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Economic Impacts of Market Implementation of Bay/Delta Water Quality Standards

Prepared for the Natural Heritage Institute

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I. Background

California growers produce a large number of crops under a variety of growing conditions. Differences in soil quality, weather, pest control problems, proximity to urban areas and water rights contribute to significant disparities in the productivity of water used in agriculture. As discussed in Sunding et al. (1994), the least productive 20% of the water used by California farmers produces only 4% of the State agricultural revenue. Table 1 is a detailed list of some low-productivity uses of water in California agriculture. The majority of these uses are to produce field crops such as hay, grains and dry beans, and for irrigated pasture. Production of these crops is also concentrated in the Sacramento Valley, the Delta and the north and east sides of the San Joaquin Valley.

The disparity in water productivity between crops and regions is critically important to the design of programs to improve water quality by reducing diversions. The huge disparity in agricultural water productivity implies that the cost of removing water from agriculture can be significantly reduced by targeting only the water with the lowest productivity. It is frequently argued that the proper way to implement the federal government's newly proposed Endangered Species Act/Clean Water Act (ESA/CWA) standards is by a pro rata water supply cut. This analysis suggests that implementing the EPA's standards by pro rata cuts has only the veneer of fairness: in truth it allocates the burden of improving water quality unfairly and results in needlessly large social and economic impacts.

A more efficient mechanism for enhancing instream flows seeks out only the water contributing the least to the economic well-being of the State. This analysis considers the economic impacts on the State of implementing the ESA/CWA standards with a purchase fund operated by the State or Federal government in which growers willingly sell their water allocation. The analysis will concentrate on the economic, or efficiency, impacts of this implementation versus a simple pro rata cut.

II. Model

This section describes an economic model constructed to measure the costs of implementing Bay/Delta water quality standards. The economic model is known as the "rationing" model, following Sunding et al. (1994) and Zilberman et al. (1994). The inspiration for the name comes from the simple observation that if growers fallow land in response to cuts in surface water supplies, they will fallow the land generating the lowest income per acre-foot of water applied. Put another way, growers will ration their water to generate the highest level of profit with the water they have available.

It is important to emphasize at the outset that the rationing model measures the impacts of ESA/CWA protection and not the actual costs of purchasing a given number of acre-feet of water. The true cost of improving environmental quality by purchasing water from a farmer is not the amount of money the farmer is paid to release the water. Rather, the true economic cost of the program is the lost value resulting from the farmer's not producing food and fiber.[1]

The key features of the rationing model are the following:

- The analysis concerns the <u>incremental</u> impacts of ESA/CWA protection given reduced CVP yields required by CVPIA.

- The impact model measures lost State economic welfare from ESA/CWA standards in terms of lost revenue. Revenue is a conservative measure of lost welfare (as it is larger than profit), and reflects the impacts of the standards on the well-being of farm laborers and agricultural suppliers as well as growers.

- The analysis conservatively assumes that only 50% of the reduced CVP yield mandated by the CVPIA contributes to meeting the ESA/CWA standards.

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[1] The assessments that would be paid into the purchase fund by the water users do not represent costs or losses to the economy because these monies are paid back out to other participants in the economy, namely those who choose to sell water for environmental compliance purposes.

- The model is built on the assumption that the CVPIA is implemented by pro rata cuts of supplies to CVP contractors in the San Joaquin Valley.

- The model is based on the assumption that at least 20% of all incremental flows necessary to meet ESA/CWA requirements must come from the San Joaquin River.

- The model is used to measure impacts in only two types of water years: an average year and a critically dry year. The incremental costs of ESA/CWA standards will be lower in wet years.

- It is assumed that growers can only fallow land in response to reduced surface water supplies. This assumption is conservative in that growers can also reduce the impacts of supply reductions by switching to less water-intensive crops and adopting modern irrigation technologies.

- The model is purposefully built to reflect implementation of the ESA/CWA standards that does not allow increased groundwater pumping. This feature increases the economic impacts of the standards, but makes the response to the standards feasible in the long-run.

- The model considers constraints on water marketing imposed by ESA and other requirements on Delta pumping. Specifically, some model scenarios reflect the strongly conservative assumption of <u>no</u> north-south trading.

It is standard to describe agricultural impact models along several dimensions: level of detail, grower behavior, policies considered, nature and extent of markets, and welfare criteria employed.

Level of Detail

The rationing model captures the behavior of growers in individual water districts and is thus much more disaggregated than other agricultural impact models such as the California Agricultural Resources Management model. The rationing model groups farmers into one of four basic classes: 1) CVP contractors in the Sacramento and San Joaquin Valleys, 2) Modesto and Turlock Irrigation Districts (MT), 3) riparian rights-holders in the Delta (Delta) and 4) urban State Water Project Contractors (SWP). CVP contractors are further divided into five basic user groups: Tehama-Colusa (TC), Delta-Mendota (DM), San Joaquin-Mendota Pool (SJMP), San Luis and Cross-Valley Canals (SLCVC), and Friant users (FR).

The rationing model also considers a wide range of crops. While field crops are generally the lowest-value crops per acre foot of water applied, the model also considers perennials such as grapes and fruit, and high-value annuals such as lettuce and tomatoes.

Data on 1987 cropping patterns, water use and returns per acre foot by individual CVP water district is taken from a data tape provided by the US Bureau of Reclamation. Data on Delta acreage and water use is taken form the Department of Water Resources model on Delta water requirements. Water use for each of the various crops is assumed to equal crop evapotranspiration requirements, also provided by DWR. Water use in Modesto and Turlock Irrigation Districts is captured by taking cropping patterns provided by the City of San Francisco and combining them with data on applied water by crop in South San Joaquin MUD.

Grower Behavior

The impact model allows growers to fallow land in response to changes in surface water supply. Other possible responses are groundwater pumping, irrigation technology adoption and crop switching. While the analysis is conservative in that it limits growers responses, the results are probably not far from the optimal solution. Crop switching is not likely since land allocation is not generally determined by water price; rather, land allocation among crops tends to follow soil type and the marketing network. Technology adoption is also not likely since the surface water supply cuts, particularly with broad-scale marketing, do not take enough water from high-value lands to induce adoption of modern technologies.

Groundwater pumping, however, is a likely response to changes in surface water allocation, as demonstrated by both theory and experience. This activity should be discouraged in a long-run optimum, however, as it is not sustainable. Thus, the analysis considers the impacts of a purchase fund where growers are required to fallow land if water is sold to the State for environmental restoration.

Water Requirements

Following the analysis in the USEPA's Regulatory Impact Analysis (RIA), the analysis assumes that the ESA/CWA standards require 0.7 MAF in an average year and 1.4 MAF in a critically dry year, including winter-run salmon requirements. These cuts must be superimposed on the pre-existing CVPIA requirements. The analysis assumes that the CVPIA will be implemented by making a 0.8 MAF pro rata cut in to CVP contract supplies in the San Joaquin Valley in an average year. In a critically dry year, this pro rata cut will be 0.6 MAF. Following discussions with USEPA and USFWS officials, the model is based on the assumption that there is a 50% overlap between the CVPIA requirements and the ESA/CWA requirements. This assumption implies that 0.3 MAF must be acquired in addition to the 0.8 MAF reduction in CVP yield to meet ESA/CWA requirements in an average year and that 1.1 MAF must be acquired in a critically dry year.

Implementation of Standards

There are two basic methods of implementing the ESA/CWA standards considered in this analysis. The first option is an environmental water fund set up by the State to purchase compliance water. The second option is for all CVP and SWP contractors to lose a pro rata share of water necessary to meet requirements.

Environmental Water Fund. A central fund could be supported through assessments on water users, state bond issues and other means. The fund could be used to purchase and/or develop water to meet all or part of the ESA/CWA standards. This analysis considers the option in which all compliance water is purchased by the Environmental Water Fund.

Pro Rata Loss by CVP/SWP. This analysis assumes that the CVP and SWP contractors respond to losses of supply by entering the water market. We consider two marketing scenarios. The first is a broad market connecting CVP contractors in the Sacramento and San Joaquin Valleys, Modesto and Turlock Irrigation Districts, and urban CVP contractors. The second scenario is a limited market in which only CVP contractors south of the Delta participate. It is important to note that Delta growers with riparian rights do not participate in either private market.

There are a number of factors leading to a limited market scenario. Most important, Delta pumping constraints imposed by ESA could limit north-south trading possibilities. Further, broad-scale water marketing of the type described here might require investments in conveyance infrastructure.[2]

Criteria for Evaluation

The model measures the impacts on agriculture of reducing surface water supplies in terms of lost sales. The use of revenue as an economic welfare measure has been discussed by Just et al. (1982) and Sunding et al. (1994). These authors have pointed out that revenue is the best welfare measure when factors of production cannot be redeployed without cost in other sectors of the economy. For example, if a farm laborer can obtain employment in some other industry, then his lost wages should not be counted as a welfare loss. However, if the laborer endures a long period of unemployment, then lost wages should be counted as a welfare loss.

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2 NHI does not advocate a limited market as a policy matter. The analysis is structured to account for various levels of water market constraints.

III. Impacts

Tables 2 - 9 display the model results for the various water year, policy and marketing scenarios. The tables show the crops fallowed under the various scenarios. The crops are listed in ascending order of income generated per-acre foot of water. The total incremental cost of the ESA/CWA standards is simply cumulative lost sales for the highest-value crop fallowed. For example, the economic cost of the scenario given in Table 2 is $6.6 million. Summary impacts are presented in Table 10.

If implemented by a purchase fund, ESA/CWA standards would cause lost agricultural sales of $6.6 million annually in an average year and $66.4 million annually in a critically dry year if there is a broad market for CVPIA cuts. In the event that water trading is limited, average year impacts are $3.7 million and critically dry year impacts of $42.9 million.

These economic costs are quite low, especially considering the conservative nature of the model and its underlying assumptions. In all likelihood, the actual economic costs of ESA/CWA standards will be lower, particularly in the long-run. The crops fallowed in this case include primarily field crops in the Delta, the north and east sides of the San Joaquin Valley, and the Sacramento Valley. The highest-value crop fallowed with a purchase fund is corn in the Friant unit, which generates revenue of $96/AF.

When implemented by pro rata cuts to CVP and SWP contractors, the impacts of ESA/CWA protection are much greater, especially when there is only a limited water market. The additional Bay/Delta standards would cause average year impacts of $19.8 million annually and $117.2 million annually in a critically dry year if there is a broad market for the cuts and average year impacts of $64.9 million and critical year impacts of $248.7 million if the market is limited. In this case where the ESA/CWA standards are implemented with a pro rata supply cut, the highest-valued crop fallowed is a portion of the cotton in the San Joaquin-Mendota Pool group, which generates revenues of $259/AF.

IV. Analysis of Impacts

When implemented by a purchase fund, the economic impacts of ESA/CWA regulation are lower if water trading is limited because there are still pockets of low-productivity water, especially in the Sacramento Valley, the Delta and the north and east sides of the San Joaquin Valley, available for purchase -- these pockets of low-productivity water have been insulated by constraints on cross-Delta transfers. Under a broad market, however, San Joaquin Valley growers and urban consumers seek out this water to replace their lost supplies and it is thus not available to meet ESA/CWA standards.

This observation should not be construed as an argument against private water marketing. As shown elsewhere, water marketing can substantially improve the efficiency of California agriculture, resulting in more income generated by the water currently available to growers. Rather, the point is that the incremental costs of ESA/CWA protection are lower if there is low-productivity water accessible by a purchase fund.

The incremental costs of ESA/CWA protection are substantially higher when implemented by pro rata cuts, particularly if there is limited water trading. Note that the marginal impact of marketing on costs is exactly the opposite here than was the case with the purchase fund: private water marketing reduces the costs of ESA/CWA protection when they are implemented by pro rata cuts. The reason is that pro rata cuts to meet ESA/CWA requirements hit many CVP and SWP contractors twice -- once for CVPIA and again for ESA/CWA. Without a market to relieve some of this burden by spreading it to growers in the Sacramento Valley and other parts of the San Joaquin Valley, contractors will quickly fallow all low-value crops and begin fallowing higher-value crops such as cotton.

It is especially important for the State to create a purchase fund when private water markets are limited in their ability to move water between regions, particularly north-south. In this case, the purchase fund creates a market where none existed previously. When private water trading is limited, a purchase fund lowers the economic impacts of additional Bay/Delta standards on agriculture by $61.2 million (a 94% reduction) in an average year and $205.8 million (an 83% reduction) in a critically dry year.

The purchase fund lowers the economic costs of ESA/CWA protection even when there is broad-scale private water trading. The purchase fund can access a number of water users who cannot participate in private trading. Most importantly, riparian users in the Delta are currently prohibited from marketing their water. Because these growers use water for low-value crops, such as alfalfa hay and irrigated pasture, the ability of the purchase fund to tap Delta water users is a significant advantage over private marketing.

There are other advantages of implementing ESA/CWA standards with a purchase fund. First, it minimizes third-party impacts of water quality improvements by compensating growers and by purchasing from growers only the amount of water that is actually needed in a given year. Pro rata cuts do not pay to remove water from agriculture, resulting in potentially large community impacts. Second, the purchase fund is easy to implement physically since no new facilities are needed. Growers selling water to the fund would simply not take delivery of their supplies, thus leaving them in the Delta. Third, the purchase fund is flexible in that it could be tailored to achieve other environmental goals such as San Joaquin River restoration and THM contamination in Delta, or to leave certain lands in production such as that used to grow rice in the Sacramento Valley.

V. Implementation

It is difficult at present to assess the private market price (or prices) of water prevailing after implementation of the CVPIA and ESA/CWA standards. Grower reservation price is determined by net income foregone plus weed control and soil conservation expenses incurred during the period of fallowing. Market price, however, is determined as a complex interaction between grower and buyer reservation prices. As a result, this analysis has not attempted to determine the actual amount of money required to implement the ESA/CWA standards with a water purchase fund.

Some precedent, however, is provided by the Drought Water Bank and water transactions among CVP contractors in the San Joaquin Valley. The Bank purchased water from growers at a price of $125/AF during a period of extreme hardship; average year prices are closer to $90/AF in the San Joaquin Valley. Should these prices prevail, the fund would need to raise $27 million in an average year and $137.5 million in a critically dry year to finance purchases.

There are strong economic efficiency arguments for financing with per-acre and per-hookup charges, rather than volummetric charges. Most important is the fact that the purchase fund already distorts economic decisions by changing the incentives for water application. Financing the program by volummetric charges induces inefficient water use.

The cost of the water fund is likely to be very small. Assuming that the water fund must expend $27 million during normal years and $137.5 million in critically dry years and assuming that there are roughly 10 million urban connections which rely upon Central Valley water, then a water purchase fund based solely on urban per-hookup assessments would require only $2.70 in normal years and $13.75 in critical years. With agricultural per-acre assessments, the cost per urban hookup would be even lower.

Table 1
Low-Productivity Water Uses in California Agriculture

Crop	*Region*	*Total Use (AF)*	*Acreage*	*Revenue ($000)*	*Revenue/AF ($)*	*Cumulative Water Use*	*Cumulative Acreage*	*Cumulative Sales*
Hay	DMC	13,524	3,381	47	3	13,524	3,381	47
Hay	SJMP	3,996	816	15	4	17,520	4,197	62
Hay	SLCVC	2,847	619	23	8	20,367	4,816	85
Hay	FR	41,681	10,166	600	14	62,048	14,982	685
Pasture	TC	62,514	10,419	947	15	124,562	25,401	1,632
Pasture	SJMP	5,960	977	92	15	130,522	26,378	1,724
Pasture	FR	91,287	18,630	1,487	16	221,809	45,008	3,211
Pasture	SLCVC	270	55	5	17	222,079	45,063	3,216
Pasture	DMC	6,002	964	111	18	228,081	46,027	3,327
Hay	TC	1,738	424	33	19	229,819	46,451	3,360
Pasture	MT	120,946	29,499	560	19	350,765	75,950	3,920
Pasture	Delta	99,085	26,600	2,070	21	449,850	102,550	5,990
Hay	MT	83,488	20,363	428	21	533,338	122,913	6,417
Hay	Delta	218,285	58,600	5,326	24	751,623	181,513	11,744
Rice	SJMP	9,523	1,253	415	44	761,146	182,766	12,159
Rice	DMC	7,539	992	336	45	768,685	183,758	12,495
Barley	TC	194	121	12	62	768,879	183,879	12,507
Rice	TC	635,522	94,854	41,481	65	1,404,401	278,733	53,988
Sorghum	FR	4,522	2,261	403	89	1,408,923	280,994	54,391
Corn	TC	12,301	3,618	1,103	90	1,421,224	284,612	55,494
Wheat	TC	35,469	18,668	3,202	90	1,456,693	303,280	58,696
Barley	DMC	1,410	881	128	91	1,458,103	304,161	58,824
Wheat	Delta	195,602	104,600	17,995	92	1,653,705	408,761	76,819
Corn	FR	90,719	27,327	8,668	96	1,744,424	436,088	85,487
Sorghum	TC	174	87	18	103	1,744,598	436,175	85,505
Sorghum	MT	712	274	29	105	1,745,311	436,449	85,534

Wheat	FR	85,270	37,074	9,241	108	1,830,581	473,523	94,775
Corn	MT	12,432	4,440	480	108	1,843,013	477,963	95,254
Barley	SLCVC	816	510	89	109	1,843,829	478,473	95,343
Corn	DMC	64	20	7	109	1,843,893	478,493	95,350
Barley	SJMP	25,596	15,999	2,948	115	1,869,489	494,492	98,298
Barley	FR	20,462	12,789	2,549	125	1,889,951	507,281	100,847
Corn	Delta	276,960	115,400	35,174	127	2,166,911	622,681	136,021
Rice	MT	881	339	44	130	2,167,792	623,020	136,065
Corn	SJMP	3,392	969	444	131	2,171,184	623,989	136,509
Sorghum	DMC	146	73	20	134	2,171,330	624,062	136,529
Wheat	SJMP	62,319	27,095	8,471	136	2,233,649	651,157	145,000
Wheat	DMC	9,947	5,526	1,365	137	2,243,596	656,683	146,365
Wheat	SLCVC	2,664	1,332	369	139	2,246,260	658,015	146,734
Corn	SLCVC	1,630	494	236	145	2,247,890	658,509	146,970
Beans	MT	3,422	1,316	222	169	2,251,312	659,825	147,192
Beans	FR	19,868	7,947	3,497	176	2,271,180	667,772	150,689
Wheat	MT	63,928	45,663	8,174	179	2,335,108	713,435	158,863
Peas	FR	103	41	20	194	2,335,211	713,476	158,883
Beans	TC	15,188	6,075	3,021	199	2,350,399	719,551	161,904

Table 2
Average Year Impacts with Fund and Broad Market

Crop	*Region*	*Total Use (AF)*	*Acreage*	*Revenue ($000)*	*Revenue/AF ($)*	*Cumulative Water Use*	*Cumulative Acreage*	*Cumulative Sales*
Pasture	Delta	99,085	26,600	2,070	21	99,085	26,600	2,070
Hay	Delta	200,915	53,937	4,512	24	300,000	80,537	6,582

Table 3
Critically Dry Year Impacts with Fund and Broad Market

Crop	*Region*	*Total Use (AF)*	*Acreage*	*Revenue ($000)*	*Revenue/AF ($)*	*Cumulative Water Use*	*Cumulative Acreage*	*Cumulative Sales*
Pasture	Delta	99,085	26,600	2,070	21	99,085	26,600	2,070
Hay	Delta	218,285	58,600	5,326	24	317,370	85,200	7,396
Rice	TC	487,031	72,691	31,787	65	804,401	157,891	39,183
Sorghum	FR	4,522	2,261	403	89	808,923	160,152	39,586
Corn	TC	12,301	3,618	1,103	90	821,224	163,770	40,689
Wheat	TC	35,469	18,668	3,202	90	856,693	182,438	43,891
Barley	DMC	1,410	881	128	91	858,103	183,319	44,019
Wheat	Delta	195,602	104,600	17,995	92	1,053,705	287,919	62,014
Corn	FR	46,295	13,945	4,421	96	1,100,000	301,864	66,435

Table 4
Average Year Impacts with Fund and Limited Market

Crop	*Region*	*Total Use (AF)*	*Acreage*	*Revenue ($000)*	*Revenue/AF ($)*	*Cumulative Water Use*	*Cumulative Acreage*	*Cumulative Sales*
Pasture	TC	62,514	10,419	947	15	62,514	10,419	947
Hay	TC	1,738	424	33	19	64,252	10,843	980
Pasture	MT	120,946	29,499	560	19	185,198	40,342	1,540
Pasture	Delta	99,085	26,600	2,070	21	284,283	66,942	3,610
Hay	MT	15,717	3,833	81	21	300,000	70,775	3,691

Table 5
Critically Dry Year Impacts with Fund and Limited Market

Crop	*Region*	*Total Use (AF)*	*Acreage*	*Revenue ($000)*	*Revenue/AF ($)*	*Cumulative Water Use*	*Cumulative Acreage*	*Cumulative Sales*
Pasture	TC	62,514	10,419	947	15	62,514	10,419	947
Hay	TC	1,738	424	33	19	64,252	10,843	980
Pasture	MT	120,946	29,499	560	19	185,198	40,342	1,540
Pasture	Delta	99,085	26,600	2,070	21	284,283	66,942	3,610
Hay	MT	83,488	20,363	428	21	367,771	87,305	4,038
Hay	Delta	218,285	58,600	5,326	24	586,056	145,905	9,364
Barley	TC	194	121	12	62	586,250	146,026	9,376
Rice	TC	513,750	76,677	33,520	65	1,100,000	222,703	42,896

Table 6
Average Year Impacts with No Fund and Broad Market

Crop	*Region*	*Total Use (AF)*	*Acreage*	*Revenue ($000)*	*Revenue/AF ($)*	*Cumulative Water Use*	*Cumulative Acreage*	*Cumulative Sales*
Rice	TC	287,031	42,840	18,666	65	287,031	42,840	18,666
Sorghum	FR	4,522	2,261	403	89	291,553	45,101	19,069
Corn	TC	8,447	2,484	757	90	300,000	47,585	19,826

Table 7
Critically Dry Year Impacts with No Fund and Broad Market

Crop	*Region*	*Total Use (AF)*	*Acreage*	*Revenue ($000)*	*Revenue/AF ($)*	*Cumulative Water Use*	*Cumulative Acreage*	*Cumulative Sales*
Rice	TC	487,031	72,691	31,787	65	487,031	72,691	31,787
Sorghum	FR	4,522	2,261	403	89	491,553	74,952	32,190
Corn	TC	12,301	3,618	1,103	90	503,854	78,570	33,293
Wheat	TC	35,469	18,668	3,202	90	539,323	97,238	36,495
Barley	DMC	1,410	881	128	91	540,733	98,119	36,623
Corn	FR	90,719	27,327	8,668	96	631,452	125,446	45,291
Sorghum	TC	174	87	18	103	631,626	125,533	45,309
Sorghum	MT	712	274	29	105	632,338	125,807	45,338
Wheat	FR	85,270	37,074	9,241	108	717,608	162,881	54,579
Corn	MT	12,432	4,440	480	108	730,040	167,321	55,058
Barley	SLCVC	816	510	89	109	730,856	167,831	55,147
Corn	DMC	64	20	7	109	730,920	167,851	55,154
Barley	SJMP	25,596	15,999	2,948	115	756,516	183,850	58,102
Barley	FR	20,462	12,789	2,549	125	776,978	196,639	60,651
Rice	MT	881	339	44	130	777,860	196,978	60,695
Corn	SJMP	3,392	969	444	131	781,252	197,947	61,139
Sorghum	DMC	146	73	20	134	781,398	198,020	61,159
Wheat	SJMP	62,319	27,095	8,471	136	843,717	225,115	69,630

Wheat	DMC	9,947	5,526	1,365	137	853,664	230,641	70,995
Wheat	SLCVC	2,664	1,332	369	139	856,328	231,973	71,364
Corn	SLCVC	1,630	494	236	145	857,958	232,467	71,600
Beans	MT	3,422	1,316	222	169	861,379	233,783	71,822
Beans	FR	19,868	7,947	3,497	176	881,247	241,730	75,319
Wheat	MT	63,928	45,663	8,174	179	945,176	287,393	83,493
Peas	FR	103	41	20	194	945,279	287,434	83,513
Beans	TC	15,188	6,075	3,021	199	960,467	293,509	86,534
Cotton	FR	25,343	7,040	5,094	201	985,810	300,549	91,628
Sugar Beets	FR	14,486	3,915	2,936	203	1,000,296	304,464	94,564
Apples	SJMP	693	210	143	206	1,000,989	304,674	94,707
Beans	SLCVC	1,005	437	209	208	1,001,994	305,111	94,916
Sugar Beets	DMC	18,112	4,526	3,990	220	1,020,106	309,637	98,906
Grapes	TC	2,510	717	557	222	1,022,616	310,354	99,463
Sugar Beets	TC	30,340	7,565	6,826	225	1,052,956	317,919	106,289
Sugar Beets	SJMP	11,165	2,791	2,512	225	1,064,121	320,710	108,801
Beans	SJMP	9,669	4,204	2,186	226	1,073,790	324,914	110,987
Sugar Beets	SLCVC	518	140	119	230	1,074,308	325,054	111,106
Beans	DMC	25,692	11,153	6,140	239	1,100,000	336,207	117,246

Table 8
Average Year Impacts with No Fund and Limited Market

Crop	*Region*	*Total Use (AF)*	*Acreage*	*Revenue ($000)*	*Revenue/AF ($)*	*Cumulative Water Use*	*Cumulative Acreage*	*Cumulative Sales*
Pasture	TC	48,600	8,100	728	15	48,600	8,100	728
Cotton	DMC	38,861	10,144	9,181	239	87,461	18,244	9,909
Cotton	SJMP	212,539	57,443	54,990	259	300,000	75,687	64,899

Table 9
Critically Dry Year Impacts with No Fund and Limited Market

Crop	*Region*	*Total Use (AF)*	*Acreage*	*Revenue ($000)*	*Revenue/AF ($)*	*Cumulative Water Use*	*Cumulative Acreage*	*Cumulative Sales*
Pasture	TC	62,514	10,419	947	15	62,514	10,419	947
Hay	TC	1,738	424	33	19	64,252	10,843	980
Barley	TC	194	121	12	64	64,446	10,964	992
Rice	TC	113,754	29,703	12,972	65	178,200	40,667	13,964
Beans	DMC	22,411	9,728	5,358	239	200,611	50,395	19,322
Cotton	DMC	216,450	56,500	51,804	239	417,061	106,895	71,126
Cotton	SJMP	682,939	185,156	177,567	259	1,100,000	292,051	248,693

Table 10
Summary Impacts of ESA/CWA Standards on California Agriculture
(million $)

Average Year

	Fund	*No Fund*
Broad Market	6.582	19.826
Limited Market	3.691	64.899

Critically Dry Year

	Fund	*No Fund*
Broad Market	66.435	117.246
Limited Market	42.896	248.693

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Non-Profit Law and Consulting in Conservation of Natural Resources and the Global Environment

Gregory A. Thomas
President

May 25, 1994

Mr. Tom Howard
Engineer
State Water Resources Control Board
901 P Street
Sacramento CA 95814

Dear Mr. Howard:

As you may know, NHI supports the creation of an Environmental Water Fund to purchase and develop all or part of the water which may be needed to meet new environmental standards in the Delta. We believe that the use of such a fund will permit significant improvements in environmental protection with a minimum of economic dislocation to California's water users.

As part of NHI's response to the proposed EPA Bay-Delta standards, NHI commissioned a study by UC Berkeley economist, David Sunding, to examine the costs of meeting proposed federal EPA and ESA requirements through a water purchase fund compared to a reallocation from users. A revised version of Dr. Sunding's study is attached.

The results were striking. Dr. Sunding found that under any reasonable scenario, the net costs[1] of using the water fund to meet EPA and ESA standards were less than even the most optimistic scenario involving the reallocation of water from water exporters. These results are summarized below:

1. Net costs represent losses of economic production. The actual cost of purchasing compliance water is a transfer payment and does not represent a net loss for California as a whole.

Compliance Mechanism	Normal year Net Cost ($M)	Critical Year Net Cost ($M)
Water Fund: north-to-south transfers constrained	3.7	42.9
Water fund: unconstrained market transfer	6.6	66.4
Reallocation from CVP/ SWP contractors: north-to-south market transfers constrained	64.9	248.7
Reallocation from CVP/ SWP contractors: unconstrained market transfer	19.8	117.2

Moreover, if the cost of water on the market is assumed to be close to the price of water during the Drought Water Bank, then the amount of funding required for the water purchase fund would total only $27 million and $137.5 million per year in normal and critical years respectively. This is very little money for a lot of benefits.

Although Dr. Sunding's work was in response to the federal standards, we believe that it should be useful to the SWRCB as well. In particular, the study makes clear that the economic impacts resulting from the SWRCB's Bay-Delta standards will depend, to a large, degree on whether they are implemented through a water purchase fund or through reallocation.

Sincerely,

David Fullerton

cc: SWRCB members
Tom Howard
Jerry Johns