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Storage and Conveyance Alternative Component Refinement Process

Prepared by the CALFED Storage and Conveyance Refinement Team
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I. Introduction

The purpose of the storage and conveyance component refinement process is to develop a range in which the storage and conveyance components are reasonably well balanced in capacities. By this we mean that the selected combination of components would operate efficiently over a normal range of hydrologic conditions, thus incurring the least cost and environmental impact associated with providing water supply opportunities. It is important to emphasize that the initial component choices in no way reflect an endorsement of or rejection of specific facilities. Increasingly detailed site and facility evaluations would take place in Phase II or Phase III of the process. In addition, a full range of operating assumptions and impact analyses will be evaluated in later phases as well.

The current refinement process evaluates various storage and conveyance components, including north of Delta surface and groundwater storage, through-Delta and dual transfer conveyance, in-Delta storage, and south of Delta surface and groundwater storage. The effect of various combinations of these components, added to the existing water management infrastructure, will be initially simulated using DWRSIM.

As a starting point, the combination of facilities shown in Table 1 will be simulated using DWRSIM. Based on the preliminary results of these simulations, further changes and refinements will be made to achieve balanced combinations of components.

During this refinement process it is impossible to anticipate what changes in operational rules may eventually be selected for operating the system to achieve environmental and water supply objectives. For the most part, it was assumed that the system would be operated according to existing rules, including the May 1995 Water Quality Control Plan. Additional assumptions were required to operate the proposed additional storage and conveyance components. These assumptions are set forth in the attached **"DWR Planning Simulation Model (DWRSIM) Assumptions for CALFED Conveyance/Storage Component Refinement Studies"** and **"DWR Planning Simulation Model (DWRSIM) Assumptions for CALFED Benchmark Study 1995C6D-CALFED-472"**. There is substantial of uncertainty over future no-project conditions, including implementation of the Central Valley Project Improvement Act, Trinity River flow allocations, allocation of American River flows, coordinated operations of the SWP and the CVP, and third-party participation in the State Water Resources Control Board Water Quality Control Plan implementation. Pending resolution of these and other uncertainties, the Team felt that the most reasonable approach was to proceed by assuming current constraints. The following paragraphs provide some background regarding the Team's reasoning in arriving at these assumptions, as well as caveats regarding their intended use.

II. Water Supply Opportunities

The proposed surface and groundwater storage components north of the Delta would be filled only after existing needs for water are met, including in-basin consumptive use, in-stream flow requirements, and Delta protective standards. In addition, this analysis also assumes that further diversions from the Sacramento River system would not occur until adequate seasonal flushing flows had occurred. Such flows are assumed to help restore river gravels, to maintain the river meander zone above Chico Landing, and to move salmon smolts downstream. A preliminary evaluation of the historical record suggests that when Sacramento River flow at the latitude of Hamilton City (River mile 200) equal or exceed 550,000 acre feet in a given month, the river will experience peak flow in excess 60,000 cfs some time during the month. For the sake of this preliminary analysis, these flows are deemed to be sufficient to meet the need for seasonal flushing.

Accordingly, in deciding when to divert surface flows to storage in a particular water year, DWRSIM will test to make sure that all existing water requirements, including Delta standards, are met and that at least one monthly flow has exceeded 550 taf. The same rule would be applied to determine when flows could be diverted to groundwater storage. If flows are limiting, DWRSIM would give a higher priority to filling ground water storage reservoirs and second priority to filling surface water storage. The reason for this is that diversion rates to groundwater are often limited by the rates at which water can be injected or infiltrated to storage.

III. Accounting for Water Supply Benefits and Impacts

It is likely that future storage and conveyance components would be integrated into both the State Water Project and Central Valley Project, with an effect on the water supply from both systems. At this point in the process, we really have no criteria for allocating the components between the two existing systems. Therefore it is assumed that the new components are all added to the SWP. It is recognized that criteria for sharing resources between the between the SWP and CVP are uncertain under the May 1995 WQCP, and therefore this modeling approach will need to be carefully reviewed and modified for Phase II of the analysis.

Similarly, there are many ways to allocate new supplies between environmental, agricultural, and urban needs. Various allocation themes can be developed through open CALFED technical discussions and negotiations and bundled as alternative operating constraints. Water supply benefits and impacts can then be compared to specific targets. Until such bundles of criteria can be developed and translated into modeling assumptions, the incremental change in SWP supplies and increases in Delta outflow during balanced conditions will be taken as an index of net water supply available for all beneficial purposes.

IV. Conveyance Assumptions

The 1994 Bay-Delta Accord is based on the need to protect a wide range of beneficial uses, based on the existing configuration of the Bay-Delta system. A significant alteration of the existing through-Delta water supply system would likely require a re-evaluation both to assure that beneficial uses are protected and to assure that operating rules are not unnecessarily restrictive.

Among the most likely candidates for re-evaluation would be the Delta export limits, designed to limit entrainment of eggs, larvae, and fish at export facilities. If part of the inflow to the Delta is diverted through one or more screened intakes at the northern end of the Delta into an isolated conveyance channel, that portion of the inflow could be either counted as part of the Delta inflow or subtracted from the Delta inflow. Similarly, export flows taken through an isolated conveyance could be counted either way. Thus there are various ways to compute the new export-inflow ratio. The two most likely approaches would be to:

o Include the isolated component in both inflow and export when computing the ratio.

o Delete the isolated flow from both inflow and export when computing the ratio.

The current export limit for April 15 through May 15 is 1500 cfs or 100 % of the 3-day running average of San Joaquin River flow at Vernalis, whichever is greater. This standard is intended to limit entrainment of San Joaquin River salmon smolts during their out migration. Isolated diversions from the Sacramento River would likely not be expected to affect San Joaquin River smolts and it may therefore be logical to exclude isolated diversions when computing allowable exports.

The Team felt that the issue of how to account for the isolated export component required discussion among a broad group of stakeholders. To facilitate that discussion and to gain some insight into the sensitivity of the system to changes in this criterion the simulations would be run both ways.

V. Surface Storage Facility Assumptions

In order to evaluate the performance of the various storage components we needed to assume specific locations, capacities, and operating rules for filling and emptying. For example, as a surrogate for north of Delta surface storage we assumed a reservoir in the foothills west of Colusa. For south of Delta surface storage, we assumed a reservoir in the vicinity of the existing San Luis Reservoir.

For in-Delta storage, specific islands were not selected. However, the assumption was made that the islands would be close enough to the SWP and CVP export facilities to provide direct connections through a series of siphons, thus eliminating the need to screen export water from this source twice.

It is important to emphasize that these choices in no way reflect an endorsement of or rejection of specific facilities. Detailed site and facility evaluations would not take place until Phase II or Phase III of the process.

VI. Groundwater Storage Facility Assumptions

Groundwater resources can be used to provide increased groundwater storage in several ways. One approach, referred to here as direct groundwater storage, involves treating groundwater basin like a surface water reservoir, except that it is filled by seepage from percolation basins or injection wells, and emptied by pumping from wells. This approach may involve high capital and operating costs, and is limited by the capacities of project facilities.

A second approach, referred to here as in-lieu groundwater storage, involves varying regional uses of groundwater and surface water resources such that surface water deliveries are supplemented in wet years and cut back in dry and critical years. This results in greater annual variations in groundwater use and storage. The net effect is to make greater stream flows available for other uses during dry and critical years. The in-lieu approach tends to be more practical and economical, because it takes advantage of water use patterns over large areas and existing water distribution and extraction facilities.

Both of these approaches will be evaluated for the areas upstream of the Delta during the component refinement process.

Direct Groundwater Storage

The evaluation of north of Delta groundwater resources was simplistic due to the lack of detailed hydro-geologic information and lack of operational experience.

The overall approach for modeling direct groundwater storage in the Sacramento Valley was to identify areas in which natural recharge through seepage from nearby streams was relatively slow. During this refinement process it is premature to model specific storage areas; rather it was assumed that the groundwater basins could be simulated as a single basin, with composite recharge, storage, and discharge characteristics. This basin would be incorporated into DWRSIM through a single node, through which flow project recharge, non-project recharge, and pumped withdrawals from storage.

A maximum of 500,000 acre-feet of operable groundwater storage capacity was assumed. A maximum project recharge rate of 500 cfs and discharge rate of 1000 cfs were assumed. In addition, the total non-project recharge capacity was limited to less than the full 500,000 acre-feet to reflect hydrogeologic constraints.

Non-project recharge will be accounted for in project operations whenever the groundwater basins are only partly filled. The rate of recharge is greatest when the groundwater basin is depleted, then diminishes as it fills. These rules crudely simulate the natural recharge pattern. Whenever artificial recharge occurs, the simulated volume of water in storage is updated, and the natural recharge rate adjusted downward accordingly.

Implementation of groundwater storage components which rely on direct withdrawal of groundwater for export from the Sacramento Valley would need to be coordinated with institutional constraints such as Sect 1220 of the Water Code. This Section prohibits groundwater extraction from the Sacramento Valley for export, unless certain conditions are met.

For south of Delta groundwater storage it was assumed that simulating a groundwater storage basin underlying the Kern River fan would provide insight into the potential effects on water supply opportunities. Such facilities have been described in detail elsewhere and the description is not repeated here.

In-Lieu Groundwater Storage

This option involves altering delivery patterns to areas where surface water and ground water resources are both used for irrigated agriculture. In wet years additional surface water would be delivered, allowing groundwater resources to accumulate; in dry and critical years surface water deliveries would be reduced, resulting in a greater use of groundwater storage in meeting total demands.

Various approaches to modeling conjunctive use within DWRSIM have been considered. The most promising approach would involve modifying the input hydrology files for one or more of the Depletion Areas. The demand pattern would have the same shape as the existing pattern within a given DA; only the annual volume would be adjusted.

The demand during wet years (based on the Sacramento River Index) would be increased to reflect increased surface deliveries, while the demand during dry and critical years would be reduced to reflect increased groundwater use. The current hydrologic record has about 20% wet and 20% dry and critical years.

As a starting point for evaluation, 100 TAF would be exercised in any given year. Subsequent evaluations could look at 200, 300, and greater annual volumes. Due to non-project seepage, additional reservoir releases would be required to transport a given water volume. For example, to deliver 100 TAF, a release of 125 TAF might be required. The 25 TAF would offset non-project recharge.

The net effect of any program which exercises groundwater storage would be a reduction in the long-term average groundwater level (except in areas where groundwater levels are already depressed due to overdraft). Therefore a key criterion for implementation would be that there be no long-term unmitigated effects.

The simulation approach would be similar for both the Sacramento Valley and the San Joaquin Valley.

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Table 1.
Conveyance and Storage Simulation Studies--Initial Set

Component	Bench-mark	Run 1, max. Dual	Run 2, Thru-Delta	Run 3, Isolated Conv.	Run 4, Small Dual	Run 5, Medium Dual
Through-Delta Conveyance, cfs	Existing	Existing 0?	15,000	0	Existing 10,000?	Existing 5,000?
Isolated Facility Conveyance, cfs	--------	15,000	0	15,000	5,000	10,000
Surface Storage, taf						
Tributary	-------					
Sacramento Valley	-------	3,000	3,000	0	0	1,500
San Joaquin Valley	-------					
In-Delta	-------	400	400	0	0	200
Off Aqueduct	-------	1,500	1,500	0	1,500	750
Groundwater Storage, taf						
Tributary	-------	500	500	0	0	250
Off-Aqueduct	-------	500	500	0	500	250

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Footnote explanation
won't take more than existing

WQ modeling
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