6.0 EVALUATION OF ALTERNATIVE WATER QUALITY OBJECTIVES

6.1 Introduction

In Chapter 5 potential objectives for salinity, temperature and dissolved oxygen were developed to protect the beneficial uses made of Bay-Delta water. In this chapter, the adequacy and reasonableness of the potential objectives are evaluated to determine if they or other objectives should be developed by the State Board.

CEQA requires that cumulative impacts be addressed and that alternatives to the project being analyzed be considered. In this case the project is the adoption of a water quality control plan to address the direct effects of salinity, temperature and dissolved oxygen. The State Board's total planning and regulatory processes include consideration of a much broader suite of alternatives than those which fall within the scope of this Plan. The record clearly shows that an important means of helping protect beneficial uses and mitigating for the effects of development is by setting instream flow requirements. Flow standards address problems other than the direct effects of salinity, etc. Therefore the Board has elected to set them in the subsequent broader phases of this process. In order to comply with the spirit of CEQA and to help set the stage for the Scoping and Water Right phases, the State Board has reviewed the effects of differing flow regimes to a limited extent. The results of the analysis are presented herein for information and guidance. A detailed analysis of flow regimes will be done during the Water Right Phase of these proceedings.

Water Code §13241 requires that the State Board consider, at a minimum, the following factors when establishing water quality objectives:

1) the past, present, and probable future beneficial uses of water;
2) the environmental characteristics of the hydrographic unit, including the quality of water available to it;
3) the water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area;
4) economics considerations; and
5) the need for developing housing within the region.

- The State Board has reviewed the beneficial uses designated for Bay-Delta waters that are included in the Basin Plans for Regions 2 and 5 and finds that the designations are still appropriate.

- The environmental characteristics of the hydrographic unit can be found in Chapter 3 and Appendix 3.0 of this Plan. The State Board took those characteristics into account in developing possible water quality objectives.

- "The coordinated control of all factors" is discussed in the implementation program found in Chapter 7.

- The only direct economic consequences for which any evidence is forthcoming are the costs of changing leaching practices for Delta agriculture; this analysis is in progress. For reasons which are summarized in Section 6.7, all other economic effects were analyzed using water availability as an indicator of economic cost. These discussions are found in the evaluation of each alternative.

- Protecting the quality of waters designated as M&I supplies is an essential part of meeting housing needs within the Bay-Delta watershed and export areas.

6.2 Water Quality Alternatives

Several specific objectives have been chosen for consideration in this chapter, ones that cover a broad range of possible protective measures; they represent a 'framework' or 'set of limits' within which alternative mixes of objectives can be compared. Some indication of the protection offered by intermediate alternatives can in this way be provided.

Table 6-1 contains a list of seven potential sets of water quality objectives for the Delta. The alpha-numeric code under the number of the alternative refers to the operation model run (DWRSIM) which was used to evaluate the relative water supply effects of the alternative. The State Board selects Alternative 3 based on the following discussion in this chapter.

The alternatives were evaluated using DWR's Planning Simulation Model, DWRSIM, a generalized computer model designed to simulate the operation of the CVP and SWP project reservoirs and conveyance facilities. These operation studies are conducted on a monthly time basis and use the historical 57-year hydrologic sequence of flows from water years 1922 through 1978. In addition, these studies account for system operational objectives, physical constraints, statutes, and agreements. These parameters include requirements for flood control in system reservoirs, hydropower generation, pumping plant capacities and limitations, and Delta operations to meet water quality objectives. A more detailed description of the DWRSIM model as well as the operations criteria used in the studies is presented in Appendix 6.1, Analysis Assumptions for Water Supply Impacts.

Operation studies are run with adjustments to the combined CVP-SWP system only. The local non-project reservoirs upstream of the Delta and the CVP Friant Reservoir on the San Joaquin River are pre-operated or have a "predetermined" operation throughout the simulation period. They are not operated to meet Delta objectives. Therefore, the combined CVP-SWP system acts as a surrogate to reflect water supply consequences of the alternatives on all users in the watershed.

Currently the operations study is not designed to analyze the water needed to meet water quality objectives for interior stations of the south Delta, nor is it designed to analyze the water distribution effects of the interior Suisun Marsh objectives. Until the Suisun Marsh hydrodynamic and salinity models presently being developed by DWR are completed, any prediction of the effects of changing the interior marsh objectives on Delta outflow (as measured at Chipps Island) or on water exports must be used with caution.

TABLE 6-1

ALTERNATIVE SETS OF WATER QUALITY OBJECTIVES

BENEFICIAL USE OR PARAMETER Alternative Name	ALTERNATIVE [1,2] 1A (A7) BASE	1B (B7) BASE w/ 40-30-30	2 (L7) 250 CL CCC/1.5 W DEL AG	3 (H7) S DEL AG/ANT SPAWN	4 (P7) 50 CL BANKS PP	5 (K7) 50 CL CCC/0.44 VERN SP	6 (N7) R,T, & E/0.3 VERN SP
Water Year Classification	Decision 1485 Water Year	40-30-30 (w/ Subn Snowmelt)	40-30-30 (w/ Subn Snowmelt)	40-30-30 (w/ Subn Snowmelt)	40-30-30 (w/ Subn Snowmelt)	40-30-30 (w/ Subn Snowmelt)	40-30-30 (w/ Subn Snowmelt)
Municipal and Industrial	250 Cl except 150 Cl 42-66% of the time at CCC Intake	Same as Base	250 Cl All Year at CCC Intake	Same as Base [3]	Same as Base Plus 0.15 Br (= 50 Cl) All Year at Banks PP [4]	0.15 Br (= 50 Cl) All Year at CCC Intake [4]	0.15 Br (= 50 Cl) All Year at CCC Intake [4]
Western / Interior Delta Agriculture	0.45-2.78 EC Apr 1-Aug 15	Same as Base	1.5-3.0 EC Apr 1-Aug 15 [5]	Same as Base	Same as Base	Same as Base	Same as Base
Southern Delta Agriculture	USBR Agreement: [6] 450 TDS Apr 1-Oct 31 500 TDS Nov 1-Mar 31	Same as Base	Same as Base	0.7 EC Apr 1-Aug 31 1.0 EC Sep 1-Mar 31 [7]	0.7 EC Apr 1-Aug 31 1.0 EC Sep 1-Mar 31 [7]	0.7 EC Apr 1-Aug 31 1.0 EC Sep 1-Mar 31 [7]	0.7 EC Apr 1-Aug 31 1.0 EC Sep 1-Mar 31 [7]
Export Agriculture	None	Same as Base	Same as Base	1.0 EC All Year	1.0 EC All Year	1.0 EC All Year	1.0 EC All Year
Antioch Striped Bass Spawning	1.5 EC Apr 15-May 5 1.6-25.2 EC in Deficiency Years	Same as Base	Same as Base	1.5 EC Apr 15-May 31 or When Spawning Ends 1.6-3.7 EC in Def. Yrs.	1.5 EC Apr 15-May 31 or When Spawning Ends 1.6-3.7 EC in Def. Yrs.	1.5 EC Apr 15-May 31 or When Spawning Ends 1.6-3.7 EC in Def. Yrs.	1.5 EC Apr 1-May 31 w/o Apr 1-Apr 15 Ramping Flow
Prisoners Point / Vernalis Striped Bass Spawning	0.55 EC Apr 1-May 5 at Prisoners Pt.	Same as Base	Same as Base	0.44 EC Apr 1-May 31 at Prisoners Pt. or When Spawning Ends 0.55 EC at Prisoners Pt. in Deficiency Years	0.44 EC Apr 1-May 31 at Prisoners Pt. or When Spawning Ends 0.55 EC at Prisoners Pt. in Deficiency Years	0.44 EC Apr 1-May 31 Vernalis to Prisoners Pt. or When Spawning Ends 0.55 EC at Prisoners Pt. in Deficiency Years	0.3 EC Apr 1-May 31 Vernalis to Prisoners Pt.
Suisun Marsh Wildlife [8]	Interim Objectives of 12.5-15.6 EC at Chipps 1978 Delta Plan Interior Marsh Obj's of 8.0-19.0 EC to be Phased In	Same as Base	Interim Objectives of 12.5-15.6 EC at Chipps Suisun Marsh Preservation Agreement	Same as Base [9]	Same as Base [9]	Same as Base [9]	Same as Base except 1978 Delta Plan Objectives [9]
Tidal Marshes R, T, & E Species	None	Same as Base	Same as Base	Same as Base [9]	Same as Base [9]	Same as Base [9]	15-20 EC Feb 1-May 31 at Martinez
Salmon [8] (Temperature)	Region 5 Basin Plan: 68 F when needed in Sacramento R., (If Controllable) [10]	Same as Base	Same as Base	68 F Apr 1-Jun 30 & Sep 1-Nov 30 in Sac R. and SJR 66 F Jan 1-Mar 31 in Sac R., (If Controllable)	68 F Apr 1-Jun 30 & Sep 1-Nov 30 in Sac R. and SJR 66 F Jan 1-Mar 31 in Sac R., (If Controllable)	68 F Apr 1-Jun 30 & Sep 1-Nov 30 in Sac R. and SJR 66 F Jan 1-Mar 31 in Sac R., (If Controllable)	66 F Apr 1-Jun 30 & Sep 1-Nov 30 in Sac R. and SJR 66 F Jan 1-Mar 31 in Sac R., (If Controllable)
Salmon [8] (Dissolved Oxygen)	Region 5 Basin Plan: [10] 5.0 7.0 DO All Year Depending on Delta Area	Same as Base	Same as Base	6.0 DO Sep 1-Nov 30 Stockton to Turner Cut	6.0 DO Sep 1-Nov 30 Stockton to Turner Cut	6.0 DO Sep 1-Nov 30 Stockton to Turner Cut	6.0 DO Sep 1-Nov 30 Stockton to Turner Cut
Flow	D-1485 Objectives	Same as Base	Same as Base	Same as Base	Same as Base	Same as Base	Same as Base

[1] The letter/number combination in parentheses below the alternative numbers identify the corresponding DWR operation study.

[2] Chlorides (Cl), Bromides (Br), Total Dissolved Solids (TDS), Dissolved Oxygen (DO) in mg/l :: Electrical Conductivity (EC) in mmhos/cm :: Temperature in degrees Fahrenheit (F).

[3] Alternative also includes a goal of 0.15 mg/l bromides, which is approximately equivalent to 50 mg/l chlorides. This goal, however, was not modeled as part of alternative 3.

[4] Operation studies P7, K7, and N7 use an M&I objective of 40 mmhos/cm chlorides to provide an operational buffer.

[5] Operation study L7 includes a 1.7 mmhos/cm EC leaching provision, which is not part of Alternative 2.

[6] At Vernalis: 450 mg/l TDS = 0.775 mmhos/cm EC; 500 mg/l TDS = 0.860 mmhos/cm EC.

LEGEND: SELECTED ALTERNATIVE

[7] The ultimate Southern Delta agricultural objectives will be phased in through 1996. The objectives and locations may be revised as the Board deems appropriate.

[8] The temperature goals and interior Suisun Marsh and dissolved oxygen objectives were not included in the operation studies due to a lack of adequate analytic modeling tools.

[9] These alternatives also include a biological assessment.

[10] All Regional Board objectives remain in effect for all alternatives.

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At this time, only rough estimates of a projected salmon survival index can be made, based on general assumptions of flow and temperature. The ability to analyze the impacts on salmon from the model runs is limited. Therefore, the discussion of the alternatives is a comment on the relative benefit or impact of a particular alternative on the Chinook salmon.

Water Supply Impacts

The "water supply impacts" of the alternatives are defined as the change in base flows and exports caused by the implementation of the alternative sets of water quality objectives. The base condition, Alternative 1A in Table 6-1, incorporates a present (1990) level of development operations study that uses the water quality objectives of the 1978 Delta Plan, the flow requirements of D-1485, and Bureau Agreement on the New Melones Reservoir as the controlling Delta criteria.

Table 6-2 presents the water supply consequences of the seven alternative sets of water quality objectives shown in Table 6-1. The water supply impacts are analyzed in terms of the following factors:

- o San Joaquin River Inflow
- o Sacramento River Inflow
- o Total Delta Exports
- o Other Flows/Diversions
- o Total Delta Outflow

Figure 6-1 shows the water supply parameters used in Table 6-1.

The Table 6-2 results are presented on average annual and April through July bases for the 57-year hydrologic period 1922 through 1978 and the critically-dry hydrologic period May 1928 through October 1934. Figures 6-2 and 6-3 graphically show the 57-year average annual water supply results from Table 6-2. The values shown in Table 6-2 and Figures 6-2 and 6-3 represent the combined effects of the water quality objectives and the new 40-30-30 water year classification. Positive values indicate an increase in flow or export; negative values indicate a decrease.

The following discussion includes, for each alternative, a short summary of the model results presented in Table 6-2 and brief comments on the reason(s) for any changes from the base condition. The statistical significance of these results cannot be determined.

It must be recognized that the impacts shown on Table 6-2 and Figures 6-2 and 6-3 and discussed in the following pages do not include the potential impacts on water supply of meeting any changes in current Suisun Marsh objective, the revised Antioch relaxation provisions for striped bass or the objectives for interior stations in the south Delta. Each of these objectives could cause a reduction in water available for other beneficial uses. When the impact of one or more of these objectives is known, the State Board will review such objectives for reasonableness and amend them, if necessary.

TABLE 6-2

WATER SUPPLY IMPACTS
OF THE
ALTERNATIVE SETS OF WATER QUALITY OBJECTIVES

WATER SUPPLY PARAMETER / ALTERNATIVE NAME	BASE CONDITIONS (TAF) D-1485 BASE		CHANGE IN BASE CONDITIONS NEEDED TO MEET OBJECTIVES (TAF) [1] — ALTERNATIVE [2]													
			1A (A7) BASE		1B (B7) [3] BASE w/ 40-30-30		2 (L7) 250 CCC/1.5 W AG		3 (H7) [4] S DEL AG/ANT SP		4 (P7) [4,5] 50 BANKS PP		5 (K7) [4,5] 50 CCC/.44 VER SP		6 (N7) [4,5] R,T, & E/.3 VER SP	
	Annual	Apr-Jul	Annual	Apr-Jul	Annual	Apr-Jul	Annual	Apr-Jul	Annual	Apr-Jul	Annual	Apr-Jul	Annual	Apr-Jul	Annual	Apr-Jul
Average																
San Joaquin River Inflow	1996	624	0	0	0	0	0	0	1	21	1	21	9	86	150	290
Sacramento River Inflow	15624	5087	0	0	-6	-16	-9	-73	-6	-37	-8	-85	-8	-127	-6	-179
Total Delta Exports [6]	6295	1762	0	0	4	1	50	20	-1	3	-207	-57	-399	-123	-674	-224
Other Flows/Diversions [7]	1652	-211	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Delta Outflow [8]	12977	3738	0	0	-10	-17	-59	-93	-6	-19	200	-7	400	82	818	335
Critically-Dry Period																
San Joaquin River Inflow	1153	315	0	0	0	0	0	0	-6	29	-6	29	58	91	247	273
Sacramento River Inflow	8890	3141	0	0	-21	-23	-47	-36	-18	-51	-19	-190	-9	-223	-4	-183
Total Delta Exports [6]	5290	1448	0	0	6	1	63	12	-11	-6	-364	-147	-984	-393	-1078	-321
Other Flows/Diversions [7]	-726	-645	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Delta Outflow [8]	4027	1363	0	0	-27	-24	-110	-48	-13	-16	339	-14	1033	261	1321	411

Footnotes:

[1] Change in base conditions = Alternative minus Base; Positive values indicate an increase in flow or export.

[2] The letter/number combination in parentheses below the alternative numbers identify the corresponding DWR operation study. The temperature goals and interior Suisun Marsh and dissolved oxygen objectives were not included in the operation studies due to a lack of adequate analytic modeling tools.

[3] Alternative 1B is the base case (1A) with the new 40-30-30 water year classification.

[4] The ultimate Southern Delta objectives will be phased in through 1996. The objectives and locations may be revised as the Board deems appropriate.

[5] Operation studies P7, K7, and N7 use an M&I objective of 40 mg/l chlorides to provide an operational buffer. P7, K7, and N7 include base Delta outflows of 3500, 6000, and 6000 cfs, respectively.

[6] Total Delta Exports include Contra Costa Canal, North Bay Aqueduct, and Banks and Tracy Pumping Plants.

[7] Other Flows/Diversions include Net Delta Consumptive Use, City of Vallejo diversions, Yolo Bypass inflow, and East Side Streams inflow. The Base Conditions values are negative when the Net Consumptive Use plus the City of Vallejo diversions are greater than the Yolo Bypass inflow plus the East Side Streams inflow.

[8] Total Delta Outflow equals the San Joaquin River inflow + Sacramento River inflow - Total Delta Exports + Other Flows/Diversions.

LEGEND:

SELECTED ALTERNATIVE

03/07/91

FIGURE 6-1

DELTA HYDROLOGIC SCHEME USED IN THE WATER SUPPLY IMPACT ANALYSIS

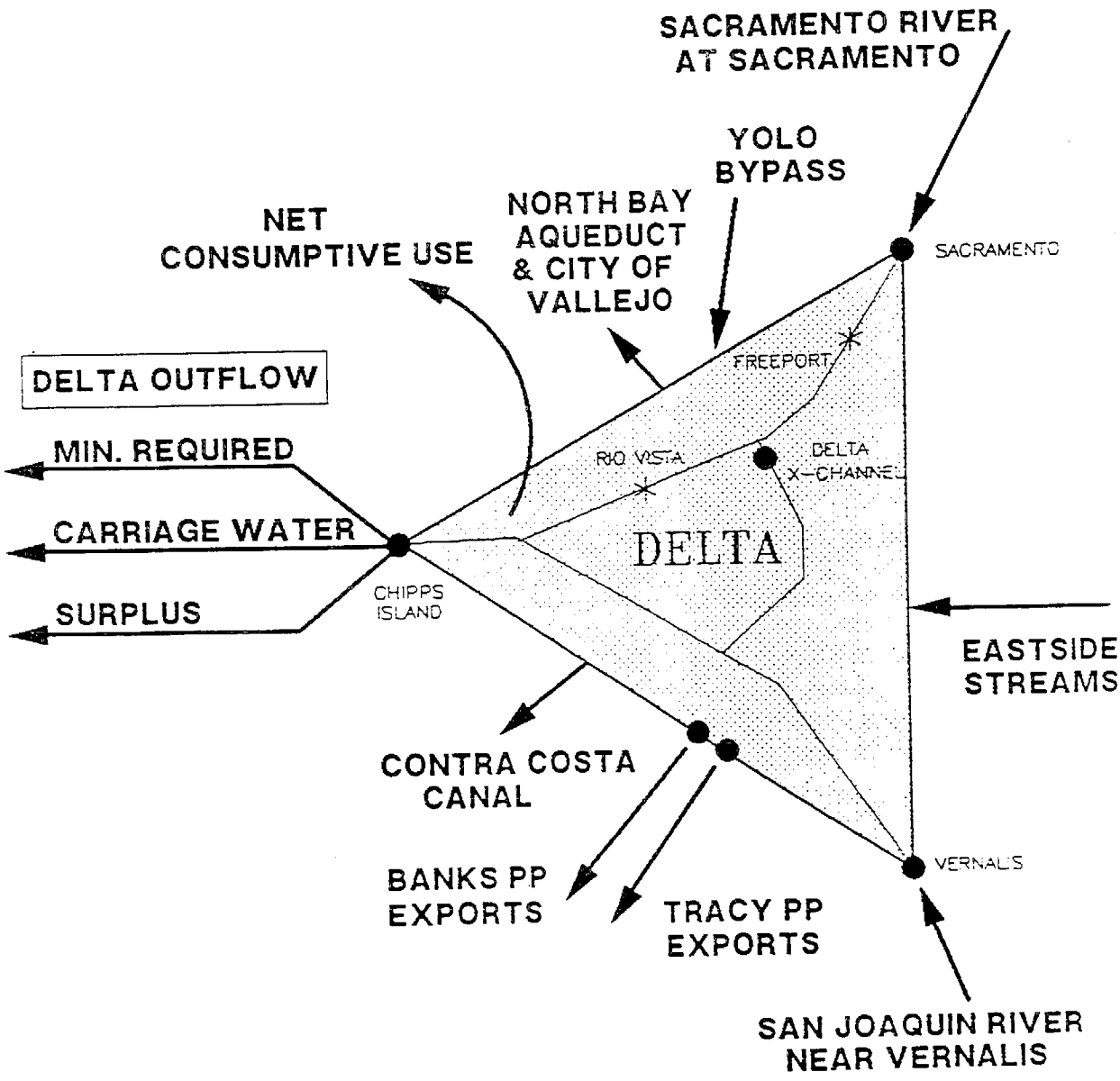
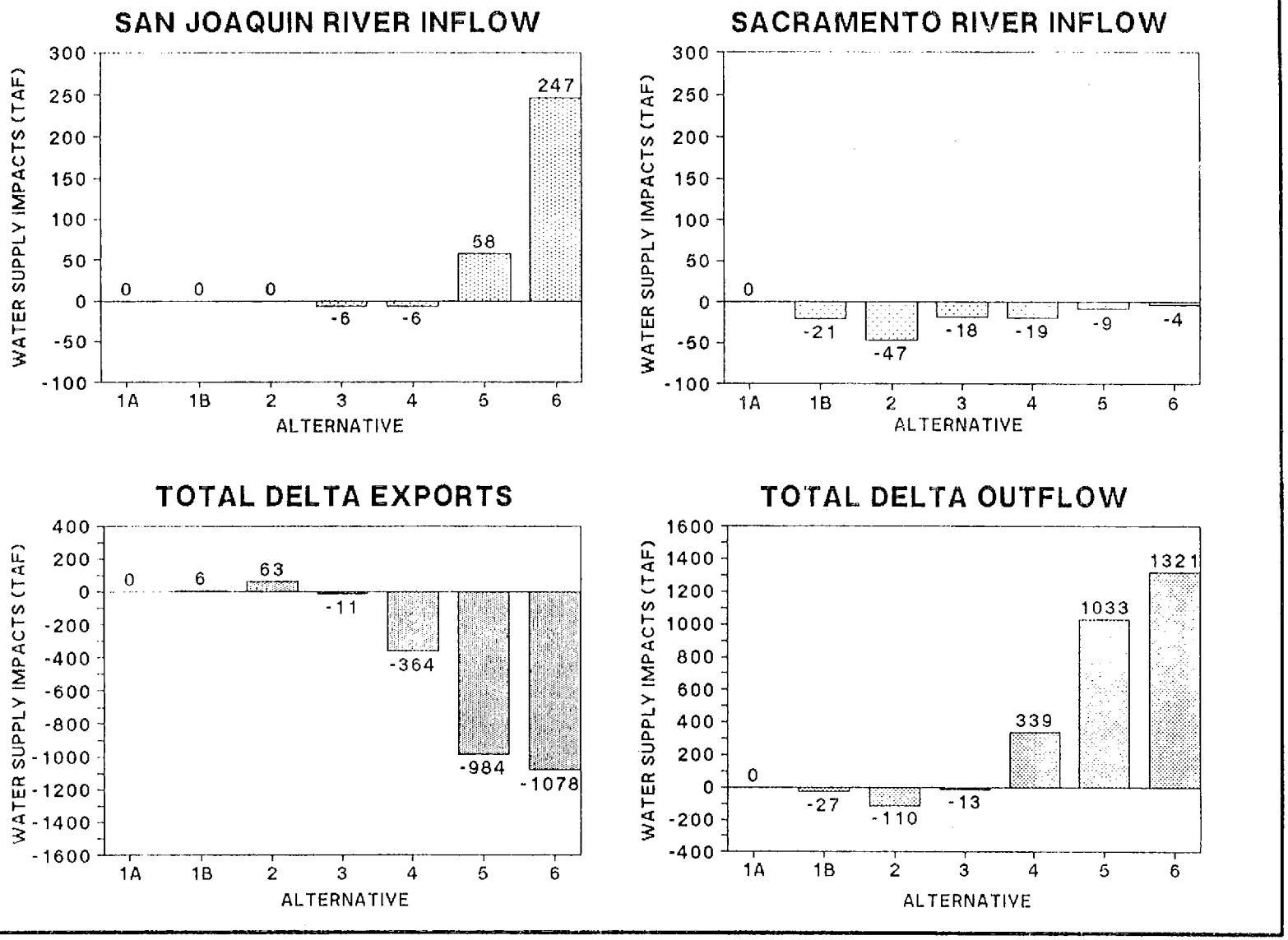


FIGURE 6-3

CRITICALLY DRY PERIOD WATER SUPPLY IMPACTS



03/08/91

6.2.1A

Alternative 1A. This is the base: it represents the 'present conditions' against which the other alternatives are compared. The base conditions include the set of water quality objectives contained in D-1485 (for more details, see Appendix 6.2, D-1485). Therefore, the model results show no changes from the base. Given the variety of locations and uses, our discussion of the alternatives has considered D-1485 objectives, special modifications used in the operations models, and actual conditions, as appropriate.

The current objectives protect striped bass spawning habitat only through May 5, and protection thereafter declines substantially in dry and critical water years because Delta Outflow Index requirements for protection of eggs and young are substantially lower. The experience of 1990 also shows that in extremely dry years when water deficiencies are imposed the expected maximum Antioch EC of 3.7 mmhos/cm was exceeded, and ECs exceeded 0.44 mmhos/cm at most locations in the central Delta spawning area and approached the present objective (0.55 mmhos/cm) at Prisoners Point.

6.2.1B

Alternative 1B is the same as the base condition with the exception of the water year classification. The year type classification used in the water supply impact analysis is the 40-30-30 year type classification described in Chapter 3.[1] Although the 40-30-30 classification does not have any adjustments, the special Decision 1485 subnormal snowmelt adjustment is retained for the reasons explained below. The subnormal snowmelt adjustment only applies to fish and wildlife flows when spring runoff from snowmelt is much less than normal. It is invoked in wet, above normal, and below normal years when the April through July unimpaired runoff is 5.9 million acre-feet or less.

The Decision 1485 subnormal snowmelt adjustment and its flow requirements are retained in the operation studies for two reasons. First, the consideration of flow requirements has been deferred to the Scoping and Water Right phases of the proceedings. Second, the use of the 40-30-30 classification with the subnormal snowmelt flow relaxation maintains approximately the same level of flow protection for fish and wildlife as under Decision 1485. Elimination of the subnormal snowmelt adjustment would prematurely alter the flow requirements before the next phase of the proceedings and would compromise the intent to isolate the effect of the technical adjustment to the classification system.

The Water Year Classification Workgroup has reviewed operation study results to determine the relative impact of the flow reduction for subnormal snowmelt on Delta flows and exports. These studies show that the removal of the subnormal snowmelt flow requirements would increase the Delta outflow and reduce the critically-dry period exports (WQCP-DWR-5,4). During the critically dry period, the operations studies results show an average loss in exports of approximately 29 TAF, or a total of about 189 TAF (29 TAF x 6.5 years). During the 57-year period, the average annual export loss is about 20 TAF.

1/ The interim Suisun Marsh objectives were analyzed using the Decision 1485 water year type classifications, including the subnormal snowmelt adjustment.

Another "classification adjustment" examined in Chapter 3 is the "year following dry or critical year" relaxation. This relaxation was not included in the water supply impact analysis since the use of the 40-30-30 classification without the "year following dry or critical year" relaxation maintains approximately the same level of flow protection for fish and wildlife as under Decision 1485.

The new year type classification has a relatively small effect; it allows decreases in the total Delta outflow during the 57-year dry and critically-dry periods by 10 and 27 TAF, respectively. The Delta outflow changes are also relatively small for the April through July periods.

These modest changes occur because the new classification shifts the average classification to a slightly drier condition.

The 40-30-30 water year type classification does not affect the flows past Vernalis on the San Joaquin River since, under the controlling USBR southern Delta Agreement, the south Delta agricultural objectives do not vary by year type. The new classification allows for some decreases in Delta inflow from the Sacramento River Basin as well as some additional export from the Delta.

The addition of the 40-30-30 Water Year Index to the base case provides little change in protection for instream uses. As discussed above, the model runs retained the "subnormal snowmelt" category. If a complete 40-30-30 Index (without this category) were implemented some additional outflow would result. The deletion of the "year following dry or critical year" category theoretically would result in additional outflow. However, the new Index offsets this effect by including the previous water year in the formula, resulting in a reclassification of the current water year into a drier category compared to the base case. Thus the Delta outflow remains essentially unchanged. This may result in a small decrease in protection for spawning and for eggs and young after May 5 compared to the base case. The frequency of occurrence or severity of deficiency for the relaxation provision is probably not changed significantly under this alternative.

Further, like the basic condition, Alternative 1B retains the 150 mg/l chloride industrial objective for a portion of the year at the Contra Costa Canal intake. This was retained for evaluation so as to avoid exacerbation of public health hazards that may be caused by the formation of disinfection by-products when the water is treated. Alternative 3 has the same proviso.

6.2.2

Alternative 2 has four differences from the base condition including the use of the 40-30-30 water year classification. The M&I objective is 250 mg/l all year at the Contra Costa Canal Intake. The western/interior Delta Agriculture objective is 1.5 mmhos/cm EC for April 1 through August 15 at Emmaton and Jersey Point and adjusted to 3.0 mmhos/cm EC from August 1 through August 15 in critical years. The SMPA Suisun Marsh objectives are the deficiency standards: 12.5 to 15.6 EC, depending on the month, at Chipps Island.

6.2.2.1 Municipal and Industrial Impacts

Salinity - A 250 mg/l chloride objective at the Contra Costa Canal Intake year-round would make paper industries unable, at times, to produce salt-sensitive products without some form of water treatment. The 1978 Delta Plan specified a chloride objective of 150 mg/l for a portion of the year solely to protect the paper industries. However, the continued need of that objective is questionable because no evidence was presented indicating that such a need still exists.

6.2.2.2 THM Formation Potential

As new and pending drinking water standards take effect, the water quality objectives in Alternative 2 may result in negative impacts for purveyors of Delta water. These negative impacts may take the form of violation of state and federal drinking water standards for disinfection by-products. It is not possible to accurately quantify those impacts at present.

6.2.2.3 Agricultural Impacts

Western and Interior Delta - The 1.5/3.0 mmhos/cm EC objectives are based on the results of the interagency Corn Study. These objectives would allow salinity to increase during wet, above normal, and below normal years, and a decrease in dry and critical years in the western Delta. In the interior Delta the objectives would allow an increase in all but critical years, and decrease in critical years. There should be little or no effect on corn yield due to these objectives if adequate leaching is performed. However, the effectiveness and economic effects of additional leaching practices are not yet known.

Southern Delta - Same as base, no impact.

6.2.2.4 Salmon - Same as base.

6.2.2.5 Striped Bass

This alternative does not make any direct changes in striped bass protection, but may have indirect effects because of changes in the Contra Costa Canal and western Delta objectives. Reduced Sacramento River inflow and increased exports may have some negative impact on survival of eggs and young in most years. However, the increased protection for western Delta agriculture may provide some incremental increased protection in critical years, as is shown by the slight increased Sacramento River inflow in these years.

6.2.2.6 Water Supply

This alternative would produce the largest reduction in total Delta outflow and, consequently, the largest increase in exports. This alternative would allow decreases in the total Delta outflow during the 57-year and critically-dry periods by 59 and 110 TAF, respectively. The corresponding increases in exports during the two hydrologic periods are 50 and 63 TAF, respectively.

These changes are caused by the modifications in the municipal and industrial objective and the western/interior Delta agricultural objectives.

The impact of the interior Suisun Marsh objectives specified in the Suisun Marsh Preservation Agreement has not been quantified because of a lack of adequate flow/salinity relationships.

6.2.3

Alternative 3 in Table 6-1 is the "Selected" alternative. Seven objectives in this alternative (in addition to the water year classification) differ from the base. The southern Delta agriculture objective is based on the UC guidelines for the water quality requirement of two important salt-sensitive crops, beans and alfalfa. The recommended water quality for beans is an EC of 0.7 mmhos/cm from April 1 to September 30; for alfalfa it is an EC of 1.0 mmhos/cm from October 1 through March 31. Export agriculture is set at an EC of 1.0 mmhos/cm in all year types. For fish and wildlife, the recommended objective for striped bass spawning at Antioch is an EC of 1.5 mmhos/cm from April 15 (with ramping) to May 31, or until spawning has ended (to be determined by monitoring), and 1.6 to 3.7 mmhos/cm in deficiency years. The other objectives for striped bass spawning are 0.44 mmhos/cm at Prisoners Point from April 1 through May 31, or until spawning has ended, and 0.55 mmhos/cm in deficiency years.

The recommended temperature objective for Chinook salmon is 68°F from April 1 to June 30 for the protection of fall-run Chinook smolts and from September 1 to November 30 for the protection of fall-run Chinook salmon adults both at Freeport on the Sacramento River and Vernalis on the San Joaquin River. A temperature of 66°F is specified from January 1 to March 31 at Freeport for the protection of winter-run Chinook salmon smolts and adults. The objective is subject to available "controllable factors" as defined in Chapter 5, Section 5.5. The dissolved oxygen objective is 6.0 mg/l from September 1 through November 30 at Vernalis for the upstream migration of fall-run Chinook salmon in the San Joaquin River.

Also, while the Suisun Marsh objective is the same as the base condition, a biological assessment is to be conducted. This assessment would include the tidal marshes and inventory of rare, threatened and endangered species habitat as well.

6.2.3.1 Municipal and Industrial

Salinity - Same as base, no impact. Note that the 150 mg/l chloride objective for industry for a portion of the year was evaluated for the same reasons stated in Alternative 1B.

6.2.3.2 THM Formation Potential

Alternative 3 will not result in any measurable negative or positive impact on THM formation over base conditions, assuming standard chlorination treatment is used.

6.2.3.3 Agriculture

Western and Interior Delta - With the hydrologic conditions that have occurred and the leaching practices that have been used since D-1485 was adopted, agriculture in the western and interior Delta has been maintained or enhanced under the base level of protection. This alternative retains this same level of protection and does not impose additional management or other economic costs on western or interior Delta farmers.

Southern Delta - The objectives were set to protect beans and alfalfa, based on University of California guidelines. However, allowable salinity levels were lowered to account for leaching limitations in the southern Delta. The impact of these objectives could be an improvement in overall growing conditions.

6.2.3.4 Salmon

Under Alternative 3 during the April through July period, San Joaquin River inflow would increase in average years; the Sacramento River inflow would decrease. The degree to which the increased flow would affect water temperatures in the San Joaquin River cannot be determined at present. A salmon smolt survival model based on spring water temperatures in the San Joaquin River has not yet been developed. The correlation that has been demonstrated between spring outflow in the San Joaquin River and adult returns two and a half years later indicates that the increased flow in the spring months may improve conditions for the outmigrating salmon smolts in the San Joaquin River.

Using the smolt survival index for the Sacramento River (USFWS), based on average April to June flow at Rio Vista, and the flow computed under this alternative, the only year type in which average salmon smolt survival index would be greater than 0.50 would be in wet years. Above normal water years would provide an average survival index of 0.42 and the remainder of the year types less than 0.30.

The implementation of the dissolved oxygen objective has not been fully explored. Apparently there is at least one source of effluent in the vicinity which contains high BOD; the lack of natural circulation in the Stockton turning basin may also negatively affect the DO levels. A partial analysis estimating the flow required (September and November only) to change the dissolved oxygen level 1 mg/l using a multiple regression analysis was submitted. Further analysis of the impacts of the water quality objectives will be made in the forthcoming proceedings. Several methods to improve DO levels besides increasing inflow are available including the traditional installation of the seasonal barrier in Old River.

6.2.3.5 Striped Bass

This alternative provides direct increased protection for striped bass spawning compared to the base case. The period of protection is extended through May 31, which covers nearly all of the period of spawning on the San Joaquin River. In addition, the 3.7 mmhos/cm EC limit on the Antioch

relaxation provision should provide some small additional protection. The definition of deficiency will be re-examined in later phases of these proceedings; the frequency of the deficiency declaration, as well as the numerical salinity limits, will further define the level of impact on striped bass spawning.

Likewise, the change in the maximum EC at Prisoners Point from 0.55 to 0.44 mmhos/cm should theoretically improve spawning conditions in this area. However, due to umbrella protections, water quality is almost always better than 0.44 mmhos/cm EC at this location. The State Board prefers specific protection rather than relying on umbrella protection. Also, the protection period has been extended from May 5 to May 31. The relaxation to 0.55 mmhos/cm EC during deficiency periods retains the base condition, and appears not to be exceeded (based on 1990 data), so there is no change in protection here.

The model run used to simulate Alternative 3 assumes some increase in San Joaquin River flow, little change in exports, reduced Sacramento River flow and reduced Delta outflow. The impacts on indirect protection for eggs and young under this alternative, as modeled, are unclear.

Potential Objective 2E in Section 5.6.3.2 for the Antioch relaxation provision called for a relaxation to 3.7 mmhos/cm EC whenever the Sacramento Valley 40-30-30 Index was equal to or less than 4.8 MAF. This alternative was not modeled, and it is not included in Table 6-1. However, it is discussed here for informational purposes. Since it was designed to reflect actual or anticipated years of deficiency (1977, 1990, 1928-1934, etc.), the impacts of using this alternative should be essentially the same as Alternative 1B with a 3.7 mmhos/cm EC limit on the Antioch relaxation provision. Its substitution in Alternatives 3 through 5 should result in somewhat reduced protection because the Antioch value goes immediately to 3.7 mmhos/cm EC regardless of the amount of deficiency, rather than according to a sliding scale as in these alternatives and D-1485. However, direct comparisons with these other alternatives are not possible because the definition and frequency of deficiency conditions have not yet been defined.

6.2.3.6 Water Supply

Without considering the potential impact of meeting the revised Antioch relaxation provision for striped bass and the interior objectives in the south Delta, and assuming that the existing Suisun Marsh standards are not revised, Alternative 3 would allow decreases in the total Delta outflow as shown in Table 6-2. This water is obtained by decreasing the total Delta exports and decreasing the Delta inflows from both the Sacramento and San Joaquin River basins.

The principal reason for the decrease in Delta outflow is the new 40-30-30 year type, which allowed for more water to be stored in the Sacramento River Basin.

The level of impact on water supplies of this alternative, not including the impact of the striped bass relaxation provision and the interior south Delta objectives, is less than 0.5 percent of the dry period exports of the CVP and SWP.

6.2.4

Alternative 4 is the same as Alternative 3 except for the M&I objective. Alternative 4 adds a bromide (Br^-) objective of 0.15 mg/l (50 mg/l) Cl in all years at Banks Pumping Plant.

6.2.4.1 Municipal and Industrial

Drinking Water Quality - Salinity - The impact of setting a 50 mg/l chloride objective at Banks Pumping Plant will be to lower chloride levels at the Contra Costa Canal intake to less than 140 mg/l if seawater intrusion were the primary source of the chlorides. The chloride levels at the Banks Pumping Plant will be improved significantly; the lower salinity levels in SWP water delivered via the Banks Pumping Plant will enhance reclamation efforts and will improve the taste of the water and reduce corrosion.

6.2.4.2 THM Formation Potential

Alternative 4 will result in improved water quality, that is, less THM formation potential, over Alternative 3, particularly at the Banks Pumping Plant. This positive effect at Banks Pumping Plant may result in lower THM formation potential in the water at Rock Slough. It is not possible to quantify these impacts.

6.2.4.3 Agriculture

Western and Interior Delta - Same as Alternative 3

Southern Delta - Same as Alternative 3

6.2.4.4 Salmon - Same as Alternative 3

6.2.4.5 Striped Bass

This provides the same level of direct protection for striped bass spawning as Alternative 3. The indicated increase in San Joaquin River inflow and Delta outflow, combined with reductions in exports, may provide additional indirect protection for eggs and young even though Sacramento River inflow is reduced.

6.2.4.6 Water Supply

Alternative 4 is the same as Alternative 3 except for the additional 0.15 mg/l bromide objective at the Banks Pumping Plant to meet the trihalomethane objective. The changes in exports and total outflow are shown in Table 6-2.

6.2.5

Alternative 5 is also the same as Alternative 3 except for a change in the M&I and striped bass objectives. This alternative changes the location of M&I bromide objective of 0.15 mg/l to the Contra Costa Canal intake all year. It extends the location of the striped bass spawning objective from Prisoners Point to the area between Vernalis and Prisoners Point.

6.2.5.1 Municipal and Industrial

The 50 mg/l chloride objective at Contra Costa Canal will significantly reduce salinity levels at this intake. This will result in more improvement in water quality than Alternative 4.

6.2.5.2 THM Formation Potential

Alternative 5 would result in more positive impacts for Delta water purveyors (less THM formation potential) than Alternative 4. It is believed that the chloride/bromide levels provided by this alternative would result in THM levels well below the current maximum contaminant level (MCL) of 100 parts per billion (ppb).

6.2.5.3 Agriculture

Western and Interior Delta - Same as base

Southern Delta - Same as Alternative 3

6.2.5.4 Salmon - Same as Alternative 3

6.2.5.5 Striped Bass

This alternative provides for expansion of spawning habitat beyond Prisoners Point to Vernalis, potentially restoring access to spawning habitat formerly available in the upper San Joaquin River and its tributaries. The effects of deficiencies are the same as for Alternative 3. This alternative also provides additional protection for eggs and young because of reduced exports and additional San Joaquin River inflow. It has been hypothesized that allowing spawning farther upstream will simply expose these eggs and young to entrainment, and other effects of the projects, through Old River. Even if some are lost by this method, there may still be a net increase in survival because of reductions in exports and reverse flows, since substantial spawning would still occur in the central Delta area where reverse flows and entrainment have substantial impacts. Given the recommendations of DFG, consideration of this alternative will be deferred until the entrainment question of project operations is dealt with.

6.2.5.6 Water Supply

Alternative 5 is the same as Alternative 4 except for the additional 0.15 mg/l bromide objective at the Contra Costa Canal Pumping Plant #1 and the extension of the Prisoners Point striped bass spawning objective upstream on the San Joaquin River to Vernalis. The principal reason for the

increase in total Delta outflow is the increased carriage water needed to meet the 0.15 mg/l bromide (50 mg/l chloride) objective at the Contra Costa Canal. Like Alternative 4, the primary source of this additional water is from a corresponding reduction in exports and/or reduction in upstream diversion and use.

The combined effect of the southern Delta agricultural objective and the Prisoners Point to Vernalis (0.44 mmhos/cm EC) striped bass spawning objective requires an additional 9 and 58 TAF, respectively, in the 57-year and critically-dry period flows. Since Alternative 4, which includes the agriculture objective and the Vernalis inflow, is independent of the change in exports, the differences in the Alternative 4 and 5 Vernalis flows represent the additional water needed for the Prisoners Point striped bass spawning objective. Consequently, about 8 and 64 TAF of additional Vernalis flows are needed to meet the striped bass objective during the average and dry conditions, respectively.

The overall water supply effects of this alternative are considered more adverse than Alternative 4.

6.2.6

Alternative 6 includes the bromide objective of 0.15 mg/l at the Contra Costa Canal Intake and changes five other objectives from the "Recommended" alternative. In the striped bass spawning objective at Antioch, the provision for the higher EC values during deficiency years (1.6 to 3.7 mmhos/cm) is deleted. It also eliminates both the provision for raising the EC during this period if spawning ends earlier and the ramping flow between April 1 and April 15. The striped bass spawning objective between Vernalis and Prisoners Point is changed to an EC of 0.3 mmhos/cm from April 1 to May 31. The Suisun Marsh wildlife objective is modified from the Alternative 3 to include the original D-1485 objectives. For the protection of the Tidal Marshes and Rare, Threatened and Endangered Species, an objective of 15 to 20 mmhos/cm EC is set from February 1 through May 31 at Martinez in all years. The final change is the Chinook salmon temperature objective. The water temperature in the Sacramento and San Joaquin rivers in the fall and spring is reduced to 66°F for the protection of fall-run Chinook salmon.

6.2.6.1 Municipal and Industrial

While it is likely that this alternative would provide water quality equal to or slightly better than Alternative 5, the degree of improvement would be dependent upon the source of water to the San Joaquin River. Currently there is no model adequately sensitive to quantify the water quality changes.

6.2.6.2 THM Formation Potential - See 6.2.6.1

6.2.6.3 Agriculture

Western and Interior Delta - While the objectives are the same as in Alternative 3, the "umbrella" protection provided by the other objectives is likely to provide water of lower salinity to the Delta agricultural areas. This should, in turn, reduce the need for leaching.

Southern Delta - See 6.2.6.3

6.2.6.4 Salmon

This alternative provides an increase in San Joaquin River inflow on the average during the months April through July. However, the Sacramento River inflow is decreased during this period. Therefore this alternative would probably not improve the temperature conditions in the Sacramento River in the spring but temperatures may be improved in the San Joaquin River. In addition, because total Delta outflow is increased over the base condition and exports are decreased, it is possible that salmon rearing habitat in the Suisun Bay would be improved and reverse flows and entrainment into the pumps may be reduced. These conditions should result in minor improvements for salmon.

6.2.6.5 Striped Bass

This alternative provides full protection for striped bass spawning from April 1 to May 31 from Antioch to Vernalis, with no relaxation provision. Substantial increases in San Joaquin River inflow and Delta outflow, combined with substantial decreases in exports, also would provide extensive additional protection for eggs and young, especially in dry and critical years.

6.2.6.6 Water Supply

Alternative 6 provides the largest change from the base conditions. The additional increase in required Delta outflow, compared to Alternative 5, is due to the tidal marshes objective at Martinez and the more stringent striped bass objective. The 57-year exports decrease by 674 TAF or about 11 percent. The critically-dry period exports decrease by 1078 TAF or about 20 percent.

The water supply impacts of the "original" Decision 1485 Suisun Marsh objectives, if met solely with Delta outflow, were estimated to be 2 million acre-feet per year in the 1978 Plan (SWRCB,3, VI-11). However, this estimate should be used with caution since no documentation was provided to support it. Furthermore, this estimate has not been re-evaluated to reflect the effect of the Suisun Marsh Salinity Control Gate or future Marsh facilities.

The 0.3 mmhos/cm Vernalis to Prisoners Point striped bass spawning objective significantly increases the required Vernalis flow.

A comparison of the historical temperature data in the Sacramento River with the temperature objectives shows that, from 1978 through 1985, the five-day average temperatures are greater than the temperature objective of 66°F approximately 2 percent of the time in April, 23 percent of the time in May, and 79 percent of the time in June. A similar comparison for the San Joaquin River shows that the five-day average temperatures are greater than 66°F approximately 27 percent of the time in May and 43 percent of the time in June (WQCP-CVPWA-202).

6.3 Issues to be Considered in Establishing Water Quality Objectives

The implications of these alternatives are substantial. Any changes in salinity and temperature objectives can have pronounced effects on the economic health of California and on the protection of such resources as fish and wildlife. The total amounts of, and the parties responsible for fresh water flows in the watershed have yet to be determined. Attempts to model the effects of these factors is limited but improving rapidly. Any figures used to estimate the effects of these alternatives must be viewed with caution -- and with the commitment that these objectives can and must be altered when appropriate.

6.3.1 Cumulative Impacts of Flow Alternatives

The overall approach to the flow objectives is to provide increased protection for the salmon outmigration period and most of the striped bass spawning season, protecting both the adults and the young. The establishment and maintenance of the entrapment zone would be for the benefit of the Chinook salmon and the striped bass, as well as numerous other vertebrate and invertebrate species. It is recognized that a number of the parties are actively negotiating in an attempt to reach agreement on fishery protection measures. The State Board encourages these efforts. Any product of these negotiations will be evaluated along with flow alternatives and other options which may be proposed.

During the course of the proceedings, evidence was introduced stating that the addition of physical solutions, such as facilities, could greatly benefit the various beneficial uses of Bay-Delta waters. Evidence was also introduced that the most significant impacts to the fishery are due to the location, method, and timing of diversions, all of which affect instream flows.

As stated in Chapter 6.1 and to the extent discussed, two different flow alternatives were developed to analyze their water supply effects. One flow alternative used the objectives developed for the selected Alternative 3; the other used the objectives developed for Alternative 6. The same flows were added to both. They range, depending upon water year type, from 2,900 to 30,000 cfs at Chipps Island for the protection of striped bass eggs and larvae; from 2,500 to 22,500 cfs at Rio Vista for salmon outmigration in the Sacramento River and from 500 to 14,000 cfs at Vernalis in the San Joaquin River; and about 15,000 cfs for placement of the entrapment zone around Chipps Island.

These additional flows would result in Delta exports decreasing by 800 and 983 TAF, respectively, while the San Joaquin River inflow to the Delta would increase by 575 and 300 TAF, respectively. These comparative estimates are based upon operation study outputs.

6.3.2 Operation Studies

In this evaluation, the effects of the potential objectives were compared insofar as possible with the existing condition, or base case. The alternative objectives were reviewed for environmental impact, economic consequences and water cost.

One of the tools used in this analysis is the modelling results produced by DWR under the guidance of the operations studies workgroup. The modelling results provide valuable insight into the effects of various objectives. There are important limitations that must be recognized. The operations model generally uses the conditions of Water Right Decision 1485 (under which the CVP and SWP have operated for the past 12 years) as the base case. However, some changes have been made in recent months to improve the models, and all of the variations have not been rerun with the new assumptions. Further, the "1990 level of development" used in the model does not reflect actual diversions at this time. The modelling for the San Joaquin Basin is not as refined as is the case for the Sacramento/Delta. In recent years salinity objectives in the south Delta have been specified in Water Right Decision 1422, but the modelling uses slightly different objectives, based on a USBR/South Delta agreement. Given the variety of locations and beneficial uses, our discussion of the alternatives has considered D-1485 objectives, special modifications used in the operations models, and actual conditions, as appropriate.

The DWR representatives most familiar with the models agree that their work products should not be used to attempt to quantify effects of changes in objectives precisely. However, it has been agreed that they are very useful in establishing the relative effects of various assumptions.

In summary, better information will become available as the efforts to refine the models continue. This will be true in the foreseeable future. Despite the limitations described above, there is no valid basis for delaying our evaluation or for deferring use of the currently available model runs as a primary tool in our analysis of alternatives (See Appendix 6.3, Operation Studies.)

6.3.3 Fish and Wildlife

We recognize the importance of the protection of aquatic resources which may be primarily dependent upon aquatic habitat in the Delta. However, the State Board has received inconsistent recommendations regarding one of the most obvious problems, i.e., striped bass. With respect to spawning objectives, DFG has recommended deferring actions to restore this habitat to later phases of the hearing process, in part because it has concerns about the benefits which will accrue in view of possible large diversions of eggs and larvae to the SWP and CVP pumps via Old River. DFG does agree that expansion of appropriate habitat would be beneficial in the long run.

USFWS also recognizes that the benefits to striped bass which would be obtained by improving habitat at this time may be limited. However, it identified the issue as a water quality issue, and recommended establishing the additional salinity objectives at this time as a first step, to be combined with flows, diversion restrictions and/or physical facilities developed in later phases to provide overall increased protection.

Various participants have argued that there is no evidence that striped bass spawning habitat is limiting, and that striped bass have been observed to spawn in water with salinity higher than 0.44 mmhos/cm EC. Laboratory tests also suggest that eggs can survive and hatch in higher salinity water (see Section 5.6.2.1). On the other hand, observations on other striped bass populations indicate that, given a choice, all prefer to spawn above the limits of seawater intrusion. In the San Joaquin River, upstream salinity barriers appear to inhibit their ability to move entirely out of the effects of ocean salinity. We agree that the evidence for whether spawning habitat is limiting for striped bass, and what the maximum allowable salinity might be, is not definitive, particularly when comparing laboratory and field observations. However, we also recognize that spawning success, as measured by survival of eggs and young bass, is inextricably linked to the effects of flows, toxics, and other factors, so that distinguishing the effects of spawning habitat salinity alone may be impossible. Additional studies and data analysis on actual spawning conditions, spawning locations in different year types, and spawning success are sorely needed. We invite all participants to evaluate this question further, and we propose that a thorough review of this objective be undertaken at the next Triennial Review of this Plan (see Program of Implementation, Section 7.5.2.4).

Data supporting the 0.44 mmhos/cm EC are not without question and the data on the potential effects of extending the striped bass spawning protection from Prisoners Point to Vernalis are too inconclusive to warrant setting the potential objective as the water quality objective.

6.4 The Water Quality Objectives

The State Board believes that, on balance, the objectives contained in Table 6-3 (Alternative 3 in Table 6-1) best protect the beneficial uses of the waters of the Bay-Delta Estuary.

- Minor improvements are provided from the 1978 Delta Plan.
- The State Board did not hear any compelling testimony nor did it receive any exhibits indicating that major changes were needed in salinity, temperature or dissolved oxygen water quality objectives for the Bay-Delta Estuary.
- The 150 mg/l chloride objective is being retained in order to protect municipal water quality at present levels until more is known about the public health hazards of disinfection by-products.
- The objectives for agriculture continue the existing water quality objectives or the recognized agreements containing them.
- The change in the striped bass objective for Prisoners Point recognizes the existing condition in the area, sets a lower salinity objective to prevent degradation and extends the spawning period protection.
- This alternative will have some minimal effect on water distribution. Therefore, the economic impacts of this plan will also be minimal.

TABLE 6-3 WATER QUALITY OBJECTIVES

A) MUNICIPAL AND INDUSTRIAL

LOCATION	SAMPLING SITE NOs. (I-A/RKI)	PARAMETER	DESCRIPTION	INDEX TYPE	YEAR TYPE	DATES	VALUES
Contra Costa Canal at Pumping Plant #1	*C-5 CHCCC06*	*Chloride (Cl-)*	*Maximum mean daily, in mg/l*	*Not Applicable*	*All*	*Oct-Sep*	*250*
Contra Costa Canal at Pumping Plant #1 - or - *San Joaquin River at Antioch Water Works Intake*	*C-5 CHCCC06* / *D-12(near) RSAN007*	*Chloride (Cl-)*	*Maximum mean daily 150 mg/l chloride for at least the number of days shown during the Calendar Year. Must be provided in intervals of not less than two weeks duration. (% of Calendar Year shown in parenthesis)*	*Sac R 40-30-30* / *Sac R 40-30-30*	*W* / *AN* / *BN* / *D* / *C*		*No. of days each Cal. Year < 150 mg/l Cl-* *240 (66%)* / *190 (52%)* / *175 (48%)* / *165 (45%)* / *155 (42%)*
West Canal at mouth of Clifton Court Forebay	*C-9 CHWST0*	*Chloride (Cl-)*	*Maximum mean daily, in mg/l*	*Not Applicable*	*All*	*Oct-Sep*	*250*
Delta Mendota Canal at Tracy Pumping Plant	*DMC-1 CHDMC004*	*Chloride (Cl-)*	*Maximum mean daily, in mg/l*	*Not Applicable*	*All*	*Oct-Sep*	*250*
Cache Slough at City of Vallejo Intake [1] and/or *Barker Slough at North Bay Aqueduct Intake*	*C-19 SLCCH16* / *SLBAR3*	*Chloride (Cl-)*	*Maximum mean daily, in mg/l*	*Not Applicable*	*All*	*Oct-Sep*	*250*

TABLE 6 – 3 (cont.) WATER QUALITY OBJECTIVES

B) AGRICULTURAL

AREA

LOCATION	SAMPLING SITE NOs. (I-A/RKI)	PARAMETER	DESCRIPTION	INDEX TYPE	YEAR TYPE	DATES	VALUES
1) WESTERN DELTA							
Sacramento River at Emmaton	*D-22 RSAC092*	*Electrical Conductivity (EC)*	*Maximum 14-day running average of mean daily, in mmhos/cm (mmhos)*	*Sac R 40-30-30*		*0.45 EC April 1 to Date Shown*	*EC from Date Shown to Aug. 15 [2]*
					W	*Aug. 15*	*--*
					AN	*July 1*	*0.63*
					BN	*June 20*	*1.14*
					D	*June 15*	*1.67*
					C	*--*	*2.78*
San Joaquin River at Jersey Point	*D-15 RSAN018*	*Electrical Conductivity (EC)*	*Maximum 14-day running average of mean daily, in mmhos*	*Sac R 40-30-30*		*0.45 EC April 1 to Date Shown*	*EC from Date Shown to Aug. 15 [2]*
					W	*Aug. 15*	*--*
					AN	*Aug. 15*	*--*
					BN	*June 20*	*0.74*
					D	*June 15*	*1.35*
					C	*--*	*2.20*

TABLE 6 – 3 (cont.) WATER QUALITY OBJECTIVES

B) AGRICULTURAL

AREA

LOCATION	SAMPLING SITE NOs. (I-A/RKI)	PARAMETER	DESCRIPTION	INDEX TYPE	YEAR TYPE	DATES	VALUES
2) INTERIOR DELTA							
South Fork Mokelumne River at Terminous	*C-13 RSMKL08*	*Electrical Conductivity (EC)*	*Maximum 14-day running average of mean daily, in mmhos*	*Sac R 40-30-30*		*0.45 EC April 1 to Date Shown*	*EC from Date Shown to Aug. 15 [2]*
					W	*Aug. 15*	--
					AN	*Aug. 15*	--
					BN	*Aug. 15*	--
					D	*Aug. 15*	--
					C	--	*0.54*
San Joaquin River at San Andreas Landing	*C-4 RSAN032*	*Electrical Conductivity (EC)*	*Maximum 14-day running average of mean daily, in mmhos*	*Sac R 40-30-30*		*0.45 EC April 1 to Date Shown*	*EC from Date Shown to Aug. 15 [2]*
					W	*Aug. 15*	--
					AN	*Aug. 15*	--
					BN	*Aug. 15*	--
					D	*Jun. 25*	*0.58*
					C	--	*0.87*

TABLE 6 - 3 (cont.) WATER QUALITY OBJECTIVES

B) AGRICULTURAL

AREA

LOCATION	SAMPLING SITE NOs. (I-A/RKI)	PARAMETER	DESCRIPTION	INDEX TYPE	YEAR TYPE	DATES	VALUES
(To be implemented by 1996) [3]		**3) SOUTH DELTA**					
San Joaquin River at Airport Way Bridge, Vernalis	*C-10 RSAN112*	*Electrical Conductivity (EC)*	*Maximum 30-day running average of mean daily EC, in mmhos*	*Not Applicable*	*All*	*Apr 1-Aug 31*	*0.7*
						Sep 1-Mar 31	*1.0*
						or	
Old River near Middle River	*C-8 ROLD69*			*If a three-party contract has been implemented among DWR, USBR and the SDWA, that contract will be reviewed prior to implementation of the above and, after also considering the needs of other beneficial uses, revisions will be made to the objectives and compliance/monitoring locations noted above, as appropriate.*			
Old River at Tracy Road Bridge	*P-12 ROLD59*						
San Joaquin River at Brandt Bridge [site]	*C-6 RSAN073*						
		4) EXPORT					
West Canal at mouth of Clifton Court Forebay -and- Delta Mendota Canal at Tracy Pumping Plant	*C-9 CHWST0 DMC-1 CHDMC004*	*Electrical Conductivity (EC)*	*Maximum monthly average of mean daily EC, in mmhos*	*Not Applicable*	*All*	*Oct-Sep*	*1.0*

TABLE 6 – 3 (cont.) WATER QUALITY OBJECTIVES

C) FISH AND WILDLIFE

HABITAT/SPECIES

LOCATION	SAMPLING SITE NOs. (I-A/RKI)	PARAMETER	DESCRIPTION	INDEX TYPE	YEAR TYPE	DATES	VALUES
CHINOOK SALMON							
DISSOLVED OXYGEN							
San Joaquin River between Turner Cut & Stockton	*RSAN050-RSAN061*	*Dissolved Oxygen (DO)*	*Minimum dissolved oxygen, in mg/l*	*Not Applicable*	*All*	*Sep 1-Nov 30*	*6.0*
TEMPERATURE							
Sacramento River at Freeport and	*RSAC155*	*Temperature*	*Narrative Objective*	*Not Applicable*	*All*	*"The daily average water temperature shall not be elevated by controllable factors above 68 deg. F from the I Street Bridge to Freeport on the Sacramento River, and at Vernalis on the San Joaquin River between April 1 through June 30 and September 1 through November 30 in all water year types." [4]*	
San Joaquin River at Airport Way Bridge, Vernalis	*C-10 RSAN112*	*Temperature*	*Narrative Objective*	*Not Applicable*	*All*		
Sacramento River at Freeport	*RSAC155*	*Temperature*	*Narrative Objective*	*Not Applicable*	*All*	*"The daily average water temperature shall not be elevated by controllable factors above 66 deg. F from the I Street Bridge to Freeport on the Sacramento River between January 1 through March 31." [4]*	

TABLE 6-3 (cont.) WATER QUALITY OBJECTIVES

C) FISH AND WILDLIFE

HABITAT/SPECIES

LOCATION	SAMPLING SITE NOs. (I-A/RKI)	PARAMETER	DESCRIPTION	INDEX TYPE	YEAR TYPE	DATES	VALUES
STRIPED BASS-SALINITY 1. ANTIOCH-SPAWNING							
Sacramento River at Chipps Island	*D-10 RSAC075*	*Delta outflow Index (DOI)*	*Average for the period not less than the value shown, in cfs*	*Not Applicable*	*All*	*Apr 1-Apr 14*	*6,700*
San Joaquin River at Antioch Water Works Intake	*D-12 (near) RSAN007*	*Electrical Conductivity (EC)*	*14-day running average of mean daily for the period not more than value shown, in mmhos*	*Not Applicable*	*All*	*Apr 15-May 31 (or until spawning has ended)*	*1.5*
STRIPED BASS-SALINITY 2. ANTIOCH-SPAWNING-RELAXATION PROVISION							
San Joaquin River at Antioch Water Works Intake	*D-12 (near) RSAN007*	*Electrical Conductivity (EC)*	*14-day running average of mean daily not more than value shown corresponding to deficiencies in firm supplies declared by a set of water projects representative of the Sacramento River and San Joaquin River watersheds, for the period shown, or until spawning has ended. The specific representative projects and amounts of deficiencies will be defined in subsequent phases of the proceedings.*	*Total Annual Imposed Deficiency (MAF)*		*Apr 1-May 31 EC in mmhos*	
						Dry	*Critical*
This relaxation provision replaces the above Antioch & Chipps Island standard whenever the projects impose deficiencies in firm supplies.				*0.0*		*1.5*	*1.5*
				0.5		*1.8*	*1.9*
				1.0		*1.8*	*2.5*
				1.5		*1.8*	*3.4*
				2.0 or more		*1.8*	*3.7*
				Linear interpolation is to be used to determine values between those shown.			
STRIPED BASS-SALINITY 3. PRISONERS POINT-SPAWNING							
San Joaquin River at: Prisoners Point	*D-29 RSAN038*	*Electrical Conductivity (EC)*	*14-day running average of mean daily for the period not more than value shown, in mmhos*	*Not Applicable*	*All*	*Apr 1-May 31 (or until spawning has ended)*	*0.44*

TABLE 6 – 3 (cont.) WATER QUALITY OBJECTIVES

C) FISH AND WILDLIFE

HABITAT/SPECIES

LOCATION	SAMPLING SITE NOs. (I-A/RKI)	PARAMETER	DESCRIPTION	INDEX TYPE	YEAR TYPE	DATES	VALUES
STRIPED BASS - SALINITY 4. PRISONERS POINT - SPAWNING - RELAXATION PROVISION							
			When the relaxation provision for Antioch spawning protection is in effect:				
San Joaquin River at: Prisoners Point	*D-29 RSAN038*	*Electrical Conductivity (EC)*	*14-day running average of mean daily for the period not more than the value shown, in mmhos*	*Not Applicable*	*D&C*	*Apr 1-May 31 (or until spawning has ended)*	*0.55*

SUISUN MARSH

In regard to the Suisun Marsh, the water quality objectives for Suisun Marsh are unchanged from the 1978 Delta Plan. The implementation vehicle, Water Right Decision 1485 (D-1485), was amended in 1985 to change (or delete) some monitoring stations and to revise the schedule for implementation. The DWR, USBR, DFG, and Suisun Resource Conservation District (SRCD) have signed and adopted a set of three agreements concerning the Suisun Marsh. These are the Suisun Marsh Preservation Agreement (SMPA), the Monitoring Agreement, and the Mitigation Agreement. The SMPA contains water quality standards for the managed marshes of Suisun Marsh which the four signatories would like the State Board to adopt as water quality objectives. The SMPA also describes the physical facilities that the four signatories have agreed would serve the managed marshes in order to maintain production of preferred waterfowl food plants. The facilities built so far, including the Suisun Marsh Salinity Control Gates (previously called the Montezuma Slough Control Structure), have changed the physical regime in the Marsh.

Revised water quality objectives incorporating the SMPA (with any modifications necessitated by the biological assessment) will be adopted by the State Board after the biological assessment (discussed in Section 7.4.2.6 of the plan) is completed. Until that time, the water quality standards in the amended D-1485 will continue to be implemented; see Table 1-2 for a summary of these standards.

FOOTNOTES:

[1] The Cache Slough objective to be effective only when water is being diverted from this location.

[2] When no date is shown, EC limit continues from April 1.

[3] South Delta Agriculture objectives will be implemented in stages: two interim stages and one final stage. The first interim stage will be implemented with the adoption of the WQCP, the second interim stage by 1994, and the final stage by 1996. Interim Stage 1 -- 500 mg/l mean monthly TDS all year at Vernalis. Interim Stage 2 -- (to be implemented no later than 1994) 0.7 mmhos/cm EC April 1 to August 31, 1.0 mmhos/cm EC September 1 to March 31, 30-day running average, at Vernalis and Brandt Bridge; with water quality monitored at three current interior stations -- Mossdale, Old River, near Middle River and Tracy Road Bridge, and an additional interior monitoring station on Middle River at Howard Road Bridge. Final Stage -- (to be implemented no later than 1996) 0.7 mmhos/cm EC April 1 to August 31, 1.0 mmhos/cm EC September 1 to March 31, 30-day running average, at Vernalis and Brandt Bridge on the San Joaquin River; with two interior stations at Old River Near Middle River and Old River at Tracy Road Bridge. Monitoring stations will be at Mossdale at head of Old river and Middle River at Howard Road Bridge.

OR

If a three-party contract has been implemented among DWR, USBR and the SDWA, that contract will be reviewed prior to implementation of the above and, after also considering the needs of other beneficial uses, revisions will be made to the objectives and compliance/montioring locations noted above, as appropriate.

[4] Controllable water quality factors are those actions, conditions, or circumstances resulting from human activities that may influence the quality of the waters of the State, that are subject to the authority of the State Board, or the Regional Board, and that may be reasonably controlled. Based on the record in these proceedings, controlling temperature in the Delta utilizing reservoir releases does not appear to be reasonable, due to the distance of the Delta downstream of reservoirs and uncontrollable factors such as ambient air temperature, water temperatures in the reservoir releases, etc. For these reasons, the State Board considers reservoir releases to control water temperatures in the Delta a waste of water; therefore, the State Board will require a test of reasonableness before consideration of reservoir releases for such a purpose.

Table 6-4 provides a qualitative assessment of the impacts of the various alternatives and illustrates the basis for the selection of Alternative No. 3. Alternatives 1A, 1B, and 2 would fail to implement several water quality improvements which are within the scope of this plan and which are now reasonably achievable. Alternative 4 would provide positive, but unquantified benefits with respect to M&I use. There would be a definite cost in water supply to provide the benefit. As explained in Chapter 5, the uncertainty surrounding the issue of disinfection by-products makes it premature to attempt a final analysis of the benefits and detriments of this alternative. Alternatives 5 and 6 suffer the same defects. Additionally, expansion of the bass spawning area is premature, as is amendment of marsh objectives in advance of the biological assessment. Work on those issues must be completed before the benefits of more stringent objectives can be fairly compared to the high water supply cost. None of those alternatives (except No. 2) have any potential for growth inducing impacts. In conclusion, Alternative No. 3 is the most reasonable of those evaluated.

6.5 Environmental Effects

The State Board will prepare a separate EIR for the upcoming water right decision(s). The Scoping Phase of this Proceeding will help the State Board identify the issues to be addressed in that EIR; the EIR may refer to and build upon this environmental analysis, if appropriate.

The analysis of impacts in this discussion is confined to the effects of adopting or revising certain selected water quality objectives in the 1978 Delta Plan and D-1485, as amended. This discussion does not, and indeed cannot, thoroughly analyze the effects of decisions which may be made in the future by the State Board or other public or private entities. In particular, this analysis assumes that the flow standards contained in the 1978 Delta Plan (and implemented in D-1485) will remain in effect. The impacts of any future changes in flow standards will be fully analyzed in conjunction with any decision or decisions to change those standards in the upcoming EIR on the water rights decision.

An environmental checklist of possible impacts from the proposed State Board objectives is presented in Table 6-5. The State Board has concluded that the Plan will not have any significant or potentially significant effects. Impacts of specific objectives are analyzed in Chapter 5 and in the preceeding sections of this chapter.

6.6 Implementation

The means of implementing these objectives are discussed in Chapter 7 of this Plan.

6.7 Economic Considerations

During these proceedings, the State Board has often been told that California's water resources are vital to its economy, both in areas where water originates and where it is imported.

TABLE 6-4
QUALITATIVE ASSESSMENT OF IMPACTS

BENEFICIAL USE / IMPACT CRITERIA	ALTERNATIVE						
	1A BASE	1B BASE w/ 40-30-30 YT	2 250 CL CCC/ 1.5 W DEL AG	3 S DEL AG/ ANT SPAWN	4 50 CL BANKS PP	5 50 CL CCC/ 0.44 VERN SP	6 R,T, & E/ 0.3 VERN SP
MUNICIPAL AND INDUSTRIAL							
SALINITY	O	O	—	O	+	+ +	+ +
TRIHALOMETHANE FORMATION POTENTIAL	O	O	—	O	+	+ +	+ +
AGRICULTURE							
WESTERN / INTERIOR DELTA WATER QUALITY	O	O	—	O	O	O	+
SOUTHERN DELTA WATER QUALITY	O	O	O	+	+	+	+ +
EXPORT WATER QUALITY	O	O	O	O	O	O	O
FISH AND WILDLIFE							
STRIPED BASS HABITAT	O	O	—	+	+	+	+ +
SUISUN MARSH WILDLIFE HABITAT	O	O	O	O	O	O	+
TIDAL MARSHES R, T, & E SPECIES HABITAT	O	O	—	O	O	O	+
SALMON HABITAT	O	O	O	+	+	+	+
WATER SUPPLY							
WATER SUPPLY	O	O	O	O	—	— —	— —

LEGEND:

\+ BENEFICIAL IMPACT
O INSIGNIFICANT IMPACT
— ADVERSE IMPACT

SELECTED ALTERNATIVE

NOTE:

This summary provides a gross, subjective indication of the direction and magnitude of changes in conditions

01/10/91

F vised 11 January 1991

TABLE 6-5

ENVIRONMENTAL CHECKLIST

I. BACKGROUND

Name of Proponent: State Water Resources Control Board
Address: Executive Director
P.O. Box 100
Sacramento, CA 95810
Telephone: (916) 445-3085, James W. Baetge
Date of Checklist: December 13, 1990
Agency Requiring Checklist: State Water Resources Control Board
Proposal: Adoption of Water Quality Control Plan for Salinity and Temperature for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary

II. ENVIRONMENTAL IMPACTS

Legend: Y=yes
?=maybe
N=no

1 Earth. Will the proposal result in:	
a. Unstable earth conditions or in changes in geologic substructures?	N
b. Disruptions, displacements, compaction or overcovering of the soil?	N
c. Change in topography or ground surface relief features?	N
d. The destruction, covering or modification of any unique geologic or physical features?	N
e. Any increase in wind or water erosion of soils, either on or off the site?	N
f. Changes in deposition or erosion of beach sands, or changes in siltation, deposition or erosion which may modify the channel of a river or stream or the bed of the ocean or any bay, inlet, or lake?	N
g. Exposure of people or property to geologic hazards such as earthquakes, landslides, mudslides, ground failure, or similar hazards?	N
2 Air. Will the proposal result in:	
a. Substantial air emissions or deterioration of ambient air quality?	N
b. The creation of objectionable odors?	N
c. Alteration of air movement, moisture, or temperature, or any change in climate, either locally or regionally?	N

TABLE 6 – 5 (CONT.)

II. ENVIRONMENTAL IMPACTS (CONT.)

Legend: Y=yes
?=maybe
N=no

3 Water. Will the proposal result in:	
a. Changes in currents, or the course or direction of water movements, in either marine or fresh waters?	N
b. Changes in absorption rates, drainage patterns, or the rate and amount of surface runoff?	N
c. Alterations in the course or flow of flood waters?	N
d. Change in the amount of surface water in any water body?	N
e. Discharge into surface waters, or in any alteration of surface water quality including but not limited to temperature, dissolved oxygen, or turbidity?	N
f. Alteration of the direction or rate of flow of ground waters?	N
g. Change in quantity of ground waters, either through direct additions or withdrawals, or through interception of an aquifer by cuts or excavations?	N
h. Substantial reduction in the amount of water otherwise available for public water supplies?	N
i. Exposure of people or property to water related hazards such as flooding or tidal waves?	N
4 Plant Life. Will the proposal result in:	
a. Change in the diversity of species, or number of any species of plants (including trees, shrubs, grass, crops, and aquatic plants)?	N
b. Reduction of the numbers of any unique, rare, or endangered species of plants?	N
c. Introduction of a new species of plants into an area, or in a barrier to the normal replenishment of existing species?	N
d. Reduction of acreage of any agricultural crop?	N
5 Animal Life. Will the proposal result in:	
a. Change in the diversity of species, or numbers of any species of animals (birds, land animals including reptiles, fish and shellfish, benthic organisms or insects?	N
b. Reduction of the numbers of any unique, threatened or endangered species?	N

TABLE 6 – 5 (CONT.)

II. ENVIRONMENTAL IMPACTS (CONT.)

Legend: Y=yes
?=maybe
N=no

c. Introduction of new species of animals into an area, or result in a barrier to the migration or movement of animals?	N
d. Deterioration to existing fish or wildlife habitat?	N
6 Noise. Will the proposal result in:	
a. Increases in existing noise levels?	N
b. Exposure of people to severe noise levels?	N
7 Light and Glare. Will the proposal produce new light or glare?	N
8 Land Use. Will the proposal result in a substantial alteration of the present or planned use of an area?	N
9 Natural Resources. Will the proposal result in:	
a. Increase in the rate of use of any natural resources?	N
10 Risk of Upset. Will the proposal involve:	
a. A risk of an explosion or the release of hazardous substances (including, but not limited to, oil, pesticides, chemicals or radiation) in the event of an accident or upset conditions?	N
b. Possible interference with an emergency response plan or an emergency evacuation plan?	N
11 Population. Will the proposal alter the location, distribution, density, or growth rate of the human population of an area?	N
12 Housing. Will the proposal affect existing housing, or create a demand for additional housing?	N
13 Transportation and Circulation. Will the proposal result in:	
a. Generation of substantial additional vehicular movement?	N
b. Effects on existing parking facilities, or demand for new parking?	N

TABLE 6 – 5 (CONT.)

II. ENVIRONMENTAL IMPACTS (CONT.)

Legend: Y=yes
?=maybe
N=no

c. Substantial effect on existing transportation systems?	N
d. Alterations to present patterns of circulation or movement of people and/or goods?	N
e. Alterations to waterborne, air, or rail traffic?	N
f. Increase in traffic hazards to motor vehicles, bicyclists, or pedestrians?	N
14 Public Services. Will the proposal have an effect upon, or result in a need for new or altered governmental services in any of the following areas:	
a. Fire protection?	N
b. Police protection?	N
c. Schools?	N
d. Parks or other recreational facilities?	N
f. Maintenance of public facilities, including roads?	N
g. Other governmental services?	N
15 Energy. Will the proposal result in:	
a. Use of substantial amounts of fuel or energy?	N
b. Substantial increase in demand upon existing sources of energy, or require the development of new sources of energy?	N
16 Utilities. Will the proposal result in a need for new systems, or substantial alterations to the following utilities:	
a. Sewerage?	N
b. Water?	N
c. Electricity?	N
d. Natural gas?	N
e. Telephone?	N
17 Human Health. Will the proposal result in:	
a. Creation of any health hazard or potential health hazard (excluding mental health)?	N
b. Exposure of people to potential health hazards?	N
18 Aesthetics. Will the proposal result in the obstruction of any scenic vista or view open to the public, or will the proposal result in the creation of an aesthetically offensive site open to public view?	N

TABLE 6 – 5 (CONT.)

II. ENVIRONMENTAL IMPACTS (CONT.)

Legend: Y=yes
?=maybe
N=no

19	Recreation. Will the proposal result in an impact upon the quality or quantity of existing recreational opportunities?	N
20	Cultural Resources.	
	a. Will the proposal result in the alteration or the destruction of a prehistoric or historic archaeological site?	N
	b. Will the proposal result in adverse physical or aesthetic effects to a prehistoric or historic building, structure, or object?	N
	c. Does the proposal have the potential to cause a physical change which would affect unique ethnic cultural values?	N
	d. Will the proposal restrict existing religious or sacred uses within the potential impact area?	N
21	Mandatory Findings of Significance.	
	a. Does the proposal have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a or animal community, reduce the number or restrict the range of a rare, threatened, or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory?	N
	b. Does the project have the potential to achieve short-term, to the disadvantage of long-term, environmental goals?	N
	c. Does the project have impacts which are individually limited, but cumulatively considerable?	N
	d. Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	N

TABLE 6 – 5 (CONT.)

III. DISCUSSION OF ENVIRONMENTAL IMPACTS

Responses to any Y or ? answers are found in the text.

IV. DETERMINATION

On the basis of this evaluation, I find that the proposed project will not have any significant adverse effects on the environment because the State Board has set the water quality objectives at levels designed to adequately protect the designated beneficial uses of the Sacramento–San Joaquin Delta and San Francisco Bay waters.

Gerald E. Johns 5/1/91

Signature Date

Environmental Program Manager II

Title

for the State Water Resources Control Board

The following data were offered as policy statements. The degree of dependency on imported water varies, but is high in the San Francisco Bay area and in the San Joaquin Valley; dependency is also high in southern California. The San Diego region is 96 percent dependent on imported water (T,LXXIPOL,48).

For municipal and industrial use, the prime requirements are reliability of supply and high quality drinking water. Planning for the future must focus on improved reliability of supply and improvement in water quality.

Population and economic projections indicate growing M&I water demands. California's population today is just under 30 million. The state's population grew by 750,000 in 1989 (SWC,612,p.1). The Department of Finance has estimated that the state's population will increase to 36,280,000 by 2010 (DOF,1987). The DOF expects the population of the six most populated counties in southern California--Ventura, Los Angeles, Orange, Riverside, San Bernardino, and San Diego counties to increase from the 1986 level of 15,290,000 people to 20,200,000 by 2010 (SWC,6,7). With average daily water use of 188 gallons per capita, this implies a rise in California water use of approximately 1,322,000 AF, and a rise in southern California water use of a little over 1,033,000 AF by 2010 (DWR,14,91-113). The expected additional M&I demand for Bay Delta water supply is a result both of the loss of alternative water supplies and of the increase in population (SWC,4,6).

A reliable supply of imported water is one of the most important elements of southern California's economic strength. Southern California has an estimated 6.5 million jobs, about 50 percent of the people employed in the state, income of around $260 billion, which accounts for about 55 percent of the state's tax revenue (T,LXXIPOL,114). A reduction in water supply will cause a loss of productivity, income, and jobs. The analysis of this must rest on examination of marginal costs of water to marginal industries. SWC estimates suggest that a 45 percent reduction in the M&I projected water supply (approximately 2,592,000 AF) in the year 2000, would cause a loss of 1.5 million jobs and cause a potential income loss estimated at $98 billion (SWC,51,16;SWC,3,3). These estimates and others will be studied to determine the marginal costs of developing replacement water supplies, and the effects of shifting part of the burden from the industrial to the municipal sector.

The loss of jobs and income in southern California would have economic impacts beyond the region. Related jobs and income would be lost in other areas of the state as a result of jobs and income loss in southern California. This would also mean a significant loss of sales tax and income tax revenue to the state of California. Local governments would also lose tax revenues such as the occupancy tax for motels and hotels. Some examples from policy statements indicate the importance of imported water to the economic well being of the state and southern California. The building industry is said to generate about $55 billion in business activity representing about 22 percent of the economy of the region (T,LXXIIIPOL,54). Flower and ornamental plant sales in San Diego county total about $400 million per year and about 5,000 jobs are dependent on this industry in San Diego county (T,LXXIPOL,71). It is estimated that

the flower and ornamental plant industry uses about 600,000 AF of water per year (T,LXXIPOL,73). A related industry, landscape contractors, is said to have 1,700 members statewide with sales of $10.2 billion (T,LXXIPOL,109).

The value of agriculture, using water exported from the Bay-Delta, is discussed in the Technical Appendix (see Sections 4.0.4.1 and 4.0.9.2).

In the future the SWP and the CVP plan to expand deliveries to new areas and to areas experiencing increased need. SWP is studying a Coastal Branch which will supply water to Santa Barbara and San Luis Obispo counties, and an East Branch enlargement which will increase deliveries to the eastern part of the MWD's service area, and to San Bernardino County and the Antelope Valley. CVP is studying an extended San Felipe Branch which will supply water to Monterey and Santa Cruz counties, as well as an American River Aqueduct which will increase deliveries to EBMUD's service area in the Bay Area. SWP is also planning additional transfer and storage facilities at the following locations to increase its water distribution capabilities: the Kern Water Bank, Los Banos Grandes Reservoir, the south Delta, the north Delta, and additional pumps at the Delta Pumping Plant (DWR,707,42-53).

The issues discussed in this section address water quantity rather than quality. The availability of water for export uses is not significantly affected by this Plan. As stated in Section 6.1 and elsewhere, flow (water quantity) issues will be dealt with in detail during the Water Rights Phase of the proceedings. Interested parties that have provided testimony during the water quality phase should be prepared to discuss marginal costs and marginal value of water in their areas of interest.

7.0 PROGRAM OF IMPLEMENTATION

7.1 Introduction

A program of implementation is required in all water quality control plans (Water Code Section 13242). This chapter provides the program of implementation; it includes a discussion of how and when the water quality objectives set forth in this Plan are to be implemented, along with issues that need further study and that will be considered in the Scoping and Water Right phases of the proceedings and beyond.

To outline actions that will, or need to be taken, the discussion in this chapter has been divided into:

7.2 Implementation Measures
7.3 Compliance Monitoring
7.4 Special Studies and Reviews
7.5 Scoping and Water Right Issues.

7.1.1 Outstanding Scoping and Water Right Issues to be Discussed

The State Board will use its water quality and water right authorities and actions by others to implement the objectives in this Plan. Implementation alternatives will be further examined during the Scoping Phase. Those measures requiring water allocation adjustments will be determined by the State Board during the Water Right Phase of the proceedings.

At the end of the current proceedings (that is, after adopting a water right decision), the State Board will incorporate a revised Plan of Implementation that:

- establishes a timetable to carry out best practicable management of the resources and uses thereof;

- identifies potential new facilities and time schedules for planning and construction to achieve best practicable management;

- outlines suitable mitigation measures based on negotiated agreements to offset losses if some specified beneficial uses are not reasonably protected;

- requires modified uses to reasonably balance the allocation of fresh water resources to the beneficial uses; and

- proposes either new legislative directives or suggestions for that kind of legislation.

In addition, the State Board will evaluate new major facilities:

Upstream from Delta	Auburn Dam and Reservoir (could modify water right terms); additional fish hatcheries for salmon and steelhead.

In Delta	Delta island storage (permit terms and conditions) enlarge channels; isolated conveyance.
In Export Areas	Los Banos Grandes and Los Vaqueros (permit terms and conditions); conjunctive use of ground water basins; southern California surface reservoirs.
Mitigation	Wetlands additions; improve fish hatchery outputs; improve planting of fish; improve aquatic habitat; reduce infestations of injurious phytoplankton, clams, etc.
Water Use Modification	Improve irrigation efficiencies; retire agricultural land that causes drainage and other problems; increase artificial ground water recharge; increase waste water reclamation.
Potential Legislation	Set priorities for types of beneficial uses; fund agricultural land retirement where corrective drainage costs are high (similar to buy out of environmentally sensitive lands at Lake Tahoe).

7.1.2 Statewide Water Management

Achievement of reasonable protection for beneficial uses will require better management of California's water resources and equitable sharing of responsibilities to meet water quality objectives in the Bay-Delta Estuary.

All users of Estuary waters must share in the responsibility of meeting objectives to protect Bay-Delta beneficial uses. All users should pursue reclamation and conservation of water to their full feasible potential.

Currently, only certain permits of the CVP and SWP facilities are required to meet Bay-Delta Estuary water quality and flow objectives. (Other users are required to cease diversion when those projects are releasing stored water for Delta Water Quality). These projects represent only about one-half of the almost 30 million acre-feet of storage capacity within the watershed. The State Board will consider an equitable sharing of this responsibility among all users of Bay-Delta Estuary waters during the Scoping and Water Right phases of these proceedings. A first step that the State Board will consider during the Scoping Phase is expansion of the responsibility for maintaining Estuary water quality to all in-basin reservoirs larger than 100,000 acre-feet. This action would add 31 reservoirs to the list of those assigned this responsibility. Almost 90 percent of the water stored in the watershed would then be operated to help maintain Estuary objectives. The extent to which smaller projects will be included will be considered during the Scoping Phase.

7.2 Implementation Measures

7.2.1 General

New measures are limited to a Salt Load Reduction Program and a staged implementation of water quality objectives in the southern Delta.

In regard to the Suisun Marsh, the water quality objectives for Suisun Marsh are unchanged from the 1978 Delta Plan. The implementation vehicle, Water Right Decision 1485 (D-1485), was amended in 1985 to change (or delete) some monitoring stations and to revise the schedule for implementation. The DWR, USBR, DFG, and Suisun Resource Conservation District (SRCD) have signed and adopted a set of three agreements concerning the Suisun Marsh. These are the Suisun Marsh Preservation Agreement (SMPA), the Monitoring Agreement, and the Mitigation Agreement. The SMPA contains water quality standards for the managed marshes of Suisun Marsh which the four signatories would like the State Board to adopt as water quality objectives. The SMPA also describes the physical facilities that the four signatories have agreed would serve the managed marshes in order to maintain production of preferred waterfowl food plants. The facilities built so far, including the Suisun Marsh Salinity Control Gates (previously called the Montezuma Slough Control Structure), have changed the physical regime in the Marsh.

Revised water quality objectives incorporating the SMPA (with any modifications necessitated by the biological assessment) will be adopted by the State Board after the biological assessment (discussed in Section 7.4.2.6) is completed. Until that time, the water quality standards in the amended D-1485 will continue to be implemented; see Table 1-2 for a summary of these standards.

7.2.2 Achieving Objectives for Beneficial Uses

7.2.2.1 Municipal and Industrial Uses

General Requirements

- **There is a need for water from the best available sources to meet the drinking water needs of all Californians. The water supply agencies should advise the State Board during the Scoping Phase on their plans and programs to obtain high quality drinking water through the year 2010.**

  - Within the Delta and in Export Areas

There are no differences between the M&I water quality objectives developed in this Plan and those developed in D-1485. With minor exceptions, these objectives are currently being met. The existing requirements and operations include mechanisms for dealing with violations which occur. Therefore, no new implementation measures are needed. Currently DWR and USBR are responsible for meeting these objectives.

7.2.2.2 Agriculture

o Western and Interior Delta

There are no differences between the objectives for agriculture on the Western and interior Delta developed in this Plan and those developed in D-1485. With minor exceptions these objectives are currently being met.

o Southern Delta

The implementation plan is comprised of two interim stages and a final stage.

Interim Stage 1 -- 500 mg/l mean monthly TDS all year at Vernalis.

Interim Stage 2 -- (to be implemented no later than 1994) 0.7 mmhos/cm EC April 1 to August 31, 1.0 mmhos/cm EC September 1 to March 31, 30-day running average, at Vernalis and Brandt Bridge; with water quality monitored at three current interior stations -- Mossdale, Old River, near Middle River and Tracy Road Bridge, and an additional interior monitoring station on Middle River at Howard Road Bridge.

Final Stage -- (to be implemented no later than 1996) 0.7 mmhos/cm EC April 1 to August 31, 1.0 mmhos/cm EC September 1 to March 31, 30-day running average, at Vernalis and Brandt Bridge on the San Joaquin River; with two interior stations at Old River near Middle River and Old River at Tracy Road Bridge. Monitoring stations will be at Mossdale at head of Old River and Middle River at Howard Road Bridge.

or

If a three-party contract has been implemented among DWR, USBR and the SDWA, that contract will be reviewed prior to implementation of the above and, after also considering the needs of other beneficial uses, revisions will be made to the objectives and compliance/monitoring locations noted above, as appropriate.

o Export Agriculture

The export agriculture EC objective is presently met at virtually all times. The salt load reduction goal discussed here will help to continue achieving this objective.

o Salt Load Reduction Goal

o **Upon adoption of this Plan, the State Board will request the Central Valley Regional Board to develop and adopt a salt-load reduction program. The goal of this initial program will be to reduce annual salt-loads discharged to the San Joaquin River by at least 10 percent and to adjust the timing of salt discharges from low flow to high flow periods. During the Water Right Phase of these proceedings, the Regional Board should discuss how it intends to implement this program (for example, drainage operation plans and best management practices).**

The goal of this program shall be to reduce the salt load discharged to the San Joaquin River by at least 10 percent. This amount should be achieved by increasing the irrigation efficiency on the west side of the San Joaquin River Basin to a target level of 73 percent with a five percent leaching fraction as recommended by the Agricultural Water Conservation Workgroup. This should reduce the annual subsurface drainage from tile drained portions of the west side by about 40 percent as envisioned by the State Board's Technical Committee and the San Joaquin Valley Drainage Program (see EDF,11,V-13-20 and San Joaquin Valley Drainage Program, 1990). Since about 25 percent of the annual San Joaquin River salt load is from west side subsurface drainage, this drainage reduction amounts to a 10 percent reduction in annual San Joaquin River salt load (0.40 x 0.25 = 0.10) based on State Board staff modeling results (see EDF,11,Appendix C). Annual salt loads could be further decreased by reducing and recycling tailwater discharges to the San Joaquin River from the west side.

In addition to annual reduction in salt load, it would also be possible to adjust the timing of salt load discharge from the west side of the San Joaquin River Basin through storage of drainage flows (see Pickett and Kratzer, 1988). The need for dilution flows from the east side of the San Joaquin River Basin to meet seasonal water quality standards in the southern Delta would be reduced.

The salt load reduction policy, which would help to protect beneficial uses in the southern Delta, should be achieved through development of best management practices and waste discharge requirements for non-point source dischargers. The Central Valley Regional Board should present the policy to the State Board no later than the Water Right Phase of the proceedings. If adequate progress is not being made, the State Board will proceed under its authorities.

7.2.2.3 Chinook Salmon

The temperature objectives at Freeport on the Sacramento River and at Vernalis on the San Joaquin River are to be implemented through controllable factors (see Section 5.5.2.5). Methods of implementation will be discussed during the Scoping Phase.

7.2.2.4 Striped Bass

The striped bass spawning protection objectives set specific EC requirements at Antioch and Prisoners Point. These objectives will be implemented by flows, primarily by Sacramento River flows in most years. Responsibility for meeting these requirements by specific water rights holders will be determined in the Scoping and Water Rights phases.

7.2.2.5 Other Fish and Wildlife

No implementation measures are needed currently, since there are insufficient data to set water quality objectives for this beneficial use. Additional data are requested to help determine if objectives are needed.

7.2.2.6 Suisun Marsh

The implementation schedule for the Suisun Marsh objectives is the schedule in D-1485, as amended in 1985 (see Table 1-2). Once the biological assessment described in Section 7.4.2.6 is completed, the implementation schedule will be reviewed and, if necessary, revised.

7.3 Compliance Monitoring

7.3.1 General

The goals of the compliance monitoring program are to (1) ensure compliance with the water quality objectives contained in this Plan; and (2) identify meaningful changes in any significant water quality parameters potentially affecting the designated beneficial uses. In the main, the compliance monitoring stations in Table 7-1 are the same, or only slightly relocated, stations as in the original D-1485 adopted in 1978. The only differences are in Suisun Marsh and south Delta agriculture. The Suisun Marsh control stations have been changed to those in the 1985 amendment to D-1485. Some compliance monitoring stations have been added in the south Delta (see Table 7-1 for details). Any additional monitoring not required by D-1485 will have to be adopted in future actions by the Board.

- Operate and maintain continuous electrical conductivity recorders at the stations indicated in Table 7-1 to report representative water quality conditions.

- Conduct water quality profiles in the main navigation channels in South Bay and between the Golden Gate Bridge on the west and Stockton and Rio Vista on the east, using a boat-mounted continuous recorder for the following parameters: water temperature, electrical conductivity, pH, dissolved oxygen, turbidity, and *in vivo* chlorophyll.

- Establish continuous recorders at representative stations in selected channel sections of the Bay-Delta Estuary to collect information on air and water temperature, wind velocity and direction, pH, dissolved oxygen, turbidity, and, where feasible, *in vivo* chlorophyll. These data should be evaluated and correlated with conditions as they exist in the adjacent main channels.

- Conduct ongoing and future monitoring surveys recommended by DFG and concurred with by the State Board, concerning food chain relationships and fish and wildlife impacts as they are affected by implementation of this Plan. The responsibility for funding and performing these surveys and preparing a report will be addressed and assessed during the Scoping and Water Right Phases of the proceedings.

The results of the above monitoring should be provided to the State Board and other interested agencies upon request. Detailed annual reports summarizing the previous water year's findings and detailing future study plans shall be submitted to the State Board by April 1 of each year. This report will not be required until after the Water Right Phase.

TABLE 7-1
BAY-DELTA ESTUARY WATER QUALITY MONITORING PROGRAM [1]

	Station Location	E.C. *	Base* Param. [2]	Phyto.* [3]	Phos.,TDS* & Cl [4]	H.M/Pest [5] *	Benthos [6]
C2	Sacramento River @ Collinsville	C					
C3	Sacramento River @ Greens Landing	C	SM/M	SM/M	M	SA	SA
C4	San Joaquin River @ San Andreas Landing	C					
C5	Contra Costa Canal @ PP#1	C [7]					
C6	San Joaquin River @ Brandt Bridge (site)	C					
C7	San Joaquin River @ Mossdale	C	SM/M	SM/M	M	SA	SA
C8	Old River near Middle River	C					
C9	West Canal @ mouth/intake to Clifton Ct. Forebay	C [7]	SM/M	SM/M	M		
C10	San Joaquin River near Vernalis	C/TEMP	SM/M		M		
C13	Mokelumne River @ Terminous	C					
C19	Cache Slough @ City of Vallejo Intake	C [7]					
NBA	North Bay Aqueduct Intake @ Barker Slough	C [7]					
D4	Sacramento River above Point Sacramento		SM/M	SM/M	M	SA	SA
D6	Suisun Bay at Bulls Head Point nr. Martinez		SM/M		M	SA	SA
D7	Grizzly Bay @ Dolphin nr. Suisun Slough		SM/M	SM/M	M		SA
D8	Suisun Bay off Middle Point nr. Nichols		SM/M	SM/M	M		
D9	Honker Bay near Wheeler Point		SM/M	SM/M	M	SA	SA
D10	Sacramento River @ Chipps Island	C/FLOW	SM/M		M		
D11	Sherman Lake near Antioch		SM/M		M	SA	SA
D12	San Joaquin River @ Antioch Ship Canal		SM/M	SM/M	M	SA	
D12N	San Joaquin River @ Antioch Water Works	C [7]					
D14A	Big Break near Oakley		SM/M		M	SA	SA
D15	San Joaquin River @ Jersey Point	C	SM/M	SM/M	M		
D16	San Joaquin River @ Twitchell Isl.		SM/M		M		
D19	Franks Tract near Russo's Landing		SM/M		M	SA	SA
D22	Sacramento River @ Emmaton	C	SM/M		M		
D24	Sacramento River below Rio Vista Bridge	FLOW	SM/M	SM/M	M		
-	Sacramento River @ Freeport (RSAC155)	TEMP					
D26	San Joaquin River @ Potato Point		SM/M	SM/M	M		
D28A	Old River near Rancho Del Rio	C	SM/M		M	SA	SA
D29	San Joaquin River @ Prisoners Point	C					
D42	San Pablo Bay near Rodeo		SM/M	SM/M	M		
DMC1	Delta Mendota Canal	C [7]					
MD6	Sycamore Slough near Mouth		SM/M		M		SA
MD7	South Fork Mokelumne River below Sycamore Sl.		SM/M	SM/M	M		SA
MD10	Disappointment Slough @ Bishop Cut Turner Cut @		SM/M	SM/M	M		
-	Light 26 (RSAN050)	C					
-	San Joaquin River @ mouth of Fourteen-mile Slough (RSAN052)	C	SM/M				
P8	San Joaquin River 1.5 Km NW of Rough & Ready Island @ Light 40 (Buckley Cove) (RSAN056)	C	SM/M	SM/M	M	SA	SA
-	San Joaquin River @ Country Club Landing @ Light 43 (RSAN059)	C	SM/M				
-	San Joaquin River @ Rough & Ready Island (RSAN062)	C	SM/M				
-	San Joaquin River between Turner Cut & Stockton (RSAN050 - RSAN061)	D.O. cont.					

TABLE 7-1 (cont.)
BAY-DELTA ESTUARY WATER QUALITY MONITORING PROGRAM [1]

	Station Location	E.C. *	Base* Param. [2]	Phyto.* [3]	Phos.,TDS* & Cl [4]	H.M/Pest [5] *	Benthos [6]
P10	Middle River @ Borden Highway	C/G.H.	SM/M		M		
P11	Middle River @ Howard Road Bridge	C/G.H.					
P12	Old River @ Tracy Road Bridge	C	SM/M		M		
S21	Chadbourne Slough @ Chadbourne Road	C/G.H.					
S33	Cordelia Slough, 550 ft. west of Southern Pacific crossing at Cygnus	C/G.H.					
S35	Goodyear Slough at Morrow Island Clubhouse	C/G.H.					
S36	Suisun Slough near Mouth	C/G.H.					
S42	Suisun Slough 300 ft. south of Volanti Slough	C/G.H.	SM/M	SM/M	M		
S49	Montezuma Slough near Beldon's Landing	C/G.H.					
S54	Montezuma Slough @ Hunter's Cut	C/G.H.					
S64	Montezuma Slough @ National Steel	C/G.H.					
S75	Goodyear Slough 1.3 mi. south of Morrow Island [Drainage] Ditch @ Pierce	C/G.H.					
S97	Cordelia Slough @ Cordelia-Goodyear Ditch (proposed)	C/G.H.					
-	Water supply intake locations on Van Sickle Island and Chipps Island	C/G.H.					

* Column Abbreviation Key

E.C. – Electrical Conductivity

B.P. – Base Parameters

Phyto.– Phytoplankton

Phos. TDS & Cl– – Phosphorous, Total Dissolved Solids, and Chlorides

H.M/Pest.– Heavy Metals , Pesticides

C – Continuous

SM – Semi-Monthly (twice a month)

M – Monthly

SA – Semi-annually (spring and fall)

G.H. – Gage Height

[1] The compliance monitoring needed for this plan or Decision 1485 are shaded.

[2] Air and water temperature, electrical conductivity, pH, dissolved oxygen, turbidity, water depth to 1% light intensity, secchi disc depth, volatile and non-volatile suspended solids, nitrate,nitrite, ammonia, total organic nitrogen, chlorophyll a, silica.

[3] Enumeration and identification to the species level where possible.

[4] Orthophosphate and total phosphorus.

[5] Heavy metals – arsenic, cadmium, chromiun (all valences), copper, iron, lead, manganese, mercury, zinc.

Pesticides – chlorinated hydrocarbones to include: Aldrin, Altrazine, BHC, Chlodane, Dacthal, DDD, DDE, DDT, Dieldrin, Endrin, Endosulfan, Heptachlor, Kelthane, Lindane, Methoxychlor, Simazine, Toxaphene, PCB.

Sampling to take place in water column and bottom sediments. Sediment samples are to be taken in transects across the channel.

[6] Benthic samples are to include identification and enumeration to the lowest taxonomic level possible. Samples to be taken in transects across the channel. Continuation of this aspect of the monitoring program will be reevaluated annually.

[7] Municipal and industrial intake objectives are specified in chlorides. EC can be monitored and converted to chlorides.

7.3.2 Compliance Monitoring for Specific Beneficial Uses

7.3.2.1 Municipal and Industrial

Barker Slough, the diversion point for the recently completed North Bay Aqueduct, is monitored and additional monitoring requirements are needed. The Cache Slough Intake, the previous location of the diversion point for the Vallejo M & I water supply, will be used only on a limited and irregular basis. Therefore, monitoring need only be done at the Cache Slough Intake when diversions occur.

7.3.2.2 Agriculture

See Table 7-1 for appropriate monitoring requirements.

7.3.2.3 Salmon

Monitoring of temperature to verify achievement of the proposed objective would require recording and reporting daily temperatures at Freeport on the Sacramento River and Vernalis on the San Joaquin River. This requirement should be carried out by USGS until other responsible parties are identified.

The temperature data collected are to be submitted to the State Board, which will then make a determination whether controllable factors should be controlled.

DO levels in the lower San Joaquin River have been monitored by DWR between Turner Cut and Stockton since at least 1969. DWR should continue the monitoring for the protection of Chinook salmon in the lower San Joaquin River.

7.3.2.4 Striped Bass

Compliance with the Antioch objective is presently documented by continuous monitoring of EC at Antioch, as well as by grab samples taken as part of the DWR compliance monitoring program. Prisoners Point does not have a continuous monitor in place since D-1485 does not require one. Apparently, no monitoring was required at Prisoners Point because the objective was in effect for such a short time period each year. Some monitoring has been accomplished by the taking of occasional grab samples at Prisoners Point, and by extrapolation from observations taken at a monitoring location in Potato Slough. These data have indicated that ECs at Prisoners Point have apparently not exceeded the current objective of 0.55 mmhos/cm EC for the period April 1 to May 5. Given the proposed lowered EC objective in the present Plan and the extended period of protection, continuous monitoring should be instituted at Prisoners Point (see also discussion in Special Studies, 7.4).

7.3.2.5 Other Fish and Wildlife

o Benthos

For the present time, the 1978 Delta Plan benthic monitoring program will continue unchanged, pending any changes resulting from input received during the Scoping and Water Right phases.

7.3.2.6 Suisun Marsh

See Table 7-1 for appropriate monitoring requirements.

7.4 Special Studies and Reviews

o **Past studies of the estuarine habitat have been extensive. Relatively few have led to specifically quantify the lower levels of conditions that protect the beneficial uses. The studies discussed below should lead to actions that can be implemented to protect these uses more effectively.**

7.4.1 General

The purpose of special studies is to develop a better understanding of the hydrology, hydrodynamics, water quality, water use, and significant ecological interactions of the Bay-Delta Estuary and its watershed and export areas. The activities necessary to accomplish this goal include performing special studies and developing and enhancing physical, chemical, and biological predictive tools. This information will be necessary for future revisions of this Plan and for use in the Scoping and Water Right phases of the proceedings.

7.4.2 Special Studies for Beneficial Uses

7.4.2.1 Municipal and Industrial Uses

o **Additional information is required to assess adequately the impact of Delta agricultural drains on THM formation. There is a need to conduct appropriate, comprehensive monitoring of agricultural discharges. The Central Valley Regional Board shall require the development and implementation of best management practices or other means to appropriately control these discharges. This task should begin in the Rock Slough area.**

o An Interagency Program led by DWR has been formed to continue the work conducted by the Delta Health Effects Study and the Delta M&I Workgroup. The primary task of the new workgroup is to investigate conditions that adversely affect drinking water. The State Board requests this workgroup to design and implement a comprehensive THMFP monitoring program for the Delta by June 1991, and to present annual progress reports to the State Board commencing in January 1992.

The primary tasks of the new workgroup should be to:

1) Continue the studies conducted by DWR to assess completely the impact of agricultural drain discharges affecting the Delta with relation to THMFP. Agricultural drains located near municipal water supply intakes which are suspected of causing significant effects on drinking water quality should be given priority. The State and Regional Boards shall employ appropriate measures to ensure monitoring can be conducted. Design and implement a comprehensive THMFP monitoring program for the Delta by July 1991. This program should be designed around the Municipal Water Quality Investigation. Results and recommended actions should be completed no later than January 1, 1993.

2) Encourage continued research on various techniques of disinfection which may reduce or eliminate the production of hazardous DBPs. Research should focus on promising techniques such as PREOZONATION and ozonation/chlorination/ammoniation. Progress of research and recommended actions should be reported by January 1, 1992.

3) Develop a correlation between THMFP, as measured by the monitoring program, and THM concentrations in treated drinking water.

7.4.2.2 Agriculture

o Western and Interior Delta

o **The Corn Study provides important information on the sensitivity of corn. A leaching study was recently begun to evaluate its effectiveness, practicality, and costs. This information is needed before a new objective can be set to protect the western and interior Delta agriculture. This study should be completed and the results submitted during the Water Right Phase of the proceedings.**

o Southern Delta Agriculture

The information presented in Phase I and in the Southern Delta Agriculture Subworkgroup has shown that more information is needed to resolve differences. A study in the following areas is needed:

- crop requirements during germination and the early stage of growth,

- potential leaching fractions,

- effectiveness of rainfall in reducing leaching requirement,

- timing of the objective, and

- response of crops other than beans and alfalfa.

This proposed study should be jointly-funded by the beneficiaries, performed by the University of California Cooperative Extension and completed in time to be used in the next Triennial Review.

7.4.2.3 Salmon

The Five Agency Salmon Committee (composed of DFG, DWR, USBR, USFWS, and NMFS) will continue to pursue studies which identify the critical factors influencing smolt survival. In the short-term, studies will probably be designed to investigate the influence of temperature, especially in the San Joaquin River, on smolt survival. The effect of temperature will be analyzed in relation to various release sites, diversion curtailments, export levels, reverse flows, total outflow levels, migratory routes, Bay survival, etc. The State Board recommends that the Committee work with agricultural representatives to study whether agricultural methods can be modified to minimize increasing the temperature of the receiving water in the Sacramento and San Joaquin River waters during April through June.

SWC recommended that a salmon and striped bass punchcard management system be implemented by DFG to assist them in more accurately assessing the total annual catch of salmon and striped bass in the inland sport fishery. Such a program could be useful as well for the ocean sport fishery.

Water quality parameters, such as temperature and dissolved oxygen, have been discussed in terms of the fall-run Chinook salmon. Winter-run may also be adversely affected by these parameters. There is no evidence of a winter-run in the San Joaquin River system; however, the winter-run of Sacramento River (and possibly Calaveras River) origin may be drawn into the central and south Delta during the up-or downstream migrations. Therefore, two things need to be investigated: 1) when and where do the winter-run migrate through the Delta, and 2) what are the ranges of temperatures and dissolved oxygen in those areas during those times. The Five Agency Salmon Management Committee should investigate the particular methods possible to better define the critical pathways and times of occurrence of winter-run in the Delta. As stated in Chapter 5.5.2.3 in the Bay-Delta DFG differentiates winter-run salmon from fall-run salmon by size difference. We recommend that DFG continue its effort to find a better method of differentiation.

Salmon Smolt Survival in the Delta

There is a great variety of potential studies that would improve our understanding of salmon smolt survival in the Sacramento-San Joaquin Delta. Some of these have been implemented and will be continued. The studies listed below (Kjelson et al., 1990) are not necessarily listed by priority and should be considered by the Five Agency Committee for implementation.

All appropriate studies will be considered; the list of studies is not meant to be exclusive.

- Evaluate the survival of smolts under a wide range of inflow/export ratios with particular emphasis to ratios between 1.0 and 5.0 when inflow is greater than about 5000 cfs.

- Document the proportion of smolts that are diverted into upper Old River under varied flows, export rates and tidal conditions.

- Measure survival of fish released above the upper Old River diversion point (i.e., Vernalis or Mossdale) to compare with survival data from past releases in upper Old River and in the San Joaquin River at Dos Reis Park.

- Evaluate survival of smolts, tagged with coded wires and released in the lower Mokelumne River, at Jersey Point, Dos Reis Park, and lower Old River at varied export and inflow levels.

- Evaluate the effect of high cross Delta flow on smolt survival migrating out of the San Joaquin River as would characterize conditions with DWR's Delta alternative projects. A barrier in upper Old River with high exports would yield such conditions.

- Evaluate the relative proportion of smolts entering the intakes to Clifton Court Forebay and the CVP's Tracy Facility.

- Evaluate direct and indirect mortality in the Delta using multiple release locations in varied channels and control release sites at the intakes to Clifton Court Forebay and the Tracy Facility.

- Evaluate the louver efficiencies and general effectiveness of the Tracy Fish Facility.

- Evaluate smolt survival in the San Joaquin Delta at varied temperatures (60° to 70°F).

- Evaluate the difference in survival of smolts that are restricted to salvage at the Tracy Facilities to those that are vulnerable to both Clifton Court and the CVP intakes.

- Evaluate the effectiveness of pulse flows of different timing, magnitude and duration in the Sacramento and San Joaquin rivers.

The studies already implemented are evaluated on an annual basis and are compared among years. Study designs are evaluated and improved each year prior to the fall-run Chinook salmon smolt emigration period. Any modification of water quality objectives should be based on the results of the annual studies compiled to date.

7.4.2.4 Striped Bass

o **Continuous EC and temperature monitoring equipment should be installed at various locations in the San Joaquin River between Antioch and Vernalis to obtain data on salinity conditions for striped bass spawning.**

The Interagency Ecological Study Program and others need to study:

1. EC and the effects of different salinities on striped bass and their habitat between Antioch and Prisoners Point;

2. Water quality effects of salinity and temperature on eggs and larval development, particularly in the San Joaquin River;

3. The annual die-off of striped bass to determine if it is due to water quality factors;

4. The effects of agricultural return flows on striped bass;

5. The actual patterns of spawning periodicity, locations, water quality conditions, and fate of eggs and young; and

6. The impact of introduced exotic organisms, e.g., Potamocorbula amurensis, and other factors on striped bass food chains.

These studies could provide data which are critical to our understanding of the effects of water quality on striped bass migration and spawning success.

7.4.2.5 Other Fish and Wildlife Studies

o American Shad

The DFG data on American shad suggest a pattern of relationships between upstream migration into tributary streams for spawning and subsequent early rearing of young. The role of the Delta and Suisun Bay areas as spawning and nursery habitat is not clearly presented in terms which can be quantified to establish water quality objectives, flow requirements or operational constraints. Substantial additional information is required before the State Board can implement either water quality objectives or water right permit terms and conditions for the protection of this fishery in the Estuary. Participants should plan to present information and any demonstrations that specific objectives are needed at the next Trienniel Review.

o Delta Smelt

In 1991, DFG should analyze existing data on environmental conditions, including reverse flows, affecting Delta smelt growth, survival, reproductive success and spatial distribution; this information should be ready for submittal to the State Board during the Scoping Phase.

The feasibility of a mark and recapture study or other study to better document seasonal movements and habitat preferences of Delta smelt in its various life stages should be investigated by DFG. Such a study would require a few years of sampling to document trends, and should be completed and analyzed by the Trienniel Review of the Plan.

Historical SWP and CVP data on Delta smelt salvage has not been very reliable. DFG is confident that, currently, quality control is sufficient for the enumeration of trends in species composition. DFG will be assuming responsibility for enumerating fish at the SWP facility this next year. Improvements in procedures will be made in future. Salvage data on Delta smelt from both facilities, including sampling methods, should be submitted during the forthcoming proceedings.

o Benthos

Benthic communities in various parts of the Estuary must be viewed in terms of their role in the overall Estuary. Their relative value, particularly in terms of balancing the needs of various beneficial uses, is difficult to determine when compared to striped bass, agricultural crops or other beneficial uses which can be more readily measured and compared. Parties should be prepared to discuss ways to answer these questions in terms of the overall functioning of the Estuary, as well as the specific reactions of individual species or groups of species (such as bay shrimp) to changing salinity, flow, and other conditions. Parties should plan to present these discussions during the Scoping and Water Right Phases.

7.4.2.6 Marshes around Suisun Bay

A. Biological Assessment

o **A new comprehensive Biological Assessment is being conducted concerning the rare, threatened and endangered species (and their habitat) of the managed and unmanaged wetlands around Suisun Bay.**

The information needed for the Biological Assessment under CESA includes:

1. A full description of the Sacramento-San Joaquin Delta/San Francisco Bay region, with an explanation of the area affected by any proposed changes in the water quality objectives, plus maps.

2. The known and potential distribution of rare, threatened, and endangered species in the region and affected area based on recent field surveys. In addition, the State Board needs information about any federal candidate species and any species of special concern to DFG in order to discuss fully possible impacts on those species as required under CEQA.

3. Any additional information on species distribution and habitat requirements from the literature, scientific data review, and discussion with experts.

4. Analysis of the possible effects of the proposed water quality objectives on these listed species, including any cumulative effects.

5. An analysis of alternatives designed to reduce or eliminate adverse effects to listed species.

For Item 1, the State Board has sufficient information to describe the Bay-Delta region. The State Board is as yet unable to delineate in any clear way the actual area where the water quality objectives could result in detectable changes in water quality. Adoption of the SMPA water quality objectives for the Suisun Marsh and Bay would, according to DWR, result in higher salinities in Grizzly and Honker bays, but the full extent of the affected area is not clear (DWR,511,11-18,27,60). Salinity modeling studies are needed to allow the State Board to predict the effects of these objectives better.

For items 2 and 3, the State Board has information for some of the listed species, but in some cases it is neither recent nor geographically comprehensive. Most of the information has been collected or noted during work done for other purposes, and is thus spotty both in time and geography. Where information is missing, additional studies will be needed. Compilation of information from the literature as well as from unpublished data sources can be done in parallel with field work. Additional laboratory studies determining the salinity requirements of some of the rare plants may be needed.

For item 4, once a sufficiently accurate salinity model is operable and the environmental requirements of the various species are known, this analysis can proceed. The relative effects of alternatives on other beneficial uses can then be estimated and a final set of objectives chosen.

DWR has volunteered to conduct the biological assessment to evaluate the impacts of adopting the SMPA standards as water quality objectives. The State Board will need an acceptable biological assessment on or before April 1, 1996, allowing review of the results of the assessment as part of its regular triennial review.

B. Studies

- **Studies are needed to determine the relationship between channel water salinity and soil water salinity in the tidal wetlands around Suisun Bay.**

These studies should include at least:

1) A regular monitoring program for the managed areas of one or more of the channel islands (Roe, Ryer, Snag, and Freeman islands) including a) the EC of the applied water, the EC of water in the root zone, and the seed production per acre at two or more sites; and b) continuous EC measurements of the applied water and monthly measurements of the soil water from October through June (the results should be reported as mean monthly EC of applied water, monthly EC of soil water, and annual seed production per acre).

2) A regular monitoring program for the unmanaged tidal wetlands within the legally-defined Suisun Marsh including: at least one site on either Joice or Grizzly Island near the mouth of Montezuma Slough, a site north of Cutoff Slough, a site on one or more of the channel islands or on the shore of Simmons Island facing the channel islands, and a site on Van Sickle or Wheeler Island facing Honker Bay. This

distribution of sites should give the State Board sufficient information to determine the effects of the water quality objectives and to estimate the effects of any changes that may be proposed or needed in the future.

3) The interagency programs, including the Suisun Marsh Fish Monitoring Program, and the Neomysis/Zooplankton Survey, are on-going; coordination of these activities should provide the State Board with the information necessary to monitor the effects of the water quality objectives.

7.4.3 Other Special Studies and Reviews

7.4.3.1 Aquatic Habitat Status Report

Although many individual studies on various aspects or species have been conducted over the years, an integrated picture of the overall condition or "health" of the Estuary has not been produced. Such an overall condition or status report is needed to provide a context for past, present and future conditions in the Delta. The data are sufficient in many areas to provide at least an overall view of recent (last 20 to 25 years) changes and current status. Such a status report would provide an overall context in which to view proposals for new projects, physical structures and operational changes, and for the impacts of newly introduced species, etc. Future sampling and monitoring programs should be designed and executed with a view to integrating the results obtained into a comprehensive overview.

Parties should discuss during the Scoping Phase the feasibility of preparing such a report, the responsibilities and plans for developing it and means to update and revise this status report on a regular basis. Parties should consider the idea of an annual oral summary review and presentation to the State Board as one way to communicate and update this status report, combined with appropriate documentation and timely data analysis.

7.4.3.2 Modeling Needs

A. Current Modeling

- **The three-dimensional model currently being developed by USGS for evaluating hydraulic and biological processes in the various embayments of the San Francisco Bay should be finalized.**

- **An Interagency Modeling Development and Use Committee should be formed to:**

  - **facilitate exchange of modeling information and to reduce duplication,**

  - **improve access of information to all interested parties**

  - **simulate operations of major reservoirs in addition to the CVP and SWP,**

  - **consider effects of antecedent conditions,**

- **improve temperature modeling for the Sacramento and San Joaquin River basins,**

- **improve Delta channel depletion estimates in DAYFLOW,**

- **improve both water quality and flow modeling for the San Joaquin River Basin,**

- **update hydrology to reflect current land use and groundwater/surface water interactions.**

To facilitate the exchange of modeling information and to reduce the duplication of modeling work, some members of the modeling community have suggested that an Interagency Modeling Development and Use Committee should be formed. As envisioned, this committee would meet periodically to perform the following tasks:

o Work cooperatively to develop and improve computer models and data bases;

o Train new model users on the proper use of existing and new computer models;

o Inform others on the advances in computer technology, including geographic information systems (GIS); and

o Review various study modeling assumptions, and assure that when assumptions are varied they are clearly documented when reporting model outputs.

DWR, USBR, CCWD, the State Board and other participants of the Operation Studies Workgroup are already working together to improve the operation studies model, DWRSIM. DWRSIM, which simulates the operation of the CVP and SWP reservoirs and conveyance facilities, is being revised by incorporating the following:

o Flow/salinity relationships that consider antecedent (preceding) conditions.

o A new up-to-date hydrology, which is the result of more recent land use information.

o The new Central Valley Ground Water Simulation Model, which significantly improves the estimates of ground and surface water interaction.

The Board encourages DWR to link DWRSIM with major M&I operations models such as those in the Los Angeles, San Diego, Sacramento and San Francisco Bay areas.

The Board believes that models would be improved by incorporating field data from the following types of studies:

- o Water quality profiles in the main navigation channels in South Bay and between the Golden Gate Bridge on the west and Stockton and Rio Vista on the east, by the use of a boat-mounted continuous recorder for the following parameters: water temperature, electrical conductivity, pH, dissolved oxygen, turbidity, and in vivo chlorophyll;

- o Better description of Delta hydrology, including inflow and outflow measurements, amount of in-Delta diversions, and channel velocities; and

- o Water quality, tidal height, water temperature, turbidity, meteorological and other data throughout the Estuary.

B. State Board Modeling Capability

- o **The Board recognizes the need to develop its own modeling capability which will assist in the consideration of appropriate water transfers, new water rights, review of existing water rights and future alterations of Delta water quality and flow requirements.**

To further improve the modeling capability of the water community, the State Board is conducting a management study to determine the feasibility of enhancing the State Board's modeling capability. The purpose of this enhancement would be to ensure that the State Board (and others) have adequate resources to evaluate the water supply, environmental, and economic impacts of future water quality objectives, flow standards, or facility proposals. The possible modeling enhancement study approaches include, but are not limited to: (1) no-action, (2) more reliance on other state and federal water agencies, (3) more reliance on private consulting firms, and (4) enhancement of the State Board's "in-house" modeling capability. In addition, the management study will address the need for enhancement of water right and water resources databases that will be needed for modeling purposes.

C. Fishery Models

The following fishery models, in addition to any others that may be proposed, may be considered, as appropriate, in the impact analysis:

- o Abundance and Survival of Delta Smolts in the Sacramento-San Joaquin Estuary by the USFWS.

The USFWS (since 1978) has annually conducted research on the survival and abundance of Chinook smolts and fry as they migrate down the Sacramento through the Estuary. The research has led to the development of several different models, including: annual index of abundance of fall-run smolts; smolt survival based on adults returns 2-1/2 years later; and smolt survival index using flow, temperature, percent diverted at Walnut Grove, export rates and migration route variables. A San Joaquin River smolt survival index is being developed based on different release sites, various levels of inflow from the San Joaquin River, SWP and CVP export rates and ocean recoveries of adults.

o Chinook Salmon Population Model for the Sacramento River Basin by BioSystems Analysis, Inc.

This model estimates the abundance of fall-run Chinook salmon under a given set of flow and temperature conditions, mortality parameters, and assumptions about harvest in the ocean and river fisheries for the Sacramento River Basin. At present it serves as an indicator of the population trends as it has not yet been calibrated. Another version is presently being developed for winter-run Chinook salmon.

o Draft San Joaquin River System Chinook Salmon Population Model by EA Engineering, Science and Technology.

This is mechanistic simulation model representing the principle factors influencing the abundance and production of fall-run Chinook salmon in the San Joaquin River Basin.

7.5 Scoping and Water Right Issues

o **Only a few parties are currently responsible for meeting water quality and flow requirements and for compliance monitoring activities within the Delta. The Board requests that information be developed on how these burdens of meeting the objectives should be distributed over more water right holders and waste dischargers. This information will be considered and used by the State Board during the Scoping and Water Right phases of the proceedings.**

o **For the development of alternatives to existing points of diversion and for the coordination of preparedness planning by other agencies, information should be presented during the Scoping Phase on the impact of flood control measures, levee conditions, dredging, channel deepening, barriers and seismic activities.**

7.5.1 General

In addition to implementation issues related to water quality objectives in this Plan, other issues, as illustrated in Chapter 7.1.1, will be considered in the Scoping and Water Rights phases. To facilitate preparation for those phases, expected issues are summarized below. The list includes matters which have been discussed specifically in earlier sections.

7.5.2 Summary of Beneficial Use Issues

7.5.2.1 Municipal and Industrial Uses

- Retention of the 150 mg/l chloride objective for industry,

- Within the Delta Export water quality to enhance reclamation,

- Relative advantages and disadvantages of maintaining high water levels in SWP terminal reservoirs.

7.5.2.2 Agriculture

o Western and Interior Delta

- Consideration of objectives for crops other than corn

- Cost and feasibility of leaching

o Southern Delta Agriculture

A request by SDWA that "[w]ater quality required at the inflow points would be specified as a function of net daily inflow rate and of channel depletion by months for the channel reaches receiving water from each inflow point."; and that "[t]he required net daily inflow rates at each inflow point would be in accordance with a monthly schedule sufficient to maintain the required unidirectional net flow in each channel reach" (SDWA,116,2).

7.5.2.3 Salmon

- Flow needs of migrating salmon

- Use, timing and quantity of water for pulse flows

- Appropriate use of hatcheries to supplement natural production

7.5.2.4 Striped Bass

Agreements and information on the following issues will be helpful for developing an appropriate environmental impact report.

o **The direct entrainment losses of striped bass and other fish at the major diversions in the Delta are well documented. The Bureau of Reclamation and the Contra Costa Water District should each negotiate a fishery agreement with the Department of Fish and Game that would provide for mitigation of the direct entrainment losses at the Tracy Pumping Plant and Contra Costa Pumping Plant No. 1. These agreements should be completed prior to the conclusion of the Water Right Phase. Direct entrainment losses at Delta agricultural diversions are not well documented. The parties should evaluate such losses and identify corrective measures.**

o **A real-time monitoring program should be developed and used to assess the daily densities of striped bass eggs and larvae in the Sacramento River during the spring and initiate periodic closure of the Delta Cross Channel to reduce diversion of striped bass into interior Delta channels. Closure of the Delta Cross Channel should be coordinated with short duration pulsed flows in the Sacramento River, in combination with short-term reductions in export pumping and reduced reverse flows, to transport striped bass eggs and larvae into the Suisun Bay.**

- There is the need to initiate a detailed investigation and evaluation of alternative sites for establishing facilities for rearing juvenile striped bass salvaged from the SWP and CVP facilities for subsequent release to the Bay-Delta system.

- A detailed review and evaluation of alternative recreational angler harvest management options including, but not limited to, specific area and seasonal closures, alternative size limits including initiation of a slot limit, and restrictions on fishing gear such as use of single barbless hooks should be conducted. In addition, the impacts of poaching on the striped bass population should be evaluated, funding sources for expanded enforcement should be sought, and the unrestricted sale of striped bass in California should be eliminated. Temporary changes in fishery harvest regulations should be considered as part of an overall short-term approach to improve the situation until longer-term measures may be instituted. The Board does not believe such measures should substitute for its own responsibilities to provide suitable habitat.

- Additional water project operation tests should be conducted in the Delta to better determine the effects of diverting water from and upstream of the Delta on striped bass.

To make certain that the State Board develops water quality objectives that are based on sound scientific data, and which are appropriately protective of striped bass spawning habitat, we request DFG to analyze the protective values of setting up a specific spawning habitat zone of 0.44 mmhos/cm EC, or some other more appropriate EC value, in the river reach between Jersey Point and Prisoners Point. Analysis of historical springtime EC data indicates that 0.44 mmhos/cm EC at Jersey Point would apparently maintain an EC at Antioch of just about 1.5 mmhos/cm, which DFG would like to retain. DFG should also analyze the possibility and the effects of relating a relaxation provision to declared deficiencies. Specifically, DFG should be prepared to discuss the effects of reducing the spawning habitat by moving the downstream end of the spawning habitat reach upstream from Jersey Point a distance proportional to the percent reduction in delivery of firm supplies, along the lines proposed in the table below. In the remaining reach, the 14-day running average of the mean daily EC would be no more than 0.44 mmhos/cm EC for the period April 1 to May 31, or until spawning has ended.

Percent Delivery Reduction	Percent River Reach Reduced
0	0
1-10	10
11-20	20
21-30	30
31-40	40
>40	40

Deficiencies are defined as deficiencies in firm supplies declared by a set of water projects representative of the Sacramento River and San Joaquin River watersheds. The specific projects and amounts of deficiencies would be defined in subsequent phases of these proceedings.

DWR should be prepared to discuss the potential effects, i.e., water costs, that would result if the State Board were to adopt water quality objectives as outlined above. The Board would like to hear from USBR, USFWS and any other interested parties on this subject at the next Triennial Review.

7.5.2.5 Other Fish and Wildlife Issues

o Marine Habitat

Issues concerning marine habitat center on the effects of Bay outflow rather than salinity, and so will be considered in the Scoping and Water Right phases.

o Navigation

Effects on beneficial uses of deepening the Sacramento Deep Water Ship Channel

o Export Recreation and Export Fishery Habitat

In the Scoping Phase, participants should be prepared to discuss the effects of more variable levels and flows on fishery habitat, especially as related to temperature stress, turbidity, algal growth, dissolved oxygen depressions and other water quality considerations.

Documentation is required of the types and extent of water-associated recreational activities, particularly in terms of present usage of both reservoir activities and flowing-stream activities (fly-fishing, rafting, kayaking, etc.). In addition, estimates are needed of the potential impacts of changes in operations on recreational activities, or on storage levels of reservoirs both upstream and in the export areas. Participants should be prepared to discuss these topics in at least qualitative terms during the Scoping Phase, and have quantitative data available by the Water Right Phase. With the type of information addressed above, the State Board will be better able to develop a balanced water management program.

o Estuary Recreation

The information presented during Phase I was based upon data gathered over ten years ago. Current surveys of recreational uses of facilities within the Estuary are needed. Appropriate agencies should provide current data.

7.5.2.6 Marshes around Suisun Bay

A biological assessment will be continuing during these phases.

7.5.3 Other Scoping and Water Right Issues

- **Additional means including the use of biocriteria should be developed to assess the general health of the Estuary and serve as a basis for determining the impacts of new projects, physical and operational changes, introduced species, etc. DFG should develop a priority list of tasks to be performed. Consideration should be given to specific components such as American shad, Delta smelt, and the benthos. Also, use of biocriteria should be considered.**

o **There is a need to examine further the impacts of San Francisco Bay inflows on fish, invertebrates, and other public trust resources, particularly as these inflows, including pulse flows, affect distribution, abundance, and reproduction success of species inside the Estuary. Studies are also needed to provide the linkage, if any, between phytoplankton, and higher trophic levels.**

7.5.3.1 Water Year Classification

o **The current Sacramento River Water Year Classification approximates annual conditions of water availability with five distinct categories. The Water Year Classification subworkgroup has adopted, in concept, the addition of a sliding scale to the classification to smooth the transitions between categories. There is a need for the parties to study this proposal and submit the results for review during the Scoping Phase of the proceedings.**

o **Due to a previous lack of analytical tools, the San Joaquin River Basin classification needs refinement.**

There is a need for the parties to develop a San Joaquin River Basin classification with similar methodology as used for the Sacramento River Basin and submit the results for review during the Scoping Phase of the proceedings. Other issues, such as the variation in hydrologies among tributary basins, and the absence of coordination between the major San Joaquin River basin reservoirs, can then also be addressed. This system, together with the Sacramento River classification, will be used during the Scoping and Water Right phases to determine how the responsibilities of meeting water quality objectives should be distributed.

Development of Annual Four Basin Unimpaired Flow

Part of the process to determine each water year's classification is the estimation of the Sacramento and San Joaquin basins' Four River Unimpaired Flow Indexes, a measure of seasonal wetness. For the months of February through May, estimates of these unimpaired flow indices are made on the first of each month. Unimpaired flow is estimated from both measured and forecasted flows and snowpack amounts. The hydrologic portion of the water year index that relies on forecasts is subject to assumptions made by the forecaster. This forecasting process is performed by DWR. There is no documentation explaining this process. The assumptions and process should be documented and readily available. DWR should convene a technical forum for interested parties for the purpose of providing the parties with the details of the methodology and assumptions used in the forecasting process. After this initial forum,

additional meetings should be convened only when the methodology or the assumptions are changed.

7.5.3.2 Economic Analysis

The Scoping Phase will help identify alternative methods to provide the protections needed for the beneficial uses made of Bay-Delta waters. To determine if an alternative is reasonable the State Board considers economic effects. For example, studies will be needed to determine the costs of south Delta facilities, the cost of dilution releases to the farmers required to forego use of water, and the secondary costs associated with reservoir reoperation and other actions. Determination of the overall costs of alternatives will require input from technical studies on the appropriate mixes of required actions.

7.5.3.3 Entrapment Zone

- **Studies are needed to better define the degree of linkage between the location and productivity of the entrapment zone and the effects on the population levels of important fish species.**

The Phase I hearing record includes many pages of exhibits and testimony concerning the importance of the entrapment zone. The definition and placement of the entrapment zone is more closely tied to freshwater outflow than to salinity. Further consideration of this issue will occur in the Scoping and Water Right Phases of these proceedings. During the Scoping Phase, the State Board seeks further information on the following:

1. The location of the entrapment zone in relation to freshwater outflow;

2. The importance of the entrapment zone organisms in the fish food chains, especially with regard to striped bass, Delta smelt, and out-migrating salmon smolts;

3. The significance of introduced invertebrates, both benthic filter-feeders and zooplankton, on food supplies in the Bay-Delta waters,

4. The relative importance of phytoplankton, bacteria and detritus as food sources for higher trophic levels in the entrapment zone;

5. The relationship between entrapment zone location and level of primary productivity or phytoplankton concentrations; and

6. The relationship between phytoplankton abundance, zooplankton abundance and fish productivity.

These topics are not exclusive; if any parties believe that other subjects need to be addressed, they are welcome to introduce them.

7.5.3.4 Physical Facilities

Information Needed on Physical Facilities

During the first two phases of the Bay-Delta proceedings several parties indicated that proper facilities would help stretch the water supply to

meet more of the needs of various beneficial uses. Included in these discussions were several isolated facilities to provide better water quality for export M&I, hatcheries to help supplement the populations of specific fisheries and reservoirs to help store water from times of surplus for distribution during times of need (see below). While the State Board supports these concepts in theory, it must have detailed information as to their effects on beneficial uses in the Estuary.

Isolated facilities can provide better water quality for M&I use. However, some questions need to be answered:

- o Are there appropriate and cost-effective ways of isolating this water from that large volume of water exported for agriculture purposes which do not need the higher quality? What would be the effects of this facility on areas of origin, on the Bay-Delta Estuary's aquatic habitat, etc.

- o Since this water would be expensive, should consideration of separate plumbing for internal domestic use be addressed? To help reduce project cost should the use of existing rights-of-way be considered?

New reservoirs are being planned south of the Delta. The State Board believes that additional information is needed particularly in regard to the timing and amount of diversions to these facilities. During the Scoping Phase, parties should be prepared to discuss the potential effects of diversions to South-of-the-Delta reservoirs on beneficial uses in the Estuary.

Specific Physical Facilities and Projects to be Discussed in the Scoping Phase

A. Delta Water Management Facilities - Three DWR Delta Water management programs comprise a plan to enhance the SWP capability to increase exports while attempting to solve problems affecting Delta beneficial uses. These programs are:

1) The North Delta Water Management Program - The primary objectives of this program are to help alleviate flooding in the north Delta area, reduce reverse flow in the lower San Joaquin River, improve water quality, reduce fishery impacts, and improve water supply reliability. Secondary objectives are to improve navigation and enhance recreational opportunities. Under this program the South Fork Mokelumne River will be dredged, the Delta Cross Channel gates may be modified, partial tide gate structures in the Sacramento River may be built to raise water levels in the Sacramento to divert additional water into the Delta Cross Channel, a partial tide gate structure in Three-Mile Slough may be built, and a new Sacramento River connecting channel near Hood or Isleton may be built to divert additional flow through the interior of the Delta.

2) The Western Delta Management Program - This program includes four major issues: flood control, water quality, wildlife concerns, and water supply reliability. Sherman Island, the major Delta island situated farthest west, is the focus of this program. Levee rehabilitation and land acquisition for the development of wildlife and wetland habitat will be a part of this program.

3) The South Delta Water Management Program - The objectives of this program are to help solve the following problems: water level and water circulation related to agricultural needs in the south Delta, water quality, project water supply reliability, and fishery impacts. Under this program four barriers will be installed in the south Delta, a portion of Middle River will be enlarged, Clifton Court Forebay will be enlarged, and an additional forebay will be constructed on the northern half of Victoria Island with a siphon connection to Clifton Court Forebay (DWR & USBR, 1990).

B. Isolated Facilities - The purpose of such a facility is to isolate water being conveyed from the Sacramento River to Clifton Court, from the Delta. This facility would improve the salinity, and drinking water quality of this water, while theoretically reducing the carriage water requirement and permitting better control of Delta circulation (Brown and Caldwell, Delta Drinking Water Quality Study, May 1989). The reduction of the carriage water requirement and the control of circulation patterns has the potential for enhancing the beneficial uses that continue to be made of water directly from the Estuary. There is a great concern among many, especially northern Californians, that the isolated facility would be operated in a manner that would harm the Estuary. Proponents of the isolated facility have stated that protection of all Delta beneficial uses is a primary concern, and that an isolated facility would not be built without guaranteeing this protection. A number of alternative isolated facilities have been suggested. The facilities most often discussed are the following:

1) Peripheral Canal - This is a 42-mile-long isolated channel rejected by California voters in 1982. This facility would convey water from the Sacramento River around the Delta, releasing a portion of it for Delta channel flow improvement, and delivering the remaining water to Clifton Court Forebay and then to the Delta export pumps.

2) Dual Transfer System - This facility would convey about half of the water being exported from the Delta through existing channels, and the remainder in a isolated channel extending from Hood on the Sacramento River to the Clifton Court Forebay.

3) Bifurcated System - This facility is the same as the Dual Transfer System, except that it would provide a bifurcated transmission system south of the Delta so that only high quality water would be delivered to southern California for M&I purposes.

4) Sierra Source-to-User System - This isolated facility would be comprised of a number of facilities used to convey water for M&I water use from the Feather River/Sacramento River confluence around the Delta and directly to the Tracy Pumping Plant.

C. Auburn Dam - The proposed Auburn Dam was originally designed to be a 2.3 MAF multipurpose reservoir for water supply, power, recreation, flood control, and fishery enhancement. Construction was begun in 1967 but stopped in 1976 to permit further study of seismic and design issues. Environmental issues have further affected the future of the Auburn Dam. Currently, there are three proposals for an Auburn Dam: a dry dam used only for flood control, a flood control dam with the

flexibility to allow later expansion to a multi-purpose dam, and a full multi-purpose dam (DWR & USBR, 1990).

D. Kern Water Bank - The Kern Water Bank (KWB) is a conjunctive use ground water project being developed by DWR, in conjunction with the Kern County Water Agency and local water districts, to augment the dependable water supply of the SWP. The KWB would allow storage and extraction of ground water, in coordination with the operation of surface water storage and conveyance facilities. In general, water would be banked in the basin during years of above-average water supply and withdrawn during drier years, when surface water supplies are below average. The first stage, with a capacity of 300 TAF, is planned for development by 1991, with maximum capacity of 1 MAF planned for development by 1994 or 1995 (DWR & USBR, 1990).

E. Los Banos Grandes Reservoir - The Los Banos Grandes Reservoir (LBG) is proposed to be solely an SWP off-stream water supply facility filled with water from the California Aqueduct. LBG will provide operational flexibility for the SWP to allow improved operation for the fisheries and enable a greater shift in exports to months when fish are not as abundant and when very high Delta outflows occur. The current schedule estimates that the LBG facilities could be completed and in operation by the year 2002 (DWR & USBR, 1990).

F. Los Vaqueros Reservoir - The proposed Los Vaqueros Reservoir, to be operated by the Contra Costa Water District, will be a 100,000-AF reservoir in the hills southeast of Contra Costa County. The purpose of this reservoir is to improve the quality and reliability of delivered water and is scheduled for completion in 1995 (Jones & Stokes, 1991).

G. Delta Wetlands Project - The Delta Wetlands Project is proposed by Bedford Properties, a land development company, to store water seasonally on four Delta islands (Bacon and Bouldin islands, and Holland and Webb tracts) and to manage the islands for wetland wildlife habitat during July-December. Stored water would be diverted from unregulated Delta outflow when available during January-April of each year. Stored water (up to 270,000 AF) would be discharged from the islands during May-July for sale to various water users (Jones & Stokes, 1990).

H. Additional Banks Pumping Plant Capacity - DWR is installing four additional pumping units at the Banks Pumping Plant, increasing the pumping capacity from 6,400 cfs to 10,300 cfs. In order to operate the Banks Pumping Plant above 6,400 cfs a revised Corps of Engineers permit is required. These pumps begin operation in 1991 and will provide standby capacity for the present units and permit a larger share of the pumping with cheaper off-peak power. DWR plans to divert more water during the winter to facilitate offstream storage reservoirs and groundwater recharge operations south of the Delta (DWR & USBR, 1990).

I. Baldwin and Stockton Ship Channel Projects - These two ship channel projects, undertaken by the Corps of Engineers, will deepen existing or create new channels that will allow larger commerce shipping access to inland ports.

J. Desalination Projects - In California, desalting is used to reclaim brackish ground water, desalt sea water, and treat water for such industries as the electronics industry, which require processed water of high purity. The principal limitation of desalting is its high cost, which is directly linked to its high energy requirements. Of various desalting techniques, the membrane processes (reverse osmosis and electro-dialysis) offer the best potential to further reduce costs and thus increase use. Recent research has been able to reduce the energy requirements dramatically. With further reductions in the energy requirements and future increases in competition for water supplies, desalting is becoming a viable alternative for the development of marginal water supply (DWR & USBR, 1990). Currently, Santa Barbara, Marin, and MWD are considering construction of desalting facilities to develop marginal water supply during dry periods.

K. Reclamation Projects - Reclaimed water is used for various purposes, including crop and landscape watering, industrial cooling, and ground water recharge. Industries sometimes recycle water at a facility to recover heat or materials, to save water, and to eliminate the cost of discharge to a municipal system. Waste water can be treated to drinking water quality, but the higher cost of such treatment, institutional prohibitions, and public reluctance to use reclaimed water discourages its use when water of equal quality is available from other sources. Urban water managers continue to seek suitable locations to replace drinking quality water with treated municipal waste water for such applications as landscape and crop irrigation. The greatest potential for wider use exists in the coastal areas of southern California where hundreds of thousands of acre-feet of treated water are discharged to the ocean every year. Dual or separate delivery water systems are being studied. These dual delivery systems will separate water delivered for human consumption from reclaimed water delivered for irrigation or industrial uses. Use of wastewater for M&I purposes has not received complete acceptance by the public and the health authorities (DWR, Bulletin 160-87, pp. 53-54).

The parties should be prepared to discuss in detail these and other issues concerning physical facilities during the Scoping Phase of the proceedings. The Board will use this information to form a balanced decision in the Water Right Phase.

7.5.3.5 Agricultural Water Conservation

The overall goal of the Agricultural Water Conservation Workgroup and its Subworkgroups is to identify potential water savings (annual and seasonal) through increased irrigation efficiency within the following constraints:

1) Maintain present level of crop production (i.e., protection of "present" beneficial use),

2) Maintain present amount of annual net recharge to ground water in non-saline sink areas,

3) Reduce annual net recharge to ground water in saline sink areas (if possible) by increasing irrigation efficiencies to the minimum target efficiency for irrigation, and

4) Maintain salt balance in the crop root zone as necessary to maintain present crop productivity.

The Workgroup will attempt to identify annual savings in saline sink areas and seasonal savings in non-saline sink areas. The State Board anticipates receiving valuable information from the Agricultural Water Conservation Workgroup during the Scoping Phase.

7.5.3.6 Conjunctive Use

The State Water Project Conjunctive Use (SWPCU) Workgroup is evaluating both put-and-take or seasonal storage, and long-term storage forms of conjunctive use. The SWPCU Workgroup's study area is primarily the SWP service areas. The workgroup intends to provide the State Board with a report for the Scoping Phase. This report should detail the following information for the major ground water basins of California:

(1) existing ground water production capacity, (2) imported water delivery capacity, (3) ground water-surface water delivery overlap, (4) existing recharge capacity, (5) available capacity by month, (6) potential existing recharge facility expansion, (7) potential new recharge facility projects, and (8) ground water basin constraints.

7.5.3.7 Suggested Legislation

Water Rights Monitoring

Under the Porter-Cologne Act (Water Code Section 13267(b)), a Regional Board may require any discharger of waste to prepare technical or monitoring program reports. No similar provision allows the State Board to require technical or monitoring program reports from water right holders who divert and use water from a watercourse. The diversion and use of water may cause adverse effects to downstream beneficial uses of water. For example, the diversion and use of water may adversely affect aquatic life downstream, cause seawater intrusion into underground water supplies, cause pollution as a result of return flows into rivers, and impair the water supplies of other water users.

While the State Board is able to require new appropriators of surface water to monitor potential impacts, the State Board cannot conveniently require existing water right holders to initiate new monitoring programs. In order to require an existing water right holder to conduct a monitoring program under current law, the State Board must conduct an enforcement action, a change petition proceeding, a proceeding to prevent waste and unreasonable use under Article X, Section 2 of the Constitution or a proceeding to apply the public trust doctrine.

Legislation should authorize the State Board through administrative means to require monitoring by individual water right holders where such a requirement is related to the individual's diversion. The legislation should also authorize the State Board to impose annual fees on all permit

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and license holders to assure that an adequate compliance monitoring program can be implemented.

Screening of Agricultural Diversions

Screening of agricultural diversions in the Delta has been identified as a method of improving young striped bass and salmon survival in the Estuary. A recent survey by DWR determined there are over 1,900 pumps and siphons in the Delta with intake pipe diameter ranging from 3 to 36 inches (Sato et al., 1987 in Hopelain 1989). Salmon entrainment data collected in the Delta and Feather River ranged from averages of 1.38 to 4.66 salmon per acre foot, respectively and average numbers of juvenile striped bass lost through Delta agricultural diversions during April through July, 1978 and 1979 were 19 and 12 million, respectively (Hopelain, 1989).

Fish and Game Code, Sections 5980 through 6028 apply to screening and preventing fish losses through water diversion intakes. The sections essentially state that if a diversion was constructed after 1971 and adversely affects fish populations, the owner is required to construct, operate and maintain a screen on the diversion. If the diversion was constructed prior to 1971 and is larger than 250 cfs, the costs of screening is to be shared equally by the owner and DFG. If the diversion was constructed prior to 1971 and is less than 250 cfs, the entire cost of screening is to be borne by DFG. Most Delta agricul-tural diversion fall into the latter category with the financial responsibility resting with DFG; consequently, the agricultural diversions remain unscreened. DFG should prepare a report to SWRCB presenting a plan of action and possible sources of funding and proposed legislation by the beginning of the Water Right Phase of the proceedings.

Finally, a program is needed to produce information about the Bay-Delta system relevant to management decisions. Such a program should:

1) Identify the manageable (man-induced) effects on the Bay-Delta;

2) Identify responsibilities for developing studies to allow resource agencies to better manage the Bay-Delta system;

3) Develop a stable funding mechanism through fees on point source dischargers, non-point source dischargers and upstream water users; and

4) Develop time schedules and oversight committees to ensure timely implementation and coordination.

APPENDICES

A. Abbreviations for Information Sources and Citations
B. List of Abbreviations/Symbols
C. Glossary
D. Monitoring Stations by Interagency Number and by River Kilometer Index
E. Map of Salinity Control Stations
F. Notice of Filing
G. Transcript Index

APPENDIX A
ABBREVIATIONS FOR INFORMATION SOURCES AND CITATIONS

ABBREVIATION	NAME
ACH	THE CITIES OF AVENAL, COALINGA & HURON
ACWD	ALAMEDA COUNTY WATER DISTRICT
AFC&WCD	ALAMEDA FLOOD CONTROL AND WATER CONSERVATION DISTRICT
AHI	AQUATIC HABITAT INSTITUTE
ANTIOCH	THE CITY OF ANTIOCH
ASA	CALIFORNIA ASSOCIATION OF SANITATION AGENCIES
BAAC	BAY AREA AUDUBON COUNCIL
BADA	BAY AREA DISCHARGERS ASSOCIATION
BALIA	BAY AREA LEAGUE OF INDUSTRIAL ASSOCIATIONS
BCDC	SAN FRANCISCO BAY CONSERVATION AND DEVELOPMENT COMMISSION
BISF	THE BAY INSTITUTE OF SAN FRANCISCO
BUSCH	ANHEUSER-BUSCH COMPANIES
Bureau	U.S. BUREAU OF RECLAMATION (also USBR)
CALCWD	CALAVERAS COUNTY WATER DISTRICT
CBE	CITIZENS FOR A BETTER ENVIRONMENT
CCCWA	CONTRA COSTA COUNTY WATER AGENCY
CCIQW	CONCERNED CITIZENS FOR IMPROVED QUALITY WATER
CCWD	CONTRA COSTA WATER DISTRICT
CDWA	CENTRAL DELTA WATER AGENCY
CFBF	CALIFORNIA FARM BUREAU FEDERATION
CMWD	CASITAS MUNICIPAL WATER DISTRICT
CNPS	CALIFORNIA NATIVE PLANT SOCIETY
COE	U. S. ARMY CORPS OF ENGINEERS (also U.S. Corps)
CSPA	CALIFORNIA SPORTFISHING PROTECTION ALLIANCE
CVAWU	CENTRAL VALLEY AGRICULTURAL WATER USERS
CVPWA	CENTRAL VALLEY PROJECT WATER ASSOCIATION
CVWD	COACHELLA VALLEY WATER DISTRICT
CWA	CALIFORNIA WATERFOWL ASSOCIATION

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ABBREVIATIONS FOR INFORMATION SOURCES AND CITATIONS

ABBREVIATION	NAME
CWPC	COMMITTEE FOR WATER POLICY CONSENSUS
CWPC	COMMITTEE FOR WATER POLICY CONSENSUS
CWPCA	CALIFORNIA WATER POLLUTION CONTROL ASSOCIATION
CWPCA	CALIFORNIA WATER POOLUTION CONTROL ASSOCIATION
DAWDY	DAVID R. DAWDY
DDWD	DEVILS DEN WATER DISTRICT
DELTAWET	DELTA WETLANDS (a.k.a. BEDFORD PROPERTIES, INC.)
DFG	CALIFORNIA DEPARTMENT OF FISH AND GAME
DOF	DEPARTMENT OF FINANCE
DRWD	DUDLEY RIDGE WATER DISTRICT
DTAC	DELTA TRIBUTARY AGENCIES COMMITTEE
DUNNING	HARRISON C. DUNNING, PROFESSOR OF LAW
DWA	DESERT WATER AGENCY
DWR	DEPARTMENT OF WATER RESOURCES
EA	EA ENGINEERING, SCIENCE AND TECHNOLOGY, INC.
EBMUD	EAST BAY MUNICIPAL UTILITY DISTRICT
EBRPD	EAST BAY REGIONAL PARK DISTRICT
ECCID	EAST CONTRA COSTA IRRIGATION DISTRICT
EDF	ENVIRONMENTAL DEFENSE FUND
EPA	U.S. ENVIRONMENTAL PROTECTION AGENCY (also Agency)
EWID	EMPIRE WESTSIDE IRRIGATION DISTRICT
FAO	FOOD AND AGRICULTURAL ORGANIZATION OF THE UNITED NATIONS
HOOPA	HOOPA VALLEY TRIBE
KCWA	KERN COUNTY WATER AGENCY
LADWP	LOS ANGELES DEPARTMENT OF WATER AND POWER
LCC	LEAGUE OF CALIFORNIA CITIES
LWVC	LEAGUE OF WOMEN VOTERS OF CALIFORNIA
MAS	MARIN AUDUBON SOCIETY
MET	SEE MWD
MID	MODESTO IRRIGATION DISTRICT
MWD	THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA (formerly MET)

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ABBREVIATIONS FOR INFORMATION SOURCES AND CITATIONS

ABBREVIATION	NAME
NASOC	NATIONAL AUDUBON SOCIETY
NDWA	NORTH DELTA WATER AGENCY
NHI	NATURAL HERITAGE INSTITUTE
NMFS	U.S. NATIONAL MARINE FISHERIES SERVICE
NOAA	U.S. NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION
NRDC	NATURAL RESOURCES DEFENSE COUNCIL
OFWD	OAK FLAT WATER DISTRICT
OWD	OAKLEY WATER DISTRICT
PALMDALE	PALMDALE WATER DISTRICT
PCFFA	PACIFIC COAST FEDERATION OF FISHERMEN'S ASSOCIATIONS
PCWD	PLACER COUNTY WATER DISTRICT
PG&E	PACIFIC GAS & ELECTRIC
PICYA	PACIFIC INTER-CLUB YACHT ASSOCIATION
PRBO	POINT REYES BIRD OBSERVATORY
RIC	RICE INDUSTRY COMMITTEE
RWQCB_2	SAN FRANCISCO BAY REGIONAL WATER QUALITY CONTROL BOARD (REGION 2)
RWQCB_4	LOS ANGELES REGIONAL WATER QUALITY CONTROL BOARD (REGION 4)
RWQCB_5	CENTRAL VALLEY REGIONAL WATER QUALITY CONTROL BOARD (REGION 5)
Region 2	See RWQCB_2
Region 5	See RWQCB_5
SACTO	THE CITY OF SACRAMENTO
SACTOCO	THE COUNTY OF SACRAMENTO
SAVESF	SAVE THE SAN FRANCISCO BAY ASSOCIATION, THE
SAWPA	SANTA ANA WATERSHED PROJECT AUTHORITY
SCLDF	THE SIERRA CLUB LEGAL DEFENSE FUND
SCVWD	SANTA CLARA VALLEY WATER DISTRICT
SCWC	SOUTHERN CALIFORNIA WATER COMMITTEE, INC.
SDIEGO	SAN DIEGO COUNTY WATER AGENCY AND THE CITY OF
SDWA	SOUTH DELTA WATER AGENCY
SFBAWUA	SAN FRANCISCO BAY AREA WATER USERS ASSOCIATION
SFEP	EPA's SAN FRANCISCO ESTUARINE PROJECT

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ABBREVIATIONS FOR INFORMATION SOURCES AND CITATIONS

ABBREVIATION	NAME
SFRISCO	THE CITY AND COUNTY OF SAN FRANCISCO
SHELL	SHELL OIL COMPANY
SIERRA	SIERRA CLUB, THE
SJVAWC	SAN JOAQUIN VALLEY AGRICULTURAL WATER COMMITTEE
SMUD	SACRAMENTO MUNICIPAL UTILITY DISTRICT
SRCD	SUISUN RESOURCE CONSERVATION DISTRICT
SRWCA	SACRAMENTO RIVER WATER CONTRACTORS ASSOCIATION
SWC	STATE WATER CONTRACTORS
SWRCB	CALIFORNIA STATE WATER RESOURCES CONTROL BOARD (also State Board)
TIBCEN	THE ROMBERG TIBURON CENTER FOR ENVIRONMENTAL STUDIES
TID	TURLOCK IRRIGATION DISTRICT
TLBWSD	TULARE LAKE BASIN WATER STORAGE DISTRICT
TRACY	THE CITY OF TRACY
TRI-TAC	TRI-AGENCY TECHNICAL ADVISORY COMMITTEE -- LCC, CASA AND CWPCA
TRICO	TRINITY COUNTY
UAC	UNITED ANGLERS OF CALIFORNIA
USBR	U.S. BUREAU OF RECLAMATION (also Bureau)
USDA-SCS	U.S. DEPARTMENT OF AGRICULTURE - SOIL CONSERVATION SERVICE (also SCS)
USDI	U.S. DEPARTMENT OF THE INTERIOR (also DOI)
USFDA	U.S. FOOD AND DRUG ADMINISTRATION (also FDA)
USFWS	U.S. FISH AND WILDLIFE SERVICE
USGS	U.S. GEOLOGICAL SURVEY
VCC	VALLEJO CHAMBER OF COMMERCE
WACOC	WATER ADVISORY COMMITTEE OF ORANGE COUNTY
YCWD	YUBA COUNTY WATER DISTRICT
YOLO	YOLO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

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LIST OF ABBREVIATIONS/SYMBOLS

ABBREVIATION/ SYMBOL	DEFINITION
AF	Acre-Foot = 43,560 cubic feet = 325,900 gallons
AF/yr	Acre-Feet per year
AW	Total applied water (in acre-feet per acre)
As	Arsenic
BAT	Best available technology
BOD	Biochemical oxygen demand
BU	Beneficially used applied water (in acre-feet per acre)
Br	Bromine
Br-	Bromide ion
CAC	California Administrative Code (OBSOLETE--Now Cal. Code of Regulations, CCR)
CCC	Contra Costa Canal
CCR	California Code of Regulations (formerly Cal. Administrative Code, CAC)
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	U.S. Code of Federal Regulations
COD	Chemical oxygen demand
CP	Amount of water applied due to cultural practices (in ac-ft/ac)
CVP	Central Valley Project
CWC	California Water Code
Cl	Chlorine
Cl-	Chloride ion
D-1485	SWRCB Water Rights Decision 1485 (1978)
DBP(s)	Disinfection by-product(s)
DMC	Delta-Mendota Canal
DO	Dissolved oxygen
DOI	Delta outflow index
Delta	Sacramento-San Joaquin Delta
Delta Plan	1978 SWRCB WQCP - Sacramento-San Jouquin Delta and Suisun Marsh
EC	Electrical conductivity (also refered to as specific conductance)
ECe	Electrical conductivity of a soil saturation extract (generally in dS/m)

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ABBREVIATION/ SYMBOL	DEFINITION
ECi	Electrical conductivity of applied irrigation water
ECsw	Electrical conductivity of soil water in the root zone (ECsw approx. = ECe / 0.6
Estuary	San Francisco Bay and Sacramento-San Joaquin Delta Estuary
FSA(s)	Flow study area(s)
GAC	Granular activated carbon
I-A/RKI	Interagency/River Kilometer Index Station Code
IDHAMP	Interagency Delta Health Aspects Monitoring Program
IE	Irrigation efficiency (in acre-feet per acre)
M&I	Municipal and Industrial (generally associated with "water supply")
MAF	Million acre feet
MCL(s)	Maximum contaminant level(s) (associated with drinking water)
MCLG(s)	Maximum contaminant level goal(s)
MGD	Million(s of) gallons per day
MLLW	Mean lower low water
Mn	Manganese
Ni	Nickel
PIE	Preirrigation efficiency
PPD	Pollutant Policy Document
Plan	1988 or 1990 Draft Water Quality Control Plan (also WQCP)
Region 2	San Francisco Bay Basin (also Basin 2). See RWQCB_2
Region 5A	Sacramento River Basin (also Basin 5A)
Region 5B	Sacramento-San Joaquin Delta Basin (also Basin 5B)
Region 5C	San Joaquin River Basin (also Basin 5C)
SBI	Striped bass index
SMPA	Suisun Marsh Preservation Agreement
SMR	Applied water needed for soil moisture replacement (in ac-ft/ac)
SS	Suspended solids

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ABBREVIATION/ SYMBOL	DEFINITION
SWP	State Water Project
Se	Selenium
TAF	Thousand acre feet
TDS	Total dissolved (filterable) solids
THM(s)	Trihalomethane(s)
THMBr(s)	Brominated trihalomethane(s)
THMFP	Trihalomethane formation potential
TOC	Total organic carbon
TTHMFP	Total trihalomethane formation potential
WQCP	1988 or 1990 Draft Water Quality Control Plan (also Plan)
WY	Water year (October 1 through September 30)
YOY	Young-of-year
ac	Acre = 43,560 square feet
cfs	Cubic feet per second = 448.8 gallons per minute = 1.983 acre-feet per day
dS/m	DeciSiemen/meter = 1.0 milliSiemen/cm (a measure of electrical conductivity)
ft	Foot or feet
g/l	Grams per liter
g/sq. m.	Gallons per square meter
gpcd	Gallons per capita per day
hr(s)	Hour(s)
lb	Pound (avdp.) = 16 oz (avdp.) = 453.6 grams
m	Meter or meters = 3.28 feet
mS/cm	milliSiemens per centimeter = millimhos per centimeter
mg/l	Milligrams per liter (approximately equal to ppm in aqueous solutions)
mmhos/cm	Millimhos per centimeter = 1,000 umhos/cm (a measure of EC)
ppb	Parts per billion (approximately equal to ug/l in aqueous solutions)
ppm	Parts per million (equal to mg/kg, approx. equal to mg/l in aqueous solutiions)
ppt	Parts per thousand (approximately equal to g/l in aqueous solutions)

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ABBREVIATION/ SYMBOL	DEFINITION
sq. ft.	Square foot or feet
sq. mi.	Square mile = 640 acres = 259 hectares
uS/cm	MicroSiemens per centimeter = micromhos per centimeter (a measure of EC)
ug/l	Micrograms per liter (approximately equal to ppb in aqueous solutions)
umhos/cm	Micromhos per centimeter (a measure of EC)

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WORD/PHRASE	DEFINITION
1-in-20 dry year	A statistical term refering to a water year with a total annual runoff exceeded by 95% of the water years which are likely to occur.
Acaricide (Miticide)	A material used primarily in the control of plant-feeding mites (acarids) especially spider mites. Typical acaricides with little insect-killing efficiency are chlorobenzilate, Kelthane, and Omite. Some insecticides, especially phosphorous compounds, are effective also against mites. [Farm Chemicals Handbook, 1987]
Acre-foot (AF)	The quantity of water which will cover an acre of land to a depth of one foot (i.e. 43,560 cubic feet or 325,900 gallons).
Alevin	See Fry.
Algae	Simple rootless plants that grow in bodies of water at rates in relative proportion to the amounts of nutrients available in the water or, in the case of nitrogen, in the atmosphere overlying the water body.
Ambient	The prevailing condition in the vicinity, usually relating to some physical measurement such as temperature. Sometimes used as a synonym for background. [SWRCB Order No. WQ 85-1]
Anadromous	Pertaining to fish that spend part of their life cycle in the ocean and return to freshwater streams to spawn. [SWRCB Order No. WQ 85-1]
Anaerobic	Life or processes that can occur without free oxygen.
Applied water	The quantity of water delivered to the intake to a city's water system, the farm head gate, the factory, and for wildlife, the amount of water supplied to a marsh or other wetland either directly or by incidental drainage flows. [DWR Bulletin 160]
Aquifer	State of California definition: A geologic formation, group of formations or part of a formation that is water bearing and which transmits water in sufficient quantity to supply springs and pumping wells. [DWR Bulletin 74-81] Federal definitions: (1) A formation, group of formations, or part of a formation that contains sufficient saturated permeable material to

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WORD/PHRASE	DEFINITION
	yield significant quantities of water to wells and springs (10 CFR 960.2) (2) A geologic formation, group of formations, or part of a formation capable of yielding a significant amount of ground water to wells or springs. Any saturated zone created by uranium or thorium recovery operations would not be considered an aquifer unless the zone is or potentially is (a) hydraulically interconnected to a natural aquifer, (b) capable of discharge to surface water, or (c) reasonably accessible because of migration beyond the vertical projection of the boundary of the land transferred for long-term government ownership and care (10 CFR 40 Appendix A). (3) A zone, stratum, or group of strata that can store or transmit water in sufficient quantities for specific use (30 CFR 710.5). (4) A geological formation, groups of formations, or part of a formation, that is capable of yielding a significant amount of water to a well or spring (40 CFR 146.03; 260.10; 270.2). (5) A geologic formation, group of formations, or portion of a formation capable of yielding usable quantities of ground water to wells or springs (40 CFR 257.3-4). [USGS, Federal Glossary of Selected Terms: Subsurface-Water Flow and Solute Transport, August 1989]
Arsenic (As)	A highly poisonous metallic element. Arsenic and its compounds are used in insecticides, weed killers and industrial processes. [SWRCB Order No. WQ 85-1] Arsenic occurs in two environmentally significant valence states, As +3 or As III (trivalent) and As +5 or As V (pentavalent), with different toxic properties. The various organic forms of arsenic include: methylated forms, arseno-lipids, arseno-sugars, arseno-betaine, and arseno-choline.
Bacteria	Single-cell, microscopic organisms that possess rigid cell walls; may be aerobic (need oxygen), anaerobic (no oxygen present), or facultative (either with or without oxygen); can cause disease; and some are important in the stabilization of solid wastes. [Resources Conservation Glossary]
Banks Pumping Plant, Harvey O.	The Department of Water Resources' State Water Project main deltapumping plant located West of Tracy. The source of the

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WORD/PHRASE	DEFINITION
	water in the California Aquaduct.
Basin Plan	A plan for the protection of water quality prepared by a Regional Water Quality Control Board in response to the Porter Cologne Water Quality Control Act also contains Water Quality Standards for the federal Clean Water Act.
Bathymetry	Measurements of the differences in depth between mean lower low water and the bottom of the bay.
Bay-Delta Estuary (the Estuary)	San Francisco Bay, the Sacramento-San Joaquin Delta and Suisun Marsh, as defined in Sec. 6610 and 6611 of the Cal. Government Code, Sec. 12220 of the Cal. Water Code, and Sec. 29101 and 29101.5 of the Cal. Public Resources Code, respectively.
Beneficial uses	"Beneficial uses" of the waters of the state that may be protected against quality degradation include but are not limited to, domestic, municipal, agricultural and industrial supply; power generation; recreation; esthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves. [CWC Sec. 13050(f)] Equivalent to "designated uses" under federal law.
Benthos	The whole assemblage of plants or animals living on the bottom of a water body: distinguished from plankton.
Best available technology (BAT)	The best technology, treatment technique, or other means which the Administrator [of the EPA] finds, after examination for efficacy under field conditions and not solely under laboratory conditions, are available (taking cost into consideration). For the purposes of setting MCLs for synthetic organic chemicals, any BAT must be at least as effective as granular activated carbon. [40 CFR 141.2]
Best management practices (BMPs)	State definition: A practice, or combination of practices, that is the most effective and feasible means of controlling pollution generated by nonpoint sources for the attainment of water quality objectives. [23 CCR 2601] Federal definition: A practice, or combination of practices, that is determined after ...problem assessment, examination of alternative practices, and appropriate public participation to be the most effective, practicable (including technological,

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WORD/PHRASE	DEFINITION
	economic, and institutional considerations) means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals. [40 CFR]
Bioaccumulative	A characteristic of a chemical species when the rate of intake into a living organism is greater than the rate of excretion or metabolism. This results in an increase in tissue concentration relative to the exposure concentration.
Bioassay	A method for determining the relative toxicity (or other biological activity) of a substance by observing its effects on a suitable organism under controlled conditions.
Biochemical oxygen demand (BOD)	The results of an empirical test in which standardized laboratory procedures are used to determine the relative oxygen requirements of wastewaters, effluents, and polluted waters. [Standard Methods ..., 14th ed., 1975] Usually considered, the amount of oxygen required by bacteria while stabilizing decomposable organic matter under aerobic conditions. The BOD test is widely used to determine the pollutional strength of domestic and industrial wastes in terms of the oxygen that they will require if discharged into natural watercourses in which aerobic conditions exist. The test is essentially a bioassay procedure involving the measurement of oxygen consumed by living organisms (mainly bacteria) while utilizing the organic matter present in a waste, under conditions as similar as possible to those that occur in nature. [Sawyer, C.N. and McCarty, P.L., Chemistry for Sanitary Engineers, 1967]
Bioconcentration	The positive difference in concentration of a chemical between water and that in an organism living in that body of water due to direct uptake of the chemical from the water. [SWRCB Order No. WQ 85-1]
Biocriterion (plural biocriteria)	Short for "biological criterion" The numerical or narrative expression of the biological characteristics of ambient aquatic communities (often structural measures, e.g., species composition, organism abundance or diversity). Biocriteria, as generally applied in State programs, are designed to reflect attainable characteristics under minimally impacted conditions. As such, biocriteria describe the ecological potential for aquatic community health in a given watershed, drainage basin or ecological region. [EPA, Report of the National Workshop on Instream Biological Monitoring and Criteria, Lincolnwood, IL, 12/2-4/87]

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WORD/PHRASE	DEFINITION
Biodegradable	Any substance that decomposes through the action of microorganisms.
Biomagnification	The net accumulation and increase of a substance in an organism as a result of consuming organisms from lower trophic levels, e.g., the consumption of algae by fish or water plants by ducks. [SWRCB Order No. WQ 85-1]
Biomass	The total amount of living material, plants and/or animal, above or below ground in a particular habitat or area. [40 CFR]
Biota	All living organisms that exist in an area.
Bloom	A proliferation of algae and/or higher aquatic plants in a body of water.
Cancer	Any disorder of cell growth that results in invasion and destruction of surrounding healthy tissue by the abnormal cells.
Carcinogen	Any agent that produces cancer, e.g. tobacco smoke, silica and asbestos particles, certain industrial chemicals, and ionizing radiation (such as X-rays and ultraviolet rays).
Carquinez Strait	The narrow strait between Suisun and San Pablo bays. It has a mean surface area of 12 sq. mi., mean depth of 29 ft., and mean volume of 223,000 AF.
Carriage water	The amount of Delta outflow needed to meet all of the water quality requirements of D-1485 less (minus) that needed to meet the requirements excluding those for Contra Costa Canal at Pumping Plant No. 1 (D5) and Clifton Court Forebay Intake at West Canal (C9). The quantity of additional Delta outflow (carriage water) is a function of Delta export pumping and south Delta inflow rates. It is necessary to reduce the effects of sea water intrusion into the Delta around the south side of Sherman Island (reverse flows up the San Joaquin River). This definition differs from that used by others in that it does not include additional Delta outflow which may be needed to meet certain contractual obligations of the Department of Water Resources. [T,III,8:25-10:23]
Central Bay	Central San Francisco Bay. That portion of San Francisco Bay bounded by the Golden Gate, San Francisco-Oakland Bay and Richmond-San Rafael bridges. Surface area = 103 sq. mi. at MLLW, mean depth = 35 ft, and mean volume = 2.307 MAF.

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WORD/PHRASE	DEFINITION
Chemical oxygen demand (COD)	The results of a laboratory chemical analytical technique which is used to measure the amount of oxygen required to oxidize all compounds in a sample of water, organic and inorganic. [Environmental Glossary 4th ed.]
Chlorammination	The use of a combination of chlorine and ammonia to disinfect water supplies.
Chloride (Cl-)	The ionic form of the gaseous element chlorine, usually found as a metallic salt with potassium or sodium. [SWRCB Order No. WQ 85-1]
Chlorinated hydrocarbons	A class of pesticides which contain chlorine, carbon, and hydrogen. See Chlorinated organic insecticides and acaricides. [Farm Chemical Handbook, 1987] They include solvents (e.g., TCE, TCA), heat exchangers (e.g., PCBs), contaminants (e.g., TCDD, TCDF), herbicides (e.g., ZAP), and wood preservatives (e.g., Pentachlorphenol).
Chlorinated organic insecticides and acaricides	The organic-chlorine chemicals form one of three principal pesticide families. This class in the insecticides and acaricides has related pharmacological effects, and EPA has limited the total amount of these related chemicals for residue purposes. Included are the following chemicals and their metabolites: Aldrin BHC (benzene hexachloride) Chlorbenside Chlordane Chlorobenzilate DDT Dicofol Dieldrin Endosulfan Endrin Heptachlor Lindane Methoxychlor Mirex Ovex TDE Tetradifon Toxaphene [Farm Chemicals Handbook, 1987]
Chlorination	The application of chlorine to drinking water, sewage, or industrial waste to disinfect or oxidize undesirable compounds.
Chlorine (Cl)	A greenish yellow, poisonous, readily liquified gaseous element of the halogen group, with a suffocating odor, obtained principally from common salt, and widely used in industry, medicine, etc. [Funk & Wagnalls Standard College

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WORD/PHRASE	DEFINITION
	Dictionary, 1973]
	Commonly used to disinfect drinking water and to bleach paper pulp.
Chromosomes	Thread-like bodies occurring in animal and plant cell nuclei; they contain genes, the material that makes possible the transfer of characteristics from parent to offspring.
Coagulation	A clumping of particles in water or wastewater which may result in the settling out of suspended materials. often induced by the addition of chemicals such as lime or alum, or a change in the dissolved ions in a water body such as that which occurs in an estuary when the fresh water inflow mixes with intruding seawater (i.e., in the entrapment zone).
Coliform organisms	All of the aerobic and faculative anaerobic, gram-negative, nonspore-forming, rodshaped bacteria that ferment lactose with gas formation within 48 hr at 35 degrees C. [Standard Methods ..., 14th ed., 1975]
	Large numbers of these organisms are found in the intestinal tracts of humans and warm-blooded animals, their presence in water is often used as an indicator of pollution or potentially pathogenic bacterial contamination.
Colloidal matter	Finely divided solids which will not settle by gravity but may be removed by coagulation or biological action or membrane filtration.
Conductance (Specific)	See Electrical conductivity.
Conjunctive use	The management of surface-and ground-water resources in a coordinated operation to the end that the total yield of such a system over a period of years exceeds the sum of the yields of the separate components of the system resulting from the uncoordinated operation.
	The objective of conjunctive use is to increase the yield, reliability of supply, and general efficiency of a water system by diverting water from streams or surface reservoirs for conveyance to and storage in ground-water basins for latter use when surface water is not available. [Coe, J.J., Conjunctive Use-Advantages, Constraints, and Examples, ASCE Journal of Irrigation and Drainage, v. 116, no. 3, May/June 1990]
Connate water	State definition:

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	Water entrapped in the interstices of a sedimentary rock at the time it was deposited. These waters may be fresh, brackish, or saline in character. Usually applies only to water found in geologically older formations. [DWR Bulletin 74-81] Federal definition: Water entrapped in the interstices of a sedimentary or extrusive igneous rock at the time of its deposition. [USGS, Federal Glossary of Selected Terms: Subsurface-Water Flow and Solute Transport, August 1989]
Conservative constituent (or property)	A constituent (or property) the concentration of which is not effected by chemical or biological processes. [T,XLV,5:16-5:25]
Contaminant	Federal definition: Any physical, chemical, biological, or radioactive substance or matter in water. [40 CFR 141.2]
Contamination	State definition: An impairment of the quality of the waters of the state by waste to a degree which creates a hazard to the public health through poisoning or through the spread of disease...includ[ing] any equivalent effect resulting from the disposal of waste, whether or not waters of the state are affected. [CWC Sec. 13050(k)] Federal definition: The addition to water of any substance or property preventing the use or reducing the usability of water. Sometimes considered synonymous with pollution. [USGS, Federal Glossary of Selected Terms: Subsurface-Water Flow and Solute Transport, August 1989]
Copepod	One of an order (Copepoda) of small, free-swimming, fresh-water and marine crustaceans. [Funk & Wagnalls Standard College Dicionary, 1973]
Crustacea	A class of anthropoids containing over 35,000 species distributed worldwide, mainly in freshwater and marine habitats, where they constitute a major component of plankton. Crustaceans include shrimps, crabs, and lobsters, copepods, and the terrestrial woodlice. The segmented body usually has a distinct head (bearing compound eyes, two

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WORD/PHRASE	DEFINITION
	pairs of antennae, and various mouth parts), thorax, and abdomen, and is protected by a shell-like carapace. Each body segment may bear a pair of branched (biramous) appendages used for locomotion, as gills, and for filtering food particles from the water. Appendages in the head region are modified to form jaws and in the abdominal region are often reduced or absent. Typically, the eggs hatch to produce a free-swimming nauplius larva. This develops either by a series of moults or undergoes metamorphosis to the adult form. [Dictionary of Biology, Warner Books]
Current flow conditions	Flow conditions as they exist at present. The factors considered when defining flow conditions include: land and water use patterns, reservoir capacities and operating rules, channel configurations, diversion point locations aand capacities, etc. Hydrologic investigations typically impose various sets of flow conditions upon the available "hydrologic record" and analyze the resultant effects. Within this Plan current flow conditions are those used by the Department of Water Resources to produce the results from their 1990 level of development Operations Study (e.g., DWR Exhibit 30). The DWR Operations Study used the hydrologic record for WY 1922 through 1978.
DAYFLOW	A Department of Water Resources flow accounting model used to calculate daily Delta outflow at Chipps Island. It also estimates interior Delta flows at specified locations, and fish-related parameters and indices.
DDT	The first chlorinated hydrocarbon insecticide It has a half-life of 15 years and can collect in fatty tissues of certain animals. EPA banned registration and interstate sale of DDT for virtually all but emergency uses in the U.S. in 1972 because of its persistence in the environment and accumulation in the food chain. CHEMICAL NAME: Dichloro diphenyl trichloroethane. The principal isomer present (not less than 70%) is 1, 1,1-trichloro-2, 2-bis (p-chlorophenyl)-ethane. [Farm Chemicals Handbook, 1987]
Dabbling duck	A duck which feeds in shallow water, usually from the surface or by "tipping-up." Generally a species in the family Anatidae.
Deep percolation	The drainage of soil water downward by gravity below the maximum effective depth of the root zone toward storage in subsurface strata. [USGS, Federal Glossary of Selected Terms: Subsurface-Water Flow and Solute Transport, August 1989]

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WORD/PHRASE	DEFINITION
Defoliant	Any substance or mixture of substances intended for causing the leaves or foliage to drop from a plant, with or without causing abscission. [Federal Insecticide, Fungicide, and Rodenticide Act]
Degradation	The act or process of degrading, specifically: A process of transition from a higher to a lower quality or level. [American Heritage Dictionary]
Delta	The Sacramento-San Joaquin rivers delta as defined in the CWC Sec. 12220.
Delta channel depletion	The diversions of Delta channel waters via pumps, siphons, and subsurface seepage onto the Delta uplands and lowlands for consumptive use by agriculture and native plants. [T,I,121: et. seq.] The consumptive use values used by the USBR and DWR to operate the CVP and SWP were fixed in the Federal-State Memorandum of Agreement dated April 9, 1969.
Demersal	Free-swimming on or near the bottom of a water body (as opposed to benthic, which is within or attached to the bottom, and pelagic, which is free-swimming in the water column).
Deterioration	An impairment of water quality. [DWR Bulletin 74-81]
Diatom	A marine or fresh-water plankton, unicellular or colonial, belonging to the family Chlorophyceae of microscopic green algae, characterized by bivalve walls containing silica. [Funk & Wagnalls Standard College Dictionary, 1973]
Disinfectant	Any oxidant, including but not limited to chlorine, chlorine dioxide, chloramines, and ozone added to water that in any part of the treatment or distribution process, that is intended to kill or inactivate pathogenic microorganisms. [40 CFR 141.2]
Disinfection	A process which inactivates pathogenic organisms in water by chemical oxidants or equivalent agents. [40 CFR 141.2]
Dissolved oxygen (DO)	A measure of the amount of oxygen available for biochemical activity in a given amount of water. Adequate levels of DO are needed to support aquatic life. Low dissolved oxygen concentrations can result from inadequate waste treatment. [Environmental Glossary 4th ed.]
Diving duck	A duck which feeds on bottom organisms while swimming,

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WORD/PHRASE	DEFINITION
	usually fully submerged. Generally in the family Aythyidae.
Dredge sediment (spoil)	The material removed from the bottom of a water body by the process of dredging which must be disposed of.
Dredging	The removal of material from the bottom of water bodies using a scooping or suction machine.
Drinking water	(Excluding Surface Water) Ground waters suitable, or potentially suitable, for municipal or domestic water supply are defined to be: All ground water, with the exception of: (1) portions of aquifers with waters in excess of 10,000 mg/l TDS, (2) waters with existing or potential beneficial use designations which are unsuitable for domestic or municipal use, and (3) subsurface oil-bearing zones. (This definition is not intended for any purpose other than this document)
Ebb tide	The reflux of tide water; the outgoing or falling tide: opposed to flood tide. [Webster's New Universal Unabridged Dictionary, 2nd. ed., 1979]
Economic poisons	Chemicals used to control pests, disinfect, preserve wood, and other agricultural products; anti-foulant paints, and defoliants for cash crops such as cotton (see pesticide).
Edmonston, A.D. Pumping Plant	The Department of Water Resources State Water Project (SWP) pumping plant located at the south end of the San Joaquin Valley. The prime mover for all SWP water used south of the Tehachapi Mountains, in Southern California.
Effluent	(1) Solid, liquid, or gaseous wastes that enter the environment as a by-product of man-oriented processes. (2) The discharge or overflow of fluid from ground or subsurface storage.
El Nino	A weather phenomenon also know as the "Southern Oscillation" which refers to a periodic failure of upwelling off Peru and associated wind and current changes in the Pacific Ocean.
Electrical conductivity or conductance (EC)	The EC of a water sample is an indirect measure of the total dissolved solids (TDS) or salinity levels of a water sample (i.e., the higher the EC the greater the TDS). Electrical conductivity, or specific conductance, is generally measured

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WORD/PHRASE	DEFINITION
	in milli- or micro- mhos, or milliSiemens per centimeter (mmhos/cm, umhos/cm or dS/cm, respectively.). State definitions: The relative ability of water to conduct electrical current. It depends on the ion concentration of and can be used to approximate the total filterable residue (total dissolved solids) in the water. [23 CCR 2601] A measure of the ability of water to conduct electricity current at 77 degrees F (25 degrees C). It is related to the total concentration of ionizable solids in the water. [DWR Bulletin 74-90] Federal definition: [A] measure of the ability of material to conduct an electrical current. For water samples, it depends on the concentration and type of ionic constituents in the water and temperature of the water; and it is expressed in siemens per meter. [USGS, Federal Glossary of Selected Terms: Subsurface-Water Flow and Solute Transport, August 1989]
Enrichment	Sewage effluent, or agricultural drainage or runoff adding nutrients (nitrogen, phosphorus, carbon compounds) to a water body, greatly increasing the growth potential for algae and aquatic plants.
Entrainment	For purposes of this report entrainment is meant to include primarily the effects of project operations, such as closure of the Delta Cross Channel gates, pumping, and reverse and low flows.
Entrapment zone	An area in an estuary where suspended materials (including certain biota) accumulate. Net upstream transport of the particulate materials that settle into the bottom density current is nullified by the net downstream transport of materials in the river inflow. As a result, certain suspended materials concentrate in the area where the bottom currents are nullified (see Null Zone). [Arthur, J.F. and Ball, M.D., The Significance of the Entrapment Zone Location to the Phytoplankton Standing Crop in the SF Bay-Delta Estuary, USBR, November 1980]
Escapement	The number of adult salmon escaping harvest and returning to the spawning grounds.
Estuary	The mouth of a stream which serves as a mixing zone for fresh and ocean water. Mouths of streams which are

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WORD/PHRASE	DEFINITION
	temporarily separated from the ocean by sandbars are considered as estuaries by the SWRCB. Estuarine waters are generally considered to extend from a bay or the open ocean to a point upstream where there is no significant mixing of fresh water and seawater. Estuarine waters are considered to extend seaward if significant mixing of fresh and seawater occurs in the open coastal waters. [SWRCB, Water Quality Control Policy for the Enclosed Bays and Estuaries of California, May 1974] In this document Estuary is used when referring to the San Francisco Bay and Sacramento-San Joaquin Delta Estuary.
Euryhaline	Designating aquatic organisms that can tolerate a wide range of salinity. Euryhaline organisms may be found in an estuary (salt content approximately 14 parts per 1000) or in the open sea (salt content 35 parts per 1000). [Dictionary of Life Sciences, 2nd ed., revised, 1983]
Evaporation	The process by which a substance passes from liquid or solid state to the vapor state. [Glossary of Geology, 1972]
Evapotranspiration	The combined loss of water from a given area by evaporation from the land and transpiration from plants. [USGS, Federal Glossary of Selected Terms: Subsurface-Water Flow and Solute Transport, August 1989]
Exchange contractors	Those who formerly diverted water from the San Joaquin River, but exchanged their diversion rights for a contract that granted more consistent water supplies from the Delta Mendota Canal. The maximum contractual entitlement of these users is 0.84 million AF/yr. [USBR, Factsheet: "Exhibits and Testimony before SWRCB, Bay-Delta Hearing 1987", 1987]
Fertilizer	Any organic or inorganic material of natural or synthetic origin that is added to a soil to supply elements essential to plant growth. [Resources Conservation Glossary]
Filter feeding	A method of feeding, found in many aquatic invertebrates, in which minute food particles are ingested from the surrounding water. Filter feeders are common in plankton and benthos communities. [Martin, E.A., Dictionary of Life Sciences, 2nd ed., 1983]
Flocculation	A process to enhance agglomeration or collection of smaller floc particles into larger, more easily settleable particles through gentle stirring by hydraulic or mechanical means. [40 CFR 141.2]
Flood tide	The rising tide: opposed to ebb tide. [Webster's New

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WORD/PHRASE	DEFINITION
	Universal Unabridged Dictionary, 1979]
Flow-weighted sampling	Samples taken in a manner that allows determination of mass emissions, i.e., samples taken in proportion to the rate of flow of a river or stream.
Flushing	The process by which contaminant concentrations in a body of water are diluted by river inflow and, where applicable, tidal exchange of "new" uncontaminated water combined with the net advection of the contaminants away from their source by residual currents.
Food chain	The pyramidal relationship of producers (plants) and consumers (animals) by which solar energy is converted through photosynthesis to plant tissue which is consumed by animals which are in turn consumed. At each step up the food chain consumers are usually larger but fewer in number.
Food web	The sum of the interacting food chains in an ecological community. [SWRCB Order No. W.Q. 85-1]
Fry	The stage in the life of a fish between the hatching of the egg and the absorption of the yolk sac (same as sac fry or alevin). From this stage until they attain a length of one inch the young fish are considered advanced fry. [Bell, M.C., Fisheries Handbook of Engineering Requirements and Biological Criteria, U.S. COE, 1986]
Geochemistry	The science dealing with the chemistry of the earth's crust.
Geometric mean	The antilogarithm of the mean of a group of logarithms of a measured variable. The geometric mean is used to transform logarithmically distributed numbers for statistical purposes. (See definitions for Logarithm and Logarithmic Distribution.)
Grab sample	A single sample taken at an instant in time to represent the conditions at that instant.
Gravitational circulation	Net internal motions caused by horizontal density gradients. The denser fluid flows along the bottom and lighter fluid along the surface in an attempt to restore a stable vertical stratification. In the case of a longitudinal salinity gradient, this produces a net landward bottom current and compensating seaward current of fresher water at the surface. Also refered to as Baroclinic Circulation. (Also see Null Zone.)
Gravitational overturn	The formation of a lens of fresh water on the surface of an estuary during a period of high runoff. Also refered to as

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	Gravitational Overflow. This surface layer can spread beyond the mouth of the estuary into the ocean.
Ground water	(1) That part of the subsurface water that is in the saturated zone.
	(2) Loosely, all subsurface water as distinct from surface water.
	(3) All water which occurs below the land surface. It includes both water within the unsaturated and saturated zones.
	(4) The water below the land surface in a zone of saturation, for purposes of this appendix, ground water is the water contained within an aquifer (10 CFR 40 Appendix A).
	(5) All water which occurs below the land surface (10 CFR 60.2).
	(6) All subsurface water as distinct from surface water (10 CFR 960).
	(7) Subsurface water that fills available openings in rock or soil materials to the extent that they are considered water- saturated (30 CFR 710.5).
	(8) water below the land surface in a zone of saturation (40 CFR 270.2; 40 CFR 146.3; 40 CFR 144.3).
	(9) water in a saturated zone or stratum beneath the surface of land or water (40 CFR 300.6; 40 CFR 257.3-4).
Ground water banking	The act, by a public agency, of recharging or replenishing a ground water basin. There is an account kept on the water recharged and it is extracted in dry years to meet dry-year needs. A ground water bank is operated very much the same as a surface reservoir. The extraction of the stored water is controlled by the public agency and is not restricted to overlying users such as is the case with normal ground water use. See Overdraft correction programs.
Ground water basin	A ground water basin consists of an area underlain by permeable materials which are capable of storing or furnishing a significant water supply; the basin includes both the surface area and the permeable materials beneath it. [DWR Bulletin 74-81]
Ground water	The condition of a ground water basin in which the amount of

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WORD/PHRASE	DEFINITION
overdraft	ground water withdrawn under current development exceeds the amount of water that replenishes the basin over a hydrologically mean period. [DWR Bulletin 118]
Grow-out facilities	Ponds at a hatchery or pumping facility where fish are kept until they are large enough to survive on their own.
Gyre	A circular or spiral motion: whirl: revolution.
Habitat	The sum of environmental conditions in a specific place that is occupied by an orgeniam, population, or community.
Hard water	Those waters that require considerable amounts of soap to produce a foam or lather and that also produce scale in hot-water pipes, heaters, boilers, and other units in which the temperature of water is increased materially. [Sawyer, C.N. and McCarty, P.L., Chemistry For Sanitary Engineers, 1967]
Hardness	A waters content of metallic (i.e., positive) polyvalent ions, principally calcium and magnesium, that react with sodium soaps to produce solid soaps and that react with negative ions, when the water is evaporated in boilers, to produce solid boiler scale. Hardness is usually expressed as mg/l of equivalent calcium carbonate (CaCO3). [Camp, T.R. and Meserve, R.L., Water And Its Impurities, 1974]
Hazardous material	(a) "Hazardous material" means a substance or combination of substances which, because of its quantity, concentration, or physical, chemical, or infectious characteristics, may: (1) Cause, or significantly contribute to an increase in serious irreversible, or incapacitating reversible, illness; or (2) Pose a substantial present or potential hazard to human health or environment when improperly treated, stored, transported or disposed of or otherwise managed. (b) Unless expressly provided otherwise, the term "hazardous material" shall be understood to also include extremely hazardous material. [22 CCR 66100 et seq.]
Heavy metals	Metallic elements like mercury (Hg), chromium (Cr), cadmium (Cd), arsenic (As), and lead (Pb), with high molecular weights. They can damage living things at lov concentrations and tend to accumulate in the food chain.
Herbicides	All substances or mixtures of substances used to control or destroy undesirable plants.

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WORD/PHRASE	DEFINITION
Historic flows	Depending on the context used can mean either; (1) those flows before man began influencing river flows (i.e., the Natural Flow), [SWRCB,3] or (2) flow conditions that actually occured over the historic hydrological period and were measured at various locations in the Central Valley Basin using flow measuring devices. These flows reflect upstream impoundments, diversions or use of runoff under the existing upstream storage and channel configurations at the time of measurement. [SWC Comments on January 19, 1990 Draft Revised WQCP, p. 6, April 9, 1990]
Homologous	In Biology: Anatomical features of different organisms (species) which correspond in structure and evolutionary origin, as the flipper of a seal and the arms of a human being. [American Heritage Dictionary 2nd ed.] In Chemistry: The members of a series of organic compounds having the same structure, but in which each differs from the preceding one by a constant increment, as the methane series. [Funk & Wagnalls Standard College Dictionary, 1973]
Hybrid	An offspring of two animals or plants of different races, breeds, varieties, species, or genera.
Hybridization	The act or process of producing hybrids.
Hydraulics	The branch of physics having to do with the mechanical properties of water and other liquids and with the application of these properties in engineering.
Hydrocarbons	A large and important group of organic compounds that contain only hydrogen and carbon. There are two types, saturated and unsaturated. Saturated hydrocarbons are those in which adjacent carbon atoms are joined by a single valence bond and all other valences are satisfied by hydrogen. Unsaturated hydrocarbons have at least two carbon atoms that are joined by more than one valence bond and all remaining valences are satisfied by hydrogen. The saturated hydrocarbons form a whole series of compounds starting with one carbon atom and increasing one carbon atom, stepwise. These compounds are also known as the paraffin series, the methane series, and as the alkanes. The principal source is petroleum. Gasoline is a mixture containing several of them; diesel fuel is another such mixture.

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	The unsaturated hydrocarbons are usually seperated into four classes: (i) the ethylene series of compounds all contain one double valence bond between two adjacent carbon atoms; (ii) the diolefin series of compounds all contain two double bonds in their molecules; (iii) the polyenes contain more than two double bonds, these compounds occur in the wastewaters produced by the canning industry (the chlorine demand of wastewaters containing polyenes is extremely high); (iv) the acetylene series of unsaturated hydrocarbons have a triple bond between adjacent carbon atoms, these compounds are found in some industrial wastewater (particularly those from the manufacture of some types of synthetic rubber).
Hydrodynamics	The motion and action of water and other liquids, i.e., the dynamics of liquids, and the study thereof.
Hydrology	The science of water in nature: its properties, distribution, and behavior.
Impairment	A change in quality of water which makes it less suitable for beneficial use. [DWR Bulletin 74-81]
In vivo	Designating biological processes that are performed, outside living organisms, traditionally in a test tube. [Dictionary of Life Sciences, 2nd ed., 1976]
Injection well	Any bored, drilled, driven shaft, dug pit, or hole in the ground into which water or fluid is discharged, and any associated subsurface appurtenances, and the depth of which is greater than the circumference of the shaft, pit, or hole. [CWC Sec. 13051]
Insecticides	All substances or mixtures of substances intended for preventing or inhibiting the establishment, reproduction, development, or growth of, destroying or repelling any member of the Class Insecta or other allied Classes in the Phylum Arthropoda considered to be a pest.
Irrigation efficiency (IE)	The efficiency of a single on-farm irrigation; the ratio of the depth of water beneficially used (BU) to the depth of applied water (AW), expresses as a percent. $IE = (BU/AW) \times 100$ [Westlands Water District, Water Conservation and Drainage Reduction Programs, 1987-1988, Definition of Terms, November 1989]

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Kesterson National Wildlife Refuge (Kesterson NWR)	A waterfowl management area adjacent to Kesterson Reservoir in Merced county California which was originally planned to utilize San Luis Drain water. When first established, Kesterson National Wildlife Refuge (NWR) used a mixture of fresh CVP water and local tailwater to develop wetland habitat. As the use of San Luis Drain water, including an increasing proportion of tile drain waters, was phased in, deformities and reproductive abnormalities began to affect the birds nesting there. [SWRCB Order No. WQ 85-1]
Kesterson Reservoir	A water storage facility adapted as an interim evaporation basin for the Central Valley Project San Luis Drain. [SWRCB Order No. WQ 85-1]
Larvae	The juvenile stage in the life cycle of most invertebrates, amphibians, and fish, which hatch from eggs, is unlike the adult in form, and is usually incapable of sexual reproduction. It develops into the adult by undergoing metamorphosis. Larvae can feed themselves and are otherwise self-supporting. Examples are the tadpoles of frogs, the caterpillars of butterflies, and the ciliated planktonic larvae of many marine animals. [Dictionary of Biology. Warner Books]
Leachate	Any fluid formed by the drainage of liquids from waste or by the percolation of liquid through waste. It includes any constituents extracted from the waste and dissolved or suspended in the fluid. [23 CCR 206]
Leaching	The flushing of salts from the soil by the downward percolation of water.
Leaching fraction	That fraction of the total amount of applied water that passes through a crop root zone. [SWRCB, 29, 2]
Lead (Pb)	A soft, malleable, ductile, bluish white dense metallic element, with a variety of toxic salts. [SWRCB Order No. WQ 85-1]
Levee	An embankment, especially along the shore of a river, built for portection against floods. [Funk & Wagnalls Standard College Dictionary, 1973]
Logarithm (Log)	The exponent expressing the power to which a fixed number (the base) must be raised in order to produce a given number (the antilogarithm). The most common logarithms are for the base 10. For example, 3 is the base 10 logarithm of 1,000 -- 100 is the base 10 antilogarithm of 2. See Natural logarithum

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Logarithmic distribution	The distribution of a set of observations of a variable which is limited at its lower end by zero (i.e., cannot have a value of less than zero) but is otherwise unrestrained. The logarithms of the observations of a logarithmically distributed variable are symmetrical about (i.e., 50% above and 50% below) the logarithm of the geometric mean of the variable.
Logarithmic mean (or log mean)	See definition of geometric mean.
Lunar day	The time of rotation of the moon about the earth, 24.84 hours.
Manganese (Mn)	A hard, brittle, grayish white metallic element, oxidizing readily and forming an important component of certain alloys, as manganese steel. [Funk & Wagnalls Standard College Dictionary, 1973]
Marsh or marshland	A tract of low, wet, soft land; swamp; bog; morass; fen.
Maximum contaminant level (MCL)	The maximum permissible level of a contaminant in water which is delivered to the free flowing outlet of the ultimate user of a public water system, except in the case of turbidity where the maximum permissible level is measured at the point of entry to the distribution system. Contaminants added to the water under circumstances controlled by the user, except those resulting from corrosion of piping and plumbing caused by water quality, are excluded from this definition. [40 CFR 141.2]
Maximum contaminant level goal (MCLG)	The maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on the health or persons would occur, and which allows an adequate margin of safety. Maximum contaminant level goals are nonenforceable goals. [40 CFR 141.2]
Maximum total trihalomethane potential (MTTP or MTP)	The maximum concentration of total trihalomethanes produced in a given water containing a disinfectant residual after 7 days at a temperature of 25 degrees C or above. [40 CFR 141.2]
Measured flow	The flow of water determined with a measuring device.
Mho	A unit of measure for electrical conductivity equal to the reciprocal, or inverse, of the standard unit of electrical resistance, the ohm. One mho is equal to one Siemen, the standard unit of electrical conductivity.

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Mutagenic	An agent that causes an increase in the number of mutants (see mutation) in a population. Mutagens operate either by causing changes in the DNA of the genes, so interfering with the coding system, or by causing chromosome damage.
Mutation	A sudden random change in the genetic material of a cell that may cause it and all cells derived from it to differ in appearance or behavior from the normal type. A relatively abrupt and permanent change in DNA that can be transmitted during cell division.
National Pollutant Discharge Elimination System (NPDES)	The national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under sections 307, 318, 402, and 405 of the Clean Water Act. The term includes appoved state programs. [40 CFR]
Natural or true natural flow	The embayment and channel flows which existed at the time of the first Spanish exploration of California, i.e., before the Gold Rush.
Neap tide	The tide occurring just after the first and third quarters of the lunar month: at these times the difference between high and low tides is smallest. [Webester's New Universal Unabridged Dictionary, 2nd. ed., 1979]
Nekton	The aggregate of animal organisms capable of swimming freely, relatively independent of currents, waves, etc., ranging in size from microorganisms to whales. Compare to "Plankton"
New water	Water which has not entered the Bay for at least several tidal cycles. [Denton and Hunt, 1986]
Nickel (Ni)	A hard, ductile, mallable, silver-white metallic element of the iron-cobalt group.
Nitrate	An ion composed of one atom of nitrogen bound to three atoms of oxygen. An important plant nutrient. In high concentrations, it can bind to hemoglobin resulting in methemoglobinemia. also refers to salts of the nitrate ion with other ionic substances, usually metals. [SWRCB Order No. WQ 85-1]
Non-point source	Causes of water pollution that are not associated with point sources, such as agricultural fertilizer runoff, or sediment from construction. Examples include (i) Agriculturally related non-point sources of pollution including runoff from manure disposal areas, and from land used for livestock and

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	crop production; (ii) Siviculturally related non-point sources of pollution; (iii) Mine-related sources of pollution including new, current and abandoned surface and underground mine runoff; (iv) Construction activity related sources of pollution; (v) Sources of pollution from disposal on land, in wells or in subsurface excavations that affect ground and surface water quality; (vi) Salt water intrusion into rivers, lakes, estuaries and ground water resulting from reduction of fresh water flow from any cause, including irrigation, obstruction, ground water extraction, and diversion; and (vii) Sources of pollution related to hydrologic modifications, including those caused by changes in the movement, flow, or circulation of any navigable waters or ground waters due to construction and operation of dams, levees, channels, or flow diversion facilities.
Null zone	The region in a partially- or well-mixed estuary where the residual bottom currents are effectively zero. Landward of this point there is a net seaward residual velocity along the bottom caused by river inflow and seaward of the null zone, gravitational circulation produces a net landward transport of denser more saline water along the bottom. The null zone is the theoretical upstream boundary of the entrapment zone.
Organic	Referring to or derived from living organisms. In chemistry, any compound containing carbon. [Environmental Glossary 4th ed.]
Organism	Any living thing. [Environmental Glossary 4th ed.]
Organochlorines	A range of compounds used mainly as pesticides, and the polychlorinated biphenyls (PCBs), which are of industrial origin. These compounds share a range of properties which set them apart from other types of pollutants. They are generally of relatively low water solubility, also known as chlorinated hydrocarbons. [AHI, 304]
Overdraft correction programs	Programs wherein water is imported or local waters are used to recharge a basin for the benefit of all overlying users in the basin. There is no ownership of the recharged water. It becomes part of the safe yield of the basin. See Groundwater banking.
Oxidizing agent	A substance (such as oxygen, chlorine, or bromine) that oxidizes by taking up electrons.
Ozonation	The municipal water treatment process wherein ozone is used to disinfect a water supply.

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Ozone	An unstable allotropic form of oxygen, O3, with a pungent odor like that of chlorine, formed variously, as by the passage of electricity through the air. It is a powerful oxidizing agent, much more active than ordinary oxygen, and is used for bleaching oils, waxes, ivory, flour, [paper bulp] and starch, and for disinfecting drinking water. [Funk & Wagnalls Standard College Dictionary, 1973]
PEROXONE	A combination of ozone and hydrogen peroxide.
Partially-mixed estuary	An estuary in which vertical mixing due to tidal currents is large enough to prevent a distinct vertical density stratification between fresh and seawater but not strong enough to completely remove any vertical variation in density. The northern reach of San Francisco Bay is typical of a partially-mixed estuary.
Peat	A substance consisting of partially carbonized vegetable material, chiefly mosses, found usually in bogs. [Funk & Wagnalls Standard College Dictionary, 1973]
Pelagic	Describes open-water (or deep-water) habitat or those organisms which depend upon it.
Perozonation	The use of PEROXONE to disinfect water.
Pesticide	All chemical agents which are used for the control of some noxious insect, plant, or animal. Pesticide compounds, synthetic as well as substances which occur in nature, can be categorized into four groups as follows: (1) Chlorinated hydrocarbons containing carbon, hydrogen, and chlorine. Examples are DDT, toxaphene, lindane, chlordane, and endrin. (2) Organic phosphorus (thiophosphate) compounds of phosphorus, oxygen, carbon, and hydrogen. Examples are parathion and malathion. (3) Organic compounds including organic sulfur compounds, organic mercurials, dinitrophenols, carbamates, and natural products such as rotenone, nicotine, and strychnine. (4) Inorganic compounds of copper sulfate, arsenate of lead, zinc, chlorine, thallium, calcium arsenate, and sodium floroacetate. [ASCE, SA 5, p. 28, October, 1967]
Phytoplankton	Free-floating aquatic plants.
Piscivore	Fish eater.

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Plankton	The animal and plant organisms that drift or float with currents, waves, etc., unable to influence their own coures, ranging in size from microorganisms to jellyfish: distinguished from benthos. Compare to "Nekton". [Funk & Wagnalls Standard College Dictionary, 1973]
Point source	Any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural stormwater discharges and return flows from irrigated agriculture. [CWA, Sec. 502 (14)]
Pollution	An alteration of the quality of the waters of the state by waste to a degree which unreasonably affects (1) such waters for beneficial uses, or (2) facilities which serve such beneficial uses. "Pollution" may include "contamination". [CWC Sec. 13050(l)]
	The introduction into the groundwater of the state of an active ingredient, other specific product, or degradation product of an active ingredient of an economic poison above a level, with an adequate margin of safety, that does not cause adverse health effects. [CFAC Sec. 13142]
Polychlorinated biphenyls (PCBs)	A mixture of compounds composed of the biphenyl molecule which has been chlorinated to varying degrees. [Environmental Glossary, 4th ed.]
	PCBs are considered an environmental problem because of their abundance, very great persistence, and considerable toxicity to aquatic biota. [AHI,304]
Postammoniation	The addition of ammonia to water as the last step in municipal water treatment.
Potable water	Suitable for drinking. [Funk & Wagnalls Standard College Dictionary, 1973]
Preammoniation	The addition of ammonia to water as it first enters a municipal water treatment, prior to the application of any other water treatment process.
Precipitation	The discharge of water (as rain, snow or hail) from the atmosphere upon the earth's surface. [DWR Bulletin 118]
Preirrigation	The efficiency of an on-farm preirrigation; the ratio of the

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efficiency (PIE)	sum of the depth of water used for soil moisture replacement (SWR1) and cultural practices (CP1) to the depth of applied water (AW1), expressed as a percent. No leaching requirement is included. [Westlands Water District, Water Conservation and Drainage Reduction Programs, 1987-1988, Definition of Terms, November 1989]
Progressive wave	A tidally-driven wave which travels along an estuary. This type of wave occurs in long shallow estuaries where there is a significant frictional resistance to the tidal flow and only weak wave reflection at the head of the estuary. The tide in the northern reach of San Francisco Bay travels upstream as a progressive wave.
Pulse flow	A substantial increase in the flow of water followed by a decrease within a relatively short period of time.
Quality of water	The chemical, physical, biological, bacteriological, radiological, and other properties and characteristics of water which affect its use. [CWC Sec. 13050(h)]
Rare species	A species, subspecies, or variety is rare when, although not presently threatened with extinction, it is in such small numbers throughout its range that it may become endangered if its present environment worsens. [CFGC Sec. 1901]
Recharge	The flow to ground water storage from precipitation, infiltration from streams, and other sources of water. [DWR Bulletin 118]
Reclaimed water	Water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur. [CWC Sec. 13050(n)]
Recruitment	Addition by reproduction of new individuals to a population.
Reservoir reoperation	A quantitative study in which the operating rules for a reservoir are changed from the rules actually used in the historical operation of the reservoir. The new operating rules result in different releases from the reservoir than actually occurred historically.
Residual current	The net transport of a particle averaged over a complete tidal cycle.
Residual disinfectant concentration	The concentration of disinfectant measured in mg/l in a representative sample of water. [40 CFR 141.2]
Residue	Generally refers to that portion of a sample remaining after

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	drying at 103-105 degrees C or 180 degrees C to a constant weight. [Standard Methods ... 14th ed.,1975]
	Under certain circumstances, the toxic material found when a sample has been analyzed; usually refers to a toxicant in a food or tissue sample, expressed as a proportion of the original weight. [SWRCB Order No. WQ 85-1]
Resource	That which is, or may be, readily available as a source of supply or support; anything that can be drawn upon when needed, whether material or non-material. [Resource Conservation Glossary]
Reverse flow	In the context of this report, the term reverse flow refers to net flow being in the upstream direction in the Southern and Western Delta. This condition occurs between approximately the western end of Sherman Island (in the Delta) and the export pumps when Delta inflow is relatively, low and Delta consumptive uses and exports are high.
Riparian	Pertaining to the banks and other terrestial environs adjacent to water bodies, watercourses, and surface-emergent aquifers (e.g. springs, seeps, oases), whose waters provide soil moisture significantly in excess of that otherwise available through local precipitation. Vegetation typical of this environment is dependent on the availability of excess water.
Riparian water right	The right to use water on land bordering a stream. See also Water rights. [SWRCB Order No. WQ 85-1]
Riparian wetland	A zone which may be periodically inundated by water, characterized by moist soil and associated vegetation; typically bounded on one border by a drier upland and on the other by a freshwater body. [SWRCB Order No. WQ 85-1]
Riverine	Pertaining to or like a river; riparian. [Funk & Wagnalls Standard College Dictionary, 1973]
Run	To migrate, especially to move in a shoal in order to spawn. [American Heritage Dictionary 4th ed.]
Runoff	That part of precipitation which is not absorbed by soil, evaporated, or transpired by plants, but finds its way into streams as surface flow. [Fundamentals of Ground Water Contamination Glossary, 1985]
	Any precipitation, leachate, or liquid that drains from any part of a waste management unit. [23 CCR 2601]

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Salinity	The total concentration of dissolved ions in water, a conservative property. [T,XLV,5:12-5:25] The salt content of a water. [SWRCB Order No. WQ 85-1] Usually expressed as ppt (g/l), or ppm (mg/l).
Salvage	Those fish diverted away from or removed from screens at intakes to diversion structures and subsequently returned to a water body.
San Pablo Bay	The portion of San Francisco Bay encompassing the area from the Richmond-San Rafael Bay Bridge on the south side to the Petaluma River on the north and the Carquinez Strait on the east. It has a surface area of 105 sq. mi. at MLLW, mean depth of 9 ft., and mean surface area of 605,000 AF.
Saturated zone	An underground zone in which all openings in and between natural geologic materials are filled with water. [23 CCR 2601]
Secondary treatment	Biochemical treatment of wastewater after a primary stage, using microorganisms to consume the organic material in the wastewater. Use of trickling filters, or the activated sludge process, removes floating and settleable solids and about 90 percent of oxygen demanding substances (BOD) and suspended solids (TSS).
Selenium (Se)	A non-metallic element chemically resembling sulfur. Essential for animals at trace concentrations, selenium is toxic to animals in deficient or excessive dietary exposure. [SWRCB Order No. WQ 85-1] Selenium occurs in three environmentally significant valence states Se -2 (selenide), Se +4 (selenite), and Se +6 (selenate), with different toxic properties.
Semidiurnal tide	A tidal variation consisting of two high and two low tides per lunar day (24.84 hrs). In San Francisco Bay, the cycle typically consists of a high high followed by a low low, a low high, a high low and back to a high high tide.
Shoal	A shallow place in any body of water, or an assemblage or multitude; throng (i.e., a school of fish). [Funk & Wagnalls Standard College Dictionary, 1973]
Shorebird	Any of various birds (suborder Charadrii) that frequent beaches and also the shores of inland waters, including the snipe, sandpiper, and plover. [Funk & Wagnalls Standard

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	College Dictionary, 1973]
Siemen	The standard unit of electrical conductivity, equal to 1 mho. The reciprocal, or inverse, of the standard unit of electrical resistance, the ohm.
Slot limit	Fishing regulation which permits taking of fish only with specified lengths, usually medium-sized fish to protect both very young or immature fish and very large, older and typically more fecund (high reproductive capacity) fish.
Slough	A stagnant swamp, backwater, bayou, inlet, or pond in which waterbacks up. [Funk & Wagnalls Standard College Dictionary, 1973]
Sludge	Residual solids and semi-solids from the treatment of water, wastewater, and other liquids. It does not include liquid effluent discharged from treatment processes. [23 CCR 2601]
Smolt	An anadromous fish that is physiologically ready to undergo the transition from fresh to salt water; age varies depending on species and environmental conditions. [Bell, M.C., 1986]
Soluble, e.g., soluble selenium	Any substance capable of passing through a membrane filter with a rated pore diameter of 0.45 microns. [Standard Methods..., 14th ed., 1975] Capable of entering into solution or of being dissolved; as, a soluble substance. [Webster's New Universal Unabridged Dictionary, 1979]
South Bay	The portion of the San Francisco Bay stretching from the San Francisco-Oakland Bay Bridge on the north to Mountain View in the south. It has a surface area of 214 sq. mi. at MLLW, mean depth of 11 ft. and mean volume of 1,507,000 AF
Species	A unit used in the classification of plants and animals. Ideally a species is defined as a group of organisms that interbreed with each other to produce fertile offspring. Members of different animal species do not normally interbreed; if they do, the progeny are sterile. Hybrids of two plant species are usually sterile but may occasionally be made fertile by allopolyploidy [doubling the number of chromosomes present in the sterile hybrid]. Members of the same species usually resemble each other closely, but when species are subdivided into subspecies, clines, or cultivated varieties, the members of these subgroups often

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WORD/PHRASE	DEFINITION
	differ from one another in appearance. [Dictionary of Life Sciences, 2nd ed., 1976]
Spring tide	(1) The tide that appears at or soon after the new moon and the full moon: it is normally the highest tide of the month. (2) Any great flow, rush or flood. [Webster's New Unabridged Dictionary, 1979]
Standard	See Water Quality Standard.
Standing wave	A wave which does not travel so the point of maximum amplitude (crest to trough) remains fixed in space. Standing waves occur in an estuary when the resistance to the flow is small. The tide in South Bay is an example of a standing wave.
Statewide plan	A water quality control plan adopted by the State Water Resources Control Board in accordance with the provisions of Cal.Water Code Sec. 13240 to 13244, for waters where water quality standards are required by the Federal Water Pollution Control Act. Such plans supersede regional water quality control plans for the same waters to the extent of a conflict. [CWC Sec. 13170]
Striped bass index (SBI)	An index of the number of young bass which have survived through their first summer. Young bass are sampled with nets which are most efficient for fish about 1.5 inches in length. Sampling methods are consistent (with respect to location, frequency, technique, etc.) so that the number of young striped bass caught may be compared with the catch at various locations year to year. The number of young bass caught by the standard sampling methods allows statistical treatment of data to estimate the abundance of young striped bass and to correlate changes in the number caught with changes in environmental factors. [SWRCB, Final EIR for the 1978 WQCP and D-1485]
Subsurface agricultural drainage system	A set of tile drains, collectors and, in most cases, one or more sump pumps which are installed in a field to remove water from the root zone of any crops which may be planted. Generally installed in areas with shallow perched water tables.
Suisun Bay	The portion of San Francisco Bay between the entrance to the Carquinez Strait and Chipps Island, including Grizzly and Honker bays. It has a surface area of 36 sq. mi. at MLLW, mean depth of 14 ft. and mean volume of 323,000 AF.

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GLOSSARY

WORD/PHRASE	DEFINITION
Suisun Marsh	The marshlands generally located in southern Solano County, south of the cities of Fairfield and Suisun City. It is bordered on the south by Suisun Bay including Grizzly and Honker bays, and the confluence of the Sacramento and San Joaquin rivers; on the east from Denverton along Shiloh Road to Collinsville. Suisun Marsh occupies an area of 116,000 acres, including about 88,000 acres below the five-foot contour It is the largest contiguous brackish water marsh in the United States. Suisun Marsh's boundaries are legally defined in CPRC Sec. 29101 and 29101.5.
Suspended solids (SS)	Tiny particles of solids dispersed but undissolved in a solid, liquid, or gas. Suspended solids in sewage cloud the water and require special treatment to remove (Environmental Glossary 4th ed.). Generally considered those particles subject to Brownian diffusion.
Threatened or endangered	Fish and wildlife, and plants are in danger of or threatened with extinction because their habitats are threatened with destruction, adverse modification, or severe curtailment, or because of over exploitation, disease, perdition, or other factors. [CFGC Sec. 2051]
Tidal prism	The increase in water volume landward of a given cross-section from low tide to high tide. Related to the tidal volume on the ebb and flood tide and the cumulative upstream inflows.
Tile drains	A System of clay pipes installed beneath irrigated lands to artificially remove water saturating the soil of the crop root zone by gravity flow.
Total dissolved solids (TDS)	A measure of the salinity equal to the amount of material remaining after evaporating a water sample at 103 to 105 degrees Celsius (formerly centigrade) for one hour. [SWRCB Order No. WQ 85-1] Total dissolved solids levels are expressed in units of weight per unit of volume (e.g. mg/l).
Toxic pollutants (elements, metals or organics)	Those pollutants, or combinations of pollutants, [elements, metals,or organics] including disease-causing agents, which after discharge and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions, or physical

APPENDIX C

GLOSSARY

WORD/PHRASE	DEFINITION
	deformations, in such organisms or their offspring. [Resource Conservation Glossary]
Toxicant	(1) A chemical that controls pests by killing rather than repelling them. (2) A harmful substance or agent that may injure an exposed organism. [Environmental Glossary 4th ed.]
Trace elements (metals or organics)	Those elements [metals or organics] generally present in natural water samples at concentrations of less than one milligram per liter. [SWRCB Order No. WQ 85-1]
Tracy Pumping Plant	The U.S. Bureau of Reclamation Central Valley Project pumping plant in the Delta west of Tracy. The source of the water in the Delta-Mendota Canal.
Transpiration	The photosynthetic and physiological process by which plants release water into the air in the form of water vapor. [Resource Conservation Glossary]
Tributary area	The whole area or region from which a waterbody receives its supply of water. An alternative phrase for watershed.
Triennal basis	Once every three years.
Trihalomenthane formation potential (THMFP)	The analytical results from a non-standard laboratory technique which is used on raw water supplies in an attempt to quantify the likelihood that trihalomethanes will be formed when the water is disinfected.
Trihalomethanes (THMs) or Total trihalomethanes (TTHMs)	Singular; One of the family of organic compounds, named as derivatives of methane (CH4), wherein three of the four hydrogen atoms are each substituted by a halogen atom [e.g., chlorine, bromine] in the molecular structure. [40 CFR 141.2] Plural; (1) A subset of chemicals known as disinfection by-products (DBPs) which are formed when waters are disinfected. THMs are produced when dissolved organic substances, such as fulvic and humic acids produced by decaying crop residues or peat soil in fresh or saline waters, come in contact with the oxidizing agents used to disinfect drinking water. [T,VI,38:3-5; T,XLVI,99:11-19] (2) The sum of the concentration in mg/l of the trihalomethane compounds (trichloromethane [chloroform], dibromochloromethane, bromodichloromethane, and tribromomethane [bromoform]), rounded to two significant figures. [40 CFR 141.2]

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GLOSSARY

WORD/PHRASE	DEFINITION
Tule	A large bulrush (Scirpus acutus) growing on damp or flooded land in the southwestern United States. [Funk & Wagnalls Standard College Dictionary, 1973]
Turbidity	Hazy air due to the presence of particles and pollutants; a similar cloudy condition in water due to suspended silt or organic matter. [Environmental Glossary 4th ed.]
Unimpaired flow	The embayment and channel flows which would exist in the absence of upstream impoundments and diversions of rainfall or snowmelt runoff, but in the presence of existing channel configurations, both upstream and in the Delta.
Unsaturated zone	The underground zone in which not all openings in and between natural geologic material are filled with water. The zone may contain water or other liquid held by capillary forces, or percolating liquids. [23 CCR 2601]
Usable storage capacity	The quantity of ground water that can be economically withdrawn from storage. [DWR Bulletin 118]
Waste	Sewage and any and all other waste substances, liquid, solid, gaseous, or radioactive, associated with human habitation, or of human or animal origin, or from any producing, manufacturing, or processing operation of whatever nature, including such waste placed within containers of whatever nature prior to, and for purposes of, disposal. [CWC Sec. 13050(d)]
Water borne	(1) Floating on or supported by water; afloat. (2) Transported by water, as freight. (3) Transmitted in water, as a disease germ. [American Heritage Dictionary]
Water quality	See Quality of water.
Water quality control	The regulation of any activity or factor which may affect the quality of the water of the state and includes the prevention and correction of water pollution and nuisance. [CWC Sec. 13050(i)]
Water quality control plan	A designation or establishment for the waters within a specified area of (1) beneficial uses to be protected, (2) water quality objectives, and (3) a program of implementation needed for achieving water quality objectives. [CWC Sec. 13050(j)]

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WORD/PHRASE	DEFINITION
Water quality objective	The limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area and time frame. Water quality objectives may be either numerical or narrative. [CWC Sec. 13050] Factors to be considered in establishing water quality objectives shall include, but not be limited to all of the following: (a) past, present, and probable future beneficial uses of water, (b) environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto, (c) water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area, (d) economic considerations, and (e) the need for developing housing within the region. [CWC Sec. 13241]
Water quality standard	A term used in connection with the federal Clean Water Act which is roughly equivalent to water quality objectives and designated beneficial uses.
Water rights	A form of property rights which give their holder the right to use public waters. During the history of California, a variety of procedures have been in effect by which a person could acquire a water right A summary follows: Appropriative rights initiated prior to December 19, 1914 - prior to the 1914 statutes which established the present system for appropriating water (taking water and putting it to a use removed from property adjoining the water source) two methods of appropriation existed. Prior to 1872, appropriative rights could be acquired simply by taking water and putting it to beneficial use. In 1872, Sections 1410 through 1422 of the California Civil Code enacted a permissive procedure by which priority of rights could be established as of the date of posting of notice of intention to appropriate water, subject to a show of diligence in carrying out construction of diversion works and actual use of water. Appropriators who did not follow the permissive procedure had priority from the date of actually putting the water to use. Because in an appropriative water rights system, first in priority means first served by available water, considerable advantage attaches to an earlier date of

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WORD/PHRASE	DEFINITION
	appropriation. Appropriative rights initiated after December 19, 1914 - an appropriation of water must now comply with provisions of Part Two, Division Two of the California Water Code. The right to use water appropriated under earlier procedures as well as under the current procedure maybe lost by abandonment or non-use. Riparian rights - an owner of land adjoining a water source has, under common law, the right to use a share of the water available from the source. Only those parcels of land adjoining the source may be served by it under riparian right, unless a nonadjoining parcel was at one time part of a riparian parcel and the riparian right was transferred when the parcel was sold. No priority is established for riparian rights, and all riparian users must share the available supply. Riparian owners have priority of use over all appropriators. Prescriptive rights - rights obtained when water is taken and put to use for five years even though other right holders' interests are damaged, if the injured parties take no action in their own defense. California Water Code Section 1225 and State Water Resources Control Board policies have made obtaining secure prescriptive rights essentially impossible since 1914. [SWRCB Order No. WQ 85-1]
Waters of the state	Any water, surface or underground, including saline waters within the boundaries of the state. [CWC Sec. 13050(e)]
Watershed	The land area that drains into a body of water. [Environmental Glossary 4th ed.] Also see Tributary area
Winter ponding	The practice of flooding large agricultural field areas for the purpose of controlling weeds, and reducing salt concentrations in the upper region of the soil profile. Secondary benefits are recreation, possible salt leaching.
Yearling	An organism that is one year old but has not completed its second year.
Yolk	The store of food material, mostly protein and fat, that is present in the eggs of most animals. [Martin, E.A., Dictionary of Life Sciences, 2nd ed., 1983]
Yolk sac	The four extraembryonic membranes that surround vertebrates during early development. The yolk sac forms as a ventral

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WORD/PHRASE	DEFINITION
	outgrowth of the embryonic gut of most fish, reptiles, and birds. As the yolk is absorbed the sac is withdrawninto the embryo. [Martin, E.A., Dictionary of Life Sciences, 2nd ed., 1983]
Young-of-year (YOY)	Fish of other organisms less than one (1) year old.
Zooplankton	Free-floating aquatic animals.

APPENDIX D
MONITORING STATIONS
(ORDERED BY INTERAGENCY NUMBER)

INTERAGENCY (I-A) NUMBER	RIVER KILOMETER INDEX (RKI) NUMBER	STATION NAME
	RMKL020(?)	NORTH FORK MOKELUMNE RIVER NEAR WALNUT GROVE (EXACT LOCATION NOT SPECIFIED)
	ROLD19 (?)	OLD RIVER NEAR HOLLAND TRACT (EXACT LOCATION NOT SPECIFIED)
	ROLD32	OLD RIVER AT INDIAN SLOUGH
	ROLD51	OLD RIVER AT WESTSIDE IRRIGATION DISTRICT INTAKE
	RSAC124	SACRAMENTO RIVER AT WALNUT GROVE
	RSAC155	SACRAMENTO RIVER AT FREEPORT
	RSAN050	SAN JOAQUIN RIVER AT TURNER CUT
	RSAN061	SAN JOAQUIN RIVER AT STOCKTON
	RSAN062	SAN JOAQUIN RIVER AT ROUGH AND READY ISLAND
	SLSBT11	STEAMBOAT SLOUGH AT SUTTER SLOUGH
D-02	RSAC063	SUISUN BAY AT SEAL ISLANDS (PORT CHICAGO)
D-06	RSAC056	SUISUN BAY AT MARTINEZ
D-07	LSBB11	GRIZZLY BAY DOLPHIN 2.5 KM. NORTH OF GARNET POINT
D-07 (NEAR)	SLMZU01	MONTEZUMA SLOUGH NEAR MOUTH
D-28A	ROLD21	OLD RIVER NEAR RANCHO DEL RIO
MD-04	CFTRN1	TURNER CUT NEAR MCDONALD ISLAND BRIDGE
P-08	RSAN056	SAN JOAQUIN RIVER AT BUCKLEY COVE
S-10	SLSUS18	SUISUN SLOUGH AT BOYNTON SLOUGH
S-17	SLCRD07	CORDELIA SLOUGH AT IBIS CUT
S-31	SLSUS01	SUISUN SLOUGH NEAR MOUTH
S-32	SLCRD05	CORDELIA SLOUGH ABOVE SOUTHERN PACIFIC R.R. CROSSING AT CYGNUS
S-35 (NEW)	SLGYR03	GOODYEAR SLOUGH AT MORROW ISLAND CLUBHOUSE
S-36	SLSUS00	SUISUN SLOUGH AT MOUTH
S-48	SLMZU10	MONTEZUMA SLOUGH AT CUTOFF SLOUGH
S-63	SLDEN01	DENVERTON SLOUGH
S-64 (NEW)	SLMZU25	MONTEZUMA SLOUGH AT NATIONAL STEEL
S-75 (OLD)	SLGYR04	GOODYEAR SLOUGH 1.3 MILES SOUTH OF MORROW ISLAND [DRAINAGE] DITCH AT PIERCE

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MONITORING STATIONS
(ORDERED BY INTERAGENCY NUMBER)

INTERAGENCY (I-A) NUMBER	RIVER KILOMETER INDEX (RKI) NUMBER	STATION NAME
S-93	SLMCYO (?)	HILL SLOUGH (EXACT LOCATION NOT SPECIFIED)
S-94	SLSUS07	SUISUN SLOUGH AT HUNTER CUT

APPENDIX D
MONITORING STATIONS
(ORDERED BY RIVER KILOMETER INDEX)

INTERAGENCY (I-A) NUMBER	RIVER KILOMETER INDEX (RKI) NUMBER	STATION NAME
MD-04	CFTRN1	TURNER CUT NEAR MCDONALD ISLAND BRIDGE
D-07	LSBB11	GRIZZLY BAY DOLPHIN 2.5 KM. NORTH OF GARNET POINT
	RMKLO20(?)	NORTH FORK MOKELUMNE RIVER NEAR WALNUT GROVE (EXACT LOCATION NOT SPECIFIED)
	ROLD19 (?)	OLD RIVER NEAR HOLLAND TRACT (EXACT LOCATION NOT SPECIFIED)
D-28A	ROLD21	OLD RIVER NEAR RANCHO DEL RIO
	ROLD32	OLD RIVER AT INDIAN SLOUGH
	ROLD51	OLD RIVER AT WESTSIDE IRRIGATION DISTRICT INTAKE
D-06	RSAC056	SUISUN BAY AT MARTINEZ
D-02	RSAC063	SUISUN BAY AT SEAL ISLANDS (PORT CHICAGO)
	RSAC124	SACRAMENTO RIVER AT WALNUT GROVE
	RSAC155	SACRAMENTO RIVER AT FREEPORT
	RSAN050	SAN JOAQUIN RIVER AT TURNER CUT
P-08	RSAN056	SAN JOAQUIN RIVER AT BUCKLEY COVE
	RSAN061	SAN JOAQUIN RIVER AT STOCKTON
	RSAN062	SAN JOAQUIN RIVER AT ROUGH AND READY ISLAND
S-32	SLCRD05	CORDELIA SLOUGH ABOVE SOUTHERN PACIFIC R.R. CROSSING AT CYGNUS
S-17	SLCRD07	CORDELIA SLOUGH AT IBIS CUT
S-63	SLDEN01	DENVERTON SLOUGH
S-35 (NEW)	SLGYR03	GOODYEAR SLOUGH AT MORROW ISLAND CLUBHOUSE
S-75 (OLD)	SLGYR04	GOODYEAR SLOUGH 1.3 MILES SOUTH OF MORROW ISLAND [DRAINAGE] DITCH AT PIERCE
S-93	SLMCY0 (?)	HILL SLOUGH (EXACT LOCATION NOT SPECIFIED)
D-07 (NEAR)	SLMZU01	MONTEZUMA SLOUGH NEAR MOUTH
S-48	SLMZU10	MONTEZUMA SLOUGH AT CUTOFF SLOUGH
S-64 (NEW)	SLMZU25	MONTEZUMA SLOUGH AT NATIONAL STEEL
	SLSBT11	STEAMBOAT SLOUGH AT SUTTER SLOUGH
S-36	SLSUS00	SUISUN SLOUGH AT MOUTH

APPENDIX D
MONITORING STATIONS
(ORDERED BY RIVER KILOMETER INDEX)

INTERAGENCY (I-A) NUMBER	RIVER KILOMETER INDEX (RKI) NUMBER	STATION NAME
S-31	SLSUS01	SUISUN SLOUGH NEAR MOUTH
S-94	SLSUS07	SUISUN SLOUGH AT HUNTER CUT
S-10	SLSUS18	SUISUN SLOUGH AT BOYNTON SLOUGH

Appendix F

NOTICE OF FILING

TO: Any Interested Person

FROM: State Water Resources Control Board, Division of Water Rights
P.O. Box 2000
Sacramento, CA 95810

SUBJECT: Notice of Filing Submitted under Section 21080.5 of the Public Resources Code

PROJECT PROPONENT: State Water Resources Control Board

PROPOSED PROJECT: Water Quality Control Plan for Salinity and Temperature for San Francisco Bay and the Sacramento-San Joaquin Delta Estuary

CONTACT PERSON: Ronald Bachman (916) 322-9869

PROJECT LOCATION: San Francisco Bay and the Sacramento-San Joaquin Delta Estuary (Bay-Delta Estuary)

PROJECT DESCRIPTION: Adoption of the Water Quality Control Plan described above.

This is to advise all interested parties that the State Water Resources Control Board is going to consider the adoption of a water quality control plan for the Bay-Delta Estuary. Action on this proposed plan will be taken in accordance with Section 21080.5 of the Public Resources Code, which exempts this regulatory program from the requirement to prepare an environmental impact report under the California Environmental Quality Act (Public Resources Code 21000 et seq.), and with other applicable laws and regulations.

Copies of the substitute document, including a proposed Environmental Checklist and a discussion of reasonable alternatives and feasible mitigation measures to minimize any significant adverse environmental impacts, can be obtained from Mr. Bachman (see above).

Comments on the proposed adoption should be submitted by March 11, 1991.

Signed: Walt Pettit

Title: Division Chief
for the State Water Resources Control Board

Date: Jan 15 1991

APPENDIX G
TRANSCRIPT INDEX

HEARING PHASE	HEARING DATE	TIME	REPORTERS VOLUME NUMBER	TRANSCRIPT SEQUENCE NUMBER
I	07/07/87	AM	I	I
I	07/08/87	AM	II	II
I	07/09/87	AM	III	III
I	07/13/87	AM	IV	IV
I	07/14/87	AM	V A	VA
I	07/14/87	AM	V B	VB
I	07/21/87	AM	VI	VI
I	07/22/87	AM	VII	VII
I	07/23/87	AM	VIII	VIII
I	07/23/87	AM	IX	IX
I	07/27/87	AM	X	X
I	07/28/87	AM	XI	XI
I	07/29/87	AM	XII	XII
I	07/30/87	AM	XIII	XIII
I	07/30/87	PM	XIV	XIVPOL
I	07/31/87	AM	XV	XV
I	08/11/87	AM	XVI	XVI
I	08/12/87	AM	XVII	XVII
I	08/12/87	PM	XVIII	XVIIIPOL
I	08/13/87	AM	XIX	XIX
I	08/13/87	AM	XX	XX
I	08/14/87	AM	XXI	XXI
I	08/15/87	AM	XXII	XXII
I	08/24/87	AM	XXIII	XXIII
I	08/25/87	AM	XXIV	XXIV
I	08/25/87	PM	XXV	XXVPOL
I	08/26/87	AM	XXVI	XXVI
I	08/27/87	AM	XXVII	XXVII
I	08/28/87	AM	XXVIII	XXVIII
I	09/08/87	AM	XXIX	XXIX
I	09/09/87	AM	XXX	XXX
I	09/14/87	AM	XXXI	XXXI
I	09/14/87	PM	XXXII	XXXIIPOL
I	09/15/87	AM	XXXIII	XXXIII
I	09/16/87	AM	XXXIV	XXXIV
I	09/21/87	AM	XXXV	XXXV
I	09/22/87	AM	XXXVI	XXXVI
I	09/23/87	AM	XXXVII	XXXVII
I	09/24/87	AM	XXXVIII	XXXVIII
I	09/29/87	AM	XXXIX	XXXIX
I	09/29/87	PM	XL	XLPOL
I	10/13/87	AM	XLI	XLI
I	10/14/87	AM	XLII	XLII
I	10/15/87	AM	XLIII	XLIII
I	10/26/87	AM	XLIV	XLIV
I	10/27/87	AM	XLV	XLV
I	10/28/87	AM	XLVI	XLVI
I	10/28/87	PM	XLVII	XLVIIPOL

APPENDIX G
TRANSCRIPT INDEX

HEARING PHASE	HEARING DATE	TIME	REPORTERS VOLUME NUMBER	TRANSCRIPT SEQUENCE NUMBER
I	10/29/87	AM	XLVIII	XLVIII
I	11/09/87	AM	XLIX	XLIX
I	11/23/87	AM	L	L
I	11/24/87	AM	LI	LI
I	11/25/87	AM	LII	LII
I	11/30/87	AM	LIII	LIII
I	12/01/87	AM	LIV	LIV
I	12/08/87	AM	LV	LV
I	12/09/87	AM	LVI	LVI
I	12/10/87	AM	LVII	LVII
I	12/14/87	AM	LVIII	LVIII
I	12/15/87	AM	LIX	LIX
I	12/21/87	AM	LX	LX
I	12/22/87	AM	LXI	LXI
I	12/29/87	AM	LXII	LXII
II	01/09/89	AM		LXIII
II	02/27/89	AM		LXIV
II	06/06/89	AM		LXV
PPD	12/04/89	AM	I	LXVIA
PPD	12/11/89	AM	II	LXVIB
WQCP	02/20/90	AM	I	LXVII
WQCP	02/20/90	PM	II	LXVIIPOL
WQCP	02/21/90	AM	III	LXVIII
WQCP	02/22/90	AM	III	LXIX
WQCP	02/26/90	AM	V	LXX
WQCP	02/26/90	PM	VI	LXXPOL
WQCP	02/27/90	AM	VII	LXX
WQCP	08/07/90	AM	I	LXXI
WQCP	08/07/90	PM	II	LXXIPOL
WQCP	08/08/90	AM	III	LXXII
WQCP	08/13/90	AM	IV	LXXIII
WQCP	08/13/90	PM	V	LXXIIIPOL
WQCP	08/14/90	AM	VI	LXXIV
WQCP	08/20/90	AM	VII	LXXV
WQCP	08/20/90	PM	VIII	LXXVPOL
WQCP	08/22/90	AM	IX	LXXVI
WQCP	08/23/90	AM	X	LXXVII
WQCP	03/11/91	AM		LXXVIII
EIRSP	03/26/91	AM	I	LXXIX
WQCP	04/02/91	AM		LXXX
EIRSP	04/08/91	AM	II	LXXXI
EIRSP	04/09/91	AM	III	LXXXII
WQCP	05/01/91	AM		LXXXIII

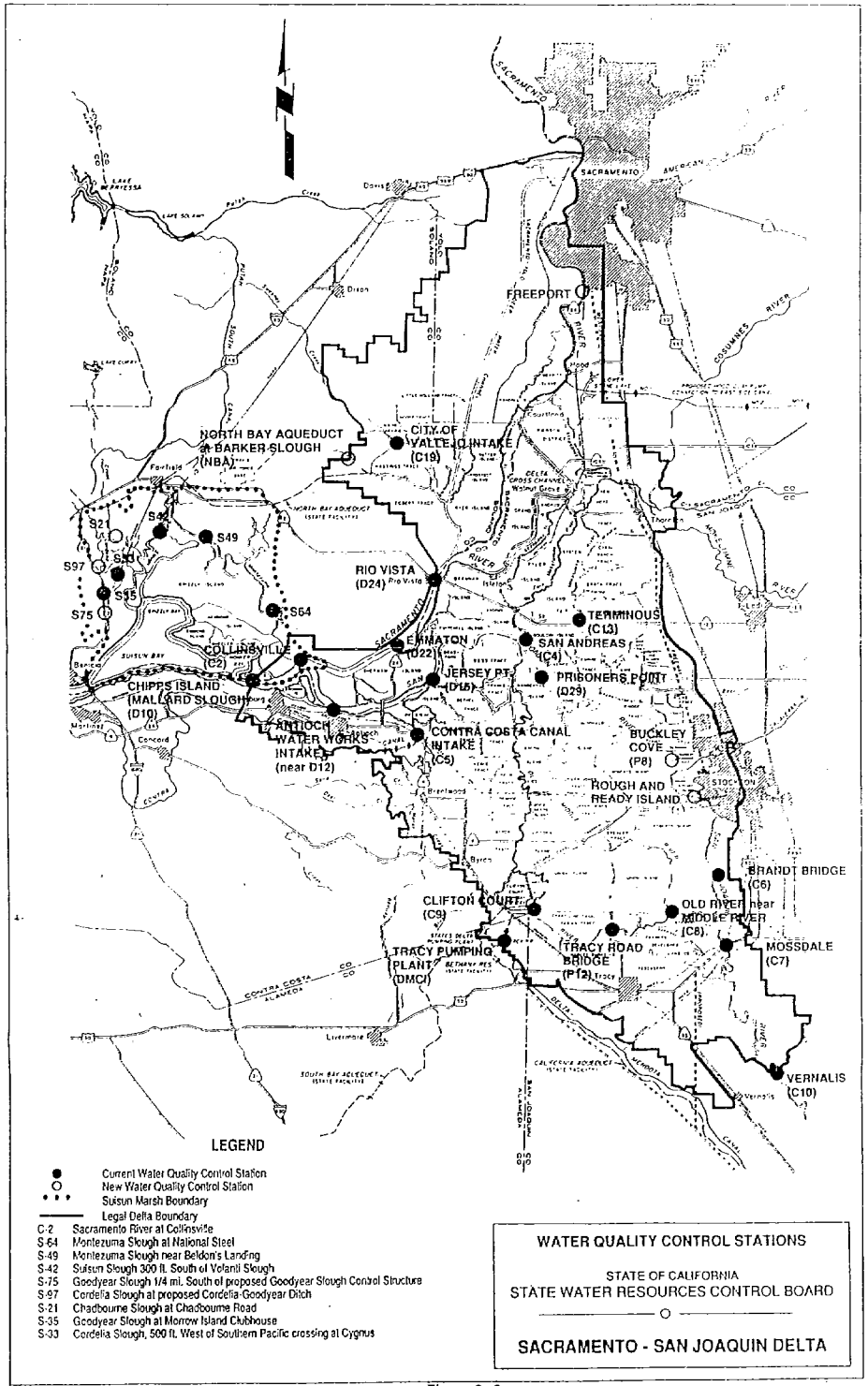
SACRAMENTO
FREEPORT
NORTH BAY AQUEDUCT at BARKER SLOUGH (NBA)
CITY OF VALLEJO INTAKE (C19)
S21
S42
S49
S97
S35
S75
S64
RIO VISTA (D24)
TERMINOUS (C13)
EMMATON (D22)
SAN ANDREAS (C4)
COLLINSVILLE (C2)
JERSEY PT (D15)
PRISONERS PUNT (D29)
CHIPPS ISLAND (MALLARD SLOUGH) (D10)
ANTIOCH WATER WORKS INTAKE (near D12)
CONTRA COSTA CANAL INTAKE (C5)
BUCKLEY COVE (P8)
ROUGH AND READY ISLAND
BRANDT BRIDGE (C6)
CLIFTON COURT (C9)
OLD RIVER near MIDDLE RIVER (C8)
TRACY ROAD BRIDGE (P12)
MOSSDALE (C7)
TRACY PUMPING PLANT (DMC)
VERNALIS (C10)
LEGEND
Current Water Quality Control Station
New Water Quality Control Station
Suisun Marsh Boundary
Legal Delta Boundary
C-2 Sacramento River at Collinsville
S-64 Montezuma Slough at National Steel
S-49 Montezuma Slough near Beldon's Landing
S-42 Suisun Slough 300 ft. South of Volanti Slough
S-75 Goodyear Slough 1/4 mi. South of proposed Goodyear Slough Control Structure
S-97 Cordelia Slough at proposed Cordelia-Goodyear Ditch
S-21 Chadbourne Slough at Chadbourne Road
S-35 Goodyear Slough at Morrow Island Clubhouse
S-33 Cordelia Slough, 500 ft. West of Southern Pacific crossing at Cygnus
WATER QUALITY CONTROL STATIONS
STATE OF CALIFORNIA
STATE WATER RESOURCES CONTROL BOARD
SACRAMENTO - SAN JOAQUIN DELTA

Figure 6 - 3