feet. Forty-five 13-foot steel shutter panels (nine per bay) and operated by the gantry crane, were installed in these guides to select the level of withdrawal from the reservoir. The shutters were initially installed in a 1-7-1 configuration which allowed some flexibility to maintain lower American River temperature requirements during power releases. The shutter panels were modified by SAFCA to a 3-2-4 configuration in the early 1990s to improve their performance in conjunction to the interim operation of Folsom Dam and Reservoir.

The current objectives for water temperatures in the lower American River address the needs for steelhead incubation and rearing during the late spring and summer, and for fall-run Chinook spawning and incubation starting in late October or early November.

The steelhead temperature objectives in the lower American River, as provided by National Oceanic and Atmospheric Administration (NOAA) Fisheries, state:

> "Reclamation shall, to the extent possible, control water temperatures in the lower river between Nimbus Dam and the Watt Avenue Bridge (RM 9.4) from June 1 through November 30, to a daily average temperature of less than or equal to 65°F to protect rearing juvenile steelhead from thermal stress and from warm water predator species. The use of the cold water pool in Folsom Reservoir should be reserved for August through October releases."

Prior to the ESA listing of steelhead and the subsequent Biological Opinions on operations, the cold water resources in Folsom Reservoir were used to lower downstream temperatures in the fall when fall run Chinook salmon entered the lower river and began to spawn. The flexibility once available is now gone because of the need to use the cold water to maintain suitable summer steelhead rearing conditions. The operational objective in the fall spawning season is to provide 60°F or less in the lower river, as soon as available cold water supplies can be used.

A major challenge is determining the starting date at which time the objective is met. Establishing the start date requires a balancing between forecasted release rates, the volume of available cold water, and the estimated date at which time Folsom Reservoir turns over and becomes isothermic. Reclamation would start providing suitable spawning temperatures as early as possible (after November 1) to avoid temperature related pre-spawning mortality of adults and reduced egg viability. Releases would be balanced against the possibility of running out of cold water and increasing downstream temperatures after spawning is initiated and creating temperature related effects to eggs already in the gravel.

A temperature control management strategy must be developed that balances conservation of cold water for later use in the fall, with the more immediate needs of steelhead during the summer. The planning and forecasting process for the use of the cold water pool begins in the spring as Folsom Reservoir fills. Actual Folsom Reservoir cold water resource availability becomes significantly more defined through the assessment of reservoir water temperature profiles and more definite projections of inflows and storage. Technical modeling analysis of the projected lower American River water temperature management can begin. The significant variables and key assumptions in the analysis include:

- Starting reservoir temperature conditions
- Forecasted inflow and outflow quantities
- Assumed meteorological conditions
- Assumed inflow temperatures
- Assumed Urban Water Supply TCD operations

A series of shutter management scenarios are then incorporated into the model to gain a better understanding of the potential for meeting both summer steelhead and fall salmon temperature needs. Most annual strategies contain significant tradeoffs and risks for water temperature management for steelhead and fall-run salmon goals and needs due to the frequently limited cold water resource. The planning process continues throughout the summer. New temperature forecasts and operational strategies are updated as more information on actual operations and ambient conditions is gained. This process is shared with the American River Operations Group (AROG).

Meeting both the summer steelhead and fall salmon temperature objectives without negatively impacting other CVP project purposes requires the final shutter pull be reserved for use in the fall to provide suitable fall-run Chinook salmon spawning temperatures. In most years, the volume of cold water is not sufficient to support strict compliance with the summer temperature target at the downstream end of the compliance reach (Watt Avenue Bridge) and reserve the final shutter pull for salmon or, in some cases, continue to meet steelhead objectives later in the summer. A strategy that is used under these conditions is to allow the annual compliance location water temperatures to warm towards the upper end of the annual water temperature design value before making a shutter pull. This management flexibility is essential to the annual management strategy to extend the effectiveness of cold water management through the summer and fall months.

The goal is to maintain the health of the hatchery fish while minimizing the loss of the cold water pool for fish spawning in the river during fall. This is done on a case-by-case basis and is different in various months and year types, Temperatures above 70°F in the hatchery usually mean the fish need to be moved to another hatchery. The real time implementation needs for the CVPIA Anadromous Fish Restoration Program (AFRP) objective flow management and SWRCB D-1641 Delta standards from the limited water resources of the lower American River has made cold water resource management at Folsom Lake a significant compromise coordination effort. Reclamation consults with the U.S. Fish and Wildlife Service (USFWS), NOAA Fisheries, and the California Department of Fish and Game (CDFG) using the B2IT process (see CVPIA discussion below) when making the difficult compromise decisions. In addition, Reclamation communicates and coordinates with the AROG on real time decision issues.

CVPIA 3406(b)(2) operations on the Lower American River **-** Actual minimum flows below Nimbus Dam would be determined in accordance with the Department of the Interior Decision on Implementation of Section 3406 (b)(2) of the CVPIA (Appendix A). Instream flow objectives below Nimbus Dam for October through April would be based on recommendations of USFWS, NOAA Fisheries, and CDFG pursuant to annual B2IT coordination.

Hydropower Operations - Folsom Powerplant contains three generating units, which have a maximum powerplant operating capability of 198,000 kW. Maximum powerplant release is 8,603 cfs.

Nimbus Dam backs up Lake Natoma, controlling flow fluctuations from Folsom Powerplant. Nimbus Powerplant is housed within the dam and includes two generating units with a maximum powerplant operating capability of 17,000 kW. Maximum powerplant release is 5,100 cfs.

2.2.4.13 Security Features

To provide the necessary level of security, Reclamation would install an appropriate level of access controls, intrusion detection, supplemental lighting and Closed Circuit television (CCTV) components throughout the Folsom Dam facilities.

- Security Features Overview - One of the objectives of this project is to have a completely integrated security system. The system would be designed, constructed, and turned over to Reclamation in a fully operational condition. The intent of the security system is to:
    - Security Control Center - Provide a security control monitoring center within the existing facility.

- Access Control - Allow the Bureau of Reclamation to issue access control cards to authorized personnel that would allow controlled access as appropriate.

- Security Cameras - Allow security personnel to monitor site conditions via CCTV. These improvements require the construction of 30-ft steel towers on concrete foundation bases on each end of Dikes 4, 5, 6, and 7, and MIAD. There would be two sizes of foundations for the steel towers; 5-ft- x 5-ft x 5-ft and 7-ft x7-ft x 7-ft. Once installed the cameras would be able to only monitor critical access control devices.

- Prevent unauthorized vehicle access to critical areas on the project - The system would allow controlled access to authorized vehicles along all vehicle access points throughout the project.

- Observation Post - Retrofit/remodel and upgrade the existing enclosed observation post on top of Folsom Dam.

- Supplemental Lighting – The upgrades would provide supplemental lighting for the Main Concrete Dam, spillway gates, shutter structure, and all associated structures.

• Location of Security Components - The installation of physical and electronic security components would take place on several features of the Folsom Dam complex. Specifically the project would augment security on the left and right ends of MIAD, and Dikes 4, 5, 6, 7, and 8. There would also be work on top of the dam as well as the Beal's Point portion of the Folsom SRA.

The new security system would provide sufficient access control and parallel monitoring capability. The key system components include:

- Vehicle Barrier at Dike 4
- Vehicle Barrier at Dike 5
- Vehicle Barrier at Dike 6
- Vehicle Barrier at Right Wing Dam
- Concrete Gravity Dam (Main Concrete Dam)
- Vehicle Barrier at Left Wing Dam
- Vehicle Barrier at Dike 7
- Vehicle Barrier at Dike 8
- Vehicle Barrier at Mormon Island Dam

Dam Observation Post – The existing observation post located on Folsom Dam would be upgraded, retrofitted, and remodeled to provide a more efficient and functional viewing location for security personnel.

- Installation of Security Measures

  The following is a breakdown of the security installation measures by location.

  - Installation at the East Gate of the Dam

    - Vehicle barrier (existing)
    - Two stop lights – 2 four-ft tall mono poles
    - Four lights – 2 mono poles with directional floodlights
    - One camera – mounted on 1 stoplight mono pole
    - Two 30-ft mono poles mounted on concrete pedestals

  - Installation at the West Gate of the Dam

    - One vehicle barrier (bollards, or pipe gates)
    - Two stop lights – two 4-ft tall mono poles
    - Four lights – twp mono poles with directional floodlights
    - One camera – mounted on 1 stoplight mono pole
    - Two 30-ft mono poles mounted on concrete pedestals

  - Installation at the Folsom Dam Complex Entrance

    - One 30-ft mono pole mounted on concrete pedestal
    - One camera mounted on one stoplight pole
    - One vehicle barrier

  - Installation at MIAD

    - One Camera – Barrier gate on the left abutment
    - One camera – Barrier gate on the right abutment
    - One camera – Barrier gate on the right abutment (Camera would monitor controlled access points)
    - Two 30-ft tall truss-type steel camera towers – Located at each the left and right abutment
    - One vehicle barrier (bollards, or pipe gates)

  - Installation at Dike 7

    - One 30-ft tall truss-type steel tower for communication system – Installed to avoid impacts to wetlands
    - One 20-ft tall truss-type steel tower for camera – located at barrier gate location
    - Communication shed
    - One fixed camera
    - One vehicle barrier (bollards, or pipe gates)

- Installation at the Folsom Pumping Plant
  - One camera – installed on existing pole
- Installation at the Left Wing Dam
  - One camera monitoring the access control points along the LWD and the RWD
  - One 30-ft truss-type tower – constructed at the left end of the concrete section of Dam
- Installation at the Right Wing Dam
  - One camera monitoring the access control points of the LWD and the RWD
  - One 30-ft truss-type tower – constructed at the right end of the concrete section of Dam
- Installation at Beal's Point Recreation Area
  - One 30-ft truss-type tower – Constructed at the southern edge of the public parking area adjacent to the RWD, or another area that does not impact recreation
  - Two cameras monitoring the access control points of Folsom Dam and the Right Wing Dam
- Installation at Dike 4
  - Two 30-foot truss-type towers - One each constructed at each barrier gate location
  - One camera installed on each tower monitoring access control points
  - One vehicle barrier (bollards, or pipe gates)
- Installation at Dike 5
  - Two 30-foot truss-type towers - One each constructed at each barrier gate location.
  - One camera installed on each tower monitoring access control points
  - One vehicle barrier (bollards, or pipe gates)
- Installation at Dike 6
  - Two 30-foot truss-type towers - One each constructed at each barrier gate location

    - One camera installed on each tower monitoring access control points.
    - One vehicle barrier (bollards, or pipe gates)

- Closed Circuit Television System - The system would provide information that would allow guards to monitor site conditions.

    - Closed circuit cameras - Cameras would be located at Dikes 4, 5, 6, and 7 and MIAD. One additional camera would be located within the Beal's Point recreational area.

- Vehicle Barriers Folsom Dam Road - The Bureau of Reclamation has installed vehicle barriers on either end of the concrete portion of Folsom Dam Road. Required signage would be installed to inform motorist of the barrier system and instruct them to request access to the roadway.

- Power for all Security and Communication Components - It would be necessary to provide power to all security components. All work would be on Reclamation property in areas that minimize or avoid habitat impacts. Due to the complexity of coordinating the overall large-scale construction at several locations within and around the reservoir, it is not efficient to predetermine all of the alignments that would be required to provide necessary power to the security components. The known alignments are listed below. All alignments are subject to reasonable adjustments to accommodate project needs.

  It may be necessary to provide an interim source of power to the security components on the dikes as permanent power would require coordination with the upgrades to the dikes.

    - Earth Embankment Dams - The original plan for providing power to the security system at the earth embankment dams was to utilize solar panels. Unfortunately the climate of the Folsom area and extended duration of cloudy or foggy days significantly impacted the effectiveness of this system. Consequently, there are now two plans being evaluated for providing permanent power to the controlled access locations:

        - Underground Power: Trenching along the top of the earth embankment dikes and placing underground power along the trench to the controlled access locations. This plan has potential negative impact on the integrity of the embankment dams. Major reconstruction of the embankment dams is currently in design under the Safety of Dams Project. It is possible that underground power may be incorporated into that reconstruction effort.

        - Overhead Power: Concrete poles would be placed approximately 300-feet apart at the downstream toe of the earth embankment dams with typical overhead power lines utilized to bring permanent power to the controlled access locations.

- Right and Left Wing Dams - There are currently two plans for providing permanent power and camera communication signal to the existing vehicle barriers located on Folsom Dam Road atop the Right and Left Wing Dams. Each plan would terminate at the existing concrete dam where exposed conduit would then be installed directly onto the face of the dam to the elevator tower.

- The two plans being evaluated for providing power and communication to the vehicle barriers are:

  - Underground Power: Trenching along the east (upstream) shoulder of the road and continue along the roadway to the interface with the concrete portion of Folsom Dam, where a camera tower would be installed. The conduit would then be installed in an existing utility tunnel going across Folsom Dam Road to the downstream face of the dam.

  - Above ground power: Conduit would be installed along the backside of the existing guardrail located along Folsom Dam Road. This exposed conduit would terminate at the concrete portion of the dam and continue as previously described.

- Folsom Dam Industrial Area - The current plan is to provide permanent power to facilities located within the Folsom Dam Complex from the existing power transfer facilities located within the Folsom Dam Industrial area.

- Power Alignments

  - The alignment for power to Dikes 4-6 begins at the left barrier of Dike 6, and runs along the downstream face of the embankments of Dikes 6, 5, and 4, terminating at the right abutment of Dike 4. Power lines would either be trenched along the toes of the structures or installed utilizing 30-ft high concrete poles along the tops of the embankment structures at 300-ft intervals, or 30-ft poles at 300-ft intervals at some distance from the toe of the structures.

  - A second trench would be excavated and conduit installed from the existing vehicle barriers located on the RWD embankment. This trench would be excavated along the east (upstream) shoulder of the road and continue along the roadway to the interface with the concrete portion of Folsom Dam, where another camera tower would be installed. The conduit would then be installed in another excavated trench going across Folsom Dam Road to the downstream face of the dam. Exposed conduit would then be installed directly onto the face of the dam to the elevator tower where a hole would be drilled and the conduit run into the Elevator Tower. Instead of trenching, conduit may be fixed to the back of the existing guardrails.

- A third trench would be excavated and conduit installed from the existing elevator tower south along Folsom Dam Road. This conduit would be installed along the upstream face of the dam up to the end of the concrete section of the dam then a trench would be excavated along the upstream side of the existing roadway. This trench and conduit would continue south along Folsom Dam Road to the Overlook Parking Area and tie into a camera located on a 30-foot tall tower to be installed at the Overlook Parking Area. Instead of trenching, conduit may be fixed to the back of the existing guardrails.

- Staging Areas - Overnight staging would take place in several potential locations that have been identified for the overall project, or other areas downstream of the dam in vacant areas on Reclamation property. During construction, equipment would be staged on the dam road, or other paved areas. It may also be necessary to stage some equipment in the Overlook Parking Area. Staging would occur in previously identified areas for the Joint Federal Project. Staging areas would be located adjacent to the embankments, and would be used to store power poles, and all of the equipment required to construct this piece of the project, including, but not limited to portable restrooms, and a temporary construction office. Two or more contractors working on related or unrelated project work may use staging areas concurrently.

- Gates and Vehicle Barriers – Folsom Dam Road - Folsom Dam Road is approximately 2.3 miles in length and crosses over the LWD, the concrete gravity dam and a portion of the RWD. In order to prevent unauthorized access of large vehicles, Reclamation has installed vehicle barriers at either end of Folsom Dam.

- Project Lighting - Additional lighting would be installed for the Main Concrete Dam, spillway gates, shutter structure, and all dikes. Appropriate lighting would be installed to support monitoring of the barrier system.

2.3 No Action/No Project Alternative

The No Action/No Project (No Action) Alternative serves, under NEPA, as the baseline against which the action alternatives are compared to determine the level of impacts. The No Action Alternative “represents a projection of current conditions to the most reasonable future responses or conditions that could occur during the life of the project without any action alternatives being implemented” (Reclamation 2000).

For the purposes of the No Action/No Project Alternative, the “life of the project” (i.e., construction work on Folsom facilities) is 8 years from late 2007 through mid-2014.

Under NEPA, No Action has two interpretations. The first “may be thought of in terms of continuing with the present course of action until the action is changed” (CEQ 2006). The second includes cases where the proposed action would not take place and environmental effects of not taking action are compared to effects from taking action. The Folsom DR/FDR No Action Alternative uses both interpretations of No Action.

Under CEQA, the "no project" alternative should describe the existing conditions, as modified by "what would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services." (State CEQA Guidelines, Section 15126.6(e)). If the project is other than a land use plan or regulatory plan, for example a development or improvement project on an identifiable property, the "no project" alternative is the circumstance under which the project does not proceed. Here the discussion would compare the environmental effects of the property remaining in its existing state against environmental effects which would occur if the project is approved.

Because of the current level of risk, Reclamation has determined that no significant risk reduction benefit is obtained by altering operations in order to avoid the hydrologic risks associated with the Folsom Facilities. Therefore, the No Action/No Project Alternative includes continuing with the current Folsom Dam and Lake Water Control Manual of 1987. However, under the No Action/No Project scenario, the current hydrologic, seismic, static, and flood management risks would go unabated into the future. Additionally, the action alternatives include various construction measures that would not occur under the No Action/No Project Alternative. The No Action/No Project Alternative consists of the environmental effects of not implementing construction on the Folsom DR/FDR.

Finally, the No Action/No Project Alternative takes into account changes in the future such as land use changes; therefore, this alternative is often also called the Future without Project alternative. The period of analysis for this project is the construction window of 2007-2014. Future without project conditions for the No Action/No Project Alternative would take into account future changes within this period of analysis. Future-without-project conditions include the following projects planned to be implemented by other agencies during the period:

- Construction of a new, permanent Folsom Bridge by the Corps.

2.4 Alternative 1

Alternative 1 includes a fuseplug Auxiliary Spillway with no dam or embankment raise; crest reinforcement for selected the RWD, LWD, MIAD, and selected dikes; along with additional seismic and static design elements at the Main Concrete Dam and selected embankments. Alternative 1 and its features reflect a stand-alone Safety of Dams alternative which addresses only hydrologic, seismic, and static concerns.

Although the wing dams, MIAD, and some dikes may be subject to an minimal increase in height as part of crest reinforcing, resurfacing and protection of some of the structures, the height increase relates to the need to protect the structural integrity of the facilities during a PMF, seismic or static event, and not to increase temporary flood storage capacity, as would be accomplished by the other alternatives.

Alternative 1 includes the features summarized in Table 2-12. Table 2-13 provides the estimate quantities of materials required to construct the alternative.

Table 2-12
Features of Alternative 1

Feature	***Project Component***
Main Concrete Dam	• No Dam raise • Post-tensioned anchors, shear key elements, and or toe blocks • Foundation drain enhancements • Significant pier reinforcement • No spillway bridge improvements • Minor to moderate spillway gate Improvements
Auxiliary Spillway	• PMF -520-ft wide fuseplug, partially-lined spillway
Left and Right Wing Dams	• ≤4-ft earthen raise crest protection • Crest filters in upper portion of dam and along contact with concrete dam
Mormon Island Auxiliary Dam	• ≤ 4-ft earthen raise for resurfacing, reinforcement and/or crest protection • Toe drains • Full-height filters • Jet grouting downstream foundation • Downstream overlay
Dikes 1, 2, 3, 7, & 8	• No activity
Dikes 4, 5 & 6	• ≤ 4-ft earthen raise for resurfacing, reinforcement and/or crest protection • Toe drains • Full-height filters
Non-Federal Property Protection	• No activity
Staging and Site Development	• Utility and Road Relocations • Haul Road Construction • Borrow Site and Staging Area Development • Stockpiling and Borrow Material Processing • Concrete Batch Plant and Jet Grout Processing

Table 2-13 ***Estimated Quantities – Alternative 1***						
Embankment Feature	***Estimated Quantities (cy)***					
	Excavation	***Shell Material***	***Slope Protection***	***Filter***	***Asphalt Pavement***	***Concrete***
Main Concrete Dam	50,000	0	0	0	0	25,000
Auxiliary Spillway	3,152,000	55,000	1400	14,700	1,100	124,809
Right Wing Dam	306,640	227,259	0	65,495	2,000	0
Left Wing Dam	97,075	66,128	0	20,662	600	0
MIAD	235,300	905,000	0	333,000	1,520	0
Dike 1	0	0	0	0	0	0
Dike 2	0	0	0	0	0	0
Dike 3	0	0	0	0	0	0
Dike 4	11,757	3,719	0	15,311	460	0
Dike 5	70,984	99,332	0	31,202	600	0
Dike 6	26,311	14,520	0	18,340	430	0
Dike 7	0	0	0	0	0	0
Dike 8	0	0	0	0	0	0
TOTALS	**3,950,067**	**1,370,958**	**1,400**	**498,710**	**6,710**	**149,809**

Each of the project components is described in greater detail in the following sections.

2.4.1 Main Concrete Dam

Under Alternative 1, there would be no raise to the concrete dam, and minor to moderate improvements to the spillway gates and significant improvement to the spillway piers. The major activity under Alternative 1 would be installation of post tensioned anchors, shear key, or toe block elements. A staging area would be developed near the dam for contractor office and parking, materials storage, and for a concrete batch plant. Cement and aggregate would be hauled to the staging area from local Sacramento area suppliers. Standard construction equipment would be used to install the elements of Alternative 1.

2.4.2 Stilling Basin

There would be no modifications to the existing stilling basin under Alternative 1. However, the stilling basin would need to be dewatered to allow installation of shear keys and toes blocks.

2.4.3 Fuseplug Auxiliary Spillway

The fuseplug Auxiliary Spillway would be a 520-ft wide, fuseplug control structure, with a partially-lined chute. The spillway site would be developed by excavating up to 3.2 million cubic yards of material. The material would be placed in haul trucks and taken to a processing plant site at the overlook parking area, Folsom Point and/or Beal's Point. At the processing plant site, the material would be screened and crushed to size required to reinforce the shells of MIAD, the wing dams, and the dikes.

Following processing, the material would be hauled to Dike 7, Folsom Point, or MIAD for stockpiling.

The fuseplug Auxiliary Spillway for the partially lined chute option would have a 520-ft wide control structure at the head of a 1,100-ft long, 520- to 300-ft wide roller compacted, concrete-lined channel. This channel would lead to a 1,700-ft unlined channel discharging into the American River. The fuseplug control structure would be designed with multiple embankment sections to allow passage of progressively larger floods up to helping pass the PMF. To construct the control structure, it may be necessary to place a cofferdam or rely on a rock plug within the reservoir area near the approach channel entrance to preclude reservoir water from flooding the work site during periods of maximum reservoir water storage.

2.4.4 Left and Right Wing Dams

The LWD and RWD would be subject to similar static and hydrologic treatments. The existing shell would be stripped to allow placement of new filters. To provide drainage control, crest filters would be installed on the downstream side to a depth between 20 and 40 ft. In order to prevent piping along the interface of the wing dams with the Main Concrete Dam, processed material filters would also be installed along the embankment, concrete contact. Construction of the filters would involve removal of a portion of the outer shell and stockpiling the material. Processed material from either a local commercial source or manufactured from local granitic material would be placed in a layer across the excavated face of the dike. The excavated shell material would then be replaced and recompacted. Earthen material for the LWD would be taken from one of the nearby stockpiles. Earthen material for the RWD would be taken from the Beal’s Point borrow and processing site.

2.4.5 Mormon Island Auxiliary Dam

MIAD would undergo several treatments to address seismic, static, and hydrologic concerns. To address the seismic concerns related to the foundation of MIAD, jet grouting would be used to solidify the base. Staging for the work on MIAD would occur on site. A mobile concrete production plant would be used to mix the grout material. Pilot holes, drilled into the cobbles present at the base of MIAD, would be used as access points to inject grout. Raw cement to produce the grout would be trucked to the site from Sacramento area commercial sources.

To address static concerns, full-height filters and drains would be installed. The filters would be installed in the same manner as the dikes. A layer of shell material would be excavated for the placement of a layer of filter processed material. The shell material would be replaced, following by additional shell material.

The downstream overlay would be constructed using borrow material obtained from one of the local storage sites (Auxiliary Spillway excavation material) or D2 borrow site. The material would be transported locally for placement at MIAD. Additional shell material would be added to MIAD to increase its mass (static) and to raise the height to address hydrologic concerns. Increasing the height of MIAD would prevent it from being over topped during extreme runoff events from the upper American River watershed. MIAD would not be raised to increase the flood storage capacity of Folsom Reservoir.

2.4.6 Dikes 1, 2, 3, 7, and 8

There would be no dam safety improvement activities conducted for Dikes 1, 2, 3, 7, and 8 under Alternative 1.

2.4.7 Dikes 4, 5, and 6

Dikes 4, 5, and 6 would be subject to similar static and hydrologic treatments, with construction practices similar to that of the wing dams. The existing shell would be stripped to allow placement of new filters. In addition to construction of toe drains the dikes would be upgraded with full-height filters. Construction work for Dikes 4, 5, and 6 would be staged at Beal's Point, which would include a materials processing plant to screen and crush granitic materials to sizes adequate for construction of shell material. Borrow for placement of additional shell material would be developed at the Beal's Point borrow site.

2.4.8 Non-Federal Property Protection

There would not be a need for non-government property protection actions under Alternative 1 as there would be no raise in reservoir surface elevation from existing conditions.

2.4.9 Staging and Site Development

The staging areas being considered for Alternative 1 are as follows:

Granite Bay Staging and Borrow
Staging at Granite Bay would not be required under Alternative 1.

Beal's Point Staging and Borrow
Staging at Beal's Point would include a materials processing plant. Borrow developed at Beal's Point would be processed at a local screening and crushing plant. It is anticipated that borrow development along the reservoir shoreline would be to 30 ft below existing surface. Borrow material would be stored locally prior to use at Dikes 4, 5, and 6, and the RWD.

Main Concrete Dam Overlook Parking Lot Staging
A construction office, parking, materials storage, and a concrete batch plant would be staged near the Main Concrete Dam, extending the area into the reservoir. Fill from the Auxiliary Spillway excavation would be use to accomplish the fill. The

Main Concrete Dam staging area would also be used to support all construction activities related to the Auxiliary Spillway. A mobile processing plant to screen and crush materials excavated from the Auxiliary Spillway site would be placed at the overlook parking. Material processed at this location would be hauled to the Dike 7 materials stockpile site, Folsom Point, or MIAD.

Folsom Point Staging

A contractor work area, construction materials and equipment storage, and borrow material storage would occur at Folsom Point. A crushing plant could also be set up to process materials from the Auxiliary Spillway.

MIAD Staging

A staging site would be constructed near MIAD to support the production of grout (concrete batch plant) and placement of the downstream overlay, as well as other construction-related activities.

D2 Borrow Site

Soil with low permeability properties would be excavated at the D2 borrow site for use at all structures subject to an earthen raise.

Dike 7 Borrow Material Storage

Borrow material excavated from the Auxiliary Spillway site could be temporarily stored at Dike 7, within the reservoir, or downstream of the structure. A temporary cofferdam may be constructed using borrow material at the 400-ft contour when the reservoir is at its lowest water elevation. Borrow material would then be placed behind the cofferdam for storage until it is needed.

Internal Haul Routes

Internal haul routes would be used as described in Section 2.2.4.

2.4.10 Alternative 1 Operations

Construction and utilization of the project features in Alternative 1 would not significantly alter current Folsom Reservoir operations in most water years.

Alternative 1 is primarily a stand-alone Safety of Dams alternative, and was designed to pass the PMF and address the seismic and static risks. If the current version of the JFP were not to be expeditiously implemented, Reclamation would independently proceed with this alternative. If this alternative was implemented, it is anticipated that the features would only be operated once every 300 years or greater.

This alternative includes a fuseplug that would be designed to operate in the above scenario. Once the fuseplug has operated, it would be necessary to rebuild the fuseplug to refill the reservoir once the PMF has been passed. It would take approximately one month to rebuild the fuseplug. The materials required to rebuild the fuseplug would be stockpiled onsite.

Downstream Effects –The Auxiliary Spillway with a fuseplug would only operate at a point when over 500,000 cfs was already being released downstream through the existing spillway. The fuseplug spillway in conjunction with the existing spillway could release a total discharge between 850,000 and 900,000 cfs.

At releases above 160,000 cfs, multiple levee failures would be probable. Above 190,000 cfs, the levees have all been overtopped and the communities downstream have been evacuated. In all probability, all of the gravel in the lower American River would have been mobilized prior to fuseplug operation, and all aquatic habitat including salmonid habitat, would have been fully impacted. Releases associated with this alternative would come at a point where all of the downstream impacts from operations-related actions had already occurred. Therefore, the operation of this feature under Alternative 1 would not result in a notable change to the downstream impacts that would otherwise occur.

2.4.11 Alternative 1 Security Upgrade Features

It would be necessary to hardwire power to all security components. A permanent source of power would be considered first. If it is not possible to install permanent power for whatever reason, it would then be necessary to install a temporary power source. Power would be required to power the cameras, lights, bollards and other equipment on each dike, and the wing dams. If a permanent power source can be constructed from the outset, then there would not be a need for a temporary power source. Temporary power sources would only be utilized until a permanent power source can be constructed.

All work would be on Reclamation property in areas that minimize or avoid habitat impacts. Due to the complexity of coordinating the overall large-scale construction at several locations within and around the reservoir, it is not efficient to predetermine all of the alignments that would be required to provide power to all of the security components.

Power poles, one potential for delivery of permanent power, would be installed downstream of Dikes 4-6, at Dike 7, and at MIAD. The power poles would be installed at a distance, up to 50-ft. from the toe of the structures. In general, the power poles would be placed at 300-ft. intervals, plus or minus 30-ft. Adjustments would be made during construction to accommodate problem areas, structural issues, or other factors that would require a different spacing. The entire project would require approximately 88 poles.

Generators and upgraded solar panels are the two temporary sources of power that are being considered for project purposes. Two to three generators would be required to provide temporary power to Dikes 4-6. Two more generators would be required to provide power to Dike 7 and MIAD. The generators would be running 24 hours a day. The size (horsepower) of the generators has yet to be determined. The generators would be housed to reduce noise impacts, and placed to avoid conflict with the public. The generators would be fenced and or secured in another way to secure the equipment from public access.

If solar panels prove to be the superior alternative, then large enough panels would be employed to power all of the hardware at each of the structures. It may be necessary to utilize a combination of solar panels and generators as a backup system.

Staging would occur in previously identified areas for the DS/FDR actions. Staging areas would be located adjacent to the embankments, and would be used to store power poles, and all of the equipment required to construct this piece of the project, including, but not limited to portable restrooms, and a temporary construction office. Two or more contractors working on related or unrelated project work may use staging areas concurrently.

2.5 Alternative 2

The principle features of Alternative 2 are a fuseplug Auxiliary Spillway with an underlying tunnel, an embankment raise of up to 4 feet along with additional seismic and static design elements at the Main Concrete Dam and select embankments. Alternative 2 and its features reflect both Safety of Dams hydrologic, seismic, and static concerns with a tunnel element to meet flood damage reduction objectives.

The raise component is dependent on assumptions made about the fuseplug spillway width. The alternative as analyzed assumes a narrower fuseplug spillway approximately 350-400 feet wide at the control section. Substitution of the larger fuseplug spillway described in Alternative 1 would reduce the amount of any required raise to that as incrementally justified for flood damage reduction only. If the raise were significantly reduced or eliminated by substitution of the larger fuseplug spillway, the wing dams, MIAD, and some dikes would be subject to only a minimal increase in height as part of reinforcing, resurfacing and protecting the crest of the structures. The height increase relates to the need to protect the structural integrity of the facilities during a PMF, seismic or static event, and not to a need to increase temporary flood storage capacity, which is the reason for a raise in the other alternatives.

Under Alternative 2, there would be a 4-ft raise to all facilities except for the Main Concrete Dam crest. The Main Concrete Dam already has a 4 foot parapet wall. The raise in Alternative 2 has been designed to allow for safe passage of the PMF. The alternative also has the additional required flood surge storage capacity to reach the 1 in 200 event FDR objective. Under this or any alternative with a raise component, the additional storage is for flood control only and not for increasing the storage capacity of the reservoir. Alternative 2 includes the features provided in Table 2-14. Table 2-15 provides the estimated quantities for construction of this alternative. Each of the project components is described in greater detail in the following sections.

Table 2-14
Features of Alternative 2

Feature	*Project Component*
Main Concrete Dam	• In filling of existing parapet wall gaps across non-overflow section • Post-tensioned anchors, shear key, and/or toe block elements • Foundation Drain Enhancements • Significant spillway pier reinforcements • No spillway bridge improvements • Minor to moderate spillway gate modifications
Auxiliary Spillway	• PMF fuseplug with partially- or fully-lined chute • Control Structure – 350 to 400-ft wide Fuseplug • Tunnel with 3 Submerged Tainter Gates and Fully-Lined Discharge Channel
Left and Right Wing Dams	• 0.5-ft Earthen, 3.5-ft Parapet Concrete Wall • Toe Drains • ½ Height Filters
Mormon Island Auxiliary Dam	• 4-ft Earthen Raise • Toe Drains • Full-height Filters • Excavation and Replacement of Downstream Foundation • Downstream Overlay
Dikes 1, 2, 3, 7 and 8	• 4-ft earthen raise • Toe Drains
Dikes 4, 5 & 6	• 4-ft earthen raise • Toe Drains • Half-height Filters
Non-Federal Property Protection	• New Embankment Protection • Acquisition of Property Rights (easements or fee title)
Staging and Site Development	• Utility and Road Relocations • Haul Road Construction • Borrow Site and Staging Area Development • Stockpiling and Borrow Material Processing • Concrete Batch Plant • Excavation Blasting

Table 2-15
Estimated Quantities – Alternative 2

Embankment Feature	*Estimated Quantities (cy)*					
	Excavation	*Shell Material*	*Slope Protection*	*Filter*	*Asphalt Pavement*	*Concrete*
Main Concrete Dam	50,000	0	0	0	0	25,000
Auxiliary Spillway	3,190,000	55,000	0	14,700	1,100	124,650
Spillway Tunnel	1,656,330		0	0		134,570
Right Wing Dam	268,500	189,500	5,712	94,615	2,550	1,173
Left Wing Dam	371,800	254,400	1,734	90,808	816	367
MIAD	3,815,715	905,000	5,600	333,852	1,520	46,960
Dike 1	10,890	30,000	1,785	870	673	0
Dike 2	8,525	21,000	1,734	840	500	0
Dike 3	6,830	13,500	1,479	730	439	0
Dike 4	8,580	23,000	1,428	1,380	510	0
Dike 5	26,400	94,000	1,887	5,554	551	0
Dike 6	13,750	44,000	1,428	1,673	520	0
Dike 7	7,150	23,000	847	1,451	255	0
Dike 8	4,070	10,500	734	360	224	0
TOTALS	9,438,540	1,953,900	24,,368	546,893	9,658	332,450

2.5.1 Main Concrete Dam

Under Alternative 2, the existing parapet wall would be strengthened to serve as a 4-ft raise to the non-spillway portion of the dam structure; the existing spillway crest height would remain the same. Other dam improvements would be the same as Alternative 1.

2.5.2 Stilling Basin

There would be no modifications to the stilling basin under Alternative 2. However, the stilling basin would need to be dewatered to allow installation of shear keys and toes blocks.

2.5.3 Auxiliary Spillway

The new fuseplug Auxiliary Spillway would be a 350- to 400-ft wide fuseplug control structure, with a partially-lined or fully-lined chute options. Spillway width is ultimately dependent on optimal tunnel discharge capacity and raise component. The spillway site would be developed by excavating up to 3.5 million cubic yards of material (for the spillway and tunnel). The material would be placed in haul trucks and taken to a processing plant site at the overlook parking area.

The fuseplug Auxiliary Spillway (for the partially-lined option) would have a 350- to 400-ft wide control structure at the head of a 1,100-ft long, 350- to 400-ft roller compacted concrete-lined channel, which would narrow to 300 ft in width. This channel would lead to a 1,700-ft unlined channel discharging into the American River. The fuseplug control structure would be designed with multiple embankment sections to allow passage for progressively larger floods up to helping pass the PMF without discharging more than the maximum inflow. To construct the control structure, it may be necessary to place a cofferdam or leave a rock plug within the reservoir area near the approach channel entrance to preclude reservoir water from flooding the work site during periods of maximum storage.

2.5.4 Auxiliary Spillway Tunnel

The main differentiating feature for Alternative 2 would be the construction of an Auxiliary Spillway tunnel. The tunnel would be excavated in an area adjacent to and beneath the proposed Auxiliary Spillway using standard excavation, tunneling and earth moving equipment and handled in the same manner as the Auxiliary Spillway materials.

To construct the tunnel opening and control structure on the waterside of the facility, a cofferdam or rock plug may be constructed to control reservoir water during periods of maximum storage. The tunnel spillway would consist of three 26-ft diameter intakes and tunnels, a 45-ft diameter concrete-lined upstream pressure tunnel, and a 50-ft diameter concrete-lined modified horseshoe downstream tunnel located through the left abutment of the LWD. Flow through the tunnel spillway would be regulated by three 14- by 25-ft submerged tainter gates. In addition, 14- by 25-ft wheel mounted guard gates would be provided upstream of each tainter gate to provide for additional security.

The tunnel would discharge into a spillway chute shared by the fuseplug spillway. The fuseplug spillway would be constructed first and would provide for expedited hydrologic risk reduction for the dam overtopping concern. The initial fuseplug spillway configuration would consist of a 500-ft wide fuseplug (divided into segments) with a crest at elevation of 477 ft. The fuseplug in this configuration would pass the PMF with the existing concrete dam spillway and outlets at a maximum water surface elevation of 477.0 ft. Once the tunnel was completed, the fuseplug width would be reduced to 350-ft and the crest raised to 480-ft.

2.5.5 Left and Right Wing Dams

The LWD and RWD would require similar treatments. To provide drainage control, toe drains and full-height filters would be installed on the downstream side. Additional shell material would be placed in the wing dams to raise their elevation approximately 4 ft. Construction would be similar to that of Alternative 1.

2.5.6 Mormon Island Auxiliary Dam

Under Alternative 2, MIAD would undergo several treatments to address seismic, static, and hydrologic concerns. To address static concerns, toe drains and full-height filters would be installed. The filters would be installed before placement of the final layer of the overlay. To address the seismic concerns related to the foundation of MIAD, the foundation would be excavated from the downstream side to access foundation material. Unstable foundation material would be removed and the downstream foundation rebuilt with high strength compacted fill. As part of reconstruction, a downstream overlay would be built that would raise the height of MIAD by approximately 4-ft. The overlay shell material would be obtained from the Dike 7 storage site, Folsom Point, or MIAD (Auxiliary Spillway excavation material). The material would be transported locally for placement at MIAD.

2.5.7 Dikes 1, 2, 3, 7 and 8

Dikes 1, 2, and 3, adjacent to the Granite Bay staging area, would be subject to a 4-ft earthen raise. Borrow material for constructing the earthen raise to Dikes 1, 2, and 3 would be developed at Granite Bay. Toe drains would be installed at the base of each dike.

Dikes 7 and 8 would receive treatments similar to Dikes 1, 2, and 3. However, because Dike 8 is located along the southern shore of the reservoir, work at Dike 8 would be staged from Folsom Point. Borrow material for the Dike 8 construction would be taken from the closest stockpile area.

2.5.8 Dikes 4, 5, and 6

Dikes 4, 5, and 6 would be subject to a 4-ft earthen raise. In addition to construction of toe drains and placement of more shell material, the dikes would be upgraded with ½-height filters. Construction of the filters would involve removal of a portion of the outer shell and stockpiling the material. Processed material from either a local commercial source or manufactured from local granitic material would be placed in a layer across the excavated face of the dike. Shell material would then be replaced with additional shell material added to accomplish the 4-ft earthen raise. Construction work for Dikes 4, 5, and 6 would be staged at Beal's Point with borrow developed locally.

2.5.9 New Embankments/Flood Easements

The raising of the reservoir pool elevation during a PMF event could potentially flood areas beyond the boundaries of the Folsom facilities. The areas of concern are primarily located along Mooney Ridge, north of Granite Bay, and along the eastern shoreline.

To address the potential flooding issue, the government would either construct additional embankments at locations where developed property was threatened or obtain flood easements for non-developed property. The embankments would be constructed from earthen material excavated at the specific site. Because the details and requirements for the embankments are not known at the time of development of this EIS/EIR, supplemental environmental documentation to describe construction effects would be produced once the details are known.

2.5.10 Staging and Site Development

Four staging areas are proposed to address Alternative 2 construction as follows:

Granite Bay Staging and Borrow

Staging at Granite Bay would include contractor offices and parking, construction materials storage, a borrow material processing (screening and crushing) plant, and borrow materials storage. To develop borrow for raising and strengthening structures (Dikes 1, 2, and 3), granitic material from along the shoreline would be excavated using standard construction equipment. Competent rock foundation at this location has the potential to be crushed into processed material. Excavation up to 50 feet below the existing surface is possible. Excavation of rock foundation would require the use of blasting agents.

Excavated borrow material would be transported locally to the processing plant for screening and crushing and stored locally until used. Processed material produced at

Granite Bay would be transported on internal construction haul roads to Beal's Point or by city streets to Folsom Point/MIAD.

Beal's Point Staging and Borrow

Staging at Beal's Point would be similar to that at Granite Bay, with the exception of the potential for a concrete batch plant. Borrow developed at Beal's Point would be processed at a local screening and crushing plant. It is anticipated that borrow development along the reservoir shoreline would be up to 30 ft below existing surface. Borrow material would be stored locally prior to use at Dikes 4, 5, and 6, and the RWD.

Main Concrete Dam Staging

A construction office, parking, materials storage, and a concrete batch plant would be staged near the Main Concrete Dam. The Main Concrete Dam staging would also be used to support construction of the Auxiliary Spillway.

Auxiliary Spillway

A mobile processing plant to screen and crush materials excavated from the Auxiliary Spillway site could be placed at the overlook parking lot east of the LWD. Material processed at this location would be hauled to Dike 7, Folsom Point, or the MIAD materials storage site.

Folsom Point Staging

A contractor work area, construction materials and equipment storage, and borrow material storage would occur at Folsom Point. A crushing and sorting operation could also be set up at Folsom Point.

MIAD Staging

A contractor work area would be established near MIAD for excavation and shell replacement activities.

D2 Borrow Site

Soil with low permeability properties would be excavated at the D2 borrow site for use at all structures subject to an earthen raise.

Dike 7 Borrow Material Storage

Borrow material excavated form the Auxiliary Spillway site could be temporarily stored at Dike 7, upstream of the structure. A temporary cofferdam would be constructed using borrow material at the 400-ft contour when the reservoir is at its lowest water elevation. Borrow material would then be placed behind the cofferdam for storage until it is needed.

Internal Haul Routes

Internal haul routes would be as described in Section 2.2.4.

2.5.11 Alternative 2 Operations

Construction and utilization of the project features in Alternative 2 would not significantly alter current Folsom Reservoir operations. Alternative 2 is a Flood Damage Reduction alternative, and was designed to pass the PMF. If this alternative was implemented, it is anticipated that the features would be operated as necessary to control flood flows.

Downstream Effects – The fuseplug spillway features of this alternative would only operate at a point when over 500,000 cfs was already being released downstream as described in Alternative 1. The tunnel would provide a significantly lower level of discharge capacity, allowing for the initiation of earlier releases, and maintaining flows at 160,000 cfs or below for duration's equivalent to the 1 in 200 year event. T.

Cumulative Effects – Joint flood releases from the fuseplug spillway and tunnel would be made only during large, rare, infrequent flood events occurring on the order of greater than 1 in 300 years for the fuseplug spillway and tens to hundreds of years for the tunnel. Releases above 160,000 cfs would come at a point in the flood event where the vast majority of the impacts have all ready occurred, as previously described in Alternative 1. Therefore, the cumulative impacts from Alternative 2 would be not be significant.

Reservoir Vicinity Effects – A 4-ft raise could result in a short-term temporary increase in the maximum reservoir pool elevation during extreme flood flow events. This would result in inundation of land surrounding the reservoir and could flood lower elevation areas adjacent to the federal property boundary. The lower elevation areas are primarily in the Mooney Ridge, Granite Bay, and eastern shoreline areas.

Land use actions would be necessary to address the potential for flooding related to a 4 ft raise. Structural or real estate remedies, or a combination of both, would be pursued in cooperation with impacted non-federal property owners. Probable actions in lower elevation areas would include construction of new flood protection berms (and associated access and flood protection structure easements if berms are located on non-federal property) and/or acquisition of flood easements on impacted non-federal parcels. With a 4 ft raise, Reclamation's preliminary planning-level analysis also indicates the acquisition of fee title of approximately four non-federal properties as a possible scenario, including one residential property. In the event that acquisition of fee title of non-federal property is required, impacted property owner(s) will be entitled to fair market value, assistance with replacement housing, and relocation benefits and services in accordance with Public Law 91-646. However, efforts would be made to design and construct flood protection structures that will reduce or eliminate the need for building flood protection berms and/or acquiring real estate rights (easements or fee title), including potential relocation of residents, on impacted non-federal parcels.

2.5.12 Alternative 2 Security Upgrade Features

Delta barriers or swing gates may be installed to achieve the projects goal to upgrade security at each of the structures associated with Folsom Reservoir. This alternative would still require a permanent source of power. Power would be required for the cameras, lights, and other hardware that would be installed. No power would be required for the Delta barriers or the swing gates.

This alternative would employ underground power: Trenching would take place along the top of the dikes and underground power would be placed along the trench to the controlled access locations. This plan has a potential negative impact on the integrity of the embankment dams. Major reconstruction of the embankment dams is currently in design under the Safety of Dams project. It is possible that underground power may be incorporated into that reconstruction effort.

All work would be on Reclamation property in areas that minimize or avoid habitat impacts. Due to the complexity of coordinating the overall large-scale construction at several locations within and around the reservoir, it is not efficient to predetermine all of the alignments that would be required to provide power to all of the security components.

Staging would occur in previously identified areas for the SD/FDR action areas. Staging areas would be located adjacent to the embankments, and would be used to store power poles, and all of the equipment required to construct this piece of the project, including, but not limited to portable restrooms, and a temporary construction office. Two or more contractors working on related or unrelated project work may use staging areas concurrently.

2.6 Alternative 3

Alternative 3 combines four distinct groupings of alternatives for the purpose of analyzing the cumulative effects of the project features, that when combined, meet all of Reclamation’s Safety of Dams needs, as well as the Corp’s Flood Damage Reduction needs. Specifically, Alternative 3 includes all of the features of the Joint Federal Project, which is strictly defined as gated Auxiliary Spillway structure with a 900-ft. approach, control structure with 6 submerged tainter gates, and a fully lined spillway channel. Alternative 3 also include the Safety of Dams features from Alternative 1, the Corp’s Flood Damage Reduction features, and the majority of the Security Upgrade features.

The stand-alone Flood Damage Reduction feature of the alternative – as incrementally justified - is a potential 3.5-ft parapet concrete wall raise to all facilities, except for the concrete dam where the existing 3.5-ft parapet wall would require minor modification to serve as a water barrier. The raise would allow for additional flood surge storage capacity, on a temporary basis, and not for increasing the storage capacity of the reservoir. Alternative 3, which would serve as a functionally equivalent project to the Corps' authorized Folsom Dam Mods and Folsom Dam Raise Projects, includes the features outlined in Table 2-16.

Table 2-16
Features of Alternative 3

Feature	***Project Component***
Main Concrete Dam	• No Dam raise – minor modifications to existing parapet wall (3.5 ft) • Modify/Replace Existing Spillway Bridge • Modify/Replace 3 emergency gates; main spillway/service gate modification • Significant spillway pier modification • Post-tensioned anchors • Shear Key Elements • Toe Blocks • Foundation Drain Enhancements • Stilling Basin Extension (50-75 ft)
Auxiliary Spillway	• Joint (PMF/Flood Control) Auxiliary Spillway w/ Fully-lined Chute and approach channel • Control Structure – 6 Submerged Tainter Gates plus redundant water supply outlet option • The Control Structure incorporates a bridge over the structure • Fully-lined stilling basin
Left and Right Wing Dams	• Potential 3.5-ft Parapet Concrete Wall • Training wall between Left Wing Dam and Auxiliary Spillway • Crest filters in upper portion of dam and along contact with concrete dam
Mormon Island Auxiliary Dam	• Potential 3.5-ft Parapet Concrete Wall • Toe Drains • Full-height Filters • Jet Grouting Downstream Foundation • Downstream Overlay
Dikes 1, 2, 3, 7 & 8	• Potential 3.5-ft Parapet Concrete Wall • Replace filter material removed at Dikes 1-3, 7 & 8 for parapet wall construction
Dikes 4, 5 & 6	• Potential 3.5-ft Parapet Concrete Wall • Toe Drains • Full-height Filters
Non-Federal Property Protection	• New Embankment Protection • Acquisition of Property Rights (easements or fee title)
Miscellaneous	• Utility and Road Relocations • Security Provisions option • Haul Road Construction • Borrow Site and Disposal Site Development • Staging, Borrow Material Processing, Concrete Batch Plant and Jet Grout Processing • Excavation Blasting; Underwater Blasting and Dredging

Each of the project components would be described in greater detail in the following sections.

2.6.1 Main Concrete Dam

Under Alternative 3, there would be minor modifications to the existing upstream parapet wall on the concrete monoliths of the Main Concrete Dam to serve as a water barrier and the equivalent of the parapet wall raise on the other structures. Upgrades could include the addition of rebar and concrete, both to strengthen and increase the height of the structure, as well as other materials to completely seal the parapet. The existing spillway crest height would remain the same.

As a potential enhancement, the three emergency spillway gates would be replaced or modified because structural components of the existing emergency gates would be impacted during passage of large flood releases. When replaced, the new gates would be higher with the tops of the three gates raised to 487.5 ft. The advantage of replacing the emergency gates is to increase the pool elevation (the tops of the three existing emergency spillway gates, when closed, are at elevation 471 feet). This effectively limits the flood control operation to that elevation.

Either a new spillway bridge would be constructed at the top of the piers on the upstream side of the new or modified emergency spillway gates, or the existing spillway bridge would be modified to accommodate the new or modified emergency spillway gates. In addition to modifying or replacing the three emergency gates, the five main spillway/service gates would be modified to reduce seismic risks under Alternative 3. Significant spillway pier modifications would include pier wraps cross bracing with structural members and installation of tendons in the piers. Foundation drain enhancements, post-tensioned anchors, shear key elements, and/or toe blocks would be installed to anchor the concrete structure.

Standard construction equipment would be used to install the project features of Alternative 3. A staging area would be developed near the dam for contractor office and parking, materials storage, a rock crushing plant, and for a concrete batch plant. Cement and aggregate would be hauled to the staging area from local Sacramento area suppliers. If the aggregate cannot be produced onsite, or purchased from a local supplier, then it would be necessary to truck the material in from a longer distance. No alternate sources outside of Sacramento have been identified at this point.

2.6.2 Stilling Basin

The stilling basin would be dewatered, and then extended 50 to 75 ft under Alternative 3 as incrementally justified under flood damage reduction objectives. A new stilling basin would also be constructed to accept full discharge from the proposed Auxiliary Spillway.

The existing stilling basin would be dewatered using pumps. Water would be pumped from the stilling basin into the river channel. Leakage from the dam makes it necessary to pump water out of the stilling basin for the duration of construction in the stilling basin. A fish recovery program would be developed prior to dewatering, and approved by the California Department of Fish and Game.

A small stream from the existing stilling basin cascades towards the river and may encroach on the excavation site of the Auxiliary Spillway stilling basin (described in

Auxiliary Spillway section). A small channel sufficient to handle the drainage flows from the main stilling basin may be excavated through rock. Furthermore, there would be seepage into the excavation channel through fissures in the rock. Depending upon water quality permitting, fissures would be grouted or, if grouting is not an acceptable means of cutting off the fissure flow, then this water would be directed into sumps, filtered, and pumped back into the river.

2.6.3 JFP Auxiliary Spillway

The JFP Auxiliary Spillway would be built adjacent to the LWD (within the current overlook parking lot) and consist of a 900-ft approach channel, a control structure with six submerged tainter gates (each 23 ft wide by 33 ft high), with a sill elevation of 368 ft, and an approximately 170-ft wide by 1700-ft long rectangular chute that leads to an energy dissipation structure and an exit channel. The entire discharge chute would be reinforced-concrete-lined and extend downstream from the control structure southwest at approximately 30 degrees diagonally to the LWD towards the downstream end of the exit channel for the Main Concrete Dam (entering the American River in almost a direct line). The JFP Auxiliary Spillway would be aligned to minimize impact on the approach road for the new permanent bridge at Folsom Dam. A separate hydraulic jump reinforced-concrete-lined stilling basin (265 ft long, 90 ft wide, 66-ft deep) would be constructed for the JFP Auxiliary Spillway at the downstream end of the chute, just upstream from where the Auxiliary Spillway flows re-enter the American River.

The 900-ft long approach channel invert and vertical sides would be reinforced-concrete-lined for a distance of 50 feet upstream from the face of the control structure. The invert elevation for this concrete lining would be at the 368 ft sill elevation for the gates. Most of the approach channel would be excavated in rock to be resistant to erosion. Construction of the approach channel would require underwater blasting, dredging and excavating approximately 250,000 cubic yards of material.

Construction of the JFP Auxiliary Spillway control structure would include the installation of a separate, M&I outlet that would create flexibility for Reclamation to meet water delivery needs. One use for the outlet would be to provide a backup system for the delivery of water in emergency situations. If a pipeline were to be built for the delivery of water to a specific entity, that action would be analyzed in a supplemental environmental document.

The Auxiliary Spillway site would be developed by excavating approximately 3.5 million cubic yards of material. The material would be placed in haul trucks and taken to a processing plant site on site, at the dam overlook parking lot, or Folsom Point. Some of the material may be utilized as riprap where needed. At the processing plant site, the material would be screened and crushed to sizes required to reinforce MIAD (MIAD overlay), the wing dams, and Dikes 4, 5 and 6. Following processing, the material would be hauled to a given structure for immediate use, or it would be stockpiled, or the material would be stored at Folsom Point, Dike 7, or near MIAD including D2. At Dike 7 and Dike 8/Folsom Point, some of the material may be placed permanently in the reservoir to create staging areas upstream of the structure. These areas would remain once construction is complete. Specifically, the areas north and south of the parking lot at Beal's Point would receive fill material to create staging and stockpiling space. Increasing staging and stockpiling space out of the major traffic and recreation areas would significantly decrease impacts to recreation.

In order to construct the control structure, a rock plug may be left in place, and/or a cofferdam would be placed within the reservoir downstream of the approach channel to preclude reservoir water from inundating the work site during periods of maximum reservoir storage.

2.6.4 Left and Right Wing Dams

Under Alternative 3, the LWD and RWD would be raised 3.5 ft using a parapet concrete wall.

Parapet Concrete Wall – The potential 3.5-ft parapet wall raise for flood control purposes would involve construction of a reinforced concrete parapet (flood) wall. The parapet wall would be located along the upstream edge of the existing crest for the LWD, RWD, MIAD and Dikes 1 through 8. The approximate length of the parapet wall for each embankment is indicated in Table 2-17.

Table 2-17
Parapet Wall Lengths

Embankment	***Wall Length (ft)***
Left Wing Dam	2,150
Right Wing Dam	6,850
MIAD	4,925
Dike 1	2,600
Dike 2	2,600
Dike 3	1,900
Dike 4	1,400
Dike 5	2,100
Dike 6	1,610
Dike 7	915
Dike 8	910
Total	27,960

Estimated quantities to construct the 3.5-ft parapet wall raise are indicated in Table 2-18. Due to the small volume of concrete placement, an on-site batch plant is not required. Concrete would be locally provided (transit-mix delivery). If justified, the potential parapet wall would be constructed on site at each dike. The number of

Table 2-18 ***Estimated Quantities – Parapet (Flood) Wall***						
Embankment Feature	***Estimated Quantities (cy)***					
	Excavation	***Trenching***	***Riprap***	***Filter***	***Backfill (common)***	***Concrete***
Right Wing Dam	9,894	507	3,552	837	3,920	3,171
Left Wing Dam	3,106	159	1,115	263	1,230	995
MIAD	7,114	365	2,554	602	2,818	2,280
Dike 1	3,756	193	1,348	317	1,488	1,203
Dike 2	5,778	148	2,407	1,681	1,144	926
Dike 3	2,744	141	985	232	1,087	880
Dike 4	2,022	104	726	171	801	648
Dike 5	3,033	156	1,089	257	1,202	972
Dike 6	2,326	119	835	197	921	745
Dike 7	1,322	68	474	112	524	424
Dike 8	1,314	67	472	111	521	421
TOTALS	42,409	2,027	15,557	4,780	15,656	12,665

loads of concrete to complete the entire concrete parapet wall system would be about 1,600, assuming 8 cubic yards per load, or about 5 truck loads for the 40 cubic yards placed every three days. Total time to complete the entire concrete parapet wall system would be about 950 days, or over 2.5 years, although construction duration could be much less if walls are built concurrently at different embankment locations.

Construction of a potential parapet wall would involve the removal and disposal of material necessary to facilitate placement of the wall. Due to the various types of material involved, i.e., riprap, fine and coarse filter materials, road base, asphaltic pavement and common embankment fill, it is anticipated that these materials would be wasted.

There are two actions that would need to be completed to address Safety of Dams and Flood Control concerns at the LWD and RWD. First, the downstream slope of these embankments would be stripped and a new filter installed as described for Dikes 4, 5 and 6. The new filter would be covered by a new shell overlay. Second, the parapet wall would be installed as described in Section 2.2.4. Filter material that is disturbed and removed during placement of the parapet walls on the LWD and RWD would be replaced on the upstream side only of the dam crests and would be followed by the crest filters.

To provide drainage control, crest filters in the upper portions of the LWD and RWD and along contact with the concrete dam would be installed as well as a training wall between the LWD and Auxiliary Spillway. The training wall would be constructed to prevent damage to the LWD from spillway overflow.

The LWD would be constructed from the Main Concrete Dam staging area, with concrete produced locally, and utilizing borrow material stockpiled from the spillway excavation. Material for construction would come from the Dike 7, Folsom Point, or

MIAD stock pile locations. The RWD would be constructed using both the Main Concrete Dam and staging areas located downstream from the RWD, or from the Beal's Point staging areas. Borrow material would be taken from Beal's Point, Dike 7, Folsom Point, or MIAD. The average haul distance is assumed to be approximately 0.5 mile. New riprap and backfill would be imported from a local stockpile. Filter material would be imported from an off-site source, unless it can be produced onsite.

2.6.5 Mormon Island Auxiliary Dam

Under Alternative 3, MIAD would undergo several treatments to address seismic, static, and hydrologic concerns. To address the seismic concerns related to the foundation of MIAD, jet grouting would be used to solidify the base. Work on MIAD would be staged at the site. A mobile concrete production plant would be used to mix the grout material. Pilot holes would be drilled into the cobbles present at the base of MIAD and used as access points to inject grout. Cement to produce the grout would be trucked to the site from Sacramento area commercial sources.

To address static concerns, toe drains and full-height filters would be installed following jet grouting. The filters would be installed in the same manner as at Dikes 4, 5 and 6. Lastly, a layer of shell material transported from a local stockpile (such as Dike 7, D1/D2, or material that was stockpiled previously at MIAD) would be placed over the layer of filter processed material. Shell material may include impervious materials excavated from the D1/D2 borrow site. The shell material would be replaced with additional material creating a downstream overlay.

If needed, a parapet concrete wall would be added to MIAD to raise the height by 3.5 ft. Filter material that is disturbed and removed on the upstream side of the dam crest during placement of the parapet wall on MIAD would be replaced.

2.6.6 Dikes 1, 2, 3, 7 and 8

Dikes 1, 2, and 3, located adjacent to the Granite Bay staging area, would be subject to a potential 3.5-ft parapet wall raise, as described in Section 2.2.4. Filter material that is disturbed and removed on the upstream side of the dike crest during placement of the parapet wall on the dike would be replaced.

Dike 7 and 8 would receive similar treatments as Dikes 1, 2 and 3. However, because these dikes are located along the southern shore of the reservoir, work would be staged from Folsom Point, D2, or MIAD.

2.6.7 Dikes 4, 5 and 6

Dikes 4, 5 and 6 would be subject to a potential 3.5-ft parapet wall raise following placement of toe drains, full-height filters, and replacement of their downstream shells. Construction of the filters would involve removal of a portion of the outer shell and stockpiling the material onsite. Processed material from either a local commercial source (or manufactured from local granitic material) would be placed in a layer across the excavated face of the dike. The original shell material would then be replaced. Since the parapet walls would be added after the full-height filters on these dikes, filter material that is disturbed and removed during placement of the parapet walls on these dikes would be replaced.

Construction work for Dikes 4, 5 and 6 would be staged at Beal's Point, or a downstream staging area, which would include a materials processing plant to screen and crush granitic materials to sizes adequate for replacement of shell material. Borrow would be developed at the Beal's Point borrow site.

2.6.8 Non-Federal Property Protection

As a result of a potential 3.5 ft parapet wall raise, residential properties along the boundary of Folsom Reservoir would potentially be subject to temporary flooding during extreme flood events. To address the potential for property damage related to the parapet wall raise, the government would acquire flood easements from each of the property owners potentially affected. Structures to reduce or eliminate the chance that private property is flooded are also being considered. The most likely solutions would be a small embankment, a parapet wall of unknown height, or another type of suitable structure. The need for, location, number, and impacts of new embankments/easements would be addressed in a supplemental environmental document.

2.6.9 Staging and Site Development

The Folsom facilities are located along an 8-mile stretch of the western and southern edges of Folsom Reservoir. Facilities to the east of the LWD are separated from all other facilities to the west by the Main Concrete Dam. If the concrete dam was closed to construction traffic and there is a need to minimize local construction traffic, the project would involve staging near each of the facility groupings. Borrow site development and processing would be located at the Auxiliary Spillway and Beal's Point. However, if the concrete dam was open to construction traffic, the project would involve staging near each of the facility groupings but borrow extraction and processing would occur primarily at the Auxiliary Spillway.

Staging and borrow areas for Alternative 3 are proposed as follows:

Granite Bay Staging

Staging at Granite Bay would be needed for approximately one year for the 3.5-ft parapet wall raise of Dikes 1-3 and would include contractor offices and parking, construction materials storage as well as other routine staging area activities. Material for the 3.5 ft parapet walls would be transported on city streets to the Granite Bay staging area.

Beal's Point Staging and Borrow

Staging areas south and north of Beal's Point would be created in reservoir, utilizing material from the spillway excavation or other excess material, to minimize impacts at this recreation site. Staging facilities would include borrow material processing in addition to activities similar to those at Granite Bay; staging would be for a longer duration however. Staging at Beal's Point would be for at least four years, if the area was used for processing material. Borrow developed at Beal's Point would be processed at a local screening and crushing plant. It is anticipated that borrow development along the reservoir shoreline would be up to 30 ft below the existing surface. Borrow material would be stored locally prior to use at Dikes 4, 5, and 6, and the RWD.

Main Concrete Dam Staging

A construction office, parking, materials storage, and a concrete batch plant would be staged near the Main Concrete Dam. The Main Concrete Dam staging area would also be used to support construction of the Auxiliary Spillway.

Auxiliary Spillway

A mobile processing plant to screen and crush materials excavated from the Auxiliary Spillway site would be placed at the overlook parking lot east of the LWD, or at Folsom Point. Material excavated from and processed at this location would be hauled to and processed at the Dike 7/Folsom Point, D1/D2, or MIAD materials sites.

Folsom Point Staging

A contractor work area, construction materials and equipment storage, borrow material storage, and a crushing and processing plant would all occur at Folsom Point. The Folsom Point area would be closed to the public for up to six years for staging, materials processing, stockpiling and other staging-related activities.

D1/D2 Borrow Site and/Stockpiling Site

The 3.5-ft raise for MIAD would more than likely require a greater quantity of material than would be produced from the Auxiliary Spillway excavation. Borrow sites would be developed at either or both the D1 and D2 sites, or the Brown's Ravine area for the earthen overlay at MIAD. This material would be processed at Folsom Point prior to transport to MIAD. D1 and D2 would be utilized for stockpiling if it was determined that the project would not move forward with a raise of any height. The sites could also be used to store material if the raise were to be implemented further along in the project schedule.

MIAD Staging and Jet Grout Plant

A staging area would be constructed near MIAD to support production of grout (concrete batch plant), as well as other construction-related activities. The staging area would include, but would not be limited to, areas for contractor and equipment parking, and a contractor's office.

Dike 7 Borrow Material Storage

Borrow material excavated from the Auxiliary Spillway site would be temporarily or permanently stored at Dike 7, D1/D2, or MIAD. A temporary cofferdam may be constructed upstream of Dike 7 using borrow material at the 400-ft contour when the reservoir is at its lowest water elevation. Borrow material would then be placed behind the cofferdam for storage until it is needed.

Permanent and temporary material storage areas

Several sites have been identified for potential permanent or temporary storage of excavated materials. The primary location would be upstream of Dike 7. Up to 500,000 cubic yards of material may be stored upstream of Dike 7. Beal's Point, Folsom Point, Dike 8, D1, D2 and MIAD have also been identified for the storage of materials. Dike 7, D2, and MIAD are the only locations where permanent storage of excess material is highly likely.

Internal Haul Routes

As part of site development, internal (i.e., within reservoir boundaries) haul roads would be constructed as needed. Standard construction equipment would be used to cut and fill the construction road. A road base material would form the primary road surface. Internal haul roads would be constructed to connect Beal's Point with Granite Bay, and the LWD with MIAD. Most of the in reservoir haul roads would be 40-ft wide.

Approach Channel Construction

The 900-ft approach channel would require dredging, and underwater blasting to construct. Standard industry techniques would be employed to accomplish this requirement of the project.

The sediments in the area would be analyzed for mercury or other constituent that would be mobilized during construction. Precautions would need to be made to avoid damaging fish in the vicinity of the blasting. Resource agencies would be consulted on the best way to avoid these types of impacts.

2.6.10 Alternative 3 Security Upgrade Features

Under Alternative 3, the security provisions would be the same as for Alternative 1.

2.6.11 Alternative 3 Operations

Under Alternative 3, Folsom Dam would then have four methods of discharging flows from the reservoir: three power penstocks, eight flood control outlets (four upper tier and four lower tier, all 5 ft x 9 ft), five service and three emergency tainter spillway gates set near the main spillway crest, and six submerged tainter gates in the proposed Auxiliary Spillway. To ensure adequate tailwater, the three emergency spillway gates may not be used unless the total outflow from the dam exceeds 240,000 cfs. This restriction makes the emergency gates unusable for normal flood control purposes and limits the use of the gates to dam safety outflows.

In general, utilization of the features described in Alternative 3 would involve greater releases earlier in a major hydrologic event that closely match downstream channel capacity. The JFP Auxiliary Spillway would allow the objective release of 115,000 cfs to be achieved sooner in a flood event, and would lessen peak flows for large, infrequent hydrologic events. A maximum flood release of 160,000 cfs, which is the emergency downstream channel capacity, would be made through the Auxiliary Spillway when necessary based on observed and anticipated reservoir inflows. Emergency releases of 160,000 cfs or above would not be made any sooner with the JFP spillway features completed than would occur under the existing condition.

Maximum releases utilizing project features would not be any larger than those allowed under the existing conditions. These larger, earlier flows would conserve flood storage space. In addition, the top of the flood control pool could be raised to increase the flood storage space. The top elevation of the flood space and the release diagram would be specified after the Corps and Reclamation are in agreement on the rate of increase in flows and dam safety freeboard.

It is anticipated that a revised Water Control Manual, and the supporting environmental compliance coordination and documentation would be completed one year prior to completion of construction of the project. However, if this does not occur, the project features would be operated under existing operating criteria. Under this scenario, the same amount of water would ultimately be released with and without the project features (due to operational constraints), but operators would have the ability to release more water sooner in a hydrologic event.

It is recognized that the full flood damage reduction benefits of the JFP spillway would not be fully realized until revision of the Water Control Manual and optimization of operation of the JFP spillway is in place.

Downstream Effects – Downstream impacts would remain the same as the Without Project Conditions. Releases would be made according to the Interim Flood Control Diagram until the new diagram was in place.

Reservoir Vicinity Effects – The need to protect non-government property from short-term temporary flooding and the actions available to the government would be similar those described for Alternative 2.

2.7 Alternative 4

Alternative 4 includes the combined flood damage reduction hydrologic control of the PMF by incorporating the JFP Auxiliary Spillway with 4 (rather than 6) submerged tainter gates. Alternative 4, the 7-ft Dam and Embankment Raise, would provide additional freeboard to all Folsom facilities, providing an additional margin of safety during a PMF event and would provide additional flood storage capacity, temporarily on an as-needed basis. The raise would not be used for additional reservoir water storage capacity. Alternative 4 includes the features presented in Table 2-19. The estimated quantities of materials required to construct Alternative 4 are provided in Table 2-20.

A 7-ft raise could be accomplished two different ways. First, the raise of the embankments could be accomplished using earthen material. Secondly, the raise could be accomplished through a combination of parapet walls and earthen material (essentially combining Alternatives 2 and 3). Each of the project components are described in greater detail in the following sections.

Table 2-19
Features of Alternative 4

Feature	***Project Component***
Main Concrete Dam	• 7-ft Raise to Non-overflow Sections • Post-tensioned anchors, shear key elements, toe blocks • Foundation drain enhancements • Significant spillway pier reinforcement • Replace existing spillway bridge • Spillway gate replacements • Stilling basin extension (50-75 ft)
Auxiliary Spillway	• Joint (PMF/Flood Control) fully-lined spillway • Control structure – 4 submerged Tainter gates
Left and Right Wing Dams	• 3.5-ft earthen raise; 3.5-ft parapet wall raise • Toe drains • Full-height filters
Mormon Island Auxiliary Dam	• 7-ft earthen raise • Toe Drains • Full-height Filters • Jet grouting downstream foundation • Downstream overlay
Dikes 1, 2, 3, 7 and 8	• 7-ft earthen raise • Toe drains • Full-height Filters
Dikes 4, 5 and 6	• 7-ft earthen raise • Toe drain • Full-height filters
Non-Federal Property Protection	• New Embankment Protection • Acquisition of Property Rights (easements or fee title)
Miscellaneous	• Utility and road relocations • Haul road construction • Borrow site and staging area development • Stockpiling and borrow material processing • Concrete batch plant and jet grout processing • Excavation Blasting; Underwater blasting and dredging of material

Table 2-20 Estimated Quantities – Alternative 4						
Embankment Feature	***Estimated Quantities (cy)***					
	Excavation	***Shell Material***	***Slope Protection***	***Filter***	***Asphalt Pavement***	***Concrete***
Main Concrete Dam	50,000	0	0	0	0	25,000
Auxiliary Spillway	3,425,057	58,135	0	14,700	1,100	124,650
Right Wing Dam	268,500	23,000	3,300	71,000	2,000	7,200
Left Wing Dam	370,200	13,500	1,900	22,260	600	4,200
MIAD	235,300	905,000	5,600	246,450	1,520	0
Dike 1	23,000	75,900	4,600	0	900	0
Dike 2	20,400	56,300	4,100	0	960	0
Dike 3	11,800	37,500	2,600	0	660	0
Dike 4	14,200	48,000	3,100	3,060	380	0
Dike 5	40,500	140,700	4,500	53,420	510	0
Dike 6	35,700	98,300	3,200	16,140	450	0
Dike 7	2,400	64,500	1,700	11,520	440	0
Dike 8	4,700	21,500	1,500	6,100	210	0
TOTALS	4,501,757	1,542,235	36,100	444,650	11,030	161,050

2.7.1 Main Concrete Dam

Under Alternative 4, there would be a 7-ft concrete raise to the non-spillway portion of the dam structure and the existing spillway crest elevation would remain the same. Existing spillway gates would be replaced with larger gates because structural members for the existing gates would be impacted during the passage of large flood releases. The proposed gates would be higher with the tops of the three gates raised to 487.5 ft.

The eight existing spillway gates would be replaced with larger gates as part of the 7-ft raise alternative. A new spillway bridge would be constructed at the top of the piers on the upstream side of the new spillway gates to replace the existing bridge. Installation of the larger gates would require modification of the piers to prevent spillway flows from impacting the trunnion tie beams. The piers would not need to be widened. The proposed gates would be taller, and the new trunnions would be out of the flow stream for large floods. Secondly, the tops of the three existing emergency spillway gates, when closed, are at elevation 471 feet. This effectively limits the flood control operation to that elevation. Since it is proposed that the dam be raised to elevation 487.5, it is necessary to replace the existing spillway gates to allow water to be stored against the closed gate up to lake elevation 483 ft. Post tensioned anchors, shear key, or toe block elements would be installed to anchor the concrete structure. Standard construction equipment would be used to install the elements of Alternative 4. A staging area would be developed near the dam for a contractor’s office and parking, materials storage, a concrete batch plant, and various construction-related activities. Cement and aggregate would be hauled to the staging area from local Sacramento area suppliers.

2.7.2 Stilling Basin

The stilling basin would be dewatered and extended 50 to 75 ft under Alternative 4.

2.7.3 4-Gate Auxiliary Spillway

The Auxiliary Spillway would be the same as under Alternative 3.

2.7.4 Left and Right Wing Dams

Under Alternative 4, the LWD and RWD would be raised 7-ft using earthen material. Construction would be similar to that described for Alternative 2 except full-height filters would be installed prior to placement of the earthen material

2.7.5 Mormon Island Auxiliary Dam

Under Alternative 4, MIAD would be subject to seismic, static, and hydrologic concerns in the same manner as Alternative 1.

2.7.6 Dikes 1, 2, 3, 7, and 8

Dikes 1, 2, and 3, adjacent to the Granite Bay staging area, would be subject to a 7-ft earthen raise. Borrow material for constructing the earthen raise would be developed at Granite Bay or Beal's Point. Toe drains would be installed at the base of each dike to address static concerns.

Dikes 7 and 8 would receive treatments similar to Dikes 1, 2, and 3. However, since the dikes are located along the southern shore of the reservoir, work would be staged from Folsom Point. Borrow material for their construction would be taken from the Dike 7 stockpile area, D1/D2, MIAD, or materials that were stockpiled at Folsom Point.

2.7.7 Dikes 4, 5, and 6

Dikes 4, 5, and 6 would be subject to a 7-ft earthen raise. In addition to the construction of toe drains and the placement of more shell material, the dikes would be upgraded with full-height filters. Construction would be the same as described for Alternative 2.

2.7.8 New Embankments/Property Acquisitions

The raising of the reservoir pool elevation during a PMF event would have the potential for flooding areas beyond the boundaries of the Folsom Facility. The primary areas of concern are located along Mooney Ridge, north of Granite Bay and along the eastern shoreline. The requirements for new embankments/flood easement are still under evaluation. A supplemental document would be required should Alternative 4 be selected.

2.7.9 Staging and Site Development

To construct Alternative 4, four staging areas (Granite Bay, Beal's Point, Overlook Parking Lot, Folsom Point) and two support areas (Main Concrete Dam and MIAD) would be proposed. Use of these areas would be the same as Alternative 2. Haul routes would be as presented in Section 2.2.4.

2.7.10 Alternative 4 Security Upgrade Features

Under Alternative 3, the security provisions would be the same as for Alternative 1.

2.7.11 Alternative 4 Operations

Alternative 4 would provide Folsom with four methods of discharging flows from the reservoir: three power penstocks, eight flood control outlets (four upper tier and four lower tier, all 5 ft x 9 ft), five service and three emergency tainter spillway gates set near the main spillway crest, and four submerged tainter gates in the Auxiliary Spillway.

In general, utilization of the features described in Alternative 4 would involve greater releases earlier in a major hydrologic event that closely match downstream channel capacity. The Auxiliary Spillway would allow the objective release of 115,000 cfs to be achieved sooner in a flood event, and would lessen peak flows for large, infrequent hydrologic events. A maximum flood release of 160,000 cfs, which is the emergency downstream channel capacity, would be made through the Auxiliary Spillway when necessary based on observed and anticipated reservoir inflows. Emergency releases of 160,000 cfs or above would not be made any sooner with the project features completed than would occur under the existing conditions.

Maximum releases utilizing project features would not be any larger than those allowed under the existing conditions. These larger, earlier flows would conserve flood storage space. In addition, the top of the flood control pool could be raised to increase the flood storage space. The top elevation of the flood space and the release diagram would be specified after the Corps and Reclamation are in agreement on the rate of increase in flows and dam safety freeboard.

It is anticipated that a revised Water Control Manual, and the supporting environmental compliance coordination and documentation would be completed one year prior to completion of construction of the project. However, if this does not occur, the project features would be operated under existing operating criteria. Under this scenario, the same amount of water would ultimately be released with and without the project features (due to operational constraints), but operators would have the ability to release more water sooner in a hydrologic event.

It is recognized that the full flood damage reduction benefits of the alternative would not be fully realized until revision of the Water Control Manual and optimization of operation of the JFP is in place.

Downstream Effects – Downstream impacts would remain the same as the Without Project Conditions. Releases would be made according to the Interim Flood Control Diagram until the new diagram was approved.

Reservoir Vicinity Effects – The need to protect non-government property from short-term temporary flooding and the actions available to the government would be similar to that described for Alternative 2, except for the following:

- More potentially impacted parcels due to the 7-ft raise height. Additional acquisition of flood easements and/or larger flood protection berms (and associated flood protection structure and access easements acquired if berms are located on non-Federal property).
- Potential acquisition of fee title of approximately nine non-federal properties, including approximately six residential properties.

2.8 Alternative 5

Alternative 5 would safely accommodate the PMF event by using the Main Concrete Dam spillways, including some overtopping of the center portion of the concrete dam, and increasing the flood surcharge without the need for an Auxiliary Spillway. The increased capacity would be used only to address flood control/safety of dams considerations and not to increase the permanent storage capacity of Folsom Reservoir. Alternative 5 would include the features presented in Table 2-21. The estimated quantities of materials required to construct Alternative 5 are provided in Table 2-22. Each of the project components are described in greater detail in the following sections.

2.8.1 Main Concrete Dam

Under Alternative 5, there would be a 17-ft raise to the non-spillway portion of the dam structure; the existing spillway crest elevation would remain the same. Existing spillway gates would be replaced with larger gates because trunions for the existing gates would interfere with the passage of large flood releases. The proposed gates would be higher with the tops of the three gates raised to 487.5 ft. A new spillway bridge would be constructed at the top of the piers on the upstream side of the new spillway gates. Other features would be similar to Alternative 4.

2.8.2 Stilling Basin

There would be no change to the stilling basin under Alternative 5.

Table 2-21 ***Features of Alternative 5***	
Feature	***Project Component***
Main Concrete Dam	• 17-ft raise to non-overflow section • Post-tensioned anchors, shear key elements and/or toe blocks • Foundation drain enhancements • Replace existing spillway bridge • Spillway gate replacements • Gate and pier reinforcement • No change to stilling basin
Auxiliary Spillway	• None
Left and Right Wing Dams	• 17-ft earthen raise • Toe drains • Full-height filters
Mormon Island Auxiliary Dam	• 17-ft earthen raise • Toe drains • Full-height filters • Excavation and replacement of downstream foundation • Downstream overlay
Dikes 1, 2, 3, 7 and 8	• 17-ft earthen raise • Toe drains • Full-height filters
Dikes 4, 5 and 6	• 17-ft earthen raise • Toe drains • Full-height filters
Non-Federal Property Protection	• New Embankment Protection • Acquisition of Property Rights (easements or fee title)
Other Project Features	• Utility and road relocations • Haul road construction • Borrow site and staging area development • Stockpiling and borrow material processing • Concrete batch plant

Table 2-22 ***Estimated Quantities – Alternative 5***						
Embankment Feature	***Estimated Quantities (cy)***					
	Excavation	***Shell Material***	***Slope Protection***	***Filter***	***Asphalt Pavement***	***Concrete***
Main Concrete Dam	50,000	0	0	0	0	25,000
Auxiliary Spillway	0	0	0	0	0	0
Right Wing Dam	156,000	1,900,000	28,400	74,600	10,500	0
Left Wing Dam	66,000	590,000	9,400	23,900	31,000	0
MIAD	932,300	1,130,000	126,150	221,150	1,520	0
Dike 1	44,000	210,000	13,600	16,500	3,700	0
Dike 2	61,000	175,000	17,400	22,000	2,200	0
Dike 3	70,000	160,000	17,300	21,300	2,500	0
Dike 4	25,000	127,000	7,400	7,400	2,000	0
Dike 5	48,000	350,000	10,000	10,000	2,200	0
Dike 6	24,000+	190,000	7,400	7,400	2,000	0
Dike 7	14,500	105,000	4,600	10,200	1,050	0
Dike 8	26,000	75,000	9,600	13,000	950	0
TOTALS	1,516,800	5,012,000	94,700	537,650	63,400	25,000

2.8.3 Auxiliary Spillway

The Auxiliary Spillway would not be a component of Alternative 5.

2.8.4 Left and Right Wing Dams

Under Alternative 5, the LWD and RWD would be raised 17-ft using earthen material. Construction would be similar to that of Alternatives 2, 3, and 4.

2.8.5 Mormon Island Auxiliary Dam

Under Alternative 5, MIAD would undergo several treatments to address seismic, static, and hydrologic concerns, in the same manner as Alternative 2. The existing foundation would be excavated to remove potential unstable river cobble and then replaced with more competent material. To address static concerns, toe drains and full-height filters would be installed. A layer of existing shell material would be excavated and replaced with a layer of processed filter material. The original shell material would then be replaced, followed by the addition of more shell material creating the overlay. See Alternative 2 for more details.

2.8.6 Dikes 1, 2, 3, and 8

Dikes 1, 2, 7 and 8 would be subject to a 17-ft earthen raise in the same manner as Alternative 4.

2.8.7 Dikes 4, 5 and 6

Dikes 4, 5 and 6 would be subject to a 17-ft earthen raise in the same manner as Alternative 4.

2.8.8 New Embankments/Property Acquisitions

The raising of the reservoir pool elevation during a PMF event would have the potential for flooding areas beyond the boundaries of the Folsom Facility. The primary areas of concern are located along Mooney Ridge, north of Granite Bay and along the eastern shoreline. The requirements for new embankments/flood easement are still under evaluation. A supplemental document would be required should Alternative 5 be selected.

2.8.9 Staging and Site Development

Staging and site development would be the same as described for Alternatives 2, 3, and 4. Internal haul routes would be the same as described in Section 2.2.4.

2.8.10 Alternative 5 Security Upgrade Features

Under Alternative 5, the security provisions would be the same as for Alternative 1.

2.8.11 Alternative 5 Operations

Alternative 5 was maintained and carried through the entire NEPA process because it is the only alternative that could contain and then pass the PMF without a spillway. The 17-ft raise was designed to contain to contain the design flood and pass it without overtopping the downstream levees. Variations in releases utilizing project features would not be any larger than those allowed under the existing conditions. In addition, the top of the flood control pool would be raised significantly to increase the flood storage space. Alternative 5 would allow significantly larger timeframe for the evacuation of downstream communities.

Downstream Effects – Downstream impacts would remain the same as the Without Project Conditions. Releases would be made according to the Interim Flood Control Diagram.

Reservoir Area Effects – The need to protect non-government property from short-term temporary flooding and the actions available to the government would be the similar to those described for Alternative 2 except for the following:

- More potentially impacted parcels due to the 17 ft raise height. Additional acquisition of flood easements and/or larger flood protection berms (and associated flood protection structure and access easements acquired if berms are located on non-Federal property).

- 45 parcels potentially affected by acquisition of fee title, including 37 possible residential relocations.

- The acquisition of fee title and residential relocations of some impacted non-federal parcel(s) under Alternative 5 is probably unavoidable**.**

2.9 Construction Sequencing and Other Construction Details

Project staging, area development, borrow development, and facility construction would be phased over an 8-year period. Not all activities would occur at the same time, with the most significant risk issues being addressed first. A preliminary proposal for project sequencing is presented in Table 2-23.

The priorities for project sequencing would be to initiate work on those facilities providing the greatest risk reduction benefit. This strategy would incrementally improve dam safety and flood benefits until the final project feature was constructed. The phased construction approach also allows for development and implementation of specific manageable “work packages” addressing both construction logistics and federal budgetary considerations. The work packages would be accomplished through the issuance of separate construction bids. Each work package would be sized to optimize meeting project objectives and priorities along with the availability of on-site and off-site materials necessary to construct the phased project feature.

Table 2-23
Folsom Project Generalized Sequencing of Construction

	Construction Year							
Project Feature	***2007***	***2008***	***2009***	***2010***	***2011***	***2012***	***2013***	***2014***
Folsom Point Staging	X	X	X	X	X	X	X	X
Auxiliary Spillway Excavation	X	X	X	X				
Auxiliary Spillway Construction				X	X	X	X	X
MIAD Jet Grouting	X	X	X					
MIAD Overlay				X	X			
Beal's Point Staging		X	X	X	X	X	X	X
Beal's Point Borrow Development		X	X	X				
Dikes 5 & 6 Construction		X						
LWD Construction						X	X	
RWD Construction			X	X	X			
Dikes 7 & 8 Construction							X	X
Granite Bay Borrow Development							X	X
Dikes 1, 2, 3, 4 Construction							X	X
Main Concrete Dam Seismic Upgrade					X	X	X	X
Main Concrete Dam Gates Reinforcement							X	X
Security Features	X	X	X	X	X	X	X	

2.10 Environmental Commitments

The following environmental commitments would be implemented where applicable, in association with construction activities for the Folsom Dam Safety/Flood Damage Reduction (DS/FDR) project. These measures are consistent with the impact analyses and mitigation measures for those impacts presented in Chapter 3 of this EIS/EIR. The environmental commitments section was developed by Reclamation and the Corps, however, the commitments would be implemented by each agency in accordance with each agency's policy, guidance, and authorities. Final determination by the federal agencies on actual mitigation measures will be specified in the Record of Decision (ROD).

2.10.1 Develop and Implement a Worker Environmental Awareness Program

Construction contractor and subcontractor personnel will be required to participate in and comply with an environmental awareness program provided by Reclamation and the Corps. This program would include, but is not limited to (1) awareness regarding federal, state, and local environmental laws and regulations and permits, as well as the penalties for noncompliance with environmental requirements and conditions: (2) special-status species, as well as their habitats; (3) required avoidance areas; (4) environmental commitments, mitigation, compensation, and restoration. A member of the contractor’s management staff would participate in the training sessions to discuss the contractor’s environmental commitment plans. If deemed necessary, after the completion of each training session, each employee would be required to sign a statement indicating that he/she has received the training.

2.10.2 Obtain and Implement the Conditions of the Environmental Permits

Reclamation and the Corps will obtain their respective required state and federal permits, unless the contractor will be required to obtain some of the permits, for the Folsom DS/FDR actions and will comply with all conditions included in those permits. Where appropriate, the permit conditions would be incorporated into the project engineering plans and specifications. These permits would include, but may not be limited to, the following:

- Section XXX of the Clean Air Act,
- Section 404 of the Clean Water Act,
- Section 402 of the Clean Water Act. National Pollutant Discharge Elimination system permit,
- Section 401 of the Clean Water Act, Water Quality Certification,
- Section 7 of the federal Endangered Species Act, and
- Section 106 of the National Historic Preservation Act.

2.10.3 Designate Work and Exclusion Zones

Reclamation, the Corps and/or their construction contractor(s) would ensure that construction equipment and associated activities would be confined to the designated work zone in areas that support sensitive resources. Construction equipment would be confined to a designated work zone would be fenced to clearly delineate the zone as well as keep unauthorized entry into the exclusion zone during construction.

Exclusion zones would be delineated in the field by qualified biologists and fenced at the appropriate or required distance. All fences would have signs attached that identify each area as an *Environmentally Sensitive Area*. The fencing would be installed before construction activities begin and would be maintained throughout the construction period.

During the environmental education program, construction personnel would be informed about the importance of avoiding ground-disturbing activities outside of the designated work zone. During construction, the constructions monitors and resource monitors would ensure that construction equipment and associated activities avoid any disturbance of sensitive resources outside the designated work zones (e.g., riparian zones, including root zones under drip lines, wetlands, springs, and seeps). Environmental monitors would conduct surveys as appropriate for threatened and endangered species and special-status species. The Plans and Specifications for each agency would include the following or similar measures:

- Use and storage of construction equipment would be confined to within the designated contractor use area limits.
- Existing roads and access points would be used to the extent possible to minimize disturbance to wildlife and their habitats.
- Staging areas, borrow material sites, parking locations, stockpile areas, and storage areas would be clearly marked and monitored.
- To the extent feasible, these facilities would be located outside of sensitive habitats.

2.10.4 Dewatering of the Stilling Basin

The contractor responsible for dewatering the stilling basin would prepare a fish removal plan that would be reviewed by a qualified fish biologist. The fish removal plan would be developed in conjunction with the California Department of Fish and Game (CDFG), would develop a fish recovery plan in advance of dewatering the stilling basin. During dewatering and construction, the Corps, in consultation with CDFG, would ensure that a qualified biologist is on site to implement a fish rescue operation. Fish would be removed in accordance with the CDFG approved fish recovery plan.

Fish would be counted and recorded by species. All fish would be released in the live channel downstream of the construction area unless it is determined these fish are downstream migrants that should be released downstream of the affected areas.

2.10.5 Implement Environmental Timeframes

When possible and practicable, habitat removal would occur during the non-breeding season and at times when protected species are not present. Construction activities that could adversely affect nesting birds and their habitat would be limited to the nonbreeding period, per the Migratory Bird Act.

2.10.6 Develop an Environmental Mitigation, Monitoring, Restoration Plan

As part of the environmental commitments, Reclamation and the Corps would develop a Mitigation Monitoring, and Reporting Plan (MMRP) that would describe the environmental commitments, mitigation, and reporting requirements of the Folsom DS/FDR Action. The document would be developed through coordination with the state and federal agencies responsible for oversight of the Folsom DS/FDR Action. This plan would provide detailed information on how each mitigation measure would be implemented and monitored during the preconstruction, construction, and post-construction periods, as is required. The plan would contain the following documents to be implemented during the construction phase:

- Stormwater pollution prevention plan (SWPPP) (including specific erosion control and site reclamation measures),
- Spill prevention and countermeasure plan,
- Habitat mitigation plan, including a wetland and riparian mitigation and monitoring plan,
- Migratory Bird Treaty Act (MBTA) compliance program, and
- Environmental compliance monitoring program.

General information describing each plan is provided in the following sections.

2.10.6.1 Stormwater Pollution Prevention Plan

Reclamation and the Corps and /or their construction contractor(s) would prepare and implement a SWPPP as part of the National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction Activities (General Permit). The SWPPP would include measures to minimize erosion and sediment transport to Battle Creek. It would include:

- Best management practices (BMPs) (e.g., sediment containment devices protection of construction spoils, proper installation of cofferdams);
- Site restoration;
- Post-construction monitoring of the effectiveness of BMPs;
- Contingency measures;
- Details about contractor responsibilities;
- A list of responsible parties; and
- A list of agency contacts.

Contingent upon the conditions and the type of construction, measures in the plan may include, but are not limited to:

- Avoiding work or equipment operation in water during in-reservoir activities by constructing cofferdams and diverting all water around construction sites;
- Conducting all construction work according to site-specific construction plans that minimize the potential for sediment input to the aquatic system, including constructing silt barriers immediately downstream of the construction site and minimizing disruption of the reservoir bed at and adjacent to the construction site;
- Using sedimentation fences, hay bales certified as weed-free, sandbags, water bars, and baffles as additional sources of protection for waters, ditches, and wetlands;
- Identifying all areas requiring clearing, grading, revegetation, and recontouring and minimizing the areas to be cleared, graded, and recontoured;
- Storing construction borrow and excavated material out of the reservoir (above the ordinary high-water mark) and protecting receiving waters from these erosion source areas with sedimentation fences or other effective sediment control devices;
- Grading spoil sites to minimize surface erosion; and
- Covering bare areas with mulch and revegetating all cleared areas with appropriate native, noninvasive species.

The Central Valley Regional Water Quality Control Board (CVRWQCB) would monitor compliance with the NPDES General Permit. An application for a waste discharge permit would be filed with the CVRWQCB, and compliance with the monitoring and reporting requirements for project construction is necessary.

2.10.6.2 Spill Prevention and Countermeasure Plan

Before construction begins, Reclamation and the Corps and/or their construction contractor(s) would prepare a spill prevention and countermeasure plan (SPCP) that includes strict on-site handling rules to keep construction and maintenance materials out of drainages and the waterway. Goals of this plan would be to:

- Prevent contamination of streamside soil and the water course from cement; concrete or concrete washing; asphalt; paint, or other coating materials; oil or cleanup procedures;
- Clean up spills immediately and notify the RWQCB immediately of any spill and cleanup procedures;
- Prepare, prior to construction, a spill control and response plan and restrict the volume of petroleum products allowed on site to the volume that can be addressed by the spill control and response measures included in the plan;
- Provide staging and storage areas outside the stream zone for equipment, construction materials, fuels, lubricants, solvents, and other possible contaminants;

- Store hazardous substances in staging areas at least 100 feet from the reservoir normal high water mark and other water surfaces;
- Perform refueling and vehicle maintenance at least 100 feet from receiving waters
- Minimize equipment operations in flowing water and remove vehicles from the normal high-water area before refueling and lubricating; and
- Inspect equipment to ensure that seals prevent any fuel, engine oil, or other fluids from leaking.

The measures listed above would be implemented, as appropriate, to prevent contamination, clean up spills, provide staffing and storing areas, and minimize equipment operations in flowing water. The State Water Board would monitor compliance with these measures and the SPCP.

2.10.6.3 Habitat Mitigation Approach

Reclamation and the Corps, in consultation with USFWS and DFG, would mitigate temporary habitat impacts associated with the Folsom DS/FDR actions on site with appropriate habitat mitigation. Permanent impacts associated with the Folsom DS/FDR actions would be compensated for based on the Coordination Act Report (CAR). The mitigation approach for permanent impacts presented herein includes consideration of the CAR requirement for compensation needs for seasonal wetland, riparian, and upland (oak woodland) habitats.

The Folsom DS/FDR MMRP would address those actions that would avoid and minimize adverse effects and mitigates the loss of habitat on site to the extent possible.

2.10.6.4 Wetland and Riparian Mitigation and Monitoring Plan

Reclamation and the Corps, in consultation with USFWS and CDFG, would prepare and implement as part of the MMRP a wetland and riparian mitigation plan to mitigate impacts on wetlands subject to Corps 404 jurisdiction in the Folsom DS/FDR action area. The plan would provide the Corps and USFWS with sufficient information to determine the adequacy of the proposed mitigation and to issue a Section 404 permit. The Corps would approve the plan prior to project construction activities that affect the Corps jurisdictional areas in the project area.

The plan would be prepared to meet the specifications and mitigation requirements pertaining to Corps jurisdictional areas specified in the Draft Fish and Wildlife Coordination Act (FWCA) report prepared for the project (U.S. Fish and Wildlife Service 2005).

To the degree required, a plan would also be provided to the state Water Board to determine the adequacy of the proposed mitigation with respect to water quality and to issue a Section 401 water quality certification for the project.

The goal of the mitigation effort is to avoid and minimize adverse effects on wetland and riparian habitat, as well as replace the acreage and function and values of wetlands and riparian habitat permanently affected by the project. To support this goal, the wetland and riparian mitigation plan would meet the following objectives:

- Provide compensatory mitigation for permanent impacts;
- To the extent practicable, provide in-kind replacement of habitat;
- Restore habitats that have been temporarily affected by Folsom DS/FDR action to construction to predisturbance conditions if appropriate;
- Integrate concerns for special-status species (e.g., valley elderberry longhorn beetle; vernal pool fairy shrimp) into the mitigation design to the degree practicable; and
- If possible, design the mitigation wetlands so that, once established, they would require no maintenance.

Reclamation and the Corps would submit a performance monitoring report to the Corps regulatory branch at the end of each monitoring year. The report would summarize monitoring methods, results, progress toward meeting the final performance standards, and corrective actions taken.

2.10.6.5 Migratory Bird Treaty Act Compliance Program

Reclamation and the Corps and/or their construction contractor(s) would implement the following mitigation measures as practical for all project construction:

1. Known or potential nesting and roosting sites, such as live trees with cavities and all snags and stumps, would be avoided to the extent practicable.
2. Nests of raptors or any other bird would be managed per the Migratory Bird Act.
3. To the extent possible, construction activities that could adversely affect nesting birds and rearing of young would be avoided during the period between September 1 and February 1, per the Migratory Bird Act.
4. If possible, habitat providing nesting cover for birds, such as grassland, chaparral, oak woodland, and riparian that must be removed for construction purposes, would be removed between September 1 and February 1 prior to construction.
5. Construction sites would be monitored for bird nesting activity during the breeding season to the extent possible.
6. If disturbance of a nest with eggs or young appears unavoidable, or nesting activity such as incubation of feeding of young may be affected, a project contact at USFWS and CDFG would be consulted before disturbance occurs.
7. If potential nesting habitat can not be avoided during the breeding season, a project contact at USFWS and CDFG would be consulted before disturbance occurs.

2.10.6.6 Environmental Compliance Monitoring Program

Reclamation and the Corps would develop an environmental compliance construction monitoring program to ensure that the mitigation measures and compensation measures identified in the Folsom DS/FDR EIS/EIR are implemented in an appropriate and timely manner. As part of this construction monitoring program, the need to have qualified biologists, environmental resource specialists, or archeologists to monitor construction activities near environmentally sensitive area, including areas that support threatened, endangered, and special-status species; migratory bird nesting; woody riparian vegetation; wetlands and perennial drainage crossings; and cultural sites, would be addressed.

Construction monitors would be responsible for regular preconstruction surveys, staking resources, on-site monitoring, clearing equipment and vehicle staging areas, documentation of violations and compliance, coordination with construction inspectors, and post-construction documentation. Resource monitors would be responsible for various activities, which may include monitoring work zones and communicating regularly with construction inspectors to ensure that barrier fencing, stakes, required setback buffers, and all other measures are maintained.

The roles and responsibilities of the resource monitors and other individuals on the project compliance documentation, and the elements of the environmental compliance monitoring program would be clearly outlined in the implementation plan.

2.10.7 Transportation

The lead construction agency would develop a traffic management plan for all public roads within the recreation areas where both public and construction traffic occur. The plan would include measures such as flagmen and appropriate signage. The traffic plan would be submitted to the appropriate entities, or included in the Plans and Specifications for construction. An appropriate mile per hour speed limit would be imposed in all public areas close to construction. Construction crews and traffic would utilize internal haul routes, to the extent practical.

2.10.8 Air Quality

Reclamation and the Corps would develop an Air Quality Compliance Plan for approval by the Sacramento Metropolitan Air Quality Management District outlining compliance with air quality regulations for the Folsom DS/FDR actions. The plan would demonstrate that heavy-duty (> 50 horsepower) off-road vehicles to be used in the construction project, including owned, leased and subcontractor vehicles, would achieve a project wide fleet-average 20 percent NO_x reduction and 45 percent particulate reduction compared to the most recent CARB fleet average at time of construction. The plan would include a comprehensive inventory of all off-road construction equipment, equal to or greater than 50 horsepower, that would be used an aggregate of 40 or more hours during any portion of the construction project. The inventory would include the horsepower rating, engine production year, and projected hours of use or fuel throughput for each piece of equipment. The inventory would be updated and submitted monthly throughout the duration of the project, except that an inventory shall not be required for any 30-day period in which no construction activity occurs. At least 48 hours prior to the use of subject heavy-duty off-road equipment, Reclamation and the Corps shall provide SMAQMD with the anticipated construction timeline including start date, and name and phone number of the project manager and on-site foreman.

The Air Quality Compliance Plan would also describe all air quality mitigation measures and actions taken to comply with the requirements. The Plan would include a discussion of locations for points of compliance and monitoring necessary to demonstrate compliance with air quality regulations.

2.10.9 Noise Abatement

Reclamation and the Corps would develop a Noise Abatement Plan addressing the measures to reduce construction noise levels at sensitive receptor locations. Including in the plan would be the proposed noise monitoring locations, discussion of noise mitigation measures, and a construction contact phone number for the local populace to present noise issues.

2.10.10 Recreation

Reclamation and the Corps would continue to coordinate with DPR to identify opportunities to, avoid significant recreation impacts at FLSRA. If significant recreation impacts cannot be avoided, the agencies would work within their guidance and authority to provide mitigation for these impacts. Final determination by the federal agencies on actual mitigation measures will be specified in the Record of Decision (ROD). Potential mitigation measures could include but are not limited to the measures listed below.

All construction-related damages to recreation facilities would be replaced in kind by the appropriate agency, in accordance with policy and guidance.

The lead construction agency, would post signage and public announcements to inform the public of construction activities, facility closures at Folsom Point, and potential increased crowding and waiting times at Beal’s Point and Granite Bay.

Construction, borrow and staging areas would be sited as far away from recreation areas as practical in order to minimize recreation impacts, as determined by the lead construction agency. When a staging area cannot be moved or relocated, appropriate measures would be taken for noise and safety considerations.

Borrow development, staging and construction activities would be re-contoured by the lead constructing agency, as appropriate, to pre construction conditions, or to contours which do not pose a safety hazard.

After all construction activities are complete at Beal's Point, Folsom Point, or Granite Bay, all disturbed recreation areas and facilities would be restored as closely as possible to pre-construction conditions.

The lead construction agency would include in the plans and specifications, if appropriate, a plan to ensure that the entrance stations at Beal's Point, Folsom Point and Granite Bay would meet public safety and traffic requirements during construction.

Construction hours would be scheduled to minimize impacts during peak recreation use periods, holidays, and special events, as practical.

The lead construction agency would develop a traffic management plan for all public roads within the recreation areas where both public and construction traffic occur. The plan would include measures such as flagmen and appropriate signage. The traffic plan would be submitted to the appropriate entities, or included in the Plans and Specifications for construction. An appropriate mile per hour speed limit would be imposed in all public areas close to construction. Construction crews and traffic would utilize internal haul routes, to the extent practical.

Suitable detours would be established, with appropriate signage, for any bike, equestrian, or pedestrian trails that are interrupted by construction, per agency guidance and policy. Public service announcements would also be distributed and posted to inform the public of route changes.

Any damage to existing improved trails from construction would be repaired in kind after construction is completed by the lead construction agency, per agency policy and guidance.

2.11 Environmentally Preferred Alternative

Table 2-24 provides a relative comparison of impacts among the five Folsom DS/FDR action alternatives. Aggregated in this table are the resource impacts evaluated in Chapter 3, which provide the basis of comparison among the alternatives. The four major categories used to assess relative impacts include the degree the alternative meets the Purpose and Need, and effects to physical resources, natural resources, and sociological resources. The two major factors related to the Purpose and Need are dam safety and flood damage reduction. The physical resources category incorporates the air quality, noise, water quality/supply, and geology/soils effects resulting from each alternative. In natural resources, the effects on aquatic, vegetation, and wildlife resources are evaluated for each alternative.

Sociological resources were characterized the impacts of each alternative on cultural resources, land use, recreation, transportation, and public utilities.

Table 2-24
Comparison of Alternatives and the Environmentally Preferred Alternative

Evaluation Category	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Purpose and Need	5	4	1	2	3
Physical Resources	1	3	2	4	5
Natural Resources	1	3	2	4	5
Sociological Resources	1	2	3	4	5
Total	**8**	**12**	**8**	**14**	**18**

Rankings within each resource category are based on a relative scale of 1 through 5. A score of 1 indicates the alternative that best meets the Purpose and Need of the five action alternatives and/or the alternative with the least impact(s) for that resource category. A score of 5 represents the alternative that least meets the Purpose and Need or for that resource category having the largest adverse impact(s). The total score for each alternative represents the sum of the resource category rankings for the alternative, with the lowest scores indicating the environmentally preferred alternative.

The No Action Alternative is the least environmentally damaging of all the alternatives, but the No Action Alternative does not meet any of the requirements in the Purpose and Need for the Folsom DS/FDR actions. Based on the comparative analysis, Alternatives 1 and 3 scored equally as the environmentally preferred alternative. Under Alternative 1, there would be fewer overall physical, natural, and sociological resources impacts due to the more limited actions taken for the majority of dikes. However, the fuseplug Auxiliary Spillway has been designed for dam safety purposes only to operate for a PMF or extreme flood event to maintain the integrity of the Folsom Facilities, and not to minimize flood damage reduction. The JFP spillway fully addresses the Purpose and Need with slightly more impacts. Therefore, Alternative 3 is the Environmentally Preferred Alternative.

2.12 Areas of Controversy and Unresolved Issues

This section presents aspects of the Folsom Joint Federal Project that could not be addressed in detail in this EIS/EIR. The issues described below require greater detail development or better definition before they can be incorporated into the detailed environmental analysis. Some of the areas discussed herein may need to be addressed in supplemental environmental documents.

- Auxiliary Spillway Approach Channel Dredging and Barging of Dredge Material – Portions of the Auxiliary Spillway approach channel would be excavated using a barge mounted dredge, with the spoils placed on barges. In order for the impacts of dredging and barging to be fully described, the following details would need to be developed.
  - Size of barges and types of tug boats
  - Shore/docking facilities, location, and sizing
  - Mechanisms for dredging, loading, and off-loading materials
  - Seasonality and expected volume of barge traffic
  - Dewatering and placement of dredged materials
- Cofferdams – The potential requirement of cofferdams for construction of the Auxiliary Spillway inlet, the storage of borrow material, and for the expansion of staging areas is introduced in this EIS/EIR and is analyzed at a programmatic level. However, in order to fully disclose impacts of the cofferdams, details are required as to:
  - Type of dam
  - Dam construction materials
  - Restoration of cofferdam site after it is not longer required
- New Embankments/Flood Easement Requirements – Each alternative that involves increasing the reservoir's water surface elevation would need additional measures to retain reservoir water. The general locations of new embankments have been identified and are evaluated on a programmatic level in this EIS/EIR. What has not been determined is the number of dikes required for each alternative, size of the dikes, construction methods, access for maintenance, etc. If an alternative with a raise feature is identified as the Proposed Project, then the analysis of the new embankments would need to be conducted and reported in a supplemental environmental compliance document.

- Extension of Dike 1 for Hydrologic Dam Safety. Recent evaluation of effectiveness of Dike 1 to retain reservoir water during an extremely large flood event, under existing conditions, indicates that Dike 1 may not be able to retain the reservoir at its location. Extension of Dike 1 may be warranted. Details regarding its extension were not available at the time of development of this EIS/EIR. Effects of the project would be discussed in a supplemental document by the Corps.