Asset Analysis
Games 1a and 1b
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Delta Storage

Refer to figure 1. Storage in the Delta islands was reconstructed from game 1b descriptions. San Luis Reservoir storage is the final output storage from the Daily Model in game 1b. Delta storage is assumed to have input/output limits of about 4 kcfs and to have storage capacity limits of 200 kaf.

Delta storage filled in most of the earlier years of game 1b, but then filled only once during the drought from 1987 – 1990 and then only partially. Probably not all of the water diverted into the Delta islands was convertible into new export supplies. For example, 200 kaf of water was diverted during the winter of 1982 onto the islands and exported during the fall of 1982. That water could not have led to greater deliveries than were made in 1983, but instead merely hastened the filling of San Luis Reservoir. However, even when Delta storage cannot be used to increase yield, it still can provide value by hastening the fill of San Luis Reservoir. In general, the earlier San Luis fills, the less damaging the entrainment associated with export pumping.

I estimate that Delta storage had the following performance during the game:

Year	Deliveries From Delta Storage	Yield	Comments
1981	200 kaf	200 kaf	Storage filled early enough to be used in allocations. Assumes demand exists.
1982	200 kaf	0	Provided some fish flexibility, but no new export supplies due to wet year.
1983	0	0	Remains full into 1984
1984	200 kaf	200 kaf	Allowed SLR to just fill in 1985.
1985	270 kaf	270 kaf	Allowed SLR to just fill in 1986
1986	200 kaf	200 kaf	Helped sustain SLR levels
1987	0	0	No opportunity to fill
1988	100 kaf	100 kaf	Helps during drought
1989	0	0	No opportunity to fill
1990	0	0	No opportunity to fill

Total Usable Deliveries	Average Deliveries	Dry Sequence Average
1070 kaf	107 kaf	25 kaf

The increase in average deliveries is very high, considering the small amount of storage used. In fact, for every acre-foot of storage space, .53 acre-feet of new exports were developed. This is a very high ratio. However, note that the increased export supplies were developed primarily in wet years. We may draw some tentative conclusions, then on how Delta storage might best contribute to a CALFED solution:

1. Allocate storage to the EWA. The EWA has a need for export supplies in wet years to offset pumping reductions. Delta storage and delivery patterns are a perfect match.
2. Allocate storage to USBR. Even wet year water is valuable to west-side contractors.
3. Operate in conjunction with additional south-of-Delta storage. In essence, Delta storage becomes a short term forebay to long-term storage south of Delta. This would be particularly valuable if Delta export capacity cannot be increased to maximum physical capacity.
4. Use Delta storage to hold market transfer water from upstream of the Delta until pumping windows open up in the export system.

Groundwater Storage

Refer to figure 2. Storage levels were taken from the baseline DWRSIM run. Input/ output limits were assumed to be 30 kaf per month. Total groundwater storage was limited to 500 kaf.

Groundwater storage had a initial value of about 220 kaf in the DWRSIM run. Storage declined to zero during the 1981 dry year. Storage levels then rose during 1982 and 1983 to the maximum physical capacity of 500 kaf. Levels began dropping during the dry year of 1985, rose a bit during 1986, then dropped to zero by early 1988. Storage levels remained at zero for the remainder of the drought.

Total new exports were as follows:

1981 219 kaf
1985 338 kaf
87/88 297 kaf

Total exports = 854 kaf
Annual average = 85 kaf
New exports/ Storage space = .17
Dry year sequence exports = 297 kaf
Dry year sequence average = 74 kaf

The groundwater storage in this game was long-term storage, as can be seen from Figure 2. Storage levels fluctuated over periods of years, not months. This was a result of the 30 kaf/month (or 500 kcfs) limit on input/ output. Given these input/output characteristics, it is no surprise that groundwater storage was used primarily to support deliveries during dry periods. This is in marked contrast to higher frequency storage such as Delta storage. The ratio of new exports to storage volume was 17%, which is perhaps typical of new south of Delta storage (which can add value only after San Luis is filled). However, since this water is delivered primarily during dry years, the water may be quite valuable.

Based upon these characteristics, we may draw some tentative conclusions on how groundwater storage south-of-the Delta may contribute to a CALFED solution:

1. Allocate storage to water projects to provide additional dry year supplies.
2. Allocate storage to EWA for use as collateral in borrowing water from the Projects during wetter years.

In either case the stored groundwater would go to the Projects. In the former case, it simply represents increased dry year supplies. In the latter case, it does not increase dry year supplies, but is used to bolster lost storage from a previous year.

Increased Shasta Storage

Refer to Figure 3. Storage levels are taken from DWRSIM runs 6 and 3. Run 6 includes the increased storage (as well as a number of other new assets) and Run 3 does not. The approximate value of increased Shasta storage can be roughly inferred from the differences between these two curves. However, the inclusion of increased Banks pumping in Run 6 does complicate the analysis. Adequate analysis may require additional DWRSIM runs.

Under the assumption that extra releases of water from enlarged Shasta are sent to San Luis Reservoir, then the enlargement of Shasta helps export supplies in only two years – 1985 and 1986 for a total of 503 kaf, or 50 kaf/ year. As a fraction of the increase in storage, this is about .17, which is about what we would expect. This value would presumably rise if less water were sent from the Trinity River in the future.

Note also that the additional storage allowed Shasta elevations to remain higher during many years. This additional water could help protect the cold water pool for salmon. In particular, note the improvements at the beginning of water years 1986 and 1988. On the other hand, the surplus did not help during the drought beyond 1988. In both 1989 and 1990, storage levels were not affected by the additional capacity.

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