

Submission to Delta Vision Strategic Plan Element: CALFED Surface Storage

Today, California has a unique opportunity to address a number of growing water management challenges. Delta Vision is developing “a durable vision for sustainable management of the Delta with the goal of managing the Delta over the long term to restore and maintain identified functions and values that are determined to be important to the environmental quality of the Delta and the economic and social well being of the State.” A foundational component of the committee’s policy direction to achieve the vision is established in its first recommendation, “the Delta ecosystem and a reliable water supply for California are the primary, co-equal goals for sustainable management of the Delta.” Another of Delta Vision’s twelve integrated and linked recommendations states, “new facilities for conveyance and storage, and better linkage between the two, are needed to better manage California’s water resources for both the estuary and exports.”

Meanwhile, the 2005 California Water Plan Update has identified two framework initiatives to ensure reliable water supplies to support a vital economy, healthy environment, and high standard of living for the State’s future. First, “implement integrated regional water management,” a formal recognition that water providers can and will make important contributions to their water management portfolios through local and regional cooperative planning efforts. The second initiative, “improve statewide water management systems,” recognizes that local and regional efforts alone would leave a number of water management challenges and opportunities unaddressed, including the sustainability of the Delta and its tributaries, flood management, source water quality, aging facilities, system reoperation and integration initiatives, and implementation of CALFED programs. Underlying the two initiatives are three foundational actions:

efficient water use, water quality protection and environmental stewardship. The foundation concept simply means that solutions to ensure reliable water supplies should be comprehensive and recognize the importance of water use efficiency, stewardship of the environment, and protection of water quality.

The Governor and Legislative leaders launched the California Strategic Growth Plan in 2006, which recommends, “investing and leveraging billions of dollars in the state’s infrastructure over the next 20 years, [so that] California can maintain vibrant economic growth, improve the environment and ensure a high quality of life for generations to come.” Within the Water Element of the strategic plan, the State’s leaders propose to invest in both Delta sustainability and water storage.

In the context of these parallel and related planning efforts, a number of consistent themes are apparent. Important questions regarding CALFED surface storage arise:

- How can surface storage contribute to the Delta Vision Strategic Plan generally and to both of the Vision’s primary goals, reliable water supply and restoration of the Delta ecosystem?
- How will surface storage improve statewide water management systems and can CALFED surface storage also support integrated regional water management, the Water Plan’s initiatives?
- Will State investment in surface storage, as recommended in the Strategic Growth Plan, address “critical gaps” that remain in California’s infrastructure?

This submission will address these questions directly and will focus on addressing each area of submission guidance provided in the invitation with emphasis on guidance for reliable water supply submissions.

An Overview of the CALFED Surface Storage Investigations

New approaches to water resources planning has resulted in a new era of surface storage project formulations designed to address a new era of water resources needs. California and the federal government have funded five surface storage investigations as recommended in the CALFED Program Record of Decision. The investigations were explicitly conceived to support at least three of CALFED's program goals: water supply reliability, water quality, and ecosystem restoration. From the outset, investigation planners acknowledged that the traditional dam building model of the past would not be helpful in solving California's water challenges. In fact, these approaches would likely exacerbate many of the State's water resources problems, including perceptions about winning and losing in California's water battles. CALFED considered new onstream storage untenable. Offstream storage or expansion of existing storage proposals were considered, but formulations would emphasize effective mitigation of potential impacts. These new proposals would not limit consideration of environmental effects to mitigation, but would instead be designed to improve environmental conditions. Project purposes emphasized multi-objective storage, combining newer objectives associated with ecosystem restoration and water quality with more traditional purposes of water supply reliability, hydro-power and flood control. These new projects would support aquatic and riparian ecosystem restoration focused on the Delta and its tributaries, improved drinking and habitat water quality, and the water supply needs associated with California's diverse economy.

In addition, these projects would need to perform well under a number of potential future conditions including climate change, alternative Delta conveyance and

management, and disaster / emergency response. Surface storage projects must remain effective as precipitation and runoff patterns change and sea level rises. These projects must provide benefits with either existing or new Delta conveyance and management. Storage must support adaptively managed restoration approaches based on “new or improved science,” changes in the viability of species, and modified restoration priorities. While flexibility may be challenging to value, a robust response to various future scenarios will help ensure that projects remain no regrets investments.

After considering over fifty surface storage options, CALFED directed DWR and Reclamation to investigate five projects including enlarged Shasta, Sites Reservoir, In-Delta storage, Los Vaqueros expansion, and Upper San Joaquin River storage. This paper will focus on the four investigations that continue to be studied by State, Federal and local agencies. The four project locations are shown in Figure 1.

The CALFED surface storage project formulations have dedicated significant project resources to broad public benefits including ecosystem restoration, habitat water quality, and water supply reliability for environmental uses (see Table 1) and would be paid for by the State and/or Federal governments. Contributions to a reliable water supply for California are also explicitly included. Urban and agricultural water supply reliability and drinking water quality are generally considered non-public benefits that would be paid for by water retailers and users.

The size and location of these surface storage projects facilitates the accomplishment of benefits in two distinct ways. First, many benefits are achieved directly by releases from a new reservoir. Second, additional storage can provide significant system flexibility such that other facilities’ operations can be modified

(without reducing current benefits) to support additional benefits within the system.

Additional water in storage can be used to either improve ecosystem functions and conditions for targeted species, or improve water quality or supply reliability for water users. Another important characteristic of these proposals is the geographic location of the benefits. A number of the environmental benefits occur within the Delta itself. Other environmental benefits are targeted at the Delta's tributaries including the Sacramento and San Joaquin rivers and the Yolo Bypass, recognizing the direct connections between tributary and estuarine health. Water supply reliability improvements are generally for State Water Project and Central Valley Project contractors or environmental uses.

Performance of the CALFED surface storage projects is measured using an operations simulation of the CVP and SWP systems, using the historic hydrologic sequence 1922 - 2003. CALSIM II provides detailed information related to operations of the system under with and without project conditions. Results are often reported with both average annual values and driest periods average annual values, reflecting the importance of performance under drought conditions. In addition, DWR and Reclamation have developed a suite of analytical tools that are used in a coordinated manner with the operations simulation to assess other important characteristics including Delta water quality; Sacramento River temperature, water quality, fishery effects, river meander, sediment transport, riparian success; and water resources economics. DWR, Reclamation, and other agencies have developed a Common Assumptions process that establishes a common set of tools, operations, planning assumptions, and reporting metrics so that projects are evaluated with a common foundation.

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More detail associated with specific benefits is shown below and is derived from each investigation's plan formulation documents. Benefits associated with the In-Delta Storage investigation are not shown here, but are described in previously completed documents. One initial alternative from each on-going investigation's planning documents is described here and summarized in Table 1. These initial alternatives are not feasibility or environmental documentation alternatives and are not preferred. However, the initial alternatives described here will be used to inform the development of alternatives for feasibility and environmental documents that are now in development.

Los Vaqueros Reservoir Expansion

Contra Costa Water District, Reclamation, and DWR are participating in Los Vaqueros Reservoir Expansion (LV Expansion) studies. Information in Table 1 is from the 2006 *Initial Economic Evaluation for Plan Formulation, Los Vaqueros Expansion Investigation* (IEEPF), which focuses on one initial project alternative. Los Vaqueros Reservoir is located near the state and federal water system pumps in the south Delta, which makes it uniquely positioned to provide environmental and water operations benefits for the Delta and Bay Area water users. The primary purposes of LV Expansion are to provide dedicated water supplies for environmental uses such as Delta and tributary fisheries protection and water supply reliability for the San Francisco Bay Area. A secondary purpose is to improve the quality of water deliveries to the Bay Area users.

The initial project alternative described in the initial economic report includes an expansion of the existing 100 thousand acre-feet (TAF) reservoir to 275 TAF. Diversion would use state-of-the-art positive barrier fish screens (planning reflects CCWD's current and proposed facilities). New conveyance to the South Bay Aqueduct would also be

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provided. Strategically, the reservoir would be filled in an opportunistic manner, when water quality is high and fish impacts are low. Specific benefits of LVE are shown below.

<u>Benefit Category</u>	<u>Quantified Performance (units)</u>
EWA replacement supply	104.2 (TAF/year)
Average annual salt load reduction to groundwater basins	2,300 (tons TDS/year)
Fish screened water diversion capacity	170 (cfs)
Emergency storage supply	143.4 (TAF)

North-of-the-Delta Offstream Storage Investigation (Sites Reservoir)

DWR, Reclamation, and local water interests are studying Sites Reservoir, a 1.8 million acre-feet reservoir offstream of the Sacramento River, as shown in Table 1. Conveyance to storage employs two existing canals and a new pipeline from the river that also provides release capacity to the river and supports downstream benefits directly. Sites Reservoir is uniquely designed to improve Delta water quality as a primary benefit. In addition to benefits derived from supplemental releases to the river from new storage, Sites Reservoir operation is integrated with both the CVP and SWP systems specifically by coordinating operations with Shasta, Folsom, and Oroville reservoirs. This operation improves system efficiency and allows benefits to be directed at the Sacramento and American Rivers, the Delta, and throughout the CVP and SWP service areas.

Sites Reservoir includes a dedicated Ecosystem Restoration Account that supports a list (see below) of restoration actions, now focused on a prioritized set of actions for the Sacramento and American rivers. The ERA is conceived to be adaptively managed so that the list of actions could be re-prioritized based upon new information, improved scientific understanding, or newly recognized restoration needs. Recently, the investigation is considering a listing of restoration actions more directly related to the

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Delta ecosystem including actions in Yolo Bypass and supplemental Delta flows. As NODOS moves into feasibility studies, the investigation team will solicit input on the relative priority of Delta restoration actions and how these actions can be integrated into and supported by the Sites Reservoir restoration account. Quantified benefits include:

<u>Benefit Category</u>	<u>Driest Periods Yield (TAF)</u>	<u>Average Yield (TAF)</u>
CVP, SWP, and local	208	184
Refuge	15	35
Environmental Water Account	39	57
Delta Water Quality	192	170
Ecosystem Restoration Actions	176 TAF	

Ecosystem Restoration Actions included in initial alternative formulation:

Improve reliability of cold water carry-over storage at Shasta Lake
 Supplemental cold water releases from Shasta and Keswick dams
 Reduce Sacramento River diversions during critical fish migration periods
 Improve the reliability of cold water carry-over storage at Folsom Lake
 Supplemental flows for cottonwood (riparian) establishment
 Stabilize fall flows below Keswick Dam to avoid fish stranding and egg desiccation
 Delta water quality action improves the position of X2 to increase pelagic habitat

Shasta Lake Water Resources Investigation

Reclamation is studying expansion of Shasta Lake and associated water resources opportunities. Primary objectives include anadromous fish survival and water supply reliability. Secondary objectives include ecosystem restoration, flood damage reduction, hydropower, and recreation. A number of expanded sizes have been investigated. The initial alternative formulation described in Table 1 includes raising the height of the dam by 18.5 feet, with an increase of 634 TAF of storage. Over half of the new storage would be dedicated to cold water pool maintenance.

<u>Benefit Category</u>	<u>Driest Periods Yield</u>	<u>Average Yield</u>
Water Supply	91 TAF	50 TAF
Smolt Production Increase (thousands)		1,503
Hydropower generation increase		94GWh/yr

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Ecosystem Actions included in formulation:

Improve reliability of cold water carry-over storage at Shasta Lake
 Supplemental flows for cold water release from Shasta and Keswick dams

Upper San Joaquin River Storage Investigation

Reclamation and DWR are studying opportunities associated with additional storage in the upper San Joaquin River basin. Primary planning objectives include enhanced water temperature and flow conditions in the San Joaquin River to support restoration of anadromous fish and water supply reliability for water users and environmental purposes. Secondary purposes include flood control, energy generation and management, recreation, and water quality. The initial alternative formulation shown in Table 1 includes a new Temperance Flat Dam within the upstream portion of Millerton Lake, diversion structures, power features, and a Trans Valley Canal to provide conveyance to SWP customers.

<u>Benefit Category</u>	<u>Driest Periods Yield</u>	<u>Average Yield</u>
SWP and Friant	230 TAF	177 TAF

Other Actions included in formulation:

Increase in cold water volume in all year types
 Available flood space at 90% exceedance 257 TAF

Delta Vision Strategic Plan and Other Planning Considerations

Following is a discussion of implementation questions associated with CALFED surface storage and the State's planning processes including Delta Vision.

Can CALFED surface storage contribute to Delta ecosystem and water supply reliability, DV's co-equal primary goals? (DV Recommendation 1)

Each of the CALFED surface storage projects has the ability to add significant flexibility to the existing water resources system. The flexibility can be used to

contribute to either or both DV goals. Initial analyses indicate that formulations that emphasize both goals are more efficient and cost-effective than focusing new resources on just one goal. Most of the investigations' primary goals can be described as ecosystem or water supply reliability. Sites Reservoir has an additional primary goal associated with Delta water quality improvement.

Will CALFED surface storage implementation affect the efficiency of California's limited water supply? (DV recommendation 4)

Each of the CALFED surface storage projects relies on coordinated operation with the existing water resources system and efficiency is improved by inclusion of a new storage facility. Developed water is used to meet both restoration and water supply reliability objectives. In many cases, water can be used to meet multiple objectives because the new storage is available. For example, supplemental water released from Shasta Lake for improved river temperature may be re-diverted at Sites Reservoir or Los Vaqueros for another restoration or supply reliability improvement later. Additional opportunities for improving system efficiency are likely to be discovered.

Is CALFED surface storage implementation consistent with California's constitutional principles of "reasonable use" and "public trust"? (DV recommendation 5)

Reasonable use requires that a beneficial use of water be reasonable. The public trust entrusts government to limit and protect the state's waters for the public. Public trust has been traditionally applied to navigation, but has also been applied to protection of natural resources including habitats, ecosystems, and animals and fauna. Since CALFED surface storage would uniquely contribute to both water supply reliability and ecosystem restoration, the public trust would be protected and a more balanced reasonable use would be supported explicitly with implementation. Restoration has rarely been a formulated purpose of a major water resources project in California.

Restoration has been added to many project purposes after implementation, frequently as a result of regulation or legal decision. Many of these regulated actions or legal decisions are established at a minimal level. CALFED surface storage implementation would dedicate and direct significant water resources assets to restoration of aquatic and riparian ecosystems associated with the Delta and its tributaries. The CALFED surface storage investigations will consider and apply reasonable use and public trust in their permitting processes and environmental documentation.

Will CALFED surface storage implementation support the goals of conservation, efficiency, and sustainable use? (DV recommendation 6)

The storage program and surface storage investigations in specific are complementary to and not in competition with other water supply reliability programs, including water use efficiency. The investigations' performance measures analysis assumes significant water use efficiency improvements in the future. Also, any surface storage implementation would set a new ecosystem baseline for tributary and Delta ecosystems and would support sustainable use of water with additional directed application of water to ecosystem uses. Flexibility in use of the ecosystem resources would facilitate an adaptively managed restoration effort. Ecosystem water supplies could be redirected to other areas of the CVP and SWP systems, allowing managers to re-prioritize restoration actions, respond to changing environmental conditions, or attempt experimental actions.

Will CALFED surface storage implementation support diversion reduction – or changes in the pattern or timing of diversions upstream, within the Delta, and exported from the Delta (DV recommendation 7)

The current Environmental Water Account is an on-going program to facilitate diversion reduction or timing changes. Shasta Enlargement, Sites Reservoir and Los Vaqueros Expansion provide long-term EWA or equivalent fisheries protection programs

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with permanent assets so that the program would not be required to purchase transfer water on the water market. Los Vaqueros Expansion would comparatively provide more diversion from the Delta through state-of-the-art fish screens rather than through the existing State and Federal pumps. Sites Reservoir would also reduce diversions during critical fish migration periods from the Sacramento River.

Will CALFED surface storage implementation remain effective with new conveyance and improve the linkage between storage and conveyance? (DV recommendation 8)

The Common Assumptions process is establishing a future no-action set of assumptions regarding Delta facilities and operations. Common Assumptions is also developing alternative future scenarios that can be used by the investigations to ensure feasibility and durability under various future scenarios. DWR is currently developing additional analyses to determine each project's effectiveness under alternative future Delta management and conveyance for State Feasibility Reports to be completed later this year.

Can investment in CALFED surface storage be integrated and consistent with strategic investments in levees, floodplain management, water circulation and quality? (DV recommendation 9)

Flood protection is a secondary objective of three of the CALFED surface storage investigations: Enlarge Shasta, Sites Reservoir, and Upper San Joaquin Storage. This means that one or all of these projects could support flood damage reduction downstream while achieving the primary purposes. Delta water quality is a primary purpose of the NODOS investigation. Improvement of delivered water quality is a secondary purpose of Los Vaqueros Expansion.

How will CALFED surface storage implementation improve statewide water management systems? (WPU Framework Initiative)

Planners and operators have acknowledged an increasing inflexibility in the SWP and CVP systems for several decades now. Any change affects users, contractors, the environment, and flood protection capability. The EWA was originally conceived to improve system flexibility. Additional storage would provide operators with additional resources and in some cases an additional release location. Flexibility will be essential to managing as yet unanticipated ecosystem needs, effects of climate change, and potential emergency conditions.

Can CALFED surface storage also support integrated regional water management? (WPU Framework Initiative)

By providing improved water supply reliability for various users, CALFED surface storage would expand and diversify many local and regional water management portfolios. Potential project participants should integrate water supply reliability options associated with CALFED surface storage projects into their integrated resources planning processes.

Can the foundational actions of the Water Plan framework be supported by CALFED surface storage implementation? (WPU Framework Foundational Actions)

Like all of the strategies described in the California WPU, no single strategy can meet all of the State's water resources challenges and needs. Efficient use of water supplies will remain essential and is reflected in the Common Assumptions. Ecosystem restoration is a primary purpose of each project formulation and would directly support environmental stewardship. Water quality is a primary purpose of Sites Reservoir project formulations and a secondary purpose for Los Vaqueros expansion.

Will State investment in CALFED surface storage, as recommended in the Strategic Growth Plan, address "critical gaps" that remain in California's infrastructure? (SGP)

Yes. The existing water management system was not designed to meet the newer objectives previously described, including ecosystem restoration and Delta water quality.

New facilities specifically designed for a more comprehensive set of California's water resources purposes CALFED surface storage would add supplemental water supplies to the currently constrained water management system both in the Delta and its tributaries, providing a diverse set of benefits. Investments in surface storage will provide increased flexibility for operators and promote integrated operations of California's water resources systems.

What are the major challenges to successful CALFED surface storage implementation? (Invitation Guidance 4)

A major challenge will be financing. Implementation of one or more CALFED surface storage projects would likely require two types of bond financing for the State. An initiative measure could approve general obligation bonds to pay for the broad public benefits such as ecosystem restoration and repayment bonds could facilitate contractor participation in benefits to specific users. Finally, federal participation in the projects would potentially make them much more effective. Both the federal and state government could invest in restoration actions that would improve conditions for aquatic and riparian ecosystems and species that depend upon them. These dedicated restoration supplies may prove an essential element in recovery of the Delta, its tributaries, and dependent species.

Also, a number of stakeholders, decision-makers, and portions of the public remain steadfast that dams are bad. This is in significant part due to the continuing detrimental effects of dams constructed over the past century. The investigations and entities like Delta Vision should consider whether we can really be smarter dam builders. Can we mitigate effects? Results from operations simulations and preliminary environmental effects assessments suggest that we can. And does it make sense to build

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dams, in part, to restore ecosystem functions and support species recovery with dedicated and applied water? The point about dedicated and applied water is an important one. Water is developed and applied. Even our current in-stream flow requirements are developed (usually with a reservoir) and applied (based upon regulatory or legal decision) by releases from the reservoir. Most locally developed supplies are not applied beyond the boundaries of a local service area. More specifically, water conservation in Sacramento will not result in an improved cold water pool in Shasta Lake and water recycling in San Diego will not result in reduced diversions at the Delta pumps. In both cases, the water is successfully developed and “applied” to improve local supply reliability, but it cannot and historically has not been applied where other needs exist in the system. A few exceptions exist. Some agricultural users have transferred previously developed water to applications in other areas of need; urban users have not. As previously noted, a regulatory or legal decision also provides an application of previously developed supplies to areas of need. The operations simulations allow the surface storage investigations to test both ability to develop supply and ability of the system to apply that new supply to an unmet need in a specific location. The integration and coordination of new reservoirs into the system allows application of newly developed supply, within system limits, to be applied to areas of need.

Will CALFED surface storage implementation be effective over multiple generations (in 2030 or in 2070)? (Invitation Guidance 6)

Water resources facilities in California typically outlast their intended economic life, which is assumed to be fifty years. The flexibility added to the State’s water resources system generally and to restoration actions specifically will be available to water and ecosystem managers for several generations.

How will CALFED surface storage address expected changes including sea level rise, seismic risks, and hydrologic changes? (Invitation Guidance 7)

The CALFED surface storage investigations are considering all of these issues in their planning. Sea level rise and hydrologic changes will be explored in greater detail with an alternative future describing the effects of climate change. Seismic risks have already been evaluated as part of each investigation's dam design. Feasibility designs will refine these analyses.

Table 1
CALFED Surface Storage Initial Project Formulations¹ Summary

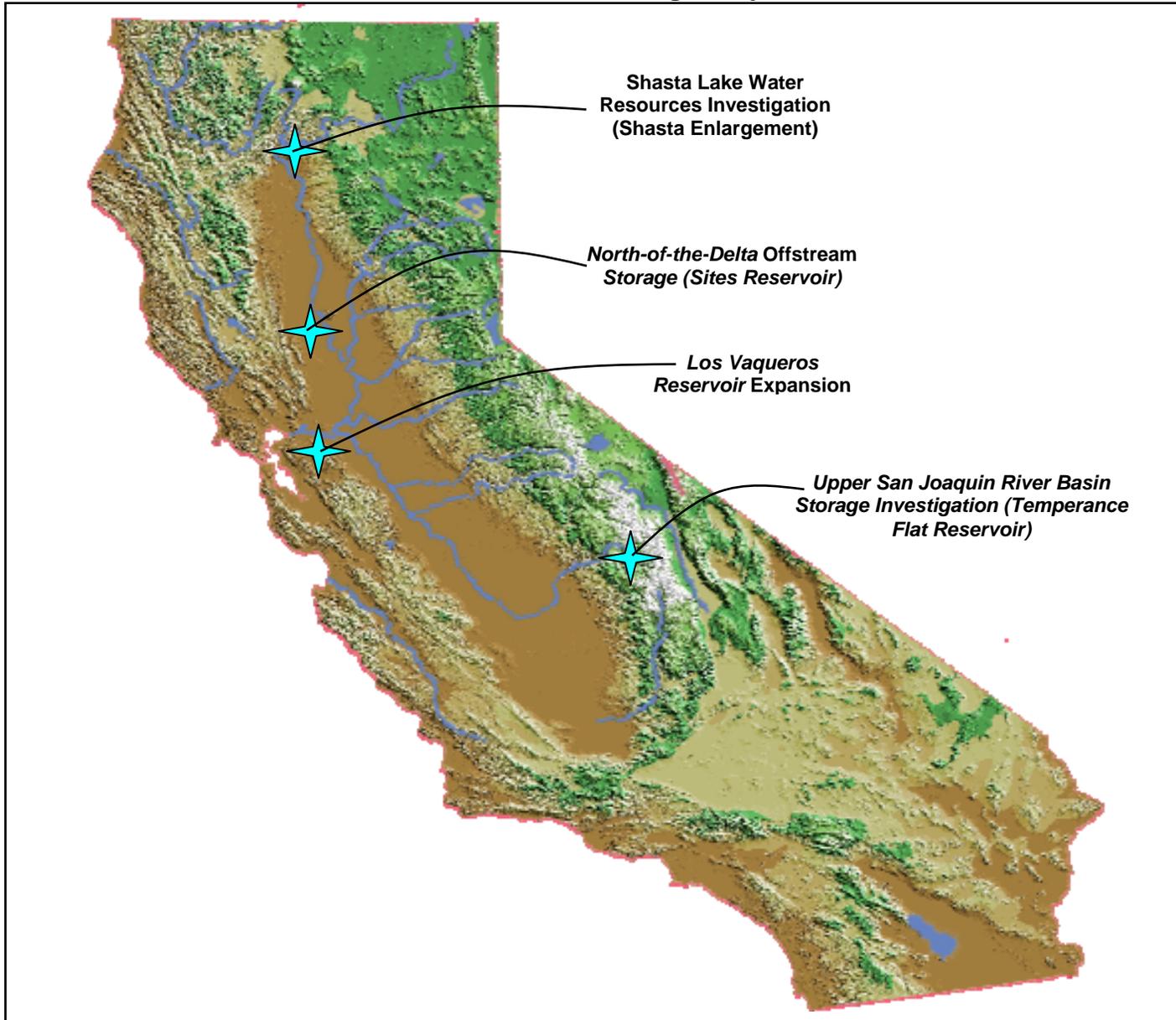
Investigation initial formulation summarized here (Reservoir)	New Storage Capacity of initial project formulation (thousand acre-feet)	Cost (millions)	Annual Cost (millions /yr)	Annual Benefit (million \$/yr)	Benefit Cost Ratio (Ann. Ben/Ann. Cost)	Approximate Percentage ² of Initial Formulation Dedicated to Environmental Public Benefits
Los Vaqueros Expansion	175	\$667	\$34	\$45	1.29	76%
North-of-the-Delta Offstream Storage (Sites Reservoir)	1,800	\$3,600	\$189	\$215	1.14	52%
Shasta Lake Water Resources	634	\$825	\$46	\$75	1.61	61%
Upper San Joaquin Basin Storage (Temperance Flat RM 274)	1,260	\$4,100	\$201	\$164 ³	not available ³	8% ³

¹ Initial Project Formulations are not feasibility or environmental document alternatives and are not preferred.

² Percentage is based upon preliminary cost allocation of initial alternative formulation

³ All of the Broad Public Benefits are not yet quantified for this investigation; a portion is. A full accounting of benefits will be included in the feasibility documents. The B/C comparison is not calculated here because benefits are incomplete. The percentage of this initial formulation dedicated to environmental public benefits will increase as more public benefits are identified and allocated costs.

Figure 1
CALFED Surface Storage Projects



CALFED Surface Storage Investigations Submittal to Delta Vision
References

General References:

Delta Vision, Our Vision for the California Delta, Blue Ribbon Task Force, December 2007
California Water Plan Update 2005, A Framework for Action, Department of Water Resources, December 2005
The California Strategic Growth Plan, Governor Arnold Schwarzenegger, 2008

Following is a listing of the documents used containing an initial project alternative for each investigation that is described in this submission:

Los Vaqueros Expansion Investigation Initial Economic Evaluation for Plan Formulation, Bureau of Reclamation, Mid-Pacific Region with MWH, July 2006
North-of-the-Delta Offstream Storage Investigation Plan Formulation Report (Administrative Draft), Bureau of Reclamation, Mid-Pacific Region, California Department of Water Resources, and URS Corporation, March 2008
Shasta Lake Water Resources Investigation Plan Formulation Report, Bureau of Reclamation, Mid-Pacific Region, December 2007
Upper San Joaquin River Basin Storage Investigation Plan Formulation Report Progress Report (Administrative Draft), Bureau of Reclamation, Mid-Pacific Region February 2008

Following is a listing of additional general information related to the CALFED surface storage investigations:

Los Vaqueros Expansion	http://www.lvstudies.com
North-of-the-Delta Offstream Storage	http://www.storage.water.ca.gov/northdelta/index.cfm
Shasta Lake Water Resources Inv.	http://www.usbr.gov/mp/slwri/
Upper San Joaquin River Basin Storage	http://www.usbr.gov/mp/scca/storage/index.html