Getting through the Next 20 Years: Two Questions about Water Supply

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The Some Characteristics of the next 20 years Water Supply

1. Delta is currently in disrepair and has a high probability (0.65) of collapsing in the next 40 years
2. Despite the opposition, the Endangered Species Act is highly likely to remain a dominant driver of change in water exports from the Delta.
3. The only logical solution is to decouple the water delivery from the Delta ecosystem by a major investment in an Isolated Facility (IF) infrastructure-(pipes, canals or tunnels).
4. Decisions and implementation of any infrastructure will take 10 - 15 years.

Two Questions facing the California water supply economy

I What can be done to minimize the financial and social cost of the Delta export cutbacks over the next ten years ?

II How should we plan to finance and operate an Isolated Facility in the Delta ?

I Minimizing Costs to the San Joaquin valley economy in the medium run.

One idea- An Expanded South of Delta Water Market

1. The use of water markets is widely advocated as a mechanism to alleviate the economic impact of droughts. In the 1991 to 1994 drought in California, a state-sponsored emergency drought water bank played a significant role in establishing the value of water and reducing the economic costs of major shortages. Most of the water traded was sold to urban areas, but some high-value agriculture also purchased water. Under the current 2009 drought, an attempt to repeat this emergency bank did not meet with success, partially due to delta export restrictions.

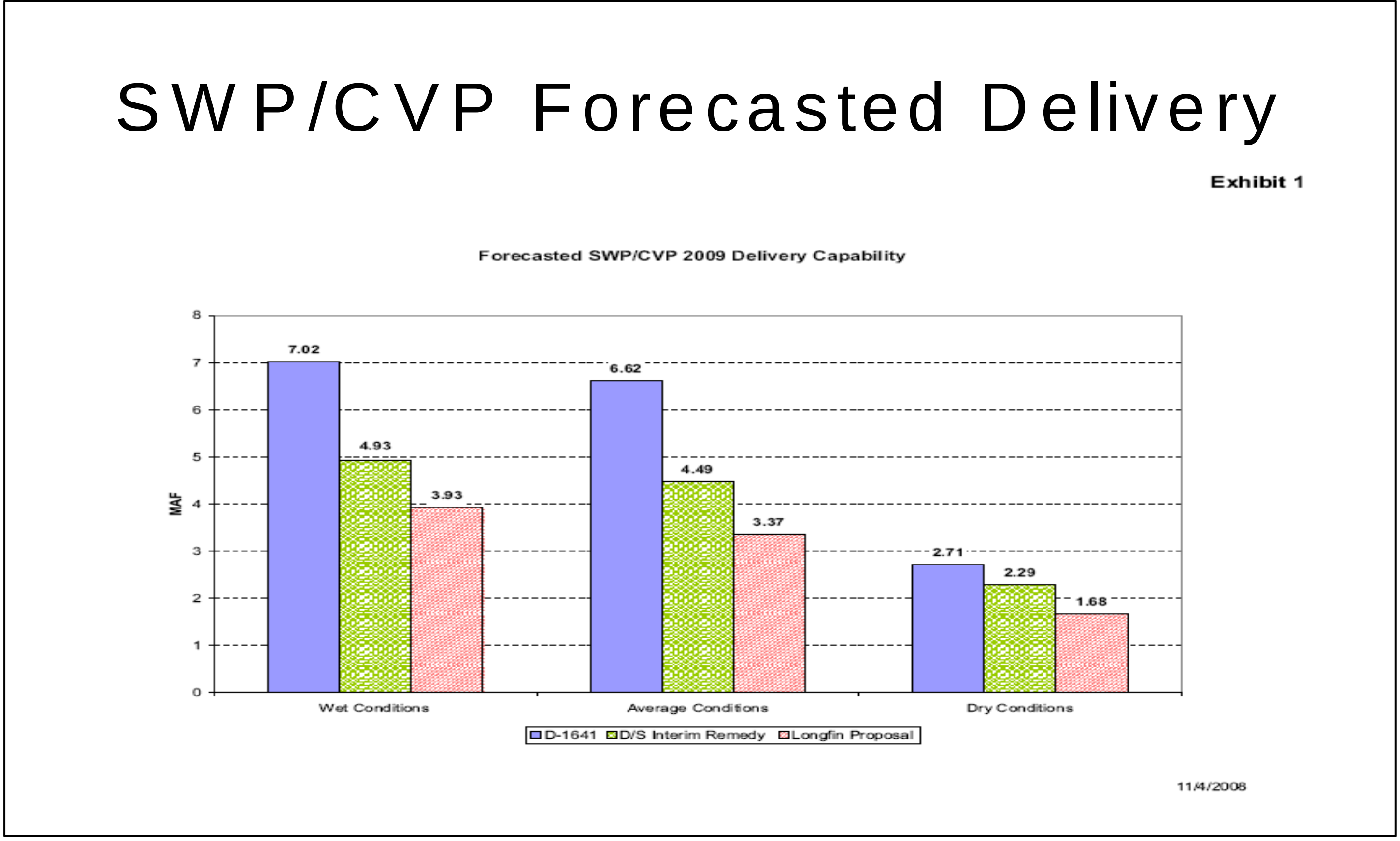


Figure 1.

2. The only publicly available data on the effect of biological constraints on total exports under different water year types is shown in figure 1. The data is a year old and based on a different species than 2010, but serves as an indicator that export cuts will be substantial over the full range of water years

3. Water trades can be modeled using a combination of engineering and economic methods. Howitt et al. (2009) adapted the Statewide Agricultural Production Model (http://swap.ucdavis.edu Howitt et al., 2001) combining economic information with infrastructure information from CALVIN, (Draper et al., 2003), feasible and economically worthwhile trades can be elicited. Constrains on these transfers include within-county trade restrictions from east to west, limits on crop stress irrigation, and excess groundwater pumping.

4. There is potential to trade large volumes within the San Joaquin valley despite constraints on inter-regional transfers. Preliminary trading regions are classified as exporters and importers in Figure 2. Figure 3 shows a potential trading network. Table 1 shows the amounts of water traded among regions in an idealized water market that includes water trading restrictions by quantity, type and location, and transport costs among trading regions.

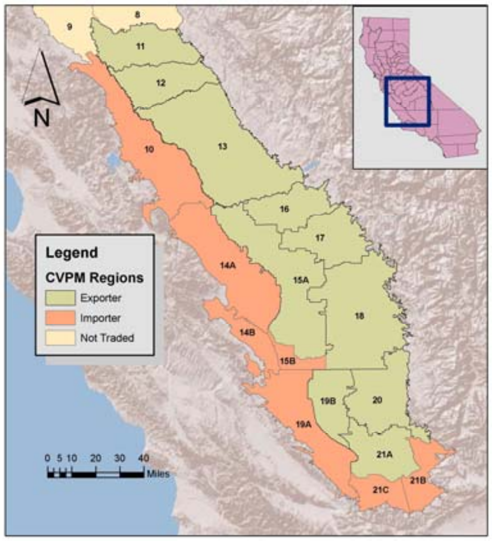


Figure 2. Agricultural regions South of the Delta.

5. A pattern of trade can be seen in Figure ,where water regions East of the Central Valley (in green), are net exporters of water. Regions west (orange in Figure), are net importers of water presumably due to higher value crops and limited water supply.

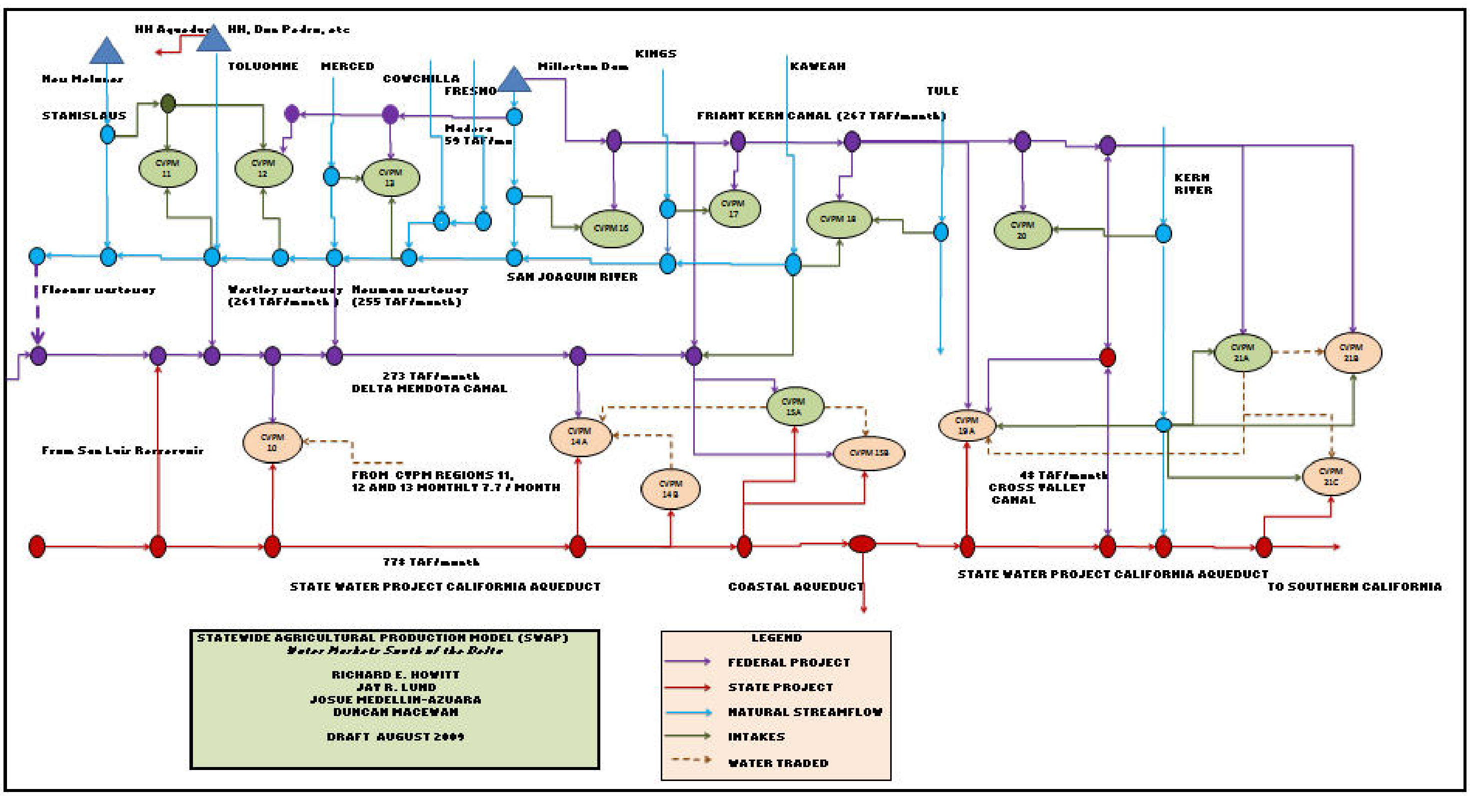


Figure 3. SWAP Model for water transfers south of the Sacramento-San Joaquin Delta.

6.
Table 1 below shows the potential transfers among regions in acre-ft per year.

		Export Regions							
		V11	V12	V13	V14B	V15A	V17	V21A	Import Total
Import Regions	V10	0	0	0	0	0	0	0	0
	V14A	52,318	37,155	80,599	3,614	34,576	20,350	0	228,612
	V15B	0	0	0	0	0	16,644	0	16,644
	V19A	0	0	0	0	55,825	0	11,104	66,929
	V20	0	0	0	0	0	0	0	0
	V21B	0	0	0	0	0	0	13,049	13,049
	V21C	0	0	0	0	0	0	0	0
	Export Total	52,318	37,155	80,599	3,614	90,402	36,994	24,153	325,235

Table 1. South of Delta economically optimal water trades (AF/yr)

Conclusion: A south of Delta water market- even with strong groundwater and local trading constraints can reduce the extremes of water scarcity costs in terms of regional revenue and job loss. However, for a larger market to evolve, local county level interests must take the lead, and state, local and federal agencies will have to cooperate over engineering and environmental constraints. This will not be easy, but it is likely that there will be plenty of time and economic pain to encourage the process.

II Financing and Sizing an Isolated Facility

Some Economic Characteristics of an Isolated Facility (IF)

1. An IF has both Public and Private Beneficiaries
2. An IF has a decreasing marginal cost
3. "Beneficiary pays" means that revenue from private users has to cover their allocated costs
4. Private beneficiaries differ greatly in their demands for water
5. The reliability of deliveries from an IF decreases greatly as capacity is expanded.
6. Point– Standard marginal cost pricing is not applicable to IF cost recovery.

There are economic differences among Private IF Beneficiaries

1. Quantities demanded at current prices are very different

Agriculture	3.5 MAF
M & I	1.5 MAF

2. Current Prices

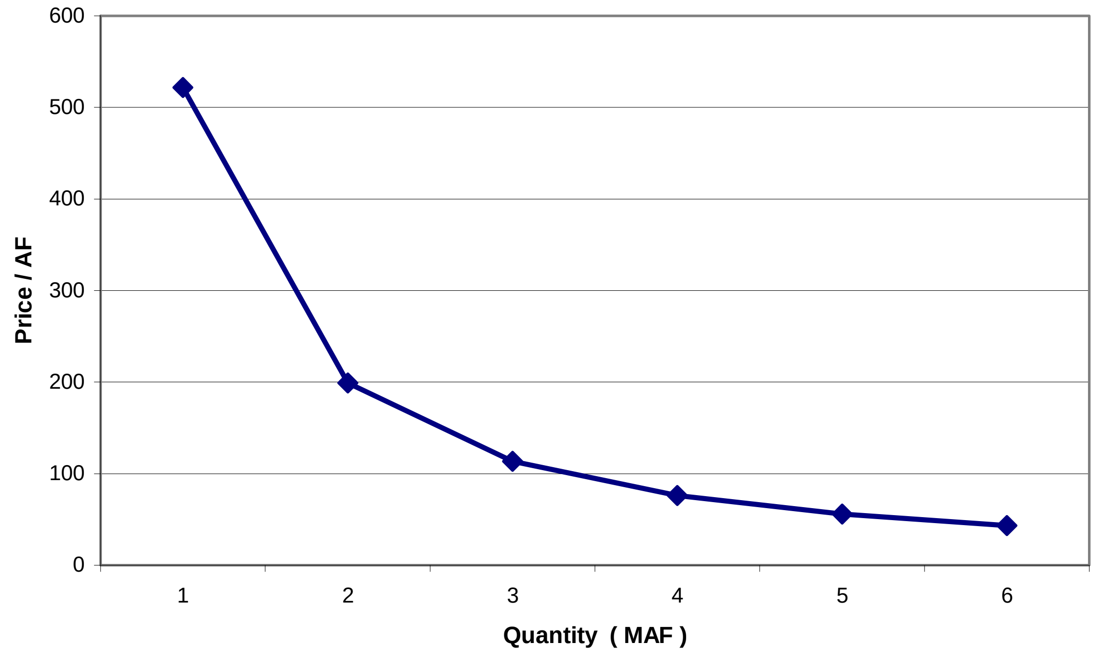
Agriculture	$65- AF
M & I	$450- AF

3. Demand Elasticities differ among beneficiaries

Agriculture	-0.75
M & I	-0.20

The importance of reliability of supply differs among beneficiaries

Figure 4. Combined Agricultural/Urban Demand ($2007)



An Economic Approach

1. Long established economic theory shows that differential pricing to users is efficient under the conditions above. Baumol & Bradford (1970)
2. Problem - If users purchase the same IF capacity reliability at different prices, subsequent transfers need to be restricted.
3. Given the future uncertainty in the Californian economy, environmental values, and climate change, use rights for an IF must be tradable among different users.

Some Economic Problems

1. How do you get the beneficiaries to pay?
2. How do you size the capacity of the Facility?
3. How do you allow future adjustment by trading rights without giving windfall gains?

Traditional Project Sizing and Costing

1. Size the project to take advantage of the optimal capacity and decreasing unit cost.
2. Use a “Field of Dreams” pricing policy after the size and total cost is set.
3. Problem– Users have no incentive to reveal their true willingness to pay.

Figure 5. Marginal Capital Cost/ Af Capacity of IF

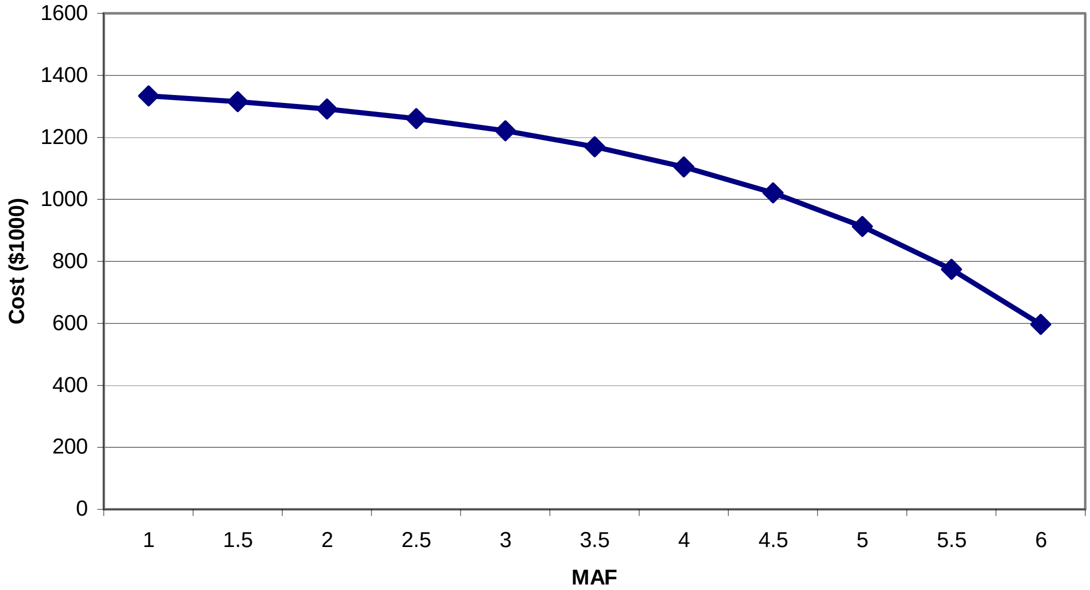
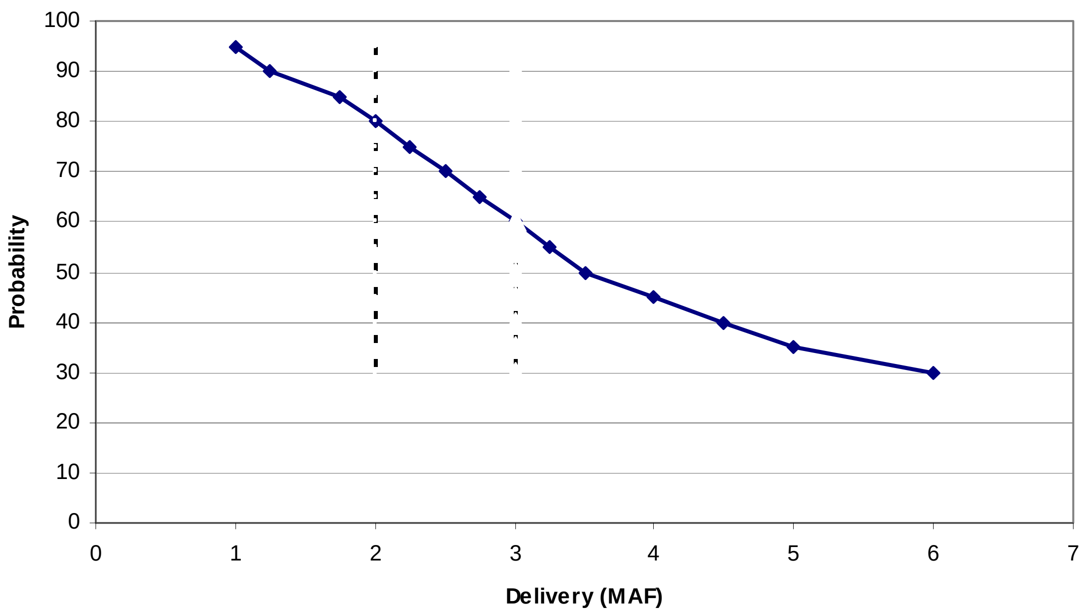


Figure 6. Exceedence for an Isolated Facility



An Alternative Approach

1. Use the Exceedence curve to define three or more reliability classes of supply. (>80%, 79%-60%, 59%-30%)
2. Define the average "public water" demand quantity and commit to pay the average cost, whatever it is.
3. Use private bids and contracts to simultaneously price and size rights in the different reliability classes.
4. Once the bids and facility size are final, allow trading of the private rights for each reliability class.

Table 2. Preliminary Results of Ramsey Pricing an IF

	Capacity	Capital Cost	Annual Cost
	MAF	$ Billion	$ Million
	5.33	7.11	1.545
	Agriculture	Environment	Urban
Quantity (MAF)	3.07	1	1.26
Demand Price $	75.51	289.85	813.85

Conclusions

1. An expanded voluntary South of Delta water market can reduce the cost of export cuts despite engineering and institutional problems.
2. We can probably define an economic structure for an IF that is self financing, self sizing, and adaptable to future changes.
3. We will have to break with traditional water project approaches.

References

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