Appendix 1B
Water Storage

1B.1 Introduction

This appendix provides an overview of the potential for additional water storage in California. For this appendix, water storage includes groundwater storage, large system storage (sometimes referred to as CALFED storage), and regional/local storage.

While water storage is a critically important tool for managing California's water resources, it is not a topic that must be addressed in the EIR/EIS for the BDCP. This is because the BDCP, as a proposed habitat conservation plan and natural community conservation plan, does not, and need not, propose storage as a project component. Although the physical facilities contemplated by the BDCP, once up and running, would be part of an overall statewide water system of which new storage could someday also be a part, the BDCP is a stand-alone project for purposes of CEQA and NEPA, just as future storage projects would be. Similarly, although new storage projects are the subject of ongoing discussions, and may well someday be formally proposed and subjected to environmental review, such projects have not reached the stage of planning that would make them "probable future projects" for purposes of CEQA or "reasonably foreseeable future actions" for purposes of NEPA. Any such potential future projects therefore need not be addressed as part of the cumulative impacts analyses in the BDCP EIR/EIS. Nor would additional storage qualify as a viable stand-alone alternative for implementation of the BDCP because it is not capable of meeting the established purpose and need for the BDCP (see adjacent text box). In short, this appendix is not required by either CEQA or NEPA, but was prepared for informational purposes.

South of Delta Water Storage Need Not Be Addressed in BDCP EIR/EIS

For many reasons, increased water storage is neither a legally required component of the BDCP nor a project that must be addressed in the cumulative impact analyses for the EIR/EIS for the BDCP. Increased storage is neither: (1) an aspect of the BDCP itself; (2) a "probable future project" within the meaning of CEQA, (3) a "reasonably foreseeable future action" within the meaning of NEPA, (4) a future phase of the BDCP project within the meaning of either CEQA or NEPA; nor (5) an EIR or EIS alternative to the proposed BDCP. As a result, such additional storage need not be included in the mandatory cumulative impact analysis for the EIR/EIS or in any section focused on alternatives.

Water storage is a tool that needs to be considered by regional/local water agencies as one potential tool in a diversified portfolio of tools. This may include development of groundwater resources, building their own regional/local surface storage, or participating with the State on larger system projects. While the BDCP does not include new water storage, the BDCP actions may present opportunities for various regions to expand their water storage or reoperate existing storage.

This appendix is intended to provide context on the importance of water storage in California and the progress that has been made in using storage as part of a diversified portfolio of water management actions.

1B.2 Background

Water storage allows saving water when it is plentiful for use at a later time. California's variable precipitation and runoff (regionally, seasonally, and from year-to-year) generally does not match the pattern of water use for most urban and agricultural areas. Storage provides a major role in shifting timing to match water needs at the point of use.

Most water users benefit from groundwater and/or surface water storage somewhere in the system. Some ecosystem uses also benefit from water storage. Use of groundwater and surface storage has been used in California since the establishment of Spanish missions.

For *California' Groundwater, Bulletin 118 – Update 2003* (DWR 2003), DWR delineated 431 groundwater basins, underlying about 40 percent of the surface area of the state. The mountainous areas of the state generally do not hold significant groundwater basins, but do support individual wells for small uses. DWR noted that previous estimates of total groundwater volume in California ranged from 850 million acre-feet (MAF) to 1.3 billion acre-feet. DWR notes that this total groundwater storage capacity is misleading because it only takes into account one aspect of the physical character of the basin. Many other factors limit the ultimate development potential of a groundwater basin. These factors may be physical, chemical, economic, environmental, legal, and institutional.

Estimates of usable storage represent only the total volume of groundwater assumed to be usable in storage, not what would be available for sustained use on an annual basis. Previous estimates of usable groundwater storage capacity range from143 MAF to 450 MAF. However, new groundwater storage can be developed only where there is available storage capacity, or the volume of a basin that is unsaturated and capable of storing additional groundwater. Natural or artificial recharge can be used to fill this available storage capacity.

California has over 1,000 surface water reservoirs. The largest 200 reservoirs, those with storage capacities over 10,000 acre-feet, have a combined capacity of over 41 MAF (DWR 2009). In addition to providing water supply, surface storage reservoirs often provide multiple benefits including flood control and release of water for hydroelectricity, water quality improvements, ecosystem, and other benefits.

On-stream surface storage reservoirs are located on active rivers or streams and are filled by the flow of the rivers/streams. Off-stream surface storage reservoirs are located away from active streams and are filled by diversions from nearby rivers or other water sources. The State and federal governments built many of the largest reservoirs in California from the late-1930s into the mid-1970s. Local and regional entities are still building new surface storage reservoirs. In recent decades, local and regional agencies have developed and built surface storage reservoirs that provide a number of benefits while minimizing impacts on the environment. These reservoirs have improved local and regional water supply reliability, improved water quality and provided a key source of emergency water if needed in times of drought or other catastrophe.

Loss of Natural Snowpack Storage

Snowmelt currently provides an annual average of 15 million acre-feet of water, slowly released between April and July each year. Based upon historical data and modeling, DWR projects that, due to climate change, the Sierra snowpack will experience a 25 to 40 percent reduction from its historic average by 2050. (DWR 2008)

Climate change may make water availability and demands even more variable, placing more demands on existing storage. While water agencies continue to expand their water storage, the average early spring snowpack, California's natural water storage, in the Sierra Nevada decreased by about 10 percent during the last century, a loss of 1.5 million acre-feet; and very considerable additional losses in snowpack are expected due to climate change (DWR 2008).

In addition to the *California Water Plan Update 2009* (DWR 2009), the Delta Vision Blue Ribbon Task Force (Task Force 2008) and the Delta Stewardship Council (Delta Stewardship 2011) recognized the value for additional storage along with improved conveyance for sustainable management of the Delta. One strategy developed by the Natural Resources Agency and DWR to help deal with climate change is to expand water storage and conjunctive management of surface and groundwater resources (Resources Agency and DWR 2008). However, the number of storage sites that can be feasibly developed is diminished with each new storage project – the best sites have already been developed.

1B.3 Integrated Regional Water Management

As indicated by its title, the *California Water Plan Update 2009: Integrated Water Management* (DWR 2009) focuses on integrated water management by preparing a strategic plan for California water management through 2050. Integrated water management recognizes the interrelated nature of various water management tools and how combinations of these tools may need to vary within a given region, among regions, or statewide. The focus is on the interrelation of the different water management tools with the understanding that changes in the use of one tool will affect the use of other tools.

Integrated water management relies on a diversified portfolio of water management tools (presented as 27 resource management strategies in the *California Water Plan Update 2009*). This diversification is essential to provide the flexibility needed to cope with changing and uncertain future conditions. In addition, no single package of management tools will work for all areas of California as each region has its own needs, constraints, and opportunities. In the context of integrated regional water management, one resource management strategy would seldom be an alternative for another strategy.

Water storage needs to be part of a diversified water management portfolio, not a stand-alone tool. Since each region has different characteristics, new water storage will play a different role, proportion, and priority within each region's integrated regional water management plan (IRWM). BDCP actions will present changed Delta conditions that will provide new opportunities for modified or new storage for many of the regions. Depending on the region and the mix of other water management tools, regional/local water agencies can reconsider the role of new groundwater or surface storage within revisions to their IRWMs. Reoperation of existing storage may provide increased benefits with implementation of BDCP. For example, improved flexibility and reliability of diverting water from the Delta under various hydrological conditions may facilitate re-operation of existing storage or the creation of new storage. In addition, new Delta conveyance may alter operation of surface storage reservoirs upstream from the Delta.

1B.4 Groundwater Storage

For *California's Groundwater, Bulletin 118 – Update 2003* (DWR 2003) DWR estimated that 9 million to 10 million acre-feet of groundwater was used in 1947. By the beginning of the 21st century, the amount of groundwater used had increased to an estimated 15 million acre-feet. In an average year, groundwater meets about 30 percent of California's urban and agricultural water demands. In drought years, this percentage increases to more than 40 percent. DWR estimates that groundwater overdraft to be about 1.5 million acre-feet annually. Figure 1B-1 shows California's groundwater basins and demonstrates that groundwater resources are widespread, but very site specific.

Unlike surface water use, groundwater use in California is not covered by a statewide management program or statutory permitting process. Most of the law governing groundwater use in California has evolved through a series of court decisions. In addition, the California Legislature has thus far treated groundwater management as a local responsibility (Sax 2002). Therefore, the State's role to date has been primarily to provide technical and financial incentives, guided by legislation, to local agencies to improve local groundwater management.

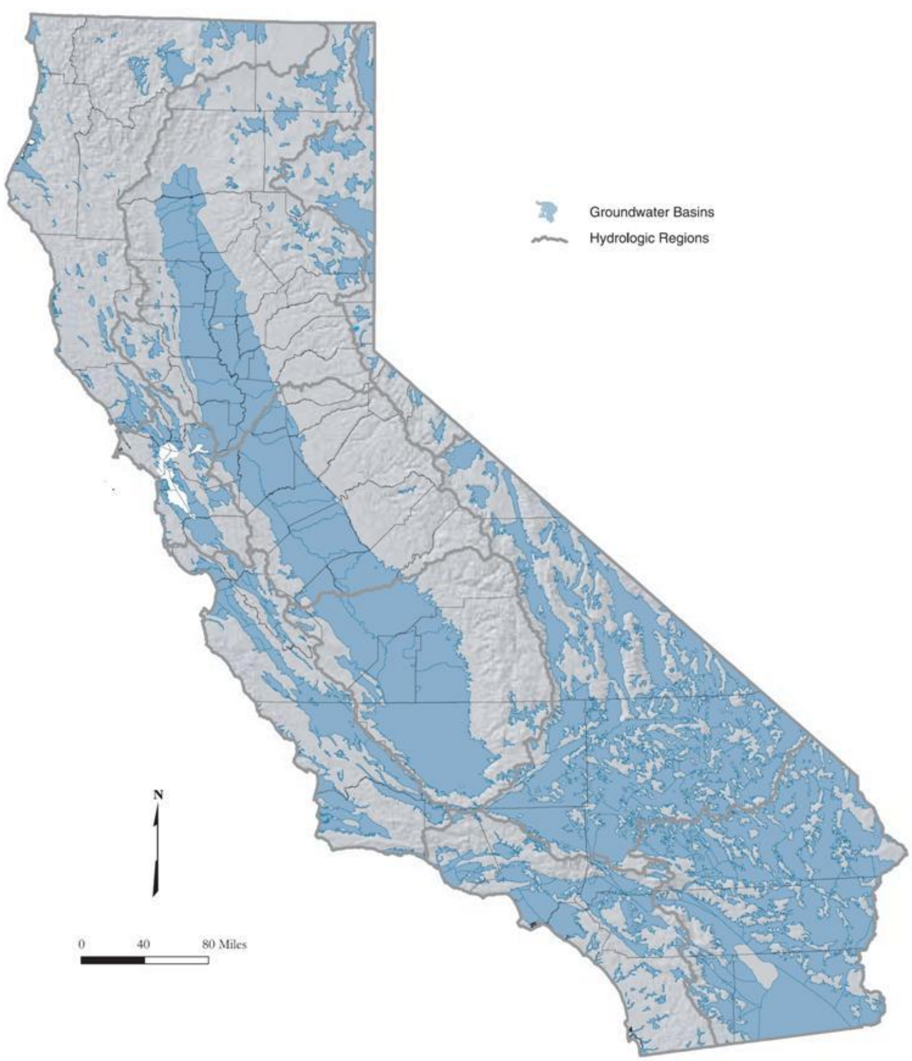

Figure 1B-1. California Groundwater Basins

There are three basic methods available for managing groundwater resources in California: (1) management by local agencies under authority granted in the California Water Code or other applicable State statutes, (2) local government groundwater ordinances or joint powers agreements, and (3) court adjudications. No law requires that any of these forms of management be applied in a basin. CEQA documents on proposed development projects also often treat groundwater overdraft as a "significant effect on the environment" to be mitigated or avoided if feasible. Management is often instituted after local agencies or landowners recognize a specific groundwater problem. Local agencies utilize existing government bodies and authority to proactively monitor and manage groundwater resource issues.

Even though groundwater resources are under local management, the State encourages coordinated, basin-wide, local agency management of groundwater resource and provides grant funds and low-interest loans to leverage local investments in their groundwater management and monitoring programs. The goal is to help local agencies better understand how to manage groundwater resources effectively to ensure the safe production, quality, and storage of groundwater in the State.

The 2000 Proposition 13 (Safe-Drinking Water, Clean Water, Watershed Protection, and Flood Protection Act) provided $205.6 million in State grant and loan funding to 62 applicants for conjunctive use projects, with total costs of $1 billion – a good example of State funding leveraging local funding. It is estimated that these projects will provide, on average, an additional 300,000 ac-ft/year to local and regional water supplies. The 2002 Proposition 50 provided $500 million of State bond funding for IRWM projects. Although this funding is not specifically targeted at groundwater management, many of the funded projects would expand groundwater storage.

In addition, the 2000 Local Groundwater Management Assistance Act of 2000 [AB 303]was enacted to provide Local Groundwater Assistance (LGA) grants to local public agencies with up to $250,000 to conduct groundwater studies or carry out groundwater monitoring and management activities. As of 2009, six (6) rounds of AB 303 grants have been awarded to support local groundwater assistance projects. Grants from new solicitation package released in January 2012 for an additional $4.7 million in funding from Proposition 84 are expected to be awarded in Fall 2012.

In 2009, the Legislature passed Senate Bill (SB)x7-6, which establishes, for the first time in California, collaboration between local monitoring parties and DWR to collect groundwater elevations statewide and provides that this information be made available to the public.

1B.4.1 State Directives and Programs

- Assembly Bill (AB) 3030 (Costa 1992) encouraged local agencies to adopt groundwater management plans for managing their groundwater resources whether or not their groundwater basins are in overdraft condition. When Bulletin 118 was published in 2003, more than 200 local agencies had adopted AB 3030 groundwater management plans. Now, with the emphasis on integrated regional water management plans, the number of areas of the state covered by IRWM plans is continually increasing.
- AB 303 (Thomson 2000), the Local Groundwater Management Assistance Act of 2000 (California Water Code Section 10795 et seq.), provides financial incentives to help local agencies better understand how to manage groundwater resources effectively to ensure the safe production, quality, and storage of groundwater in the State. Eligible projects include groundwater studies, groundwater monitoring, and groundwater basin management.

- The Proposition 13 (2000) Groundwater Storage/Recharge Program authorized DWR to provide grants for feasibility studies and construct projects to facilitate conjunctive management of surface water and groundwater to improve water supply reliability.
- Proposition 50 (2002) provided $500 million for IRWM projects. While these funds were not specifically targeted at groundwater projects, many funded projects expanded management of groundwater storage.
- AB 599 (Liu 2001) required the State Water Resources Control Board to establish a comprehensive monitoring program to assess groundwater quality in each groundwater basin in the State and to increase coordination among agencies that collect groundwater contamination information.
- SB 1938 (Machado 2002) contained new requirements for local agency groundwater management plans to be eligible for public funds for groundwater projects.
- Proposition 84 (2006) contained an additional $1 billion for IRWM projects, many expanding management of groundwater storage.
- SBx7-6 (Steinberg 2009) of the of the 2009–2010 7th Extraordinary Session of the Legislature requires local agencies to monitor and report the elevation of their groundwater basins to help manage the resource during average water years and drought conditions.

1B.4.2 Potential Increase in Water Supply

Reoperation of the existing groundwater storage system could significantly increase annual water deliveries throughout California. Conservative estimates of potential conjunctive management indicate that average annual water deliveries could be increased by 0.5 MAF (DWR 2009). More aggressive estimates indicate a potential increase in annual water deliveries by 2 MAF. However, more aggressive estimates of potential increases in water deliveries depend upon predictable and reliable exports of surface water from the Delta to provide a source of groundwater recharge. Since implementation of these projects is local and regionally controlled, estimates of costs have not been made. Also, protection of groundwater quality, including recharge area protection and groundwater/aquifer remediation, will make groundwater storage more reliable as described below.

1B.4.3 Groundwater and Aquifer Remediation

Contaminated groundwater can come from both naturally occurring and anthropogenic sources. Degraded groundwater quality can make the source unusable or at least limit its utility. Remediation systems can employ passive or active methods to remove contaminants. Passive remediation allows contaminants to biologically or chemically degrade or disperse in situ (while it is still in the aquifer) over time. Active remediation involves either treating contaminated water in situ or extracting contaminated water from the aquifer and treating it. Active in situ methods generally involve injecting chemicals into the contaminant plume to obtain a chemical or biological removal of the contaminant. Extracting and treating contaminated groundwater can involve physical, chemical, and/or biological processes.

There are about 16,000 sites in the state where investigation or remediation of contaminants is ongoing (DWR 2009). The potential benefits of remediating contaminated groundwater so the water can be used as a part of the available water supply are:

- An additional water supply is available that would not be available without remediation.
- The cost of buying an alternate water supply is avoided.
- Treated groundwater that meets water quality standards may be blended with other water supplies to increase the total available water supply.
- Groundwater from remediation projects and blended supplies that do not meet drinking water or other high water quality requirements may still be available to meet water needs that do not require such high quality water (e.g., landscape irrigation), thus increasing the overall water supply.
- A supply is maintained that is used throughout the state to meet up to 40 percent of the state's water demand.
- Future wellhead treatment costs are lessened by preventing contaminant plumes from spreading.
- Use of the remediated aquifer for storage of excess surface water supplies.

In 1989, the California Legislature established the Underground Storage Tank (UST) Cleanup Fund to reimburse petroleum UST owners for the costs associated with the cleanup of leaking petroleum USTs. As of January 2008, the State had disbursed over $2.3 billion to eligible claimants.

Based on cost data from the State Water Resources Control Board and the California Department of Public Health, Division of Drinking Water and Environmental Management, total groundwater remediation costs in California, excluding costs dealing with salt management, could approach $20 billion over the next 25 years (DWR 2009).

1B.4.4 Recharge Area Protection

Protection of recharge areas requires a number of actions based on two primary goals. These goals are: (1) ensuring that areas suitable for recharge continue to be capable of adequate recharge rather than covered by urban infrastructure, such as buildings and roads; and, (2) preventing pollutants from entering groundwater to avoid expensive treatment that may be needed prior to potable, agricultural, or industrial beneficial uses.

1B.5 CALFED Surface Storage

The CALFED Record of Decision (2000) identified five potential surface storage reservoirs that resulted from screening of 52 potential new or expanded reservoirs (CALFED 2000). See Figure 1B-2 for locations of potential projects.

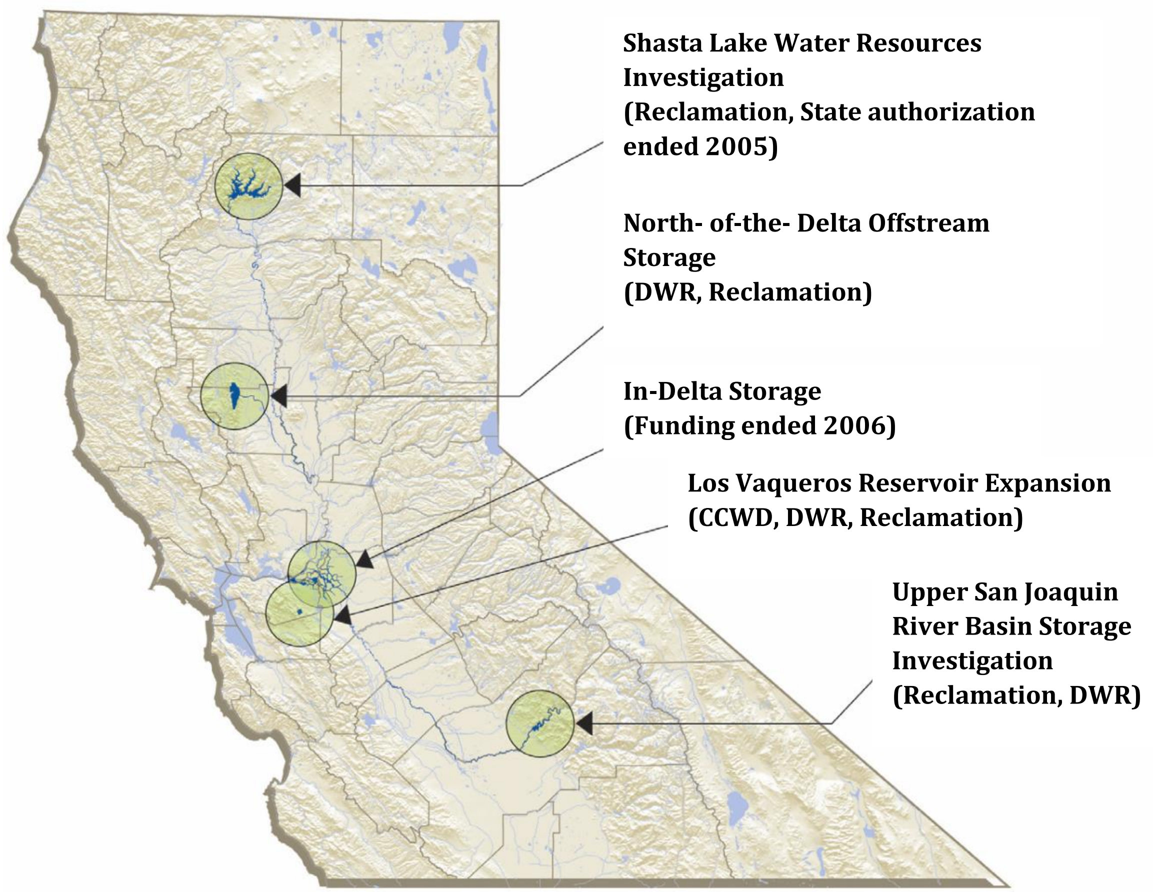

Figure 1B-2 Location of Potential CALFED Surface Storage Projects

Following is a summary of the investigations.

- **Shasta Lake Water Resources Investigation** (SLWRI) – The study is investigating enlargement of the existing Shasta Dam and Lake. The U.S. Bureau of Reclamation (Reclamation) is leading the investigation in consultation with DWR and local water interests and stakeholders. State funding for the investigation ended in 2005. Alternative project sizes are under study include 6.5, 12.5, and 18.5 foot raises of Shasta Dam. DWR's participation in the Shasta Lake Water Resources Investigation is limited due to California Public Resources Code 5093.542, which seeks to avoid adverse effect on the free-flowing condition of the McCloud River. Increased capacity in Shasta Lake could store greater amounts of water during wet years, providing more flexibility and greater supplies in subsequent years, and could help to increase and maintain a cold water pool in the future as warming temperatures due to climate change increase the challenge of maintaining water temperatures in the northern part of the Sacramento River that can support cold-water salmonid species (e.g., winter run Chinook salmon). The primary objectives of SLWRI are to increase the survival of anadromous fish populations in the Sacramento River, primarily upstream from the Red Bluff Diversion Dam and increase water supplies and water supply reliability for agricultural, M&I, and environmental purposes to help meet future water demands. Reclamation completed and released a preliminary draft environmental impact statement and a draft feasibility report for the SLWRI on February 6, 2012.

- **North-of-the-Delta Offstream Storage** (NODOS) – DWR, Reclamation, and local partners are evaluating the feasibility of offstream storage north-of-the-Delta in the northern Sacramento Valley to improve water supply and water supply reliability, increase survival of anadromous fish and other aquatic species in the Sacramento River and the Delta, improve Delta water quality, and provide flexible generation benefits to integrate renewable energy generation into California's electric grid. Among several alternative sites under study, Sites Reservoir appears to be the most promising location. Current investigation focuses on 1.2 MAF and 1.8 MAF reservoir sizes. The reservoir would be filled primarily through diversions from the Sacramento River. In August 2010, Glenn-Colusa Irrigation District, Reclamation District 108, Tehama-Colusa Canal Authority, Maxwell Irrigation District, Yolo County Flood Control and Water Conservation District, Glenn County and Colusa County formed the Sites Joint Powers Authority (Sites JPA 2010) for the purpose of developing, constructing, and managing operation of Sites Reservoir. In August 2011, the State Water Resources Control Board approved $1.75 million in Proposition 204 funds to the Sites JPA to assist DWR in completing the environmental documents for the North-of-the-Delta Offstream Storage Investigation. DWR, Reclamation, and the Sites Powers Authority are completing a draft environmental impact report/environmental impact statement (EIR/EIR) and draft feasibility report for the NODOS investigation. The draft EIR/EIS and feasibility report are not yet completed.

- **In-Delta Storage** – DWR completed the In-Delta Storage Program State Feasibility Study Report in January 2004. DWR completed a Draft State Supplemental Feasibility Report in 2006 (DWR 2006) to respond to comments received on the 2004 State Feasibility Study Report. The Draft State Supplemental Feasibility Report recommended that significant investment in field testing, data collection and modeling is needed to reduce uncertainty associated with project operations, water supply and quality benefits, and the effects of dissolved organic carbon, dissolved oxygen, temperature and taste and odor on project water supply and quality.

  DWR did not receive any expression of interest from potential project participants willing to use water developed by the project and share in project costs. DWR suspended the In-Delta Storage study in 2006.

- **Los Vaqueros Reservoir Expansion** – The Contra Costa Water District expanded its Los Vaqueros Reservoir from 100 TAF to 160 TAF. The reservoir is filled by diversions from the Delta under CCWD's existing federal water project contract and its own water right. Additional investigations by Bay Area water users are underway to further expand the reservoir from 160 TAF to 500 TAF. The Los Vaqueros Reservoir provides emergency storage and water quality benefits for CCWD and other regionally integrated Bay Area water users. Added surface storage also provides supply reliability by allowing CCWD to divert during times of Delta abundance and reduce its demands during times of scarcity or ecosystem sensitivity.

- **Upper San Joaquin River Basin Storage Investigation** – While different alternatives are under investigation, the Temperance Flat Reservoir site on the San Joaquin River at river mile 274 could provide up to 1.26 MAF storage capacity (Reclamation 2008). Under current Delta regulatory conditions, San Luis Reservoir (SLR) cannot be filled in most years. With added Delta conveyance the SLR could be filled about 85% of the time. Added storage on the San Joaquin River could be integrated with the SWP adding south-of-the-Delta Storage to the CVP and SWP systems. Under an operations integration concept, some SWP or CVP water supplies from the

Delta that are diverted to the SLR would instead be diverted to water users in the CVP Friant Division, while San Joaquin River water would be stored in the new reservoir. During wet periods this would increase the storage space available in the SLR and allow capture of additional SWP and CVP supplies from the Delta. Accumulated San Joaquin River water would be supplied through exchange to SWP and CVP south-of-Delta water users, reducing the demand on the Delta during dry periods. Added San Joaquin Surface Storage also facilitates increased groundwater storage operations in the southern central valley.

These projects were conceived to support multiple benefits that combine ecosystem restoration, water quality improvements, and other objectives with the traditional purposes of water supply reliability, hydropower, and flood protection. The potential projects need to be flexible to successfully operate under increasingly uncertain future conditions such as those resulting from climate change, declining ecosystem and water quality, greater impacts of droughts and floods, and export pumping constraints in the Delta. Project planning also needs to consider that the reservoirs will likely need to be adaptively managed to respond to improved science.

The investigations have identified a wide variety of potential operation scenarios for each reservoir to demonstrate range of potential benefits and potential State, federal, and local agency participation. While, the investigations are generally intended to identify system benefits, they will ultimately need be structured to meet the needs of the regional/local participants in the projects. The Sites Joint Powers Authority mentioned above is an example of needed local participation in the other potential projects.

1B.5.1 State Directives and Programs

The 2009 Comprehensive Water Package included a water bond (requires future public vote) that may provide up to $3 billion to fund a portion of construction for one or more CALFED surface storages, groundwater storage or groundwater contamination prevention or remediation projects, conjunctive use and reservoir reoperation projects, and local and regional surface storage projects that improve the operation of water systems in the state and provide public benefits. This public money is for investment in public benefits including ecosystem restoration, flood management, water quality, emergency response, and recreation. Water supply reliability benefits for urban or agricultural users are intended to be paid for by those beneficiaries.

1B.5.2 Potential Increase in Water Supply

While several alternative sizes and operating scenarios for each reservoir are still under consideration, Table 1B-1 shows interim benefits and costs from DWR's *CALFED Surface Storage Investigations, Progress Report* (DWR 2010). Since each potential reservoir is in a different geographic region and produces different benefits, the results in Table 1B-1 are not comparable among the potential reservoirs. Also, the interim benefits for a given reservoir are not necessarily additive to benefits for another reservoir. This data is provided for informational purposes; please see Appendix 5A for discussion of storage assumptions used in modeling for BDCP alternatives.

North-of-Delta Offstream Storage has the largest potential benefits, but also has the largest costs of the CALFED surface storage reservoirs investigated. The interim estimated capital cost for a 1.8 million acre-feet (MAF) reservoir is about $3.6 billion. The estimated long-term benefits are 560 thousand acre-feet (TAF) per year and dry period benefits are 387 TAF per year split between ecosystem, water supply, and water quality benefits.

Table 1B-1. CALFED Surface Storage Interim Benefits and Costs

Investigation	Project Type	New Storage Capacity	Estimated Capital Cost	Primary Beneficiary[a]	Delivered Water Benefits (per year): Long-term Average (Oct. 1922 – Sept 2003)	Delivered Water Benefits (per year): Driest Periods Average (May 1928 – Oct. 1934; Oct. 1975 – Sept. 1977; Jun. 1986 – Sept 1992)
Shasta Lake Water Resources Investigation	Enlarge Shasta Dam (raise height by 18.5 feet)	634 TAF	$942 million (2006 dollars)	Ecosystem	Amount TBD[b]	Amount TBD
				Water Supply	Amount TBD	76-133 TAF
				Water Quality	Amount TBD	Amount TBD
				Total	**TBD**	**76-133 TAF**
North-of-Delta Offstream Storage	New offstream Sites Reservoir	1.8 MAF	$3.62 billion (2007 dollars)	Ecosystem	180 TAF	66 TAF
				Water Supply	183 TAF	209 TAF
				Water Quality	197 TAF	112 TAF
				Total	**560** TAF	**387** TAF
Los Vaqueros Reservoir Expansion	Enlarge Los Vaqueros Dam (increase storage capacity from 160 TAF to 275 TAF	115 TAF	$985 million (2008 dollars)	Ecosystem (water deliveries through improved fish screens in lieu of diversions at export facilities)	147 TAF	86 TAF
				Water Supply	13 TAF	3 TAF
				Total	**160** TAF	**89** TAF
Upper San Joaquin River Basin Storage Investigation	New Temperance Flat Reservoir	1.26 MAF	$3.36 billion (2006 dollars)	Ecosystem	Amount TBD	Amount TBD
				Water Supply	Amount TBD	Amount TBD
				Water Quality	Amount TBD	Amount TBD
				Total	**140** TAF	**86** TAF

[a] The proportions of primary beneficiaries can be adjusted and other benefits (such as hydroelectric power generation, flood protection, recreation, emergency response water, etc.) can be included

[b] TBD = to be determined

While storage is not included as part of the BDCP, new Delta conveyance may provide opportunities for new surface or groundwater storage projects, and reoperation of existing storage. The determination of how new storage fits into regional water management portfolios are best determined by regional/local water agencies. The following three preliminary study results provide an indication on how new conveyance may provide opportunities for new storage:

- Preliminary modeling for the *CALFED Surface Storage Investigations, Progress Report* (DWR, 2010) considered how the CALFED surface storage projects could perform with a new Delta conveyance facility, such as that being considered by BDCP. With the existing south of Delta storage, the modeling indicated that the potential CALFED surface storage projects would provide approximately the same benefits with or without new Delta conveyance.
- Additional internal preliminary studies by DWR in 2010 considered the potential benefits of expanding north of Delta surface storage and expanding groundwater storage south of the Delta in combination with new Delta conveyance. Using theoretical planning assumptions that reflect essentially unlimited groundwater storage capacity (5 MAF), south of Delta water deliveries could be improved by about 100 TAF per year over deliveries with only new Delta conveyance and a 1.8 MAF Sites Reservoir.
- Based on preliminary BCDP modeling, the addition of 1 MAF of new south of Delta storage (surrogate for surface storage, groundwater storage, or re-management opportunities) could increase Delta water exports by approximately 150 TAF per year. Virtually all of the increase would occur in wetter years.

While water supply improvements of 100 TAF to 150 TAF per year from these preliminary studies are significant, the potential benefit of storage specifically derived from new Delta conveyance appears limited.

1B.6 Regional/Local Surface Storage

Many California water agencies rely on surface storage as part of their water management portfolios. Like for CALFED surface storage, regional/local surface storage can provide multiple benefits and can increase the benefits of other water management tools. Many water agencies rely both on large reservoirs that provide water supply over several regions and on regional/local reservoirs that provide water supply only within a region.

While the State and federal governments have not built new large system surface storage since the mid 1970s, water agencies continue to build new surface storage to meet localized needs. Only six new surface storage reservoirs were constructed in the 1980s and 1990s and only three have been constructed since 2000. Surface storage reservoirs constructed in the past few decades have been for regional/local use, primarily to provide water supply reliability against catastrophic events and droughts, for operational flexibility to meet peak summer water demands, and for flood control. Surface storage reservoir projects continue to be constructed or expanded to meet specialized regional and local needs. Examples of reservoirs built or updated in the last few decades include:

- **Diamond Valley Reservoir** – Metropolitan Water District of Southern California completed the 800 TAF Diamond Valley Reservoir in 1999. The lake holds enough water to meet the area's emergency and drought needs for six months.

- **Los Vaqueros Reservoir** – In 2012 the Contra Costa Water District expanded the Los Vaqueros Reservoir, built in 1998, from 100 TAF to 160 TAF for emergency supply and to manage the water quality of diversions from the Delta.
- **San Vicente Dam** – Construction began in November 2011 on San Diego County Water Authority's $450 million project to raise San Vicente Dam by 117 feet to increase reservoir capacity by 150 TAF.
- **Brock Reservoir** – Reclamation constructed Brock Reservoir (8 TAF) in November 2010 near Drop 2 on the All-American Canal in southern California. Reclamation estimates the project could save as much as 70 TAF of water a year, water that can remain in Lake Mead as a hedge against drought.

In addition, various smaller, older, obsolete dams have been removed for the primary purpose of improving fish passage to upstream habitat.

Justification for increased regional/local surface storage is based specifically on the needs within each region. The *California Water Plan Update 2009* provides resource management strategies to meet the water-related resource management needs of region and the state. The plan did not attempt to estimate potential additional regional surface storage capacities and costs because the need for additional surface storage greatly depends on the characteristics of each region, other available water management tools, the use for the potential storage, and the acceptable risk contained in each IRWM plan. It suggests that the need for additional local surface storage may be greatest in the mountainous areas of the state. Although much of the water used in the state originates in the mountains, these mountainous areas generally have limited groundwater supplies and a smaller array of available management strategies to meet local needs.

As described in the *California Water Plan Update 2009,* local storage development that could address this issue includes the reoperation of existing reservoirs in coordination with downstream reservoirs. While many existing reservoirs were built for hydropower, flood control, and consumptive water uses, new surface storage could also be considered for the following additional benefits:

- Water quality management
- System operational flexibility
- Ecosystem management
- Sediment transport management
- River and lake recreation
- Water supply augmentation including water transfer and conjunctive use facilitation
- Emergency water supply

One potential reservoir being considered for additional benefits such as those listed above is the Sites Reservoir, as described in the North-of-the-Delta Offstream Storage section. It is likely that more of the potential CALFED surface storage projects described in Table 1B-1 will also be developed specifically to meet regional/local needs.

1B.7 References

California Department of Water Resources (DWR). 2003. *California's Groundwater*. Bulletin 118, Update 2003. Sacramento, CA. October. Available: <http://www.water.ca.gov/groundwater/bulletin118/bulletin118update2003.cfm>.

———. 2006. *2006 Supplemental Report to 2004 Draft State Feasibility Study, In-Delta Storage Project*. 2006 May. Sacramento, CA. Available: <http://www.calwater.ca.gov/calfed/library/Archive_Storage_FSR_Update.html>.

———. 2009. *California Water Plan Update 2009*. Volume 2, Resource Management Strategies. Bulletin 160-09. Sacramento, CA. December. Available: <http://www.waterplan.water.ca.gov/cwpu2009/index.cfm>.

———. 2010. *CALFED Surface Storage Investigations, Progress Report*. Sacramento, CA. November. Available: http://www.water.ca.gov/storage/CALFED%20Progress%20Report%202010/index.cfm.

Blue Ribbon Task Force. 2008. *Delta Vision: Our Vision for the California Delta*. Sacramento, CA. January. Second printing. Available: <http://deltavision.ca.gov/BlueRibbonTaskForce/FinalVision/Delta_Vision_Final.pdf>.

CALFED. 2000. *Initial Surface Water Storage Screening*. Sacramento, CA. August. Available: <http://www.water.ca.gov/storage/docs/Surface%20Storage%20Misc.%20Docs/screen_final_all.pdf>.

Delta Stewardship Council. 2011. *Fifth Staff Draft Delta Plan*. Sacramento, CA. August. Available: <http://deltacouncil.ca.gov/delta-plan>.

Sites Project Authority (Sites JPA). 2010. Sites Project Authority, Joint Exercise of Powers Agreement. August. Available: <http://www.sitesjpa.net/Documents/Sites%20Project%20Authority%20Joint%20Exercise%20of%20Powers%20Agreement%20August%2026%202010.pdf>.

The Resources Agency and California Department of Water Resources. 2008. *Managing an Uncertain Future, Climate Change Adaptation Strategies for California's Water*. Sacramento, CA. October. Available: <http://www.water.ca.gov/climatechange/docs/ClimateChangeWhitePaper.pdf>.

Sax, J. L. 2002. *Review of the Laws Establishing the SWRCB's Permitting Authority over Appropriations of Groundwater Classified as Subterranean Streams and the SWRCB's Implementation of Those Laws*. Final Report. SWRCB No. 0-076-300-0. Sacramento, CA. January. Available: <http://www.swrcb.ca.gov/waterrights/water_issues/programs/hearings/groundwater_classification/docs/substreamrpt2002jan20.pdf>.

U.S. Bureau of Reclamation. 2008. *Plan Formulation Report*. October. Available: <http://www.usbr.gov/mp/sccao/storage/docs/usjrbsi_pfr/>.