PATRICK J. PORGANS
Government Regulatory Specialist

P.O. Box [illegible], Sacramento, CA 95860

Telephone (916) 972-0654 FAX (916) 972-0313

Tuesday, March 7, 1995

Mr. Tom Howard:
Bay/Delta?
State Water Resources Control Board
901 P Street
Sacramento, CA 95814

Re: My Testimony Submitted to the SWRCB at Its Last Hearing on the Bay/Delta Water Quality Control Plan

Mr. Tom Howard:

This transmission contains a copy of the "SPECIFIC QUESTIONS THAT I NEED SPECIFIC ANSWERS TO. To make it simple, I checked ✓ the little boxes in the enclosed article, which I submitted to the Board in addition to the other questions and concerns that I raised at the SWRCB's last meeting. Furthermore, I have consistently raised doubts about the logic behind the SWRCB relying on the project operators to provide both the Board and the public with modeling data when they are suppose to be the ones that are being regulated. One could argue that it may not be a wise expenditure of public funds to have the "regulatory agency" develop its own model. That argument might hold water if it wasn't for the following facts: (1) the operators' past models have been inaccurate, (2) they have consistently failed to comply with the terms and conditions of their respective water right permits, (3) they took hundreds of thousands of acre-feet of water that they had no right to take, and (4) the collective operations of their respective water projects has been a major contributing factor to the deplorable state that the Bay/Delta is in as of late.

Once again, I respectfully remind the Board and its staff that the project operators DO NOT OWN THE WATER, they only have a permit to use the water. The water is a public trust resource that belongs to ALL of the PEOPLE. It is the SWRCB's responsibility to PROTECT this PUBLICLY OWNED RESOURCE, which heretofore, it has done a VERY POOR JOB of DOING so. Here again we have those that are suppose to be regulated providing almost all the data that the SWRCB - the "regulator" is dependent on!

Lastly, I want to know specifically WHO will be held accountable if the assumptions in the model fail to be accurate and WHO is going to enforce the water quality standards in the proposed draft Water Quality Control Plan when they are violated.

As per our telephone conversation, earlier today, I explained to you that I have noticed a pattern to the SWRCB/staff failure to response to specific questions raised by members of the public. Therefore, I want specific answers to my questions. Thank you.

For the record, I have enclosed copies of additional comments that I made before the Board at its "Public Technical Workshops on Water Supply Forecasting Methodology". Please include these in the record and respond to the "general issues" contained therein which were raised by me, the SWRCB, and the Department of Finance. It is understandable that your comments to the "general issues" undoubtedly may not be specific. Please send me a written response to all of the enclosed questions as soon as they are prepared.

If you have any questions, please contact me at your earliest convenience. Thank you.

Respectfully,

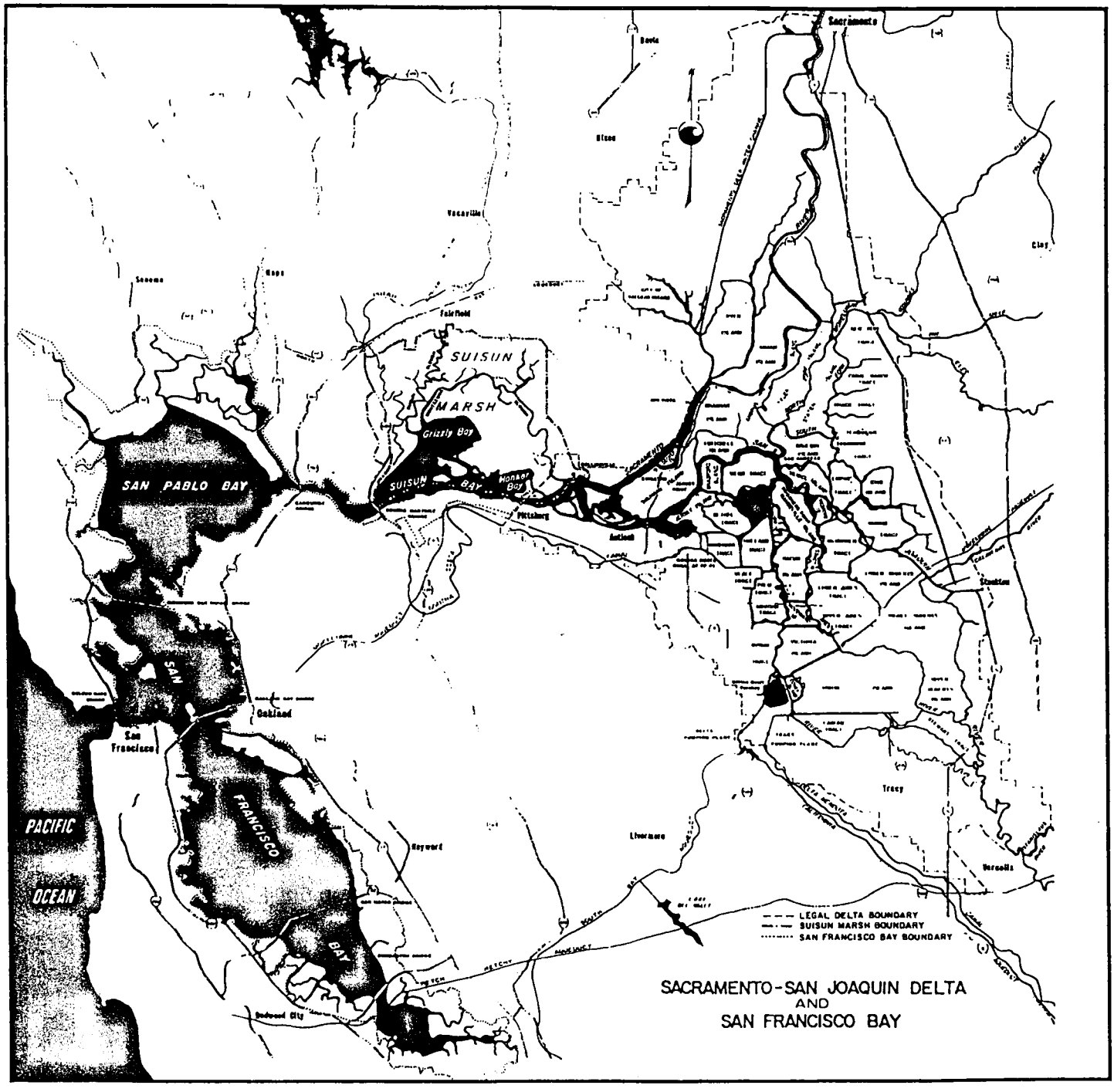
Patrick Porgans

Patrick Porgans
PP:sp BDWQCP

The PUBLIC TRUSTee

Volume 1, Number 1 January - March 1995

Banking on the Conquest of California's Delta



BANKING ON THE CONQUEST OF CALIFORNIA'S DELTA

In a carefully orchestrated and access-controlled news conference, Gov. Pete Wilson recently announced a "cease-fire" in California's never-ending water wars that supposedly will ensure protection for the Delta's water supply and dwindling fishery. Most of the media bought it hook, line and sinker.

Interior Secretary Bruce Babbitt and EPA Administrator Carol Browner stood supportively at Wilson's side during the Dec. 15 Sacramento news conference. Wilson, conceding there might be some "major sledding ahead", nevertheless contended a "truce" hammered out by the U.S. Bureau of Reclamation, California's Dept. of Water Resources (DWR), the mammoth Metropolitan Water District of Southern California, California Urban Water Association, banking interests, western San Joaquin Valley farming barons and token representation from grower-friendly environmentalists, will finally begin to "fix" the broken Delta. Don't hold your breath.

The Governor's Press Conference Announcing the Delta Water Deal

Conspicuous by their absence at the news conference (and the truce talks) were officials of the commercial and sports fishing industries, many major environmental groups, public trust advocates, and critics of California's crumbling state and federal water delivery systems who see the "peace pact" as a last ditch effort (no pun intended) by vested interests who want to continue hogging the public water that made them wealthy and created the Delta crisis in the first place.

To the skeptics, Wilson's claim of cease-fire is about as reassuring as a claim by the Serbs that they are peace-loving and want only what's best for Bosnia.

The volume of water that will be left in the Delta to meet salinity standards and protect endangered species is the big issue in the 16-year battle over Delta protection and the governor's number crunchers were busy literally right up until the time of the news conference changing those figures to quench the thirst of existing water users. And even then they were still classified as preliminary numbers. The clear intent is to squeeze every possible drop out of the Delta and hope the weather will save us from our greed.

Government officials intentionally decided not to have copies of the most recent revised plan available for the press at the news conference. In addition, the "Principles for Agreement on Bay-Delta Standards Between the State of California and the Federal Government" was not made available to reporters until after the news conference, presenting a convenient obstacle for any intelligent questions on the details of the plan. Praise and mutual-backslapping, however, flowed in abundance.

Even Rep. George Miller, D-Calif., outgoing chair of the Congressional subcommittee that oversees the Bureau, joined the love-in, calling the plan a "comprehensive and scientifically sound approach to water management and species protection." It was science all right, political science.

Bank of America's role in the Delta conquest.

Wilson singled out Bank of America Vice-President and senior economist Fred Cannon for special praise in the negotiations which raises questions about B of A's interest. Could it have anything to do with the fact that Bank of America has a substantial financial investment in the western San Joaquin Valley agricultural empire? Or because bank officials were concerned about the fact that a number of farm water contractors have been unable to pay their water bills and default on payments could have a significant impact on the bank? B of A already reluctantly owns (through repossession from hapless cotton farmers) huge tracts of western San Joaquin Valley alkali farmland that is virtually worthless without water.

Bank of America is also a trustee for a portion of the State Water Project's (SWP) funds, and it purchased/syndicated about $800 million of the General Obligation Bonds that were used to finance the initial development of the SWP. Simply stated, B of A has a great deal at stake in maintaining current methods of distributing Delta water.

In addition, B of A and other banks, insurance companies and lenders make a tidy annual profit from government-guaranteed crop production loans on that western valley desert. Why rock the boat, even if it does scrape bottom once in a while?

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Lending and banking institutions warned California's credit rating - cash flow -could be damaged if conflict over Delta water diversions was not resolved

Indeed, water world insiders say it was the banking and lending institutions that prodded Wilson to stop his stonewalling of Delta reforms. Last March, Standard & Poor's, the nation's largest financial rating service, warned that California's credit rating could be damaged if something wasn't done to resolve the long-festering battle over Delta water diversions. B of A and other banks and business executives began pressuring both Wilson and President Clinton to cut some type of a deal, which is what Interior Secretary Bruce Babbitt called it at the December 15 news conference. A deal. And while it may be a good **"deal" for the "corporate species"** in the water world it may be a "very bad deal" for the Bay-Delta Estuary and public trust interests in the long run because of several serious flaws, such as:

☑ The plan admittedly, does not guarantee the reasonable protection of the Estuary's fish and wildlife beneficial uses. Instead, the Plan will "...protect fish and wildlife beneficial uses at a level which stabilizes or enhances the conditions of aquatic resources..." However, when it comes to other uses, the Plan will "...ensure the reasonable protection of municipal, industrial, and agricultural beneficial uses..." However, as one probes it becomes clear that all of the numbers are fluid.

☑ The State Board's estimated the water costs of the new Plan at 300,000 acre-feet in average years and 900,000 acre-feet in drought years. These water costs, however, are estimated by comparing the Plan's Delta export rates with inflated base export rates, thus producing inflated water costs. A better approach is to compare the Plan's Delta exports with the historical (actual) Delta exports that caused the decline in the Delta fisheries. When this comparison is done, the results show the decline that the "State Board's Plan" allows the state and federal projects to INCREASE EXPORTS.

☑ The new Plan discards "QWEST" flow criteria that requires the streamflow in the Delta to flow downstream, the natural direction. Instead the Plan substitutes a less restrictive "Export/Inflow" ratio that allows Delta exports to continue at rates that are damaging to the Delta's fisheries. The ratio was substituted even though "[n]o definitive studies or analyses were completed to support these export/inflow restrictions".

☑ According to the Governor, "No additional Endangered Species Act listings will occur within the three-year term of the agreement absent unforseen circumstances."

☑ To add insult to injury, the "Export/Inflow" ratio even allows the state and federal water projects to increase their exports to the San Joaquin Valley and Southern California when upstream nonproject water users have to give up water for the Delta. This will happen when the Board reallocates responsibility for meeting the objectives and require other water right holders in the system to contribute water to the Delta.

☑ State Water Board staff made several groundless environmental determinations in the environmental checklist. For example, the checklist concludes that the Plan will cause "substantial reductions in the amount of water otherwise available for public water supplies". It also concludes that the Plan will result in no "deterioration to existing fish and wildlife". Finally, the checklist concludes that the "project will result in increased groundwater withdrawals to replace decreased water supplies".

☑ The new plan opens the door to another Peripheral Canal proposal, sure to reignite the north-south bitterness that earmarked the 1982 Peripheral Canal battle.

☑ The truce was hammered out by the same interests and agencies which have been overdrawing Delta supplies for decades, and omitted a number of people that participated in the board's hearings.

☑ Current water users are relieved of any liability or pressure to give up more water if endangered species in the Delta continue to decline because of a lack of clean water.

☑ The new plan is unlikely to end the continued pollution of the Delta from toxic drainage water from Western Valley factory farms. This bottleneck in any comprehensive Delta protection plan remains unsolved a decade after the Kesterson National Wildlife Refuge disaster put food chain poisoning and deformed ducks on the front pages of America's newspapers. Indeed, after $100 million in studies and cleanup, the growers that polluted Kesterson are still pushing for a master drain canal to the Delta to dump the ag drainage into the Delta near Chipps Island. And on Dec. 17 a federal judge in Fresno, at the request of Westlands Water District, ordered the Bureau to apply to the State Water Resources Control Board (SWRCB) for a permit to finish the agricultural drain to the Delta.

☑ Most important of all, there is no guarantee that the water quality standards contained in the plan will ever be enforced by either the state or federal government. The principles contained in the so-called "peace agreement" are not binding.

A little history is in order here. In August 1978, the SWRCB exercised its reservation of jurisdiction over the water right permits for the federal Central Valley Project (CVP) and the SWP by adopting Water Right Decision 1485 (D-1485). At the same time, the board adopted the Delta Water Quality Control Plan. Together, the 1978 Delta Plan and D-1485 revised existing standards for flow and salinity in the Delta's channels and ordered the Bureau and DWR to meet these standards by either reducing pumping, releasing water stored in upstream reservoirs, or both. To address the continuing uncertainties associated with possible future project facilities and the need for additional information on the Estuary's ecosystem, the board committed to reviewing the Delta Plan in 10 years.

In the 1980s, it became apparent due to the precipitous decline in many species of fish that D-1485 was inadequate to protect beneficial uses of all Delta water users.

In July 1987, the board began proceedings to reexamine water quality objectives for the Bay-Delta Estuary and consider how water right permits would be modified to meet new objectives.

The water quality hearings continued through 1993. Over $10 million was spent on the hearings, which included testimony from dozens of experts on the Delta. Some said the Delta was fine. Others said the

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Delta was in its death throws and in danger of ecological collapse. In 1993 , the board finally came up with some numbers for fresh water flows to protect the Delta estuary. Western San Joaquin Valley growers, and landholders, who include some of the biggest farmers in America, and development interests in Southern California who dream of Los Angelesizing the entire state, screamed long and hard. Gov. Wilson responded by rejecting all of the "science" from the six years of water board hearings and called for some new "sound science" more friendly to his political backers.

In March 1994, the SWRCB, once again, commenced proceedings to review the Bay-Delta plans. While every one was seemingly preoccupied with a new plan to protect the Delta, current standards were being flagrantly violated and in some cases simply ignored by the Bureau and DWR officials.

During the first four years of the last drought more water was exported from the Delta than in any other four years of history.

During the first four years of the extended California drought that began in 1987, more water was exported from the Delta than any previous four-year period in state history. During the severe drought years of 1991 and 1992, the Bureau and DWR, the two largest exporters of water from the Delta, violated existing 1978 salinity standards more than 200 times and illegally impounded and/or exported about 300,000 acre-feet of water from the Delta worth $29 million.

This publisher went to the SWRCB to formally complain about the water theft and violations and the board held a hearing and conceded the violations occurred but refused to hold either the Bureau or DWR responsible for their infractions.

The Publisher and CSPA filed a Public Trust Lawsuit against the government for illegally exporting millions of dollars of water from the Bay/Delta Estuary.

This author and the California Sport Fishing Protection Alliance (CSPA) then filed a public trust lawsuit (Superior Court, County of Sacramento, Case No. 537641), in December of 1993 to recover the $29 million value in lost water. The suit set the stage for an injunction should future violations of the Delta standards or illegal exports occur. Since the filing of the suit, both agencies have ostensibly obeyed the export and salinity rules but there is concern that the new plan may make enforcement of any new, complex standards even more difficult.

More water quality violations occurred during Governor Wilson's tenure than in all of his predecessors combined.

Indeed, Interior Secretary Babbitt, with no apparent consultation with Congress, foolhardily agreed to buy any additional water that the two agencies failed to relinquish to meet Delta standards, over and above what is required to protect existing threatened or endangered species. However, when federal officials were later asked where the money would come from to buy this water that the agencies were legally obligated to give back to the Delta, they said they didn't know.

The new plan is a long way from being in place. If it gains EPA approval, it must undergo a SWRCB hearing on Water Rights. This proceeding could take 3 to 5 years and will fo-

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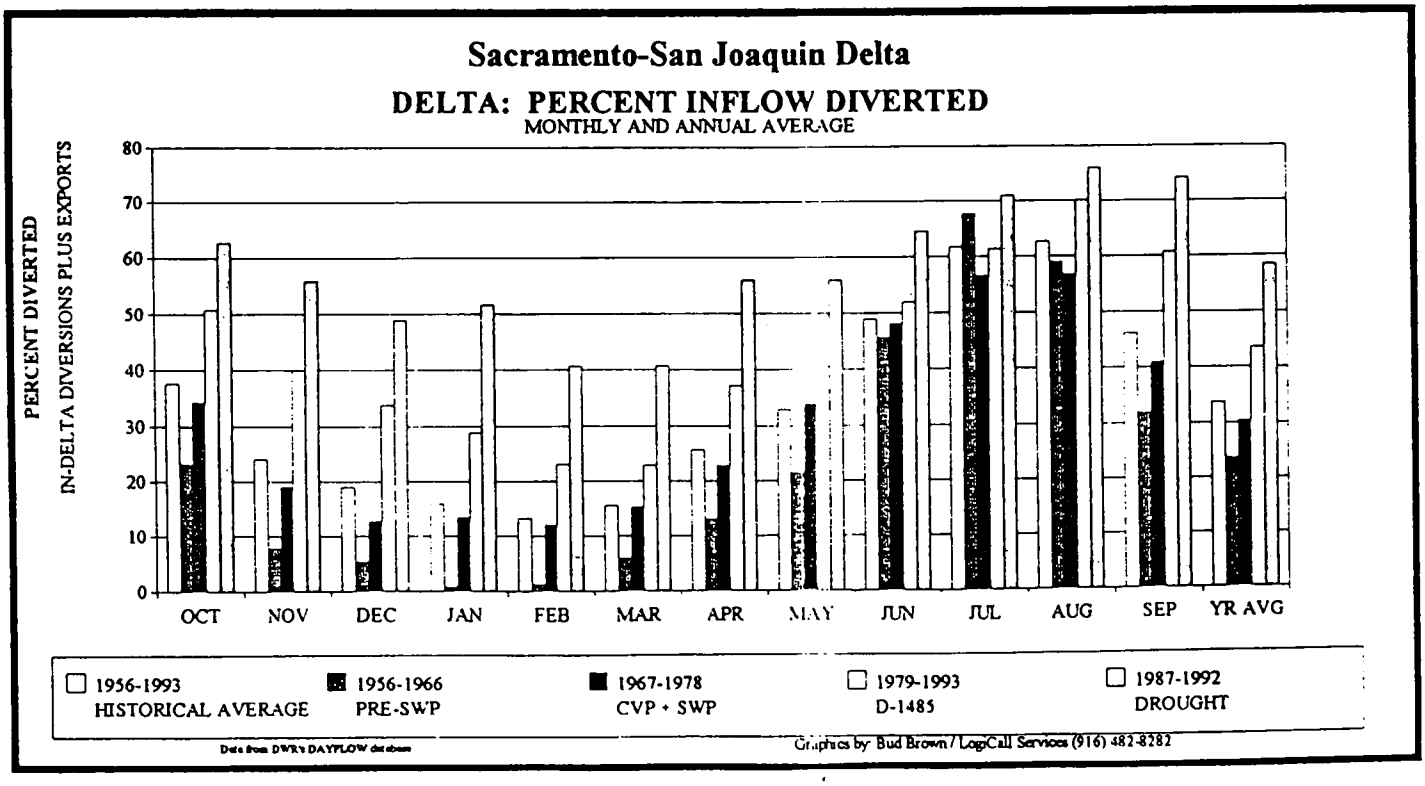

DELTA CONQUEST

Continued from page 5

cus on how much water the government water projects and upstream depletors will be required to provide to meet the water quality standards contained in the plan, which in theory will reduce their share of the water pie.

At this point, it is unclear whether the Board intends to make compliance with the plan mandatory forthwith or if compliance will be voluntary until the Board completes the hearing process. In an earlier draft of the new plan, there was language that would have required both DWR and the Bureau to implement the standards immediately, without waiting for the completion of a water rights proceeding. DWR is required to comply with California Water Code section 13247. The code section requires any state agency to comply with water quality control plans adopted by the state board. The Bureau is subject to a similar measure under the federal Clean Water Act, section 313(a) which requires federal agencies to comply with state requirements. However, the plan that was released excluded this mandatory language.

The critics may get some answers on what it all means when state Sen. Tom Hayden, chair of the Senate Natural Resources and Wildlife Committee, holds hearings (tentatively scheduled for February), on what it will mean to the Delta salmon fishery.

"On the basis of respected independent scientists, there is no assurance that California salmon will survive this political compromise," Hayden said at the time the plan was announced.

The environmentalists who participated in some of the peace talks admit the salmon fishery is not assured protection by the plan. Many governmental fisheries biologists were upset with the plan and the apparent sellout by the environmental groups. The Environmental Defense Fund has been in the doghouse with even mainstream environmental groups since it joined forces with the Westlands Water District a decade ago in an effort to find a way for the factory farms to export their drainage water laced with the deadly element selenium. An official of an environmental group who did participate in some of the "truce" talks defended his group's position and said they assessed the November elections and the prospects that the Endangered Species Act may be gutted by a Republican Congress next year and decided to cut their losses and take the best deal that they could get. See DELTA CONQUEST, page 27

STATE PUMPING WATER FROM DELTA IN EXCESS OF FEDERAL PERMIT

According to the California Department of Water Resources' (DWR's) records, it has pumped more water from the Delta, on certain days in January, than is allowed under the operational restrictions imposed by the U.S. Army Corps of Engineers (Corps). The historical pumping limitations is covered by the Nationwide permit for work completed before 1968.

If the historical levels of pumping are exceeded then DWR would be required to obtain a Section 10 permit (Harbors and River and Harbors Act of 1899), from the Corps.

The PUBLIC TRUSTee took the liberty to formally notify the Corps of the department's excessive pumping and is awaiting a reply from the Corps.

According to the Corps' the historic pumping limits at Banks pumping plant, established on August 7, 1981, is 6,880 cubic feet per second (cfs), averaged over three days. This may only be increased when flows in the San Joaquin River at Vernalis exceed 1,000 cfs during the mid-December to mid-March period. The amount that it may be exceeded is one third of the flows above 1,000 cfs.

The one and three day maximum pumping limitations are not a part of the federal-state Water Quality Control Plan. The department appear to be operating its project in accordance with the plan; however, on some days it has operated its pumps in excess of the amounts allowed under the existing Corps pumping limitation. However, to our knowledge, the Corps did not grant the department permission to exceed the pumping limitations.

The draft State Water Quality Standards and the U.S. Environmental Protection Agency's proposed standards allow exports at Banks and the U.S. Bureau of Reclamation Delta - Tracy Pumping Plant to occur as a function of total Delta inflow, regardless of flows in the San Joaquin River. Both are similar, allowing approximately 35 percent of total Delta inflow to be exported during February through June, and 65+ percent during July through January.

It is important to note that the Corps was not a party to the " Delta water quality agreement" nor was it a member of ClubFed. ■

CALIFORNIA'S MILLION DOLLAR DRAIN GAME

THE DRAIN GAME: Profits from the Past and Prospects for Future Commodities

Although the agricultural drainage problem was recognized long before most of the current lands were put into production, the government, in its infinite wisdom, built massive publicly-funded water projects. Today these projects are faced with billions in cost overruns and annual repayment deficits in order to irrigate even more lands without providing a viable solution to the drainage dilemma.

The big GAME players in the San Joaquin Valley, like Southern Pacific Railroad (which receives much of its land for free), J.G. Boswell and Salyer Land Company, have continued to amass fortunes from government subsidized water projects and at the same time they are bailed-out for the expense attributed to their self-induced drainage problems which continue to put a "drain" on the public's financial and natural resources--all part of the GAME.

If one was an entrepreneurial type and wanted to profit on a losing proposition, they would invest in California's multimillion dollar DRAIN GAME. To get into the GAME and become a viable player, one would need to develop a private corporation, preferably for tax shelter purposes. The company would then buy a few acres of desert land in the San Joaquin Valley that has access to government subsidized water. In order to qualify for a government source of revenue, the company would want to establish a special district, i.e., water irrigation or reclamation district, so that you would have the ability to float tax-free government bonds. If you had a green thumb, you could go into a lucrative cash-subsidized crop such as cotton. Or, if you were just in it for the money, you could lease the land out to some willing serf-type farmers like the policies followed by big oil and lending institutions.

However, if you want to be even further removed from the agricultural end of the GAME, you can still qualify as a player provided you can find a viable source of drainage water from other agricultural drainers or water districts. They would pay you to receive drainage from their lands and in es-

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MESOPOTAMIA

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"actualize and are not mitigated, they may prevent the Bureau from obtaining a discharge permit. However, the evidence does not establish that such prohibitory conditions now exist." (Why the government chose not to have Skorupa testify on his voluminous data on the selenium impacts in the Tulare Basin is one of the great mysteries of the trial. Can the judge really be saying that there is no evidence that "prohibitory conditions", i.e. bird mutations, are occurring, or is he just saying that the government failed to put on enough convincing evidence?)

- Expressed in 1994 dollars, the estimated project cost to complete the San Luis Drain to Chipps Island in the Delta is approximately $232 million, or $272 million at Martinez, plus costs of right-of way from Antioch to Martinez. The cost to restore drainage to the 42,000 acres of Westlands acreage that formerly drained to Kesterson is $5 million, and the cost to extend the drainage system in Westlands to all lands that will eventually need drainage is $47.3 million. Annual costs of operating the San Luis Drain will be $4 million a year. Treatment facilities for selenium removal (to less than 50 parts per billion in the drainage water, still highly toxic to fish and birds) will cost from $2.76 million to $30 million and cost from $1.9 million to $6 million a year to operate. (Anyone remotely familiar with drainage costs estimates knows that they have ranged from $7 million in 1956 to $13 billion, the figure used by former Bureau Regional Director David Houston when he was interviewed on CBS' "60 Minutes" on March 9, 1985. The government revises them so frequently it is hard to keep track.)

Significantly, Wanger found that the Westlands Water District has the ability to repay the costs of the Drain and "has the financial ability to finance the cost of treatment facilities and their operation." (The Government did not dispute this point. Westlands farmers, of course, argued during the Kesterson days and for years thereafter that it would be too expensive to treat the drainage water to remove most of the selenium.)

- As a matter of law, Wanger found that the Migratory Bird Treaty Act (MBTA), invoked by former Interior Secretary Donald Hodel in the closure of Kesterson in 1985, would not prevent the Bureau from seeking a state permit for the drain. "Even if applicable," Wanger wrote, "the MBTA is not mandatory. It directs the government to determine when, and to what extent, and by what means "to allow" the taking of any migratory bird." (For the government attorneys, who have failed since 1987 to take any enforcement action to stop bird mutations in the Tulare Basin caused by mini-Kesterson drainage evaporation ponds, it must have been somewhat embarrassing to claim the Migratory Bird Treaty would block completion of a drain. As the judge well knew, the government can hardly argue that it is against the law (MBTA) to dispose of drainage when birds are being killed, if that same government is not enforcing the bird protection act against current violators.)

- Wanger also found, as conclusions of law, that the Endangered Species Act, the Clean Water Act, and the 1992 Central Valley Project Improvement Act, were no impediments to an order to the Bureau to seek a permit to complete the drain.

Some background on Wanger is appropriate here. Wanger and Robert Coyle, the presiding justice of the Fresno federal court, are both former partners in the Fresno law firm of McCormick Barstow Sheppard Wayte & Carruth, which has many agribusiness clients in the western San Joaquin Valley. According to an April 22, 1987 article in the Fresno Bee, Coyle was among 28 investors ordered to repay $1.4 million in subsidies for 1986 cotton crops in Kings County. Karen Sorlie Russo, a Sacramento attorney hired to represent Coyle and the other investors, was quoted as saying that Coyle had first bought farmland in 1966 and had been "very active in farming."

The Agricultural Stabilization and Conservation Service, an arm of the U.S. Department of Agriculture, had found that Coyle, 24 other individuals and three trusts had all leased individual blocks of land from a 6,600-acre parcel of land subleased to them by M.A.C Management, that they had all used the same lender, Western Cotton Services, and that all 6,600 acres were farmed for the 25 investors and three trusts by a custom farming company, California Ag Management. Russo, however, claimed that Coyle and all the others were each "independent" farmers and thus eligible for payments of up to $50,000 in subsidy price supports. She said each of the investors had "extensive farming experience and each qualified as a "farmer" under the Department of Agriculture's definition: someone who earns at least $5,000 annually from farming. How an incorporeal concept such as trust can be a "farmer" was left unexplained by Russo.

Whatever the real motivations of Wanger, Coyle, the Westlands, the Justice Department and the Bureau of Reclamation in the prolonged litigation, Wanger's order, if not appealed, will finally force some hard choices by the State Water Resources Control Board, which has ducked the drainage issue since the 1960s. Wanger ruled explicitly that the State Water Board can reject a drain to the Delta if it wants to. For that, Wanger is to be commended. ■

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While some feel the standards are a giant step backwards from recent levels of protection in the Delta, which were derived from Endangered Species Act actions for Delta smelt and winter-run salmon, the Department of Water Resources views the standards as an opportunity to resume planning with a vengeance to increase exports from the Delta. Once the new Delta standards were signed, the department immediately resumed discussions with the California Department of Fish and Game for signing-off on the long awaited Article VII Agreement. In so doing, Fish and Game would: (1) release the department from any further mitigation requirements for offsetting the indirect and direct effects of their existing Delta pumping operations, (2) give the department the green light to construct and operate the South Delta Facilities and the first stage of the Kern Fan Element of the Kern Water Bank, and (3) would allow the department to proceed with modifying their Corps of Engineer permits to increase their average daily divisions into Clifton Court Forebay (Banks Pumping Plants) and to allow the department to bring their new pumps on line, pumping at maximum design capacity ,(10,300 cfs).

Wet winters may save the plan from being tested but the next long drought will undoubtedly reveal any substantive flaws in this plan to protect the Delta, which is home to 120 species of fish and provides 60 percent of the fresh water used in California. Unfortunately, as fate would have it, the Delta fish will be the guinea pigs..■

NOTICE
of
PUBLIC TECHNICAL WORKSHOP
on
WATER SUPPLY FORECASTING METHODOLOGY

Tuesday, June 9, 1992

10 a.m. - Noon

Department of Water Resources

1416 -9th Street

First Floor Auditorium

Sacramento, California

In the Bay-Delta Proceedings, the Department of Water Resources was asked to convene a technical forum for interested parties to explain and discuss the assumptions and methodology used in preparing the Four-Basin Sacramento River Index unimpaired flow forecasts. In response to this request, the Hydrology Branch staff of the Division of Flood Management will explain the methods used in preparing the water supply forecasts which are published in DWR Bulletin 120, Water Conditions in California, a product of the California Cooperative Snow Surveys program.

During the workshop, DWR staff will discuss:

- Measurement of snow
- Precipitation data used in forecasting
- Flow and the derivation of unimpaired runoff
- The runoff forecasting equations, with emphasis on April-July runoff
- Other factors used to temper the raw forecasts

There will be opportunity for questions and comments from the audience.

Further information concerning the workshop can be obtained by contacting Maurice Roos, DWR Chief Hydrologist, at (916) 653-8366, or Gary Hester, Chief Forecaster, at (916) 653-7433.

STATE OF CALIFORNIA

Pete Wilson, *Governor*

STATE WATER RESOURCES CONTROL BOARD
THE PAUL R BONDERSON BUILDING
901 P STREET
SACRAMENTO, CA 95814
(916) 657-2187

Mailing Address:
DIVISION OF WATER RIGHTS
P O BOX 2000, Sacramento, CA 95812-2000

June 2, 1992

To: Interested Parties in the Bay-Delta Proceedings

CANCELLATION OF THE PUBLIC OPERATIONS STUDY WORKGROUP MEETINGS

This is to inform you that the monthly Operations Study Workgroup meetings will be suspended until further notice. The meetings were suspended to allow for the Interim Water Rights Action Hearing, which is scheduled to begin on June 22 and run through July 23, 1992. A water right decision is anticipated in December 1992. The Operations Study Workgroup meetings may resume after that time.

The "Small Ops" coordinating group, which meets weekly to better coordinate the technical details of the operation studies, will continue to meet every Wednesday, at 9:30 a.m., in Room 210 of the Resources Building until further notice. The primary purpose of the "Small Ops" meetings during June and July, 1992, is to discuss and resolve, if possible, any unresolved issues from previous meetings of the larger Operations Study Workgroup. The next several "Small Ops" meetings are tentatively scheduled as follows:

DAY	TIME
Wednesday June 10	9:30 a.m.
Wednesday June 17	9:30 a.m.
Wednesday June 24	No Meeting
Wednesday July 1	9:30 a.m.

The minutes from the April and May Operations Study Workgroup meetings will be mailed out during the next couple of weeks. If you have any questions, please contact Richard Satkowski at (916) 657-0435.

Sincerely,

Richard Satkowski for

David R. Beringer
Program Manager
Bay-Delta Section

PATRICK J. PORGANS
Government Regulatory Specialist

P.O. Box 60940, Sacramento, CA 95860

(916) 972-0654 / FAX (916) 731-4552

Project/Subject: State Water Resources Control Board's (SWRCB's) Water Right Phase of the Bay/Delta Estuary Proceedings: Presentation at the Board's Public Workshop, Monday, January 6, 1992, which provided Interested Parties the Opportunity to Present Ideas to the SWRCB on Which Water Rights Holders Should Help Meet Flow and Salinity Standards for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary.

Introductory statement:

I would like to thank the Board for this opportunity to present my concerns and provide input into the ongoing Bay/Delta hearing process.

To begin with I share the concerns raised by the former speakers/participants that the Board's proposed December 1992 deadline to complete the water right phase of the Bay-Delta hearing process is unrealistic. In addition, I respectfully submit the following comments and concerns:

- It is a know fact that neither the Department of Water Resources (DWR) or the U.S. Bureau of Reclamation (USBR) have assessed and or fully mitigated the impacts associated with water exports from the SWP and or the CVP. State and federal fishery scientist concluded that water exports from the Delta the SWP and CVP are primarily to blame for decimating populations of striped bass, salmon and Delta smelt.

- During the first four years of the drought more water was exported from the Delta than in any other four years of California's history. According to DWR's DAYFLOW data, as much as 67 percent of the water flowing into the Delta in 1990 was diverted for either in-channel uses or exports. (Please refer to Attachment 1.) SWRCB staff have voiced their concerns that they not even sure of the levels of exports because of conflicting data from DWR and USBR. (Please refer to Attachment 2.) Despite the vast amounts of water that have already been diverted from the Delta, DWR is proposing to export even more water from the Delta in the future.

- The present condition of the Bay-Delta reflects the fact that the SWRCB has failed to protect all of the beneficial uses within the estuary. In water year 1991, while DWR and the USBR increased water exports, they violated Decision 1485 water quality standards on over 100 days; totalling over 200 violations. (Please refer to Attachment 3.) To date, the Board has failed to take an enforcement action against these agencies.

- In addition, my clients, a number of small farmers in the western portion of the Delta suffered severe economic impacts because they were unable to obtain the quality of water they were entitled to receive. The poor quality of water was primarily the result of DWR's increased water exports and its flagrant violation of water quality standards, which was to the detriment to all beneficial users in the Delta.

While I am cognizant of the Board's limitations, i.e., increased work load on staff, reduction in employees, budgetary constrictions, however, I am equally concerned about the Board's conflicting priorities, absence of critical data, and its apparent reluctance to enforce water quality laws.

Perhaps it is appropriate for me to remind the Board of its duties, obligations and commitment to the public. I will read directly from a statement recently issued by the Board.

The overall mission of the State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Boards (RWQCB) is to protect the availability and quality of California's water. In particular the mission of the Water Rights Division is 'to establish and maintain a stable system of water rights in California to best develop, conserve, and utilize, in the public interest, the water resources of the state, while protecting vested rights, water quality, and the environment.'

Effective planning and management of the future of California's water depends primarily on systematic evaluation of existing water availability and instream resources, the ability to protect future water supply and quality needs, and the capability to translate this information into a sound basis for decision-making. Modeling of hydrologic variables and dynamics can provide a valuable tool to assess the impacts of various alternative management decision, since modelers can study theoretical solutions of both real and anticipated water resources problems. Mathematical (computer) models provide a vehicle for general information on surface and ground water supplies and movement, as well as the interactions between water sources, precipitation, water management (dam releases, permits and appropriations, etc.), usage estimates, and so forth. Alternatively, such models can be used to help design and develop the water management and use policies necessary to meet pre-defined criteria for water quality and quantity.

Computer modeling is an increasingly important tool to enable the Board to analyze and protect water quantity and quality parameters, and is dependent on the availability of computer hardware and software, data and support personnel to be successfully applied to water management problems. Currently, modeling resources are insufficient for the Division to fully meet its mandates to develop comprehensive water right decisions and water quality control plan, especially in the Bay-Delta Estuary.

III. Reasons Why Problem Is Not Being Met With Current System

- *A. Insufficient in-house modeling resources*
- *B. Limited access to other agency resources*
- *C. Costs associated with private consulting firms*
- *D. Unavailability of models and datasets*
- *E. Lack of oversight of water-right holders's modeling*

IV. Program Objectives

The primary objectives of the program are:

1. *To enhance the access of Division staff to advanced hydrologic modeling capabilities, including hardware/software, datasets, and support personnel.*
2. *To provide a mechanism for integrating resources into a comprehensive information and analysis system.*
3. *To ensure that water-management information is provided to decision-makers and the public in a timely manner, in response to changing conditions and mandates.*[1] (Please refer to Attachment 4.)

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[1] SWRCB, Division of Water Rights, Bay-Delta Section, Modeling Enhancement Program, Preliminary Draft, July 13, 1990, p. 2, Section II. Problem Statement.

Problems/Solutions/Recommendations:

It is apparent from the aforementioned statements that the Board recognizes the fact that system analysis - modeling - is imperative, and that the model should be developed and in place before the water right process is completed.

It is my understanding that the Board submitted a Budget Change Proposal for the Model Enhancement Program (MEP) which was approved by the Governor along with the required funds. However, subsequent to the approval the Governor requested that all agencies make a 5 percent cutback due to the latest budget crisis. The Board opted to used the funds earmarked for the modeling enhancement program to meet the 5 percent cut. It that true. (The Board confirmed the aforementioned statement, please refer to the Board's taped-recording record of the hearing held on Monday, January 6, 1992, at the Resources Building.

I am very concerned about the Board's decision for the following reasons.

It is difficult for me to comprehend how the Board expect to proceed with the hearing process in light of the fact that it has already conceded to the fact that "Currently, modeling resources are insufficient for the Division to fully meet its mandates to develop comprehensive water right decisions and water quality control plans, especially in the Bay-Delta Estuary." (Please refer to Attachment 4, page 2, last paragraph.)

"If" the Board is serious about carrying out its mandates to protect the Bay-Delta it should take immediate steps to reinstate the funds for the modeling enhancement program. Failure to take such an action will have an irreparable impact on the Board's credibility. (Please refer to Attachment 5.)

This Board should not even consider future exports proposals by DWR or any other agency until the water quality/right issues are resolved. The Board should discourage DWR's proposal to pump additional water from the Delta because the records seem to indicate that the water may not be there.

I believe that it would be advantageous to scale down SWP entitlement as a viable means to provide Bay-Delta protection.

Conflicting laws concerning water rights: Watershed-water right priority are not inclusive in the SWRCB's data base. The hiarchy of need and priority of right needs to be addressed.

This issue of what constitutes unreasonable use needs to be defined. Over the last decade, I have testified before the Board and consistently stated my concerns over the irrigation of land in the San Joaquin Valley where there are know toxic problem areas both in the SWP and CVP service area, which I believe constitute the unreasonable use of water. These lands should be taken out of production as a means to alleviate water quality problems in the San Joaquin Valley and the Bay-Delta.

I am cognizant of the Bay-Delta watershed water availability and use study being conducted by Boyle Engineering for the Board, and I support that study, however, the study does not go far enough. Historically, I have supported the Board's Automated Water Rights Information System (AWRIS) program. I am a firm supporter and believer that we need all the data that we can obtain in order to make sound planning and management decisions. However, for decades the Board and other agencies such as DWR and the USBR have hinder the collection of this critical type of data.

Conclusion:

In conclusion, I should add that if the Board fails to assert its authority, and in so doing fails to protect the water rights of my clients, then they may be left with no recourse but to petition the Board to force it to protect their water rights. Such an action may include a "full-blown water right adjudication" in the Delta and upstream rivers. I am looking forward to the Board's response to my comments and recommendations. If I can be of any assistance to the Board please do not hesitate to contact me. Thank you.

Respectfully,

Patrick Porgans
PJP:sp

Attachments

fn/swrcbsh

The State Water Resources Control Board's Modeling Enhancement Program is a new project. The objective of this program is to provide the State Board with the modeling capability to better plan for and manage California's complex water system. Modeling capability is necessary because the Board is mandated to perform specific functions, for which modeling is the only realistic approach to support mangement decisions. More specifically, the concerns that the Board is required to investigate are:

MEMO TO SWRCB DIRECTOR FROM DIV OF WATER RIGHTS Pg 1,2 LOICE

- o The water supply and water quality impacts of proposed changes to the water system, including facilities or modificationss to water quality objectives.
- o The availability of unappropriated water.
- o The impacts of temporary and permanent changes of water rights.
- o The effect of pollutants on streams, lakes, estuaries, bays, and groundwater.
- o The need for a waste load allocation to meet a water quality objective.
- o The water conditions required to preserve instream uses, such as recreation and fish habitat.

Currently, the Board's modeling capability is very limited. The limited work is done for the Board by private consultants or other governmental agencies.

The impacts of eliminating all of the modeling funds are as follows:

10/5/90 MEMO TO FINANCE

- o Water quality and water allocation evaluations will not be done in time for water quality control plans and water right decisions, especially in the Bay-Delta Estuary
- o Public trust resources may be adversely affected if full impacts of proposed action are not fully evaluated.
- o Water project operation study results will not be evaluated leading to one-sided Board decisions. This will result in more lawsuits and extensive litigation, both of which will require expenditure of additional Board resources.

Pg 4 BCP ✓ Pg 4 FSL

- o The Board will continue to be criticized for not having sufficient modeling tools to evaluate modeling performed by major water right holders and to improve upon them.

Pg 4 BCP ✓ Pg 4 FSL

- o The Board will continue to be criticized for letting the "fox guard the hen-house" associated with having water right holders perform the modeling studies, since they often have a vested economic interest in the outcome.

Pg 3 BCP ✓ Pg 6 FSL

- o The Board will have to continue to rely on costly private engineering or consulting firms, thus costing more money in the long run.

ATTACHMENT 4

Budget Change Proposal

Division of Water Rights, Bay-Delta Section
Modeling Enhancement Program

FY 1991-92

I. Background

The overall mission of the State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Boards (RWQCB) is to protect the availability and quality of California's water. In particular, the mission of the Water Rights Division is "to establish and maintain a stable system of water rights in California to best develop, conserve, and utilize, in the public interest, the water resources of the state, while protecting vested rights, water quality, and the environment." Both supply and quality issues have captured increased public attention in recent years as a result of the on-going drought, awareness of water quality degradation, and legislative, judicial, and regulatory actions. The future outlook for the Division is that its public profile will increase and that the public will demand that it take a larger responsibility for the development of information that leads to its decisions.

Effective planning and management for the future of California's water depends primarily on systematic evaluation of existing water availability and in-stream resources, the ability to project future water supply and quality needs, and the capability to translate this information into a sound basis for decision-making. Modeling of hydrologic variables and dynamics can provide a valuable tool to assess the impacts of various alternative management decisions, since modelers can study theoretical solutions to both real and anticipated water resource problems. Mathematical (computer) models provide a vehicle for generating information on surface and ground water supplies and movement, as well as the interactions between water sources, precipitation, water management (dam releases, permits and appropriations, etc.), usage estimates, and so forth. Alternatively, such models can be used to help design and develop the water management and use policies necessary to meet pre-defined criteria for water quality or quantity.

The State Board is getting involved in more comprehensive water rights issues as water supplies become more scarce and public trust resource values in California become more important. An area of major concern is the Bay-Delta watershed, since all water management decisions in the watershed have the potential for enormous economic and environmental consequences, measured in the billions of dollars. The complexity and critical implications of Bay-Delta analysis necessitate the use of computer modeling techniques. In

addition, there are other geographic areas where the Division will be addressing comprehensive water rights issues over the next few years, including Mono Lake and the Yuba, American, Trinity, Mokelumne, Carmel, and Santa Ynez Rivers. Computer modeling will be needed in these areas as well.

In addition, advanced data analysis and modeling techniques will be necessary to the successful use of the "Clean Water Strategy" by other programs. Since the CWS is a set of tools for developing water management plans, computer modeling can both facilitate the use of the tools and, to the extent modeling helps to guide management activities, serve as a prototype for the comprehensive use of the CWS concept. Specifically, CWS consists of the Water Quality Assessment, which provides information about water quality conditions throughout the state, the nature, extent, and probable cause of problems or needs, and the extent to which beneficial uses are sustained, and of the characterization methodology, which arrays information from the Assessment and other sources to provide a systematic means of determining priorities. Support for CWS is a key component of the Division of Water Rights' and the Bay-Delta Section's modeling requirements.

Currently, the Division of Water Rights has limited modeling capabilities. Advanced modeling is highly dependent on the availability of high-performance computers, sophisticated software, reliable data, and trained and experienced users. These are available, to varying degrees, in other state departments (especially the Department of Water Resources), federal agencies (notably the US Bureau of Reclamation and Geological Survey), and private engineering and consulting firms. Use of these outside resources requires cooperative agreements and contracts to enable the work to be done as well as sufficient computational capacity and personnel in the agencies/firms to perform the required analyses.

Modeling, although exacting mathematically, is based on empirical observations and theoretical interpretations of the operation of hydrologic systems. It is highly complex and strongly dependent on the specific observations and assumptions made in the process. Good utilization of models requires regular "tuning" adjustments and re-interpretation of results. It is often the case that significantly different results can result from relatively minor model procedure or data changes. Particularly when viewed in the absolute terms of the dollar costs associated with miscalculation of water availability or quality, correct, unbiased, and rigorous modeling standards are necessary to meet Division mandates. This implies a high degree of control over the modeling process.

II. Problem Statement

Computer modeling is an increasingly important tool to enable the Board to analyze and project water quantity and quality parameters, and is dependent on the availability of computer hardware and software, data, and support personnel to be successfully applied to water management problems. Currently, modeling resources are insufficient for the Division to fully meet its mandates to develop comprehensive water right decisions and water quality control plans, especially in the Bay-Delta Estuary.

III. Reasons Why Problem Is Not Being Met With Current System

Presently the Division uses a combination of in-house resources, public agency agreements and private firm contracts. Each of these solutions imposes limitations on the overall modeling capabilities of the Division.

A. Insufficient in-house modeling resources

- A small percentage of the existing models available for analysis are currently accessible and used within the Division.
- Division computers are not powerful enough to store data required for running models, nor are the data retrievable if stored on Board data processing systems due to the absence of high-bandwidth networking.
- Existing systems are not powerful enough to run complex models in reasonable periods of time. For example, the Fischer Delta Model, a combination hydrodynamic/salinity model, requires 10 to 14 days to run on the Division's MicroVAX II computer, allowing only two to three iterations to be performed per month.
- The Division does not have sufficient modeling personnel to develop data sets, perform the model runs, and analyze the results of the studies.

B. Limited access to other agency resources

- Other agencies are constrained in the amount of modeling work that can be performed for the Division, due to their own missions and higher-priority workload.
- Agencies may be unable to perform certain functions on behalf of the Division in support of the upcoming Bay-Delta hearings since the agencies may be party to those hearings, which are anticipated to be adversarial in nature.
- Division control over how models are run and the format of various outputs is limited, and thus the integration of modeling results is very difficult.

C. Costs associated with private consulting firms

- Use of private engineering or consulting firms is too costly to allow for complex, iterative modeling of variable phenomena.
- Institutional and technical problems associated with performing analyses at various distributed sites are comparable to those of using public agency agreements.

D. Unavailability of models and datasets

- Numerous models describing hydrologic characteristics are potentially available, but are not directly usable by Division staff either in-house or through outside agreements.

- Datasets are not directly available, and cannot be made accessible on-line in the current data processing system configuration.
- Integration of data inputs and outputs is not feasible where both modeling tools and database resources are distributed in a variety of locations, and would require a "web of interconnectivity"—maintaining multiple connections among many different machines—rather than extraction and downloading to a common data/compute server.

E. Lack of oversight of water-right holders' modeling

- The State Board has been criticized for not having sufficient modeling tools to critically evaluate modeling performed by major water-right holders and to improve upon them.
- There is an appearance of "the fox guarding the hen-house" associated with having water-right holders perform the modeling studies, since they often have a vested economic interest in the outcome.

IV. Program Objectives

The primary objectives of the proposed program are:

- To enhance the access of Division staff to advanced hydrologic modeling capabilities, including hardware/software, datasets, and support personnel.
- To provide a mechanism for integrating resources into a comprehensive information and analysis system.
- To ensure that water-management information is provided to decision-makers and the public in a timely manner, in response to changing conditions and mandates.

V. Alternative Means of Solving Problem

Several alternative approaches to resolving the problems described above are available to the Division. Each of these has particular advantages and disadvantages, but all address aspects of the Division's modeling needs. These alternatives have been developed through the course of the Modeling Enhancement Feasibility Study; the Report on this Study will document the implementation details and costs associated with each alternative.

In summary, the options available to the Division include the following four alternatives:

A. Existing system ("Do Nothing")

This alternative would continue the existing program of contracting out most modeling, with some capabilities maintained within the Division using existing hardware and software. The Division has four Associate Water Resource Control Engineers currently supporting its modeling efforts, though more of their time is spent managing outside modeling activities than actually

performing model-based analyses on Division systems. Including administrative and technical support personnel, the Division is spending approximately $740,000 per year in salary, benefits, and indirect costs associated with the modeling effort in the Bay-Delta Unit alone. Of this, about $246,400 is actually dedicated to modeling and supervision of outside modeling projects (based on an average PY cost in this task area of $61,600/annum).

On the other hand, the Division also spends approximately $500,000 per year on outside modeling contracts to support both model development and data analysis (based on 1989-90 expenditures). Finally, the Division has been dependent on work done at other governmental agencies but not billed to the Board. Five to six people at the Department of Water Resources and two at US Geological Survey are dedicated to performing modeling analyses used by the Division for its own work.

This activity is not amenable to traditional workload measurement techniques, since there is no easily definable unit of work. A relatively small percentage of staff time is spent running the models out on the computer compared to the time generating the appropriate input data and analyzing the results. In other words, it may take days or even weeks to perform a particular analysis, depending on the detail required and the number of unknowns to be evaluated. (Note that this type of study would require months or even years to perform in an entirely manual way, if it were possible at all.)

As noted above, this alternative does not address the technical, information, or planning requirements of the Division.

B. Expanded consulting arrangements

Under this alternative, the Division would enter into a long-term agreement with a water resources consulting firm who could provide trained modeling personnel to the Board to work under the immediate direction of existing supervisorial staff in Board offices. Currently, there is no firm with an existing Master Services Agreement that has the necessary expertise to provide this service. Staff-year costs associated with this alternative are higher than using State Board employees, due to higher contract salary and overhead rates without a significant reduction in indirect costs (since they would be using State facilities and support staff).

The Division does not have the computer resources to support contract staff working at its own facilities, so computer time would have to be acquired through a data center contract. Teale mainframe services are available for State agencies, though they have not been traditionally oriented toward computationally-intensive work such as the modeling proposed. (Teale services are especially useful for large-scale data management projects and archival storage.)

It is likely that any available contractor would also have agreements with water rights holders, raising possible conflict of interest problems with this alternative. Explicit requirements regarding the conduct of the Bay-Delta Hearings aside, this perpetuates a system in which parties with economic interests in the

conclusions of modeling studies have some measure of control over how those studies are done.

C. San Diego SuperComputer Center

The State, through Teale Data Center, has an agreement in place governing the use of the San Diego Supercomputer Center (SDSC) by State departments. The Cray Y-MP computer, associated visualization system, consulting and programming staff, and communications options would provide a high-performance system for doing a wide range of hydrodynamic and water quality modeling. There is not the expertise at SDSC in terms of water resources that the Division is able to utilize through existing contracts, so additional in-house staff would be required to implement this alternative or the existing contractors would have to be retained to direct the modeling at SDSC. These individuals would have to be trained both in the modeling process and in the use of SDSC systems and resources.

The costs associated with using SDSC are difficult to estimate in advance, since pricing is based on "service units" - a combination of CPU time, memory usage, disk storage, and incidental charges - but in the absence of direct testing it cannot be determined how much computer time a particular model run might take. The Air Resources Board has just begun a program to use SDSC for air quality modeling, so better statistics on State costs should be available in about six months time.

The Division would have to acquire some additional equipment to use SDSC, since all supercomputer used is based on network connections using the TCP/IP communications standard. At a minimum, a moderate speed connection to DWR (via the fiber optic cable already installed to the SWRCB building) and/or to the Teale Data Center (using a telecom link) in conjunction with networking infrastructure within the building would be required. In addition, at least some microcomputers in the Division would have to be equipped with network boards and software (at a cost each of $600) to allow interaction with SCSD.

The cost of exclusive reliance on SDSC for all hydrologic modeling needs of the Division are anticipated to be very high, given the computer time costs (approximately $500 per hour for CPU[1] time) and the need to acquire hardware/software and to hire or contract additional staff.

D. In-house modeling capabilities

As noted above, the Division has limited modeling capabilities. This problem can be addressed directly by acquiring appropriate hardware and software, developing and obtaining useful datasets, and redirecting, hiring, and training modelling personnel. This option maximizes Board control and oversight of the

[1] CPU (Central Processing Unit) time refers to the number of minutes the computer actually spends performing the calculations, and is usually less than the elapsed clock time while the work is being performed.

modeling process, ensuring that Board interests are foremost in the application and interpretation of models. Of the alternatives considered, it has relatively high start-up costs associated with new facilities, and also continuing costs associated with additional staff to perform the modeling. At the same time, from a purely economic perspective, doing more modeling in-house lessens the costs of contracting model operations, retaining resources for enhancement and refinement of modeling capabilities.

The facility required for this solution would include primarily a high-performance workstation configured with a gigabyte or more of disk space, a graphics monitor, and networking. It should be capable of being interfaced directly with existing Division microcomputers as well as data processing systems. In addition, a new high-performance microcomputer should be linked via high-bandwidth networking to allow the use of software available on either the workstation or the microcomputer while sharing common datafiles.

Much modeling software is available in the public domain, and can be freely obtained from Department of Water Resources, Bureau of Reclamation, and the Geological Survey. Other proprietary software, such as the Fischer models, has already been purchased by the Board so would likewise be available to staff.

This plan would require the hiring in its first year of six to ten modeling and support personnel, with the number dependent on the degree of support to be provided to other Division functions as their modeling needs grow.

This option preserves the maximum flexibility for future support of Board activities other than Bay-Delta modeling and for integration with information systems such as AWRIS, GIS, etc. This integration is essential for future water rights tracking and modeling for purposes of projecting water availability.

VI. Recommendation

The recommended alternative is to develop in-house modeling capabilities, option 4, including hardware/software acquisition, data development, and staff hiring. However, certain advantages of the Supercomputer Center, option 3, merit inclusion in the selected alternative which can be readily accomplished with appropriate system design. Options 1 and 2 do not address basic mandates of the Division. Personnel, hardware, and software requirements for implementing this recommendation are described in the following sections.

A. Personnel

At this point in the development of Board modeling capability, the best solution is the creation of a new Modeling Support Unit in the Bay/Delta Section, including a senior supervisor in the Section and senior staff. Creation of a unit-level group both ensures that there is clear direction for the Unit's activities without too broad a diffusion of its responsibilities across multiple Division or Board functions. At the same time, much of the Unit's activities must be integrated with other Division activities, such as Environmental Review, Applications, or AWRIS. The personnel required for this Unit are summarized by

function below.

As noted above in the discussion about the existing system, it is virtually impossible to assess total personnel requirements based on a methodology of multiplying number of tasks by the time required to complete each task. Instead, the staffing level historically required at other agencies (specifically Department of Water Resources and the US Geological Survey) to perform the types of analyses required for this program was determined and used as a guide. Currently, DWR has five to six staff performing the analyses used by the Board; USGS has two. Thus eight professional staff are assumed to be needed at the Board to perform the same work. In addition, two additional staff are necessary to provide systems and information management support to modeling staff, for a total of ten. At the same time, two PY already within the Section would be redirected to this new activity, resulting in a net gain of eight. (It *may* be possible to reduce this by an additional 0.5 PY if any redirection from DPO is feasible.)

Attracting and retaining qualified technical modeling staff is a major concern because of the lack of engineers with the necessary modeling abilities. Modeling requires very specialized knowledge in the areas of mathematics, physics, and computer programming. In addition, some modeling areas, such as those concerned with the Bay/Delta, are extremely complex and controversial; these have statewide and precedent setting impacts of major importance to the Board, with substantial economic and environmental ramifications for the State.

Although the modeling activities that would be required from this Unit cover a wide range of systems, tools, datasets, and expertise, they can be divided into specific categories corresponding to the responsibilities of individual staff members. The ten positions required for the Modeling Support Unit should be distributed as listed below. It is critical to the success of the Unit that at least two positions be created for each sub-area, so that if any individual leaves the Unit, no tasks are left without qualified specialists.

- Modeling supervision. An experienced modeler/engineer would have overall responsibility for the modeling activities of the Unit. This would include technical assistance with specific modeling issues as well as direction of Unit programs.

  1 Senior Water Resource Control Engineer (Supv)

- Delta flows/salinity. Two modelers would be required to implement and utilize available hydrodynamic/salinity models for the Bay-Delta system in support of the Hearings and other Division activities. This function would capitalize on model development already funded by the Board, eg the Fischer Delta Models. In addition, the modelers would be involved in the development of a new optimization matrix/model for the delta to supplement the current Department of Water Resources operations model. It is anticipated that one of these modelers could be redirected from current Bay/Delta Section staff.

1 Senior Water Resource Control Engineer
1 Associate Water Resource Control Engineer

- Delta/upstream systems assessment. Two modelers would be required to implement and utilize various flow and water quality models used to evaluate the impacts of water management and allocation decisions on downstream water quantity and quality parameters. One of these modelers would have as an explicitly defined responsibility the integration of Modeling Unit functions with activities of the Environmental Section, both to provide direct support to modeling in that Section and to ensure coordination within the Division of datasets and procedures. One PY may be redirected from current staff.

  1 Environmental Specialist IV
  1 Senior Water Resource Control Engineer

- Bay dynamics. One modeler would work with models of open water systems developed by USGS and others. These are two- and three-dimensional hydrodynamic finite element and difference models of sub-areas of San Francisco Bay designed to examine tidal, bathymetric, flow, and related phenomena. He or she would also take the lead within the Unit for implementing visualization tools for analyzing model outputs. (One position in this sub-area is sufficient, due to on-going contracts with USGS for Bay model development.)

  1 Senior Water Resource Control Engineer

- Water availability. Two modelers would begin to develop new models for projecting availability of water to allocations based on existing water rights and estimates of anticipated water resources. This effort would mark an attempt to better integrate theoretical estimates of river and delta systems with water use statistics and delivery requirements. Because of the close ties of this effort with responsibilities of the Water Rights Administration Branch, one modeler would be directed to support and coordinate with activities of the Applications Section.

  1 Associate Water Resource Control Engineer
  1 Water Resource Control Engineer (B)

- Database management. One modeler would be focussed on database administration in support of the other modelers' analytical functions. There are two aspects to this function: management of large matrix datasets comprising observations and calculations of modeling systems (anticipated eventually to total several gigabytes of data) and development of linkages between model databases and other, external spatial and tabular database systems. A portion of this person's time would be to coordinate with the AWRIS information section and with any future Board GIS activities (although GIS work would require the hiring of additional PY).

1 Staff Information Systems Analyst (Spec)

- System administration. One-half to one PY would be required for computer systems administration, including hardware/software configuration, user accounting, operations, software installation and maintenance, and networking. It is expected that this person's responsibilities could be shared on a fifty-fifty basis with the AWRIS/GIS system.

  1 Associate Programmer Analyst (Spec)

  In addition to regular system administration staff, it is expected that two person months of consultant work will be required for initial system and network configuration.

To summarize, it is important to the success of the modeling programs within the Board that groups employ a sufficient number of senior technical engineers, environmental specialists, and information systems specialists. This is important not only to the Board's ability to attract and retain highly capable staff, but ultimately to the Board's confidence that decisions regarding California's water are based on the best available information. It should be pointed out that the percentage of additional funding needed to support senior (as opposed to mid-range) technical positions represents less than five percent of the total Unit personnel cost, and a miniscule fraction of the monies at stake in water allocation decisions.

B. Hardware

The Division currently has several microcomputers used for various applications within the Bay/Delta Section. These are not powerful enough, in terms of CPU performance, memory management, mass storage capability, display resolution, or networkability, to support the modeling requirements of the Division. At the same time, with relatively minor modifications and augmentations, they can be used as terminals or workstations to access more powerful systems.

The key components of a modeling facility are:

- Modeling Servers.

  1 RISC compute server (Sun 4/470-32 "SPARC")
  - 32 megabytes main memory
  - 1 gigabyte IPI disk storage
  - GXP 2/3-D graphics accelerator
  - 19-inch color display
  - 6250 bpi 9-track tape drive

  3 80386-based DOS microcomputer
  - 4 megabytes main memory
  - 300 megabtyes SCSI disk storage
  - VGA graphics adapter
  - ethernet

- Workstations.

  3 RISC workstations (Sun 4/20-8)

- 8 megabytes memory
- 200 megabytes local storage
- network file system
- monochrome display

3 RISC graphics/power workstations (Sun 4/65 FGX-8)

- 16 megabytes memory
- 200 megabytes local storage
- network file system
- color graphics display

1 color printer
1 laser printer

- ☐ Network.
  - 7 PC ethernet boards
  - network cabling (ethernet, twisted pair, transceivers)
  - fiber optic connection
  - 1 internet router

C. Software

The modeling software will be acquired, implemented, and developed over time by the modeling staff. There are certain basic software requirements to support the modeling efforts, however, such as compilers and networking, as well as general purpose applications software for graphics, etc.

The facility will require at the outset the following:

- ☐ UNIX† operating system, with Network File System (NFS), C compiler
- ☐ FORTRAN-77 compiler
- ☐ PC/NFS (microcomputer networking, one copy per PC)
- ☐ graphics/visualization tools

D. Cost Summary

Total costs associated with this proposal or shown in the attached table. These include personnel salary and benefit expenses, one-time equipment costs, and on-going hardware/software charges. Manufacturer/vendor names are included for informational and budgeting purposes only; final selection will be made through the normal specification/procurement process.

Costs are offset by an eventual reduction of at least $250,000 annually in consulting and professional services due to greater reliance on Division modeling resources.

[1] † UNIX is a trademark of AT&T Bell Laboratories.

COSTS
(in thousands)

HARDWARE

Item	Price	Quant	Initial	Ann Maint
Sun 4/470-32	$72.0	1	$72.0	$7.2
tape drive	10.0	1	10.0	
Sun 4/65 FGX-8	13.0	3	39.0	
Sun 4/20-8	4.0	3	12.0	
color printer	10.0	1	10.0	
laser printer	3.5	1	3.5	
80386 Micro	6.0	3	18.0	
PC network boards	.3	7	2.1	
transceivers	.2	14	3.5	
router	12.0	1	12.0	2.0
fiber link	5.0	1	5.0	0.5
Total Hardware			187.1	9.7

SOFTWARE

Item	Price	Quant	Initial	Ann Maint
OS	$0.6	1	$0.6	$0.6
Fortran	1.2	1	1.2	0.1
PC/NFS	0.3	5	1.4	
Office			2.0	1.0
Misc			5.0	2.5
Total Software			10.2	4.2

OPERATIONS

Item	Rate		Units	Initial	Annual
Cons & Prof Srvcs	$0.5	/day	80	$20.0	(a)
Teale Data Center					
SDSC	0.6	/srvc unit	80		(b) $49.0
Total Operations				20.0	49.0

OFFSETS
(in thousands)

OPERATIONS

Item	Rate	Units	Initial	Annual
Cons & Prof Srvcs				
(91-92)				50.0
(92-93)				150.0
(93-94)				250.0

(a) Unknown; dependent on special requirements for model development and Board-mandated modeling studies.

(b) To be determined, for management of SDSC contract plus access to geographic data library.

VII. Implementation/Timetable

The implementation schedule for the Modeling Enhancement Program, including staffing, hardware/software acquisition, and contracting, is shown below. Staffing is likely to be the most time-consuming aspect of the program, due to the relatively few numbers of qualified engineers and associated professionals to perform modeling. All positions are anticipated to be filled within one year of approval of the BCP.

Jan 91	FSR/BCP Approved
Jun 91	Engineer positions announced, with duties and qualifications required.
Jul 91	Funds become available for hiring and purchase. Existing staff redirected into modeling support unit. Consultant retained to develop system specifications. Computer hardware procurement started.
Aug 91	Info Systems Analyst hired. Two engineers hired (subsequently, engineers and specialists hired at average rate of one per month).
Sep 91	Network hardware installed. SDSC/Teale contracts initiated. Staff begin process of obtaining relevant model code for selected hardware.
Nov 91	Server/workstations installed and configured. Network software loaded and systems interconnected.
Jan 92	Initial models ported, tested, and running.
Jul 92	Unit becomes fully operational with analyses performed for Bay-Delta activities. Development work begun on system integration with AWRIS, GIS, and other Division and Board information systems.
Jul 93	Transfer of most model development activities from contractors to Division/Unit staff.

QSS

State of California

Memorandum

To : James W. Baetge
Executive Director

Date : SEPTEMBER 19 1989

Walter G. Pettit, Chief
From : DIVISION OF WATER RIGHTS
STATE WATER RESOURCES CONTROL BOARD

Subject: MODELING ENHANCEMENT PROPOSAL

Attached, as you requested, is a short paper on alternative methods to enhance the State and Regional Boards' modeling capabilities. The recommended alternative is to enhance the Board's "in-house" modeling capabilities and, at the same time, work more cooperatively with the other "water-modeling" agencies.

As the paper points out, it is difficult to estimate the structure and costs of the alternative modeling approaches without knowing the intended scope of the modeling program. Consequently, to reduce the workload and save time, I have directed staff to formulate possible organizational scenarios and associated costs for only the recommended alternative. We plan to have this information to you by September 22, 1989. If you have any specific ideas on the scope of this modeling effort or believe another alternative should be selected, please contact me at 4-5621.

Attachment

cc: James R. Bennett
Chief Deputy Director

Jerry Johns
Dave Beringer
Larry Attaway
Richard Satkowski

RSATKOWSKI:bjh
9/8/89

STATE AND REGIONAL BOARDS' MODELING ENHANCEMENT PROPOSAL

PROBLEM

The mission of the State and Regional Water Resources Control Boards (Boards) is to protect California's water. As California's population grows, the 103 rivers, 5000 lakes, 461 groundwater basins, and 1840 miles of shoreline within California become more difficult to protect. Californians want, and they should receive, an "adequate" supply of "clean" water, not only for human consumption and enjoyment, but also for the preservation and enhancement of fish and wildlife.

Skilled planning and careful management are essential to protect California's water. As such, the Boards are developing an ever-increasing need for more sophisticated tools to provide (1) practical answers for immediate problems, such as toxic spills and Delta island inundations, and (2) significant directions for long-range plans, such as water quality control plans and water availability studies. Mathematical (computer) models can be used to assist the Boards' in these efforts.

Currently, the State and Regional Boards have some "in-house" modeling capability, most of which is in the Bay-Delta Section of the Division of Water Rights. The Bay-Delta staff has the expertise and tools to use various mathematical models, including the San Joaquin River Input-Output (Water Quality) Model, the Central Valley Agricultural Consumptive Use model, and the Bay-Delta hydrodynamic and water quality models. Additional modeling work is done for the Boards by private consultants, such as Boyle Engineering Corporation (Boyle), and by governmental agencies, such as the Department of Water Resources (DWR), the U.S. Bureau of Reclamation (USBR), and the U.S. Geological Survey (USGS). Most of this work, however, is rather narrow in scope because of limited funds for consultants and a shortage of modeling personnel in all of the water agencies.

OBJECTIVES

The objective of this effort is to provide the Boards' with the modeling capability to better plan for and manage California's complex water system. Some of the water rights and water quality concerns that require careful planning and managing and thus could directly benefit from any enhancement of the Boards' modeling capabilities are:

- The water supply and water quality impacts of proposed changes to the water system, including facilities or modifications to water quality objectives.
- The availability of unappropriated water.

- The impacts of temporary and permanent changes of water rights.

- The effect of pollutants on streams, lakes, estuaries, bays, and groundwater.

- The need for a waste load allocation to meet a water quality objective.

- The water conditions required to preserve instream uses, such as recreation and fish habitat.

The types of water resources (computer) models and databases that, if used more widely by the Boards, would help achieve the objective are as follows:

- Water Resources Planning and Research
  - DWR Statewide Reservoir Operations Model (DWRSIM)
  - USBR CVP Reservoir Operations Model (SCHISM)
  - DWR Central Valley Agricultural Consumptive Use Model
  - DWR Central Valley (River Flow) Depletion Model
  - SWRCB/Boyle Central Valley Groundwater Model (CVGWM)
  - San Joaquin Valley Groundwater Economics Model (SJVPM)

- Water Rights
  - Water Rights Analysis Program (TAMUWRAP)
  - Water Availability Models
  - River Flow Simulation Models (HEC-1, HEC-2)
  - Hydrologic Runoff Models (Stanford Watershed Model)
  - Habitat Suitability Index Modeling System (HSI)
  - Habitat Evaluation Procedure Model (HEP)
  - Instream Flow Incremental Methodology (IFIM)
  - Steam Network Temperature Model (SNTEMP)

- Water Quality Control
  - Delta Hydrodynamics Models (DELFLO, DWRFLO)
  - Delta Water Quality Models (DELQUAL, DWRQUAL)
  - Flow-Science San Francisco Bay Water Quality Model
  - USGS 2- and 3-D Bay Circulation Models
  - San Joaquin River (I-O) Water Quality Model (SJRIO)
  - Santa Ana Basin Planning (Blending) Model
  - Water Supply Simulation Models (WSSM)
  - Orlob San Joaquin Valley Salt Balance Model
  - USBR Temperature and Dissolved Oxygen Models

- Water Resources Data Base Management
  - DWR Delta Daily Flow Data Base (DAYFLO)
  - EPA Storage and Retrieval System (STORET)
  - DWR Statewide Water Quality Inventory System (SWQIS)
  - SWRCB Automated Water Rights Information System (AWRIS)
  - California (Flow) Data Exchange Center (CDEC)
  - Geographic Information Systems (GIS)

ALTERNATIVES

Available alternatives for achieving the objective include:

1. No-Action -- Continue the current modeling approach, which includes (1) using the limited in-house modeling capability and improving the capability when time permits, (2) asking other governmental water agencies, such as DWR and USBR, to run the appropriate models, and (3) contracting with private consulting firms when 1 or 2 above are not adequate for the Boards' needs.

2. Invoke Water Code Statutes -- The State Board might be able to require DWR or other state agencies to complete specific model-related tasks by invoking Sections 13163 and 13165 of the Water Code. The statutes give the State Board limited authority to require technical investigations involving water quality matters. Section 13163 (b) states:

> "The state board from time to time shall evaluate the need for water-quality-related investigations to effectively develop and implement statewide policy for water quality control and shall transmit its recommendations for investigations to affected or concerned federal, state, and local agencies. The affected state agencies shall comply with the recommendations or shall advise the state board in writing why they do not comply with such recommendations."

Section 13165 states that:

> "The state board may require any state or local agency to investigate and report on any technical factors involved in water quality control."

3. Contract with Private Consultants -- Acquire the additional funding necessary to contract with private engineering, biological, and economic consulting firms.

4. Enhance the Boards' Modeling Capabilities -- Enhance the State and Regional Boards' modeling capabilities by (1) acquiring the necessary modeling expertise, (2) obtaining, developing, and using mathematical computer models, as needed, (3) procuring the necessary computer equipment, (4) working cooperatively with other governmental water agencies, such as DWR and USBR, and water modeling consultants, such as Boyle, through the formation of a Model Development and Use Committee, and (5) contracting with private consulting firms when necessary.

DISCUSSION

Alternative 1 -- The No-Action Alternative does provide the Boards with limited ability to model water-related concerns. However, the number of "in-house" modeling staff is not sufficient to study many of the issues that are important to Boards' mission. For example, the Bay-Delta staff is currently working overtime to provide the Boards with some of the modeling information required to develop the Water Quality Control Plan for Salinity and the Pollutant Policy Document. Unfortunately, the Bay-Delta Program does not have enough modeling staff to perform all of the required work. To attempt to overcome this problem, we have asked the other proceeding participants, such as DWR, to perform the modeling studies. However, DWR has already stated that their participation in this effort is limited by lack of personnel to complete all of the requested modeling studies.

Alternative 2 -- Although the Water Code statutes provide the State Board with limited authority to require technical investigations involving water quality matters, the statutes provide a mechanism for not performing the studies. The statutes allow the other agencies to not comply with the request if they advise the State Board in writing as to why they cannot comply. It is probably safe to assume that since many of the other water agencies have limited staff and funding, they probably won't honor the request unless the investigation is directly related to their on-going work and is consistent with the agencies' objectives.

Alternative 3 -- Relying almost exclusively on private consultants to perform the necessary modeling work would provide the Boards with more water-related information to better manage California's water system. However, the relatively high additional cost for the consultant's services would probably prohibit the wide scale use of private consultants.

Alternative 4 -- This alternative would enhance the Boards' modeling capabilities, although it would require the purchasing of more advanced computer equipment and the hiring or transferring of personnel with the necessary modeling expertise. The cost of the computer equipment and number of staff cannot be estimated unless the extent of the enhancement is better defined. However, the "in-house" costs would probably be lower than using the relatively expensive consulting firms, especially for relatively routine analyses. Some additional cost and personnel savings would be provided by the formation of an inter-agency Model Development and Use Committee. The savings would occur because the committee's exchange of modeling data and results would reduce the duplication of modeling work that now exists. This alternative would also allow for quicker turn-around times for critical analyses, such as toxic spills, and for long-term studies such as water availability studies. Finally, developing "in-house" capability would allow the

Boards to verify modeling work done by other water agencies and/or consulting firms, instead of having to rely on their word that the results are as presented.

RECOMMENDATIONS

We recommend that Alternative 4 be adopted because Alternative 4 would best accomplish the Boards' objective of planning for and managing California's complex water system.

State of California

Memorandum

To : Stan Huiga
Department of Finance
915 L Street, 6th Floor
Sacramento, CA 95814

Date : OCT 5 1990

via: William Brown
Acting Chief
Division of Administrative Services

From: Ronald J. Lucero, Budget Officer
Division of Administrative Services
STATE WATER RESOURCES CONTROL BOARD

Subject: STATE WATER RESOURCES CONTROL BOARD'S FISCAL YEAR 1991-92 BUDGET CHANGE PROPOSALS--ADDITIONAL INFORMATION

The following information is in response to your questions concerning BCP #3 -- Modeling Enhancement Program for FY 1991-92.

State Water Resources Control Board's (SWRCB)

Response to Finance
1991-92 BCP Questions

BCP #3 Modeling Enhancement Program

1 On the BCP face sheet, the SWRCB indicates that there will be future savings. How much will the savings be and where will it be coming from?

Future savings will result from a redirection of general funds currently allocated for consulting contracts. This will reach $100,000 annually compared to current year expenses. The BCP on the second page of Table 1 and on Attachment 2 show these existing resources as reducing the amount of resources needed to fund this program.

2 What are the adverse consequences of not approving this proposal?

The adverse consequences are as follows:

(1) water quality and water allocation evaluations will not be done in time for water quality control plans and water right decisions.

(2) public trust resources may be adversely affected if full impacts of proposed action are not fully evaluated.

(3) water project operations study results will not be evaluated leading to one-sided Board decisions this will result in more lawsuits and extensive litigation, both of which will require expenditure of additional Board resources.

3 Once the Bay-Delta hearings are accomplished, wouldn't the need for ongoing modeling efforts drop off considerably?

No.

These resources will be used to:

(1) determine how to implement complex water right decisions (from 30 to 7000 new water users may have to share in meeting San Francisco Bay-Delta standards. Now there are only two water users responsible for Bay-Delta standards).

(2) investigate needed water right changes in steam systems of the Bay-Delta watershed including the Trinity, Upper Sacramento, American, Yuba and San Joaquin Rivers and others.

(3) reevaluate individual State Board issues as soon as data becomes available rather than wait up to 10 years between evaluations.

4 On Page 5, the SWRCB indicates that "...staff year costs associated with this alternative are higher than using State Board employees, due to higher contract salary and overhead rates without a significant reduction in indirect costs. Why wouldn't indirect costs be reduced?

The assumption of this alternative is that the contractor's employees would work at Board facilities, and rely on Board support staff.

5 On page 6, the last sentence in the second from the last paragraph appears to be incomplete.

This sentence should read:

In addition, at least some microcomputers in the Division would have to be equipped with network boards and software (at a cost of $600) to allow interaction with SCSD.

Gerald E. Johns 10/4/90
Gerald E. Johns Date

Richard Satkowski 10-4-90
Richard Satkowski Date

Originate

State of California

Memorandum

To : James W. Baetge
Executive Director

Date : OCTOBER 11 1989

ORIGINAL SIGNED BY:

From : Walter G. Pettit, Chief
DIVISION OF WATER RIGHTS
STATE WATER RESOURCES CONTROL BOARD

Subject: MODELING ENHANCEMENT PROPOSAL -- PART II

Attached is part II of staff's proposal to enhance the State Water Resources Control Board's (Board) and Regional Boards' modeling capabilities. Part I of this proposal, which was submitted to you on September 12, 1989, addressed the different modeling enhancement approaches and recommended enhancement of the Boards' "in-house" modeling capability. Part II of this proposal examines the possible organizational scenarios and associated costs.

The recommended organizational scenario is a combination of all the alternatives described in the proposal. It includes the immediate formation of a relatively small Bay-Delta modeling support unit, consisting of six modelers and two student assistants; eventually, this unit would increase in size up to 25 full-time staff and eight student assistants. In addition, to provide the modeling staff with the necessary modeling capability, the proposal recommends that the modeling unit acquire a new computer system that is directly compatible with the Department of Water Resources' computer system.

If you believe that another alternative should be selected or you have any questions, please contact me at 4-5621.

Attachment

cc: James R. Bennett
Chief Deputy Director

Jerry Johns
Dave Beringer
Larry Attaway
Richard Satkowski

STATE AND REGIONAL BOARDS' MODELING ENHANCEMENT PROPOSAL--PART II

BACKGROUND

The purpose of Part II of the Modeling Enhancement Proposal is to examine possible organizational scenarios and the associated costs of enhancing the State and Regional Board's (Boards) modeling capabilities. Part I of this proposal, which was distributed on September 12, 1989, addressed the different modeling enhancement approaches and recommended adoption of alternative 4, the enhancement of the Boards' "in-house" modeling capabilities. Consequently, alternative organizational scenarios will be evaluated for only the recommended modeling approach. Part I should be consulted for more information on the problem, objectives, and alternative modeling approaches.

ALTERNATIVE ORGANIZATIONAL SCENARIOS

The major alternative organizational scenarios for achieving the objective include unit-level, section-level, and branch-level organizations as described below:

4A. CONSOLIDATED UNIT-LEVEL ORGANIZATION -- Attachment A shows the organizational chart for this alternative. It includes the formation of a new Bay-Delta Modeling Support Unit within the Bay-Delta Section of the Division of Water Rights. This unit could be set up in two ways: (1) a unit consisting of six (three senior level and three associate level) technical engineers and two student assistants that reports directly to the supervisor of the Engineering Analysis Unit within the same section; or (2) a unit consisting of one Senior Water Resource Control Engineer, Supervisory, four (two senior level and three associate level) technical engineers and two student assistants.

The unit would initially focus its work on acquiring, developing, and using the mathematical computer models most needed for the remainder of the Bay-Delta Proceedings. After the Proceedings are complete, the scope of the unit could be expanded to include non- Bay-Delta modeling issues, if needed. The staff (and student assistants) cost, for this alternative, assuming top step salaries and the Division of Water Rights' 80.83 percent overhead factor, would be approximately $610,000 per year.

4B. CONSOLIDATED SECTION-LEVEL ORGANIZATION -- This organizational scheme is shown in Attachment B. It consists of setting up a new Modeling & Data Support Section within the Special Program Branch of the Division of Water Rights. The section

would be headed by a Supervising Water Resource Control Engineer who would be in charge of the two modeling/data support units shown in Attachment B.

The Operations & Water Rights Management Unit would primarily be formed to better address statewide water resources planning and water rights/water use issues. Part of this unit would be responsible for studying the water supply impacts of new water quality objectives, physical facilities, and the water used by various water right holders. The models that would be needed to address these issues are listed on page 2 of Part I.

The other part of this unit would be responsible for (1) providing timely and useful water rights data to Board staff and the public, (2) improving the usefulness of the Automated Water Rights Information System (AWRIS) by incorporating water use information from those users with water rights, and (3) making the AWRIS data storage and retrieval system more user-friendly by implementing a Geographic Information System (GIS) compatible system. The unit would also maintain or interface with other water related databases, such as those shown on page 2 of Part I. The data management portion of this unit would be formed by transferring the staff currently in the Division of Water Right's AWRIS Information System Unit.

The Bay-Delta and Water Quality Control Unit, would be responsible for all of the state's flow and water quality-related modeling work, with special emphasis on the Bay-Delta. The Water Quality Control models listed on page 2 of Part I under the Water Quality Control heading would be acquired and used by this unit.

Each of the two new modeling/data units shown on Attachment B would be headed a Senior Water Resource Control Engineer, Supervisory. Besides the unit's supervisor, each unit would include five (two senior level and three associate level) technical engineering or environmental staff members and two student assistants. The units would report to a Supervising Water Resource Control Engineer and be supported by at least one clerical position. In addition, the section would employ the services of a computer specialist who would be responsible for acquiring and maintaining the computer-related hardware. In all, the modeling section would be comprised of 15 staff members and four student assistants. The costs for the Modeling and Data Support Section staff is approximately $1,454,000 per year. The additional (net) staff cost to the Board assuming that the current AWRIS Information System Unit would be transferred to the new Operations and Water Rights Management Unit is approximately $1,283,000 per year.

4C. CONSOLIDATED BRANCH-LEVEL ORGANIZATION -- This alternative (See Attachment C) would entail the formation of a Modeling & Data Support Branch within the Division of Water Rights similar to the one within the Department of Water Resources' (DWR) Division of Planning (See Attachment D). The organization of the modeling units would be the same as described in alternative 4B above, except that each of the modeling units would be divided into two units instead of one. The branch would be headed by a Principal Engineer who would be in charge of two Supervising Engineers. These supervising engineers would, in turn, be the program managers in charge of two senior level staff each. Each unit would consist of four technical staff members (two senior level and two associate level) and two student assistants who would perform almost all of the modeling work for the State and Regional Boards. In all, the modeling branch would be comprised of 25 staff members and eight student assistants. The costs to support the staff for the Modeling and Data Support Branch is approximately $2,558,000 per year. The additional (net) staff cost would be approximately $2,386,000 per year.

A variation of this scenario would be to place the modeling branch in a new "Special Projects" Division along with other sections and/or branches that either perform (1) a combination of water rights and water quality work or (2) support functions for the Boards. Some of the possible candidates for this transfer, besides the modeling section, include the Bay-Delta Section and the Division of Administrative Services' data management and computer acquisition sections. In addition, like DWR's Statewide Planning Branch, separate sections could be formed within the Special Projects Division to provide report administrative and economic services.

4D. DISPERSED UNIT, SECTION, OR BRANCH-LEVEL ORGANIZATION -- This alternative consists of establishing specialty modeling units, sections, or branches within each unit, section, or branch of the State and Regional Boards, as needed. The organization of these units, sections, or branches would be similar to those shown in alternative 4A, 4B, and 4C, respectively. It is difficult to estimate the staffing and funding resources for this alternative. However, for the same quantity and quality of modeling work, it is probably safe to assume that the costs would be somewhat higher than alternative 4C due to some modeling effort duplication and the probable need for multiple computer systems.

COMPUTER EQUIPMENT

Adoption of any of the above alternatives will require additional "number crunching" computer equipment. Numerous brands of

computers are available that incorporate the high speed central processing units needed to run complex mathematical computer models and data base management activities. These include, but are not necessarily limited to, Sun, Apollo, Digital, Hewlett Packard (HP), International Business Machines (IBM), Control Data Corporation (CDC), Prime, and Silicon Graphics. The Division of Water Rights' Bay-Delta Section has a Digital Micro-Vax II that is used to run four of the models listed on page 2 of Part I. The Micro-Vax, however, is not directly compatible with most of the other computer systems in use by the major federal, state, and local water agencies. Without direct compatibility, staff must modify the other system's program codes to conform with the Micro-Vax's operating system.

The computer acquisition process should consider: (1) compatibility with the computer systems of the other water agencies, such as DWR, the U.S. Bureau of Reclamation (USBR), the U.S. Geological Survey (USGS), and the Environmental Protection Agency (EPA) and (2) availability of computer model software. Compatible computer systems allow direct transfers and use of technical data and computer models without the need to modify the program codes. The computer model software that any "modeling" computer should be able to run is listed on Page 2 of Part I.

The major water agencies have set up various computer systems depending on each agencies needs and budgets. The following table shows the high speed computer systems used by the various water agencies:

WATER AGENCY	COMPUTER SYSTEM(s)
SWRCB	Digital (Micro-Vax), IBM 3090 (Teale Data Center)
DWR	Sun, Apollo, IBM, CDC
USBR	Digital (780)
CCWD	IBM
USGS	Prime, Silicon Graphics
EPA	IBM, Digital (Micro-Vax)

DWR has decided to base their future modeling applications on both the Sun and Apollo computer systems, since they have the best overall features. However, according to DWR's "in-house" computer expert, Gary Darling (See Attachment D), they are leaning toward the Sun. Consequently, they are currently in the process of converting their model program codes to run on the Sun computer system. In addition, DWR has recently hooked up to General Services' state-of-the art fiber optics "loop," which will allow high speed data and mail transfer at 56,000 baud or about 48 times faster than most personal computer modems. USBR is also considering switching over to the Sun, since they already use many of DWR's models and have a direct hardwired link to DWR. The newly

expanded Contra Costa Water District (CCWD) Modeling Section is also considering the purchase of the same system.

If the modeling unit is significantly enhanced, the new computer system would probably have to be dedicated solely for the purpose of running the computer models since some of the models require run times of up to 14 continuous days (x 24 hours), depending on the application. The old Micro-Vax computer system could be used for many other Board purposes, such as to interface with large off-site data bases or to store water rights and water quality data bases for government and public use.

The cost for purchasing an adequate Sun computer system, including eight megabytes (MB) of random access memory (RAM) and 1200 MB of hard disk storage, is about $40,000. The costs for fully integrating the Sun with the fiber optics system is about $23,000. Alternatively, a basic Sun computer system can be leased for about $500 per month.

START-UP COSTS FOR TRAINING

To obtain the model program codes and related training, contracts will probably be needed with DWR and/or private consulting firms, such as Boyle Engineering Corporation. The costs to train each staff member is estimated to be about $5000 per staff member. Therefore, the cost for a unit-level organization, not including the student assistants, would be approximately $30,000. Likewise, the costs for section-level and branch-level organizations would be approximately $75,000 and $125,000, respectively.

DISCUSSION

Four major factors should be evaluated when selecting the recommended organizational scenario: (1) the intended scope of the alternatives and the extent to which they will achieve the objective, (2) the authority to obtain the staffing positions, (3) the funding for staff, computer, and training , and (4) the ability to attract and retain qualified technical staff.

MODELING SCOPE -- Of all of the alternatives, the implementation of Alternative 4A, the formation of a new Bay-Delta Modeling Unit, will provide the least enhancement of the Boards' overall modeling capabilities. This is because acquisition of only six modeling staff members significantly limit the ability to handle all of the Boards' modeling needs. This unit, however, would provide the State Board with the minimum staff resources needed to model the Bay-Delta and its hydrologically-connected areas. The section-level (Alternative 4B), branch-level (Alternative 4C), and dispersed (Alternative 4D) alternatives, on the other hand, are designed to allow these groups to take care of virtually all the

Boards' modeling needs.

STAFFING -- The unit, section, and branch-level alternatives will require the commitment of 6, 15, and 25, (non-student) positions to the modeling group, respectively. However, because of the proposed transfer to the modeling group of the two staff members from the AWRIS Information System Unit, the number of new person-years needed is only 6, 13, and 23, respectively. Fewer staff positions would be needed if intra-agency staff transfers to the modeling groups would occur. For example, some of the Bay-Delta Engineering Analysis staff could be transferred after the completion of the Bay-Delta Proceedings. Any additional positions that were needed would probably have to be requested through the normal personnel augmentation process.

The number of additional staff years needed to implement the dispersed modeling alternative would be unit, section, or branch specific and, therefore, difficult to estimate. However, the staffing needs will probably be considerably larger than the 25 positions proposed for the branch-level modeling organization. This is because the dispersement of modeling staff to each of the units, sections, or branches within each Division and Regional Board would probably cause some duplication of effort. It should be noted that this organization might be better suited for the Regional Boards (except maybe Region 5) because of their distance from Sacramento.

FUNDING -- The funding needed to support the modeling enhancement alternatives is summarized below.

ADDITIONAL FUNDING NEEDED TO SUPPORT
THE MODELING ENHANCEMENT ALTERNATIVES
(in thousands of dollars)

	ALTERNATIVE				
Item	1 (no-action)	4A	4B	4C	4D
Staff	0	610	1,283	2,386	2,386 +
Computer(s)	0	40	40	40	40 +
Fiber Optics	0	23	23	23	23 +
Training	0	30	75	125	125 +
Total	$ 0	$ 703	$ 1,421	$ 2,574	$ 2,574 +

Some of the necessary funding might be available from the Torres' Bill (SB475), which provides $5,000,000 for estuary related studies. Additional funding would be available from the money saved by performing the modeling work "in-house" and reducing the

money earmarked for the state, federal, and private modeling contracts. Until a through review is performed, it is difficult to estimate the contract money savings. Nevertheless, the "in-house" costs would probably much lower than using the relatively expensive private consulting firms. The state and federal contracts should be reviewed individually to determine if savings warrant the transfer of state and federal contract dollars to the modeling section. (A preliminary review of the USGS hydrodynamics contract shows that terminating this particular contract would not be cost effective because of USGS's matching funds.)

TECHNICAL MODELING STAFF -- Attracting and retaining qualified technical modeling staff is a major concern because of the lack of engineers with the necessary modeling abilities. Modeling, in general, requires very specialized technical knowledge in the areas of mathematics, physics, and computer programming. In addition, some modeling areas, such as those concerned with the Bay-Delta, are extremely complex and controversial, and have statewide and precedent setting impacts of major importance to the Board. In these special cases, the modeling staff must possess an even higher level of technical competence.

As shown on Attachment D, DWR's Division of Planning has recognized this problem and, as a result, has upgraded numerous engineering positions to the senior engineering level or higher. In fact, approximately 40 percent of DWR's technical modeling staff is senior-level or higher. In other DWR planning sections, the percentage of senior-level or higher staff is approximately 60 percent.

A good example of the technical staff problem is the situation that occurred when staff attempted to hire an Associate Water Resource Control Engineer to perform limited modeling work in the Bay-Delta Section of the Division of Water Rights. After announcing the associate engineer vacancy, only one associate engineer applied to be interviewed. The candidate, who had previous modeling experience, decided against accepting the job offer after learning about the complex and controversial nature of the work. Consequently, this effort left the staff with no other option except to downgrade the position to any entry level engineering position. The result of this action is that some of the critical (path) Bay-Delta work has been delayed, eventhough Bay-Delta staff has significantly increased their overtime work.

RECOMMENDATIONS

Staff recommends that a combination of all of the alternative 4 (4A through 4D) scenarios be adopted as the best procedure for enhancing the Boards' modeling capability. At the onset, staff recommends that alternative 4A, the consolidated unit-level organization, be implemented to enhance the Bay-Delta's modeling

capability. This effort is particularly important because of the ongoing modeling studies that are needed for the water quality, scoping, and water rights phases of the Bay-Delta Proceedings.

Within one to three years, staff recommends that alternative 4B, the consolidated section-level organization, be implemented. This organization would provide the minimum level of modeling capability that the State Board would need to perform the basic modeling studies. If possible, this section would assist the Regional Boards with their modeling needs. At the same time, the Regional Boards should evaluate their need for modeling units and establish at least one dispersed unit-level modeling unit per region, if the need is demonstrated. After a period of at least two years after the modeling section is operational, the modeling requirement should be re-examined and enhanced to the branch level, if necessary.

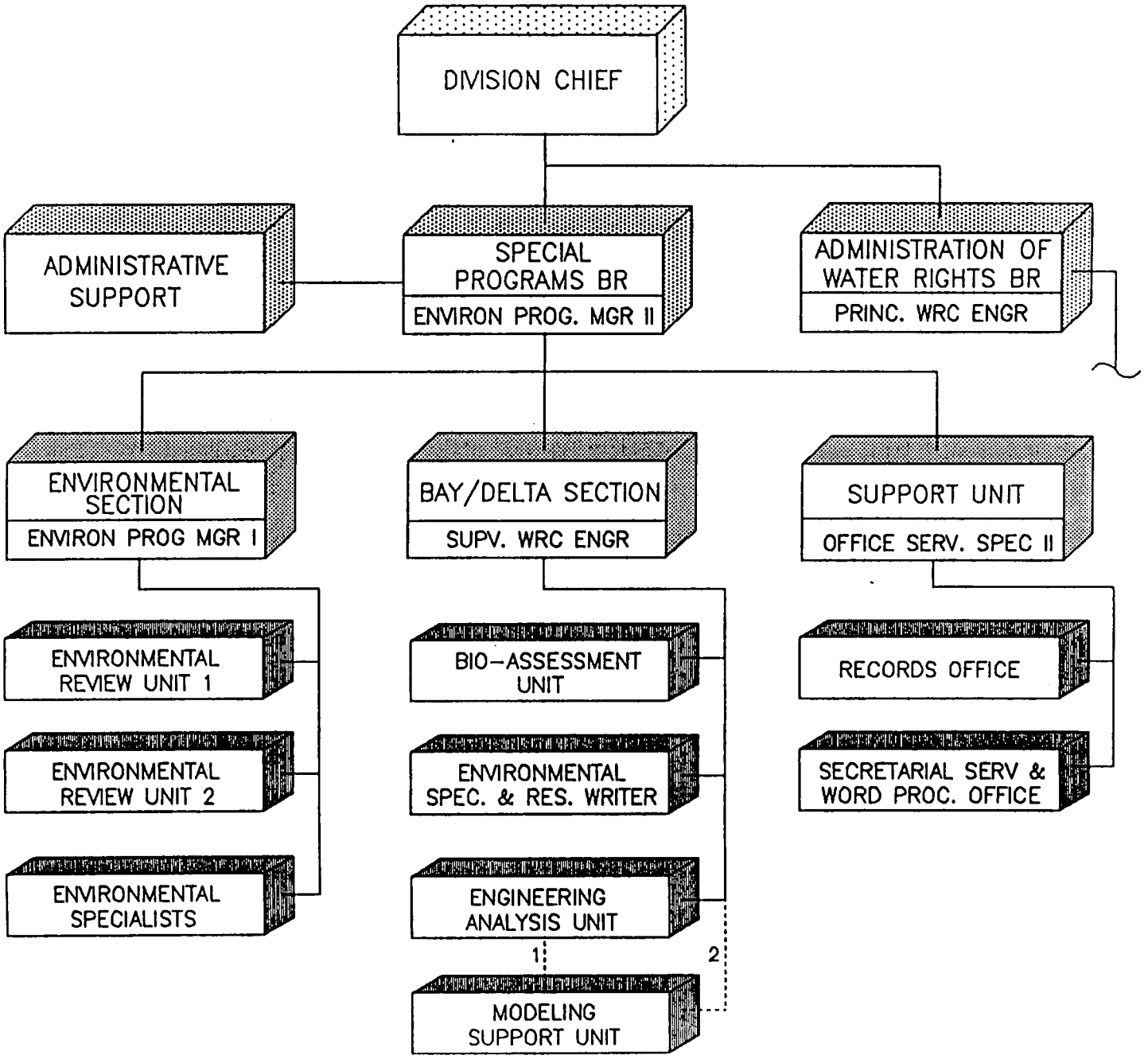
To attract and retain qualified technical modelers, staff recommends that these modeling groups employ the appropriate number of senior technical engineers and environmental specialists. Staff doubts that qualified technical personnel could be persuaded to join (and remain with) these modeling groups without adequate assurances of the senior-level classification and salary. Fortunately, however, the percentage of additional funding needed to support the senior technical positions for each organizational scenario is less than five percent of the total additional cost.

Finally, staff recommends that a Sun computer system and fiber optics "loop" be acquired to run the "number crunching" mathematical computer models. The current Digital Micro-Vax II should be retained for data management purposes. Staff also recommends that modeling and computer training be an integral part of the modeling enhancement effort.

ATTACHMENT A

DIVISION OF WATER RIGHTS

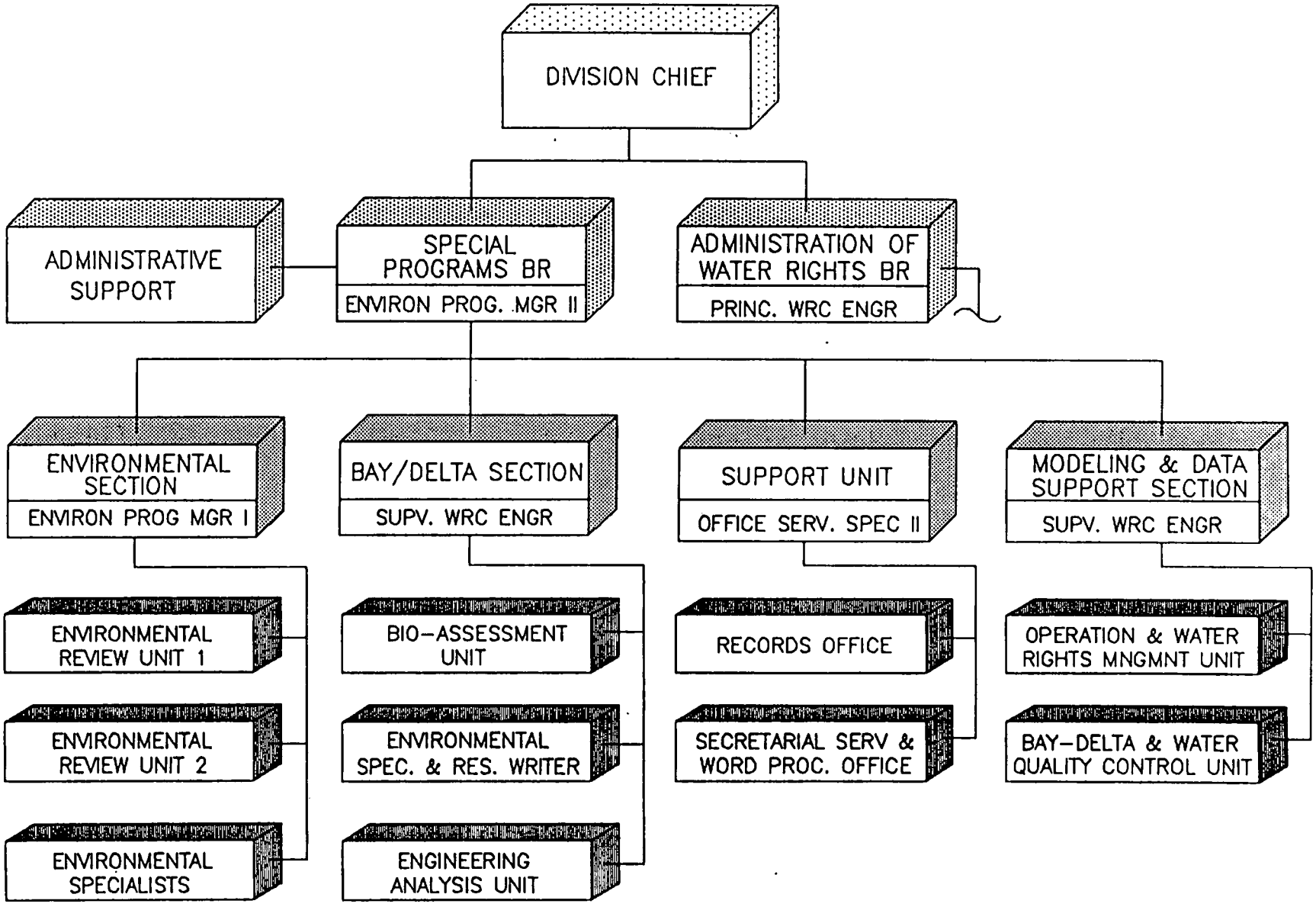
9/22/89



ATTACHMENT B

DIVISION OF WATER RIGHTS

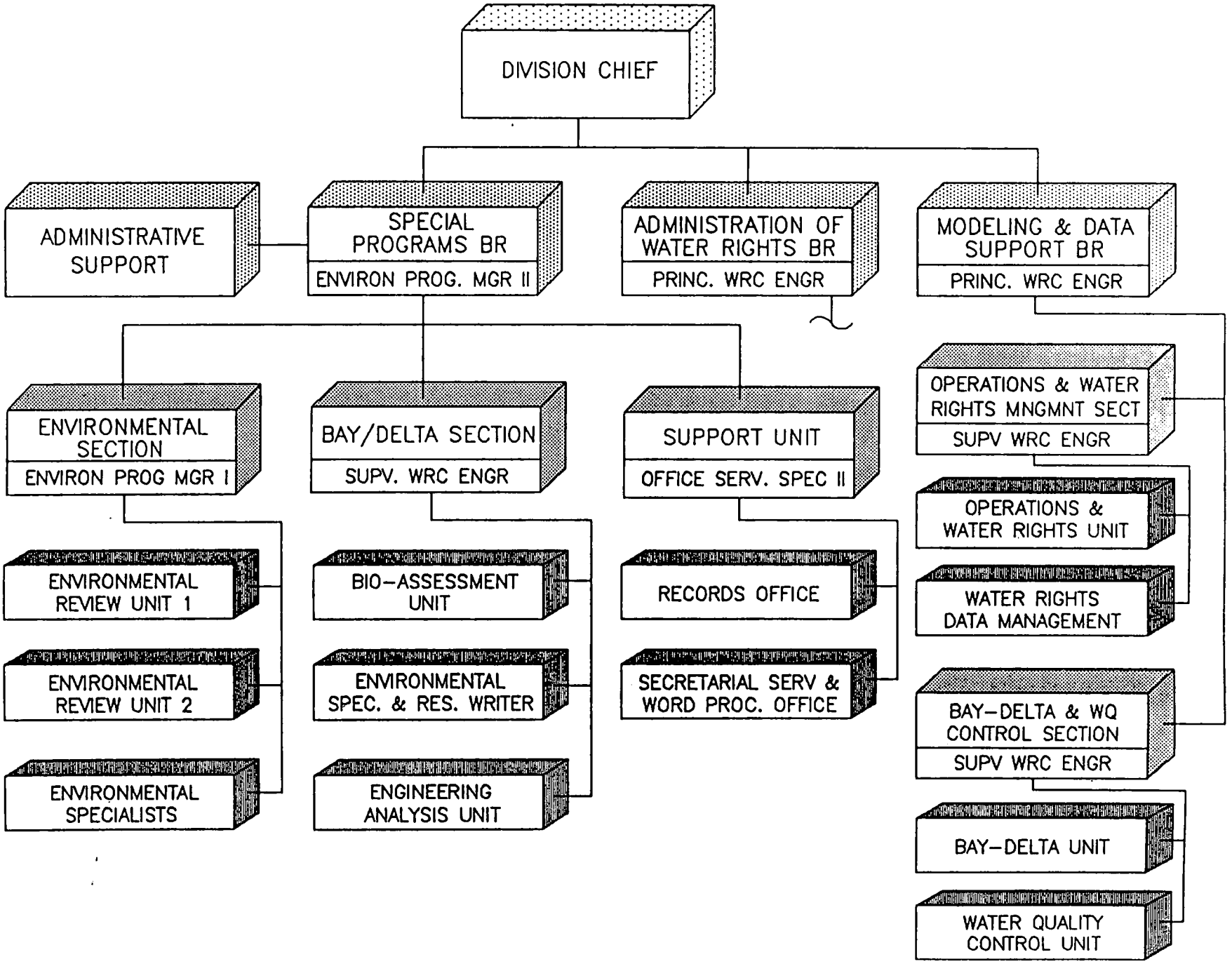
9/22/89



ATTACHMENT C

DIVISION OF WATER RIGHTS

9/22/89

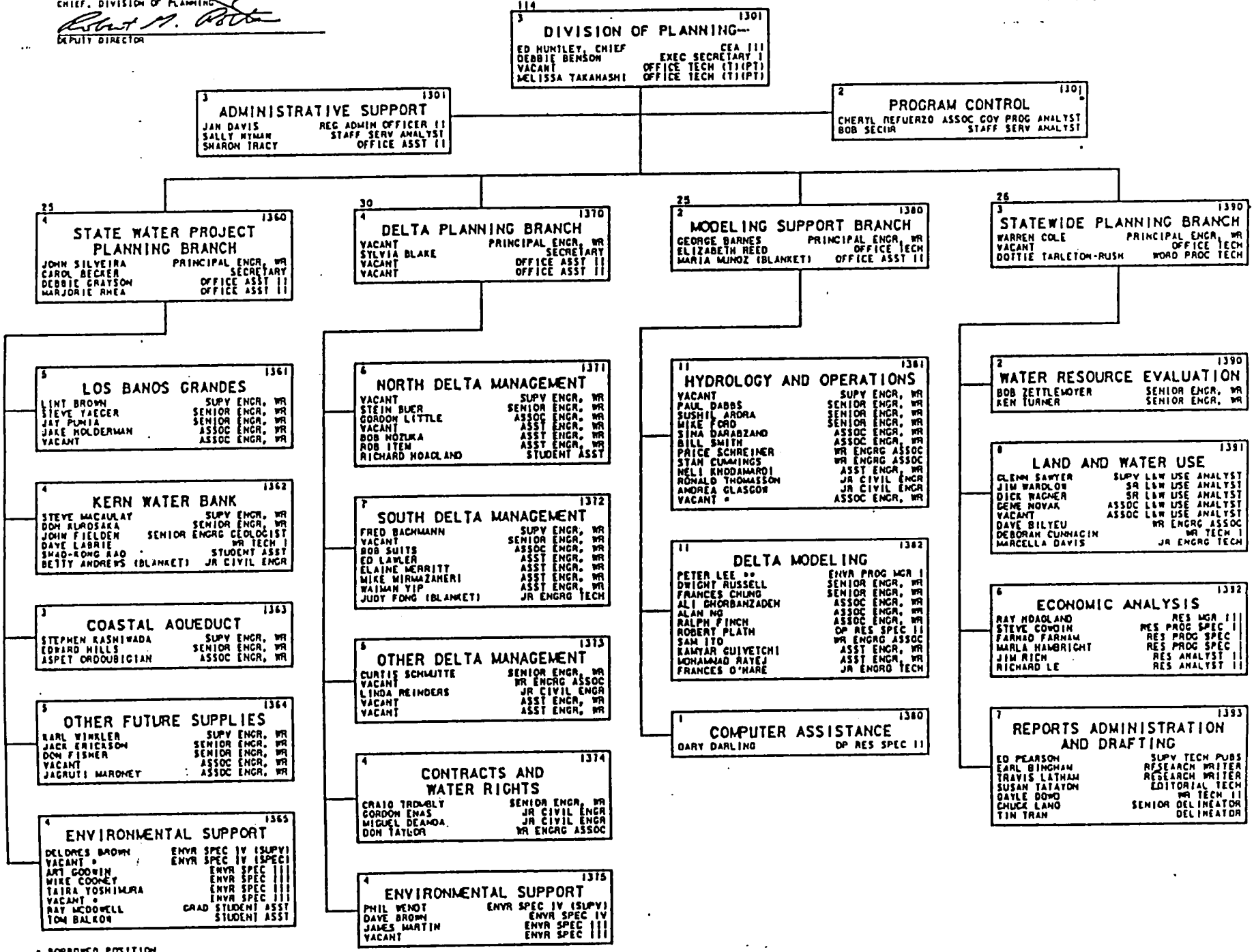


ATTACHMENT D

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF PLANNING
APRIL 1, 1989

E. F. [illegible]
CHIEF, DIVISION OF PLANNING

[illegible]
DEPUTY DIRECTOR



* BORROWED POSITION
** LOANED POSITION

State of California

Memorandum

To : Department of Finance
Office of Information Technology
915 L Street, 7th Floor
Sacramento, CA. 95814

Date : 10/11/90

for James W. Baetge
Executive Director

From : STATE WATER RESOURCES CONTROL BOARD

Subject: FEASIBILITY STUDY REPORT FOR MODELING ENHANCEMENT PROGRAM

As Executive Director of the State Water Resources Control Board, I am submitting the attached Feasibility Study Report (FSR) in support of our request for Office of Information Technology approval to undertake this project.

I certify that the FSR was prepared in accordance with State Administrative Manual Sections 4920 through 4930.1, and that our agency's feasibility study process is consistent with our information management strategy as expressed in our current Information Management Annual Plan (IMAP).

I have reviewed the project objective and the proposed solution. I agree with the project schedule and cost analysis provided in the attached FSR.

Please contact Rich Satkowski at 322-9871 if additional information regarding this FSR is needed.

Attachment

cc: Office of the Legislative Analyst
925 L Street, Suite 650
Sacramento, CA. 95814

Feasibility Study Report
Summary Fact Sheet

Agency SWRCB Date 9-19-90 OIT Project # _____
(Assigned by OIT)

Project Title Modeling Enhancement Program
(maximum 50 characters)

Delegation Status

- [X] Nonreportable project (Reportable Project defined in SAM Section 4902.1)
- [ ] Reportable project - delegated to agency (SAM Section 4819.3)
- [ ] Reportable project - not delegated to agency

Reporting Criteria (check all that apply)

- [X] Above cost threshold
- [ ] Legislative mandate (statute # _____)
- [ ] Legislative oversight (statute # _____)
- [X] Budget change proposal required
- [ ] Interagency or intergovernmental data exchange
- [ ] Confidential data (SAM Section 4846.1)
- [ ] Personal computer acquisition (no approved policy)
- [X] LAN acquisition/installation

Project Objective (brief description, maximum 400 characters)

To provide the State Water Resources Control Board the necessary resources and environment to conduct adequate computer modeling activities.

Proposed Solution (brief description, maximum 400 characters)

Establish complete in-house modeling resources (staff, hardware and software) to satisfy existing and potential modeling needs.

Project Schedule

Milestone (title/brief description, maximum 25 characters)	Target Date to Begin (mm/dd/yy)	Target Date to Complete (mm/dd/yy)
1. FSR and BCP Review and Approval		01-91
2. Redirect Exisiting Staff Into Modeling Unit		07-91
3. Hire Data Processing Staff		08-91
4. Procure and Install Hardware and Software		09-91
5. Development, Testing and Implementation		07-92

(Additional milestones may be listed on the reverse of this sheet.)

Cost Analysis

	Current FY 91-92 PYs	Current FY 91-92 Costs	Budget FY 92-93 PYs	Budget FY 92-93 Costs	Budget FY 93-94 PYs	Budget FY 93-94 Costs
One-time Costs	0.0	$ 236.3				
Continuing Costs	2.5	$ 216.9	2.5	$ 216.9	2.5	$ 216.9
Impacted Program Costs	10.0	$1066.0	10.0	$ 966.0	10.0	$ 866.0
Program Income						
Net Program Costs	12.8	$1519.2	12.5	$1182.9	12.5	$1082.9
Cost Savings						
Cost Avoidances						

(Additional fiscal years may be listed on the reverse of this sheet.)

Feasibility Study Report

State Water Resources Control Board, Bay-Delta Section Modeling Enhancement Program

1. Requirements

1.1. Background

The State Water Resources Control Board (State Board) was established by the Legislature in 1967 to administer both water quality pollution and water right functions of State government (Water Code Section 174). Until that time these two activities were handled by separate agencies. The Porter-Cologne Act and subsequent amendments to the water code state that the water quality planning and water right functions of the State must be used in conjunction to appropriately protect beneficial uses. Indeed in many areas the issues of water quality and flow are virtually inseparable. Examples include the Bay-Delta Estuary, the hub of water transfers form Northern to Southern California, and Mono Lake where critical salinity levels to protect the lake are determined by tributary inflows to the lake that must bypass the city of Los Angeles diversions. In both of these cases the State Board has embarked upon a combined water quality/water flow hearing process. Both supply and quality issues have captured increased public attention in recent years as a result of the on-going drought, awareness of water quality degradation, and legislative, judicial, and regulatory actions. The future outlook for the State Board is that its public profile will increase and that the public will demand that it take a larger responsibility for the development of information that leads to its decisions.

The State Board is getting involved in more comprehensive water flow and water quality issues as water supplies become more scarce and public trust resource values in California become more important. An area of major concern is the Bay/Delta watershed, since all water management decisions in the watershed have the potential for enormous economic and environmental consequences, measured in the billions of dollars. Moreover, the on-going Bay-Delta hearings mandate the accurate and timely assessment of hydrologic conditions and the correct projection of possible future scenarios of water use and availability. The complexity and critical implications of Bay-Delta analysis necessitate the use of sophisticated analysis techniques. In addition, there are other geographic areas where the State Board will be addressing comprehensive flow and water quality issues over the next few years, including Mono Lake and the Yuba, American, Trinity, Mokelumne, Carmel, and Santa Ynez Rivers. Computer modeling will be needed in these areas as well.

In addition, advanced data analysis and modeling techniques will be necessary to the successful use of the "Clean Water Strategy" by other programs. Since the CWS is a set of tools for developing water management plans, computer modeling can both facilitate the use of the tools and, to the extent modeling helps to guide management activities, serve as a prototype for the comprehensive use of the CWS concept. Specifically, CWS consists of a Water Quality Assessment, which provides information about water quality conditions throughout the state, the nature, extent, and probable cause of problems or needs. It provides a systematic means of determining priorities.

Support for CWS is a key component of the State Board's modeling requirements. The first Water Quality Assessment identified both water quality and low flow issues for the same water bodies that need to be addressed. The Regional Boards are capable to deal with the water quality issues. However, the merging of both flow and quality issues for the same water body are more complex and require a knowledge of the natural and man altered hydrology. It also requires a means of determining water supply impacts on water purveyors if they are required to increase instream flows to resolve water quality and beneficial use issues. Our limited experience with the issues in the Bay-Delta and Mono Lake have shown us the type of water flow/quality modeling expertise that is needed to adequately address these issues in this water short state. The Clean Water Assessment tells us that many more of these problem areas exist, far more than we have resources to address.

Currently, the State Board has limited in-house modeling capabilities. Advanced modeling is highly dependent on the availability of high-performance computers, sophisticated software, reliable data, and trained and experienced users. These are available, to varying degrees, in other state departments (especially the Department of Water Resources), federal agencies (notably the US Bureau of Reclamation and Geological Survey), and private engineering and consulting firms.

The State Board relies heavily on contracts both with other agencies and with private firms specializing in hydrologic modeling and analysis. Contracted activities include development of new modeling software, enhancements to existing models to refine their capabilities and to take advantage of improvements in hardware, creation and updating of databases reflecting past hydrologic conditions, calculation of various water quantity/quality parameters using computer models, and analysis of modeling results with respect to implications for water management decisions. State Board modeling staff, especially in the Bay/Delta Section, are largely occupied with direction of these research, development, and analysis projects and the communication of information to other information users within the Board.

Most of the foreseeable modeling work will be within the Division of Water Rights. The activities of the Division comprise two major areas, Special Programs and Administration of Water Rights. As shown on the accompanying organizational chart (Figure 1.1), Special Programs contains two major sections, the Environmental Section and the Bay/Delta Section, plus support units. Both of the sections contain several specialists and special-purpose units. In particular, the Bay/Delta Section has approximately twelve Water Resource Control Engineers and Environmental Specialists (at various levels) making up the Engineering Unit and the Bio-Assessment Unit. In close cooperation with staff of other units and sections within the Division, these engineers and specialists are collectively responsible for analyzing the effects of water management decisions on the San Francisco Bay/Delta hydrologic system. Specifically, the Bay/Delta Section analyzes the water supply impacts of any proposed changes to the water system, including water quality impacts as they impinge on existing or potential appropriations; the impacts of temporary and permanent changes in water rights; and the medium to long-term effects of water resource modifications, either from natural or human causes, on the Bay and Delta.

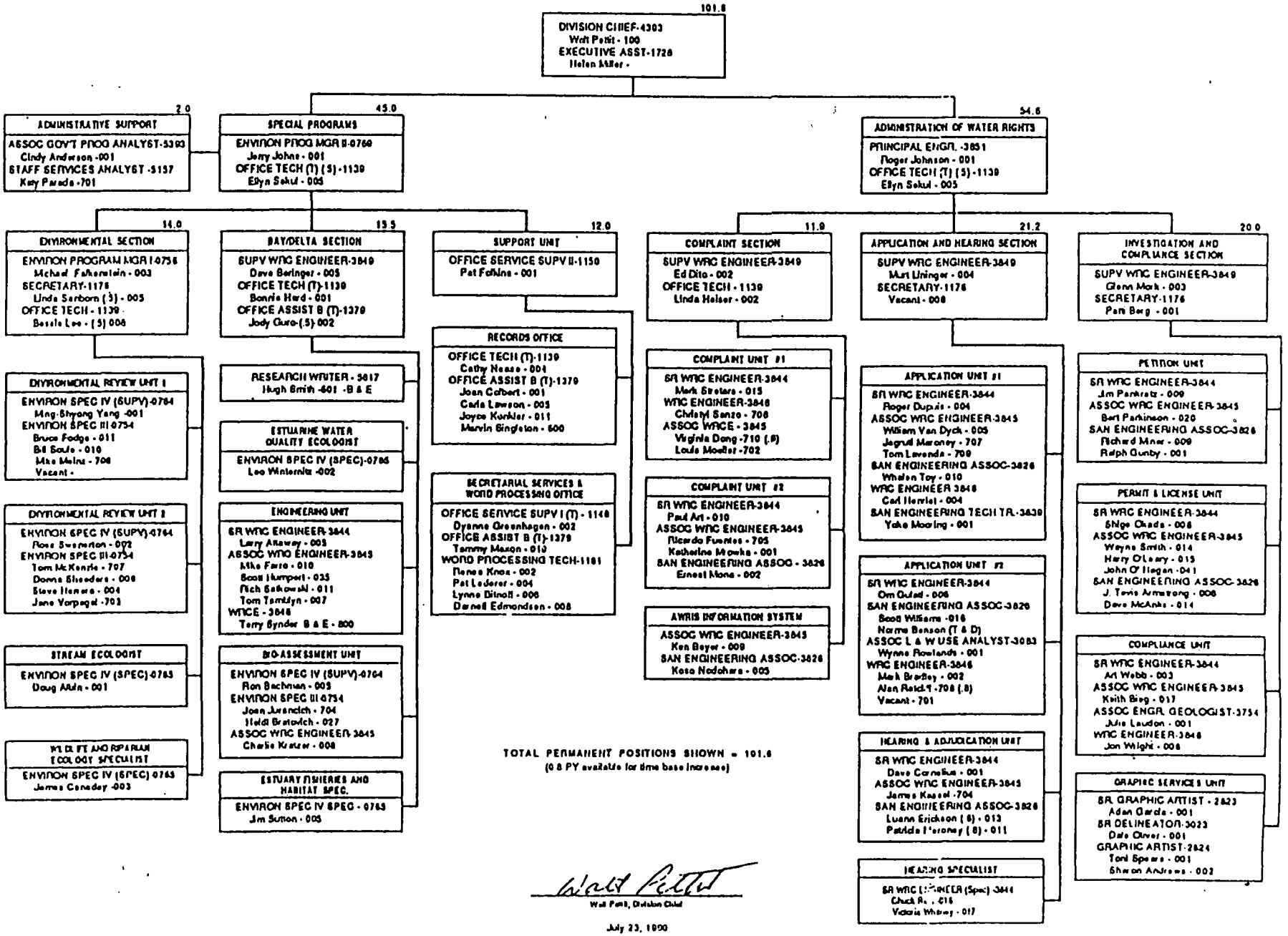
In sum, effective planning and management for the future of California's water depends primarily on systematic evaluation of existing water availability and in-stream resources, the ability to project future water supply and quality needs, and the capability to translate this information into a sound basis for decision-making. Modeling of hydrologic variables and dynamics provides a valuable tool to assess the impacts of various alternative management decisions, since modelers can study theoretical solutions to both real and anticipated water resource problems. Mathematical (computer) models provide a vehicle for generating information on surface and ground water supplies and movement, as well as the interactions between water sources, precipitation, water management (dam releases, permits and appropriations, etc.), usage estimates, and so forth. Alternatively, such models are used to help design and develop the water management and use policies necessary to meet pre-defined criteria for water quality or quantity.

1.2. Problems and Opportunities

Beneficial uses in many areas of the State are threatened by a combination of low flow and adverse water quality. The 1986 court ruling by Judge Rancanelli requires that the Board "globally balance" the competing demands for water and the effects on water quality. Computer modeling is an increasing important tool to enable the State Board to analyze and project water quantity and quality parameters and balance these competing needs. Modeling is dependent on the availability of computer hardware and software, data, and support personnel to be successfully applied to water

DIVISION OF WATER RIGHTS

Figure 1.1



management problems. The results of these models are used by the Board in its water quality control plans and water right decisions as it balances instream protection and the water supply needs of the State. Currently, modeling resources are insufficient for the State Board to fully meet its mandates to develop comprehensive water quality control plans and flow decisions, especially in the Bay-Delta Estuary.

Computer modeling is a very precise mathematical endeavor. It is based on empirical observations and theoretical interpretations of the operation of hydrologic systems. These observations of how the hydrologic system works are reduced to mathematical equations, the core of the model. The process is highly complex and strongly dependent on the specific observations and assumptions. Good utilization of models requires regular "tuning" adjustments and re-interpretation of results. It is often the case that significantly different results can result from relatively minor model procedure or data changes. Correct, unbiased, and rigorous modeling standards are necessary to meet State Board mandates when considering the dollar costs associated with miscalculations of water availability or water quality. This means that a high degree of control over the modeling process is imperative.

Currently, the State Board uses a combination of in-house resources, public agency agreements and private firm contracts. Each of these solutions imposes limitations on the overall modeling capabilities of the State Board.

Problem 1. Insufficient in-house modeling resources

- A small percentage of the existing models available for analysis are currently accessible and used within the State Board, reducing the quality of simulation/operation information required for meeting Board mandates.

- State Board computers are not powerful enough to store data required for running models, nor are the data retrievable if stored on Board data processing systems due to the absence of high-bandwidth networking.

- Existing systems are not powerful enough to run complex models in reasonable periods of time. For example, the Fischer Delta Model, a combination hydrodynamic/salinity model, requires 10 to 14 days to run on the Division's MicroVAX II computer, allowing only two to three iterations to be performed per month.

- The State Board does not have sufficient modeling personnel to develop data sets, perform the model runs, and analyze the results of the studies.

Problem 2. Limited access to other agency resources

- Other agencies are constrained in the amount of modeling work that can be performed for the State Board, due to their own missions and higher-priority workload. In particular, the Department of Water Resources will not be able to continue the level of modeling support it has provided in the past.

- Agencies may be unable to perform certain functions on behalf of the State Board in support of the upcoming Bay-Delta hearings since the agencies may be party to those hearings, which are anticipated to be adversarial in nature.

- State Board control over how models are run and the format of various outputs is limited, and thus the integration of modeling results is very difficult.

Problem 3. Costs associated with private consulting firms

- Use of private engineering or consulting firms is too costly to allow for complex, iterative modeling of variable phenomena.

- Institutional and technical problems associated with performing analyses at various distributed sites are comparable to those of using public agency agreements.

Problem 4. Unavailability of models and datasets

- Numerous models describing hydrologic characteristics are potentially available, but are not directly usable by State Board staff either in-house or through outside agreements.

- Datasets are not directly available, and cannot

be made accessible on-line in the current data processing system configuration.

- Integration of data inputs and outputs is not feasible where both modeling tools and database resources are distributed in a variety of locations, and would require a "web of interconnectivity" maintaining multiple connections among many different machines rather than extraction and downloading to a common data/compute server.

Problem 5. Lack of oversight of water-right holders' modeling

- The State Board has been criticized for not having sufficient modeling tools to critically evaluate modeling performed independently by major water-right holders and to improve upon them.

- There is an appearance of "the fox guarding the hen-house" associated with having water-right holders perform the modeling studies, since they often have a vested economic interest in the outcome.

Hardware performance and the robustness of software have increased dramatically over the last few years. Modeling analyses formerly only possible at specialized computer centers using costly hardware, software, and technical staff, can now be performed on relatively low-cost networked workstations. Modeling staff can be directed to model design and application, since coding and operations requirements have been much reduced through better software engineering. Finally, enhanced digital telecommunications provide access to a wider variety of programs and datasets than previously possible, making local systems with distributed resources attractive options.

1.3. Objectives

The overall goals of the State Board's Modeling Enhancement Program are:

- To enhance the access of State Board staff to advanced hydrologic modeling capabilities, including hardware/software, datasets, and support personnel, while ensuring control over the modeling process.

- To provide a mechanism for efficiently integrating flow and water quality information to allow balanced decisions for the protection of beneficial uses.

- To ensure that water-management information is provided to decision-makers and the public in a timely manner, in response to changing conditions and mandates.

In particular, a number of programmatic and operational objectives must be met to solve the problems outlined in the previous section. Each of these objectives is essential to the State Board's immediate requirement for effective and efficient enhancement to the existing modeling systems.

The specific objectives to address each identified problem area are summarized below:

Problem 1. Insufficient in-house modeling resources

- To provide the State Board with qualified technical/engineering staff for model development and interpretation.

- To ensure adequate administration of modeling programs to prevent duplication of effort or the proliferation on non-compatible data or analysis systems.

- To provide hardware and software of sufficient power to be usable by State Board staff for complex modeling, including software development tools for model creation and refinement.

- To guarantee processing times no greater than 12 hours (i.e., overnight) for any production or operation model.

Problem 2. Limited access to other agency resources

- To reduce direct reliance on outside agencies (especially DWR and USGS) to an advisory/consulting role, rather than a production one, and therefore that the modeling

systems are comparable to those agencies' systems.

- To encourage agreements with other agencies primarily for specialized expertise and information sharing.

- To support the creation of an ad hoc inter-agency modeling committee to address issues of common concern and to communicate the status and problems of agencies' modeling efforts.

Problem 3. Costs associated with private consulting firms

- To reduce by 50 percent in three years the amount of production contract work performed by private firms.

- To use private firms only for specialized functions unable to be performed in-house for technical, not workload, reasons.

Problem 4. Unavailability of models and datasets

- To provide on-line access to useful hydrodynamic/salinity, operations, optimization, and related models and datafiles.

- To allow network, high-bandwidth access to modeling systems resident on other agencies' and organizations' computers.

- To implement a computing environment which is supportive of open exchange of software and data.

Problem 5. Lack of oversight of water-right holders' modeling

- To avoid any substantial reliance on modeling analyses performed by water right holders and thus preclude any potential conflicts of interest.

1.4. Functional Requirements

The programmatic and operational objectives described above may be addressed in part via a variety of technological solutions, whether hardware and software is resident within the State Board or elsewhere. Any information technology solution, however, must meet the following functional requirements for technical success:

1.4.1. Outputs

The system must be capable of graphical and tabular display of complex numeric datasets. Graphical display capabilities include both simple diagrammatic representations of one-dimensional models and color visualizations of two- and three-dimensional models.

Facilities must be able to provide information interactively at a workstation, including surface, volume, route, map, drawing, image, chart, and text formats. Output devices must support generation of any of these information types in appropriate hardcopy format as well.

Data must be capable of being disseminated in standard formats, including network transmission via TCP/IP protocols to local and remote sites, and archival media such as magnetic tape and optical disk.

1.4.2. Inputs

The system must be able to incorporate data from a variety of sources, including keyboard entry, graphical input devices (digitizers, scanners, etc.), electronic media, and network file transfer.

Utilies must exist to provide necessary data type conversions, including conversion of data from outputs of other numerical models and numerical analysis systems.

1.4.3. Capabilities of Information Technology

The primary modeling server must operate using the UNIX*[1] operating system, and include Network File System (NFS),[2] X-Windows, and TCP/IP. The system must support a robust software development system, including compilers for C and Fortran, high-level math libraries, graphics routines, and tools for remote procedure calls for distributed applications.

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[1] * UNIX is a trade mark of AT&T Bell Laboratories.

[2] Network File System and NFS are registered trademarks of Sun Microsystems, Inc.

Hardware must operate at a minimum of 15 MIPS, with effective floating point performance of 5 MFLOPS or greater. Data I/O must be capable of a sustained 3MB/sec transfer rate. Network interfaces must meet standard Ethernet 10Mb/second specifications.

Specialized software tools must include statistical analysis, database management, and visualization.

1.4.4. Files

The system must be capable of efficiently managing very large datafiles (in excess of 100 megabytes), with the ability to address up to 10 gigabytes on-line magnetic disk memory. Initially, the system must include two GB of storage, plus magnetic tape and CD-ROM optical storage.

The system must support demand paging and virtual memory.

1.4.5. Application Availability

The modeling software to be used by this program is generally available in the public domain or is already licensed by the State of California. New model development is anticipated to take place largely within the Board by new modeling staff.

Subsystem software for RDBMS, GIS, CAD, statistical, office automation, and networking is commercially available. Compatibility with other information users and purveyors in terms of data formats and user familiarity is desirable, though not absolutely essential.

1.4.6. Security

Security measures must exist to control and record database and file access, including both basic system login/password protection and various database permission levels for retrieval and update of specific fields. In particular, the system must be capable of monitoring dial-up and network activity.

1.4.7. Interfaces

The operation of this system is dependent on being able to acquire and load data and software produced at other locations. The system must be capable of tape and optical media transfer for large datafiles and of direct telecommunications transfer for smaller files and for updates.

Tape formats must include standard 9-track ANSI labeled and unlabeled as well as QIC-24 cartridge format. Optical transfer standards have not matured to the point where they can be specified at this time, but any system acquisition will be evaluated in terms of emerging standards prior to purchase.

Communications should support 10 megabit/second Ethernet TCP/IP protocols. Network gateways must provide access to the Mall fiber loop for 100 mbs access to hosts at DWR, other state agencies, and other Internet hosts (notably the San Diego SuperComputer Center).

2. Alternative Analysis Section

2.1. Baseline Analysis

The State Board's existing program is one of contracting out most modeling work, with some capabilities maintained within the Division of Water Rights using existing hardware and software. The Division has the equivalent of two Associate Water Resource Control Engineers currently supporting its modeling efforts, though more of their time is spent managing State Board modeling contracts than actually performing model-based analyses on Division systems. Currently, the Division is spending approximately $777,200 annually on support of information technology for hydrologic modeling. This includes the Division's support of 0.5 persons within the DAS Data Management Section. In fact, however, little of this investment in data management directly relates to modeling, but rather is in support of other Division functions.

Including administrative and technical support personnel,the Division of Water Rights is spending approximately $620,000 per year in salary, benefits, and indirect costs associated with primarily the programmatic aspects of the modeling effort in the Bay/Delta Program. Of this, about $123,000 is actually dedicated to modeling and supervision of outside modeling projects.

The Division has spent approximately $500,000 per year on outside modeling contracts to support both model development and data analysis. In the future, about half this amount could be directed to support other alternative modeling approaches.

It is not possible to totally isolate programmatic costs (related to model development and analysis at a conceptual and operational level) from information technology costs (related to compute services and model/system operation). However, based on costs and times for operating the Fischer Delta Model, some estimates of times and costs can be made. A complex, complete run of the Fischer Model over a 57-year time span (corresponding to the existing database of hydrologic conditions), costs the Division from $1000 to $3000, depending on the level of analysis required. About three to four days are required for the computer work to prepare the dataset and operate the model, with anywhere from two days to two weeks typically required for analysis of the results (longer for complex scenario evaluation). On the other hand, a simple one-year run to examine a specific condition at a designated

location generally requires an hour or less for model preparation and operation and a few hours for analysis.

Future model development, operation, and analysis costs are projected to increase steadily with increasing modeling requirements of the Bay-Delta Proceedings and other mandates. For example, a complete 57-year Fischer run is performed for each operations study, and 50 to 60 operations studies are anticipated to be performed as part of the development of the Delta Water Quality Control Plan. Eventually, 100 or more 57-year analyses may be required per year, and two to three screening studies (a simplified version of the Fischer model to be developed under contract in 1990-91) per day may be required as well.

Finally, the Division has been dependent on work done at other governmental agencies but not billed to the Board. Through informal agreements, the State Board has received the temporary support from the Department of Water Resources (DWR) and the United States Geological Survey (USGS) to help analyze complex hydrological data in San Francisco Bay and to perform water project operation studies for the ongoing Bay-Delta hearings. Six people at the Department of Water Resources and two at US Geological Survey are dedicated to performing modeling analyses used by the Division for its own work. These agencies have stated that they will not be able to provide this support free of charge beyond the next few months. Again, it is not possible to isolate programmatic and information technology costs.

Modeling, whether development or operation/analysis, is not amenable to traditional workload measurement techniques, since there is no easily definable unit of work. Much of the work is developing new models and refining existing ones. Running existing models requires the generation of appropriate input data and analyzing the results. Therefore, in order to develop estimates on what the State Board would need to establish a minimum modeling capability we have used other agencies performing such tasks as a guide.

2.2. Alternatives Considered

The alternatives presented below describe various approaches to meeting the information technology requirements of the State Board's Modeling Enhancement Program. The overall goal of the Program, to bring substantially greater amounts of modeling capability to the State Board, will require the addition of several senior modeling staff, in addition to any staff that may be required as part of the support for a particular information technology alternative. This is discussed in detail in the accompanying Budget Change Proposal. The alternatives presented below describe technological solutions to supporting the Modeling Enhancement Program.

2.2.1. Expanded consulting arrangements (Alternative 1)

Under this alternative, the State Board would enter into a long-term agreement with a water resources consulting firm who could provide modeling services to the Board under the immediate direction of existing supervisorial staff in Board offices. The contractor would be responsible for essentially all aspects of model development and operation, including writing and debugging software to State Board specifications, assembling code into modeling procedures, calibrating and validating models against existing datasets, measuring, recording, and applying new datasets, operating the models according to State Board-specified criteria (scenario testing), producing documents and graphics for State Board use, and providing support for State Board engineers analyzing the model outputs.

The contractor would supply staff for modeling work in accordance with a Standard Agreement, under one of two implementation scenarios. In the first, all services would be provided by Contractor staff working at the Contractor's offices, using Contractor computing equipment. In the second, the Contractor staff would be assigned to work in State Board facilities using equipment provided by the State Board.

The primary benefit of this alternative is that it represents the least degree of operational change from existing State Board activities and would thus result in the minimum amount of organizational change for the State Board. In particular, under the first sub-alternative, initial costs would be relatively low, with no appreciable personal or information technology costs.

Other advantages relate to the fact that this approach can be implemented in the shortest amount of time, that it allows the use of existing modeling expertise at outside organizations to the maximum extent feasible, and that current State Board personnel can focus on mandated hydrodynamic/salinity analysis rather than model development and operation.

Disadvantages of this alternative are that, currently, there is no firm with an existing Master Services Agreement that has the necessary capabilities to provide this service. Any firm to function in this capacity would have to be staffed by experienced modelers familiar with Bay-Delta hydrologic systems and have access to adequate computing facilities to address the intensive computational requirements of hydrologic modeling. Presently, staff are only aware of no firm that could potentially provide this level of service.

It is likely that any available contractor would also have agreements with water rights holders, raising possible conflict of interest problems with this alternative. Explicit requirements regarding the conduct of the Bay-Delta Proceedings aside, this

perpetuates a system in which parties with economic interests in the conclusions of modeling studies have some measure of control over how those studies are done.

Staff-year costs associated with this alternative are higher than using State Board employees, due to higher contract salary and overhead rates. Moreover, under sub-alternative two, there would not be a significant reduction in indirect costs (since they would be using State facilities and support staff).

The State Board does not have the computer resources to support contract staff working at its own facilities, so computer time would have to be acquired through a data center contract. Teale mainframe services are available for State agencies, though they have not been traditionally oriented toward computationally-intensive work such as the modeling proposed. (Teale services are especially useful for large-scale data management projects and archival storage.)

2.2.2. San Diego SuperComputer Center (Alternative 2)

The State, through Teale Data Center, has an agreement in place governing the use of the San Diego Supercomputer Center (SDSC) by State departments. The Cray Y-MP computer, associated visualization system, consulting and programming staff, and communications options provides a high-performance system for doing a wide range of hydrodynamic and water quality modeling. Using standard computer network protocols (TCP/IP), State Board (or contractor) staff can access the supercomputer virtually as easily as a local computer system. Standards that are now emerging regarding data communications support relatively transparent interchange of software programs, datasets and databases, textual information, and graphics.

The State Board would have to acquire some additional equipment to use SDSC, since all supercomputer access is based on network connections using the TCP/IP communications standard. At a minimum, a moderate speed connection to DWR (via the fiber optic cable already installed to the SWRCB building) and/or to the Teale Data Center (using a telecom link) in conjunction with networking infrastructure within the building would be required. In addition, at least some microcomputers in the State Board would have to be equipped with network boards and software (at a cost each of $600) to allow interaction with SDSC.

The primary benefit of this alternative is the extremely high-performance computer power available from the Cray in tandem with the high level of technical support available from the Center. In one test case, the Cray performed a modeling run in about 40

minutes that took nine hours on a SPARC workstation[3] and several days on the Division of Water Rights' MicroVAX II computer. Further increases in performance are possible by optimizing software to take advantage of features of the Cray supercomputer. This optimization would be done by Center staff, given their expertise in working with the Cray.

Other advantages are that information technology costs to the State Board other than the Center contract itself would be relatively low, limited to hardware and software required to bring State Board computers on-line with the Internet, directly or via Teale Data Center.

Disadvantages of this alternative include the fact that there is not the expertise at SDSC in terms of water resources that the State Board is able to utilize through existing contracts, consequently, additional in-house staff would be required to implement this alternative or the existing contractors would have to be retained to direct the modeling at SDSC. These individuals would have to be trained both in the modeling process and in the use of SDSC systems and resources. In this regard, this alternative is not much different than the Expanded Consulting Arrangements or the In-House Modeling Capabilities, respectively.

The costs associated with using SDSC are difficult to estimate in advance, since pricing is based on "service units" - a combination of CPU time, memory usage, disk storage, and incidental charges - but in the absence of direct testing it cannot be determined how much computer time a particular model run might take. The Air Resources Board has just begun a program to use SDSC for air quality modeling, so better statistics on State costs should be available by about January 1991.

The cost of exclusive reliance on SDSC for all hydrologic modeling needs of the Division are anticipated to be very high, given the computer time costs (approximately $500 per hour for CPU[4] time) and the need to acquire hardware/software and to hire or contract additional staff.

2.2.3. In-house modeling capabilities (Alternative 3)

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[3] SPARC is an implementation by Sun Microsystems, Inc., of Reduced Instruction Set Computing (RISC) architecture for desktop/deskside workstations. Currently available systems, such as that used in this example, operate at 15 to 22 million instructions per second (MIPS).

[4] CPU (Central Processing Unit) time refers to the number of minutes the computer actually spends performing the calculations, and is usually less than the elapsed clock time while the work is being performed.

As noted above, the State Board has limited modeling capabilities. This problem can be addressed directly by acquiring appropriate hardware and software, developing and obtaining useful datasets, and redirecting, hiring, and training modelling personnel.

The facility required for this solution comprises a high-performance server/workstation configured with a gigabyte or more of disk space, a graphics monitor, and networking. This system would function as the primary data management platform and as the central modeling compute server. Its resources would be accessed via workstations for each of the senior modeling staff and by other networked systems. Workstations would be configured as "dataless" modeling platforms, meaning local processing would be done on datafiles and using software obtained via the network. In addition, one or more new high-performance microcomputers should be linked via the network to allow the use of software available on either the server or the microcomputers while sharing common datafiles. All systems must be capable of being interfaced directly with existing State Board microcomputers as well as data processing systems via a high-bandwidth (10 megabit/second) standard protocol network.

Much modeling software is available in the public domain, and can be freely obtained from Department of Water Resources, Bureau of Reclamation, and the Geological Survey. Other proprietary software, such as the Fischer models, has already been purchased by the State Board so would likewise be available to staff.

This plan would require the hiring in its first year two technical staff to operate and support the computing environment, in addition to additional program staff required to perform the actual model development and analysis. Technical support staff would include a Programmer/Analyst to do system administration, hardware/software maintenance, network management, and related functions, and an Information Systems Analyst to perform database management and application development. This alternative presumes the addition of several modelers/engineers to effectively and efficiently utilize the modeling facility. These individuals would comprise a Modeling Support Unit within the Bay-Delta Section of the Division of Water Rights to provide simulations, scenario evaluation, and operations assessments to Division and Board staff. Specific areas of functionality include delta flows/salinity, delta/upstream systems assessment, bay dynamics, and water availability. The Unit would also be expected to serve in a liaison role with other on-going digital data development functions within the Division, including links to AWRIS (the Automated Water Rights Information System) and future GIS (geographic information system) capabilities.

The primary benefit of this alternative is that it maximizes

State Board control and oversight of the modeling process, ensuring that Board interests are foremost in the application and interpretation of models. All aspects of model development, testing, operation, evaluation, and analysis, will be under the direct supervision of the Board, better meeting the State Board's public interest mission.

In addition, this alternative has the advantage of preserving the maximum flexibility for future support of Board activities other than Bay-Delta modeling and for integration with information systems such as AWRIS, GIS, etc. This integration is essential for future water rights tracking and modeling for purposes of projecting water availability. It also will significantly reduce the amount of staff time currently spent supervising modeling contracts, and allow the application of State Board expertise directly to the modeling and analysis problems currently facing the Board.

The main disadvantages of this alternative are that, of the alternatives considered, it has relatively high start-up costs associated with new facilities, and also continuing costs associated with additional staff to perform the modeling. At the same time, from a purely economic perspective, doing more modeling in-house lessens the costs of contracting model operations, retaining resources for enhancement and refinement of modeling capabilities.

Total costs of this alternative include 100,000 to 200,000 dollars for initial hardware/software acquisition, two persons for information technology support, and eight programmatic persons to utilize the system effectively.

3. Recommended Alternative

The recommended alternative is to develop in-house modeling capabilities, Alternative 3, including hardware/software acquisition, data development, and staff hiring. However, certain advantages of the Supercomputer Center, Alternative 2, merit inclusion in the selected alternative which can be readily accomplished with appropriate system design. Alternative 1 and the Baseline/No Action alternative do not address basic mandates of the State Board.

3.1. Rationale

In-house modeling is the only alternative that simultaneously meets the objectives of accurate and timely simulations/operations modeling and direct Board control of the modeling process. In addition, it will successfully address future workload requirements associated with a reduction in Department of Water Resources support for Board modeling. Finally, it provides these

capabilities at a cost to the State that, while higher than other alternatives in terms of initial outlay, is projected to be mitigated by an overall reduction in the level of contract costs and the amount of staff time spent supervising modeling contracts.

3.2. Impact on Existing Operations

The proposed alternative will have a great impact on current State Board modeling procedures, notably in the area of personnel for the Division of Water Rights. A major goal of the modeling enhancement program is to have State personnel perform much of the modeling work currently contracted to private firms. The recommended alternative is the creation of a Modeling Support Unit within the Bay-Delta Section that will comprise expert modelers/engineers and support staff. A companion Budget Change Proposal documents the need for these additional programmatic staff; specific positions are described under the Management Plan.

It is important to the success of the modeling programs within the Board that groups employ a sufficient number of senior technical engineers, environmental specialists, and information systems specialists. This is important not only to the Board's ability to attract and retain highly capable staff, but ultimately to the Board's confidence that decisions regarding California's water are based on the best available information.

3.3. Source of Funds

The primary source of funds, both for information technology and programmatic requirements, is from a redirection of State Board general fund money (See the CEQA Regulatory BCP for more detail).

3.4. Authorizations Required

Authorizations needed are approval of this FSR by the Chief of the Division of Water Rights, the Data Management Office Chief, and the Chief of the Division of Administrative Services. Subsequent review and approval by the Office of Information Technology is required for this FSR. Final implementation of the contract is subject to the approval of the Division of Administrative Services.

3.5. Equipment and Software

The Division of Water Rights currently has several microcomputers used for various applications within the Bay/Delta Section. These are not powerful enough, in terms of CPU performance, memory management, mass storage capability, display resolution, or networkability, to support the modeling requirements of the Division. At the same time, with relatively minor modifications and augmentations, they can be used as terminals or workstations to access more powerful systems.

The modeling software will be acquired, implemented, and developed over time by the modeling staff. There are certain basic software requirements to support the modeling efforts, however, such as compilers and networking, as well as general purpose applications software for graphics, etc.

The key components to implement a modeling facility are:

Hardware

- Modeling Servers.
  - 1 RISC compute server (Sun 4/470-32 "SPARC")
    - 32 megabytes main memory
    - 1 gigabyte IPI disk storage
    - GXP 2/3-D graphics accelerator
    - 19-inch color display
    - 6250 bpi 9-track tape drive
  - 3 80386-based DOS microcomputer
    - 4 megabytes main memory
    - 300 megabytes SCSI disk storage
    - VGA graphics adapter
    - ethernet

- Workstations.
  - 3 RISC workstations (Sun 4/20-8)
    - 8 megabytes memory
    - 200 megabytes local storage
    - network file system
    - monochrome display
  - 3 RISC graphics/power workstations (Sun 4/65 FGX-8)
    - 16 megabytes memory
    - 200 megabytes local storage
    - network file system
    - color graphics display
  - 1 color printer
  - 1 laser printer

- Network.
  - 7 PC ethernet boards
  - network cabling (ethernet, twisted pair,transceivers)
  - fiber optic connection
  - 1 internet router

Software

- UNIX operating system, with Network File System (NFS), C compiler
- FORTRAN-77 compiler
- PC/NFS (microcomputer networking, one copy per PC)
- graphics/visualization tools

3.6. Procurement

All hardware and software procurements, other than contracted model development, will be specified and bid per Board procedures. Note that the inclusion of manufacturer/vendor names are included for informational and budgeting purposes only; final selection will be made through the normal specification/procurement process.

3.7. Microfilm

Not applicable.

3.8. OCR

Not applicable.

3.9. Confidentiality/Privacy and Security

Systems will be made secure through the application of logon/password procedures for all authorized users. Network security will be maintained through host and user verification. Datasets containing proprietary or sensitive information and proprietary software will be secured from inappropriate access by file/directory permissions, and where necessary, physical removal of media.

3.10. Standardized Economic Analysis

Total costs associated with this recommendation are shown in the attached tables. These include one-time equipment costs, on-going hardware/software charges, and personnel salary and benefit expenses.

Costs are offset by an eventual reduction of at least $250,000 annually in consulting and professional services due to greater reliance on in-house modeling resources.

4. Management Plan

4.1. Project Responsibilities

The project will be under the direction of the Bay-Delta Section, Division of Water Rights. Initial responsibilities will fall to the Division Chief. However, once the Modeling Support Unit is formalized, responsibilities for unit operations will be delegated to the new supervisor of the unit.

The information technology and programmatic positions anticipated are detailed below:

- Modeling supervision. An experienced modeler/engineer would have overall responsibility for the modeling activities of the Unit. This would include technical assistance with specific modeling issues as well as direction of Unit programs.

  1 Senior Water Resource Control Engineer (Supv)

- Delta flows/salinity. Two modelers would be required to implement and utilize available hydrodynamic/salinity models for the Bay-Delta system in support of the Hearings and other Division activities. This function would capitalize on model development already funded by the Board, e.g., the Fischer Delta Models. In addition, the modelers would be involved in the development of a new optimization matrix/model for the delta to supplement the current Department of Water Resources operations model. One of these modelers is proposed to be redirected from current Bay/Delta Section staff.

  1 Senior Water Resource Control Engineer

  1 Associate Water Resource Control Engineer

- Delta/upstream systems assessment. Two modelers would be required to implement and utilize various flow and water quality models used to evaluate the impacts of water management and allocation decisions on downstream water quantity and quality parameters. One of these modelers would have as an explicitly defined responsibility the integration of Modeling Unit functions with activities of the Environmental Section, both to provide direct support to modeling in that Section and to ensure coordination within the Division of datasets

ECONOMIC ANALYSIS WORKSHEET -- BASELINE

	91-92 PY	91-92 Costs	92-93 PY	92-93 Costs	93-94 PY	93-94 Costs
Information Technology Costs						
One-time						
Agency Personnel						
Contract Personnel						
Equipment Purchase/Lease						
Software Purchase/Lease						
Agency Facilities						
Supplemental Services/Processing						
Other						
Total One-time	0.0	0.0	0.0	0.0	0.0	0.0
Continuing						
Agency Personnel	0.5	30.8	0.5	30.8	0.5	30.8
Contract Personnel						
Equipment Purchase/Lease						
Software Purchase/Lease						
Agency Facilities						
Supplemental Services/Processing						
Other						
Total continuing	0.5	30.8	0.5	30.8	0.5	30.8
TOTAL Information Technology	0.5	30.8	0.5	30.8	0.5	30.8
Impacted Program Costs						
Agency Personnel	2.0	123.2	2.5	154.0	3.0	184.8
Contract Personnel						
Agency Facilities						
Supplemental Services/Processing		500.0		550.0		600.0
Other						
Total Program	2.0	623.2	2.5	704.0	3.0	784.8
Net System Costs	2.5	654.0	3.0	734.8	3.5	815.6

ECONOMIC ANALYSIS WORKSHEET -- IN-HOUSE MODELING UNIT

	91-92		92-93		93-94	
	PY	Costs	PY	Costs	PY	Costs
Information Technology Costs						
One-time						
Agency Personnel	0.0	0.0				
Contract Personnel	0.3	39.0				
Equipment Purchase/Lease		187.1				
Software Purchase/Lease		10.2				
Agency Facilities						
Supplemental Services/Processing						
Other						
Total One-time	0.3	236.3	0.0	0.0	0.0	0.0
Continuing						
Agency Personnel	2.5	154.0	2.5	154.0	2.5	154.0
Contract Personnel	0.0	0.0				
Equipment Purchase/Lease		9.7		9.7		9.7
Software Purchase/Lease		4.2		4.2		4.2
Agency Facilities						
Supplemental Services/Processing		49.0		49.0		49.0
Other						
Total continuing	2.5	216.9	2.5	216.9	2.5	216.9
TOTAL Information Technology	2.8	453.2	2.5	216.9	2.5	216.9
Impacted Program Costs						
Agency Personnel	10.0	616.0	10.0	616.0	10.0	616.0
Contract Personnel						
Agency Facilities						
Supplemental Services/Processing		450.0		350.0		250.0
Other						
Total Program	10.0	1066.0	10.0	966.0	10.0	866.0
Net System Costs	12.8	1519.2	12.5	1182.9	12.5	1082.9

and procedures. One position is proposed to be redirected from current staff.

1 Environmental Specialist IV

1 Senior Water Resource Control Engineer

- Bay dynamics. One modeler would work with models of open water systems developed by USGS and others. These are two- and three-dimensional hydrodynamic finite element and difference models of sub-areas of San Francisco Bay designed to examine tidal, bathymetric, flow, and related phenomena. He or she would also take the lead within the Unit for implementing visualization tools for analyzing model outputs. (One position in this sub-area is sufficient, due to on-going contracts with USGS for Bay model development.)

  1 Senior Water Resource Control Engineer

- Water availability. Two modelers would begin to develop new models for projecting availability of water to allocations based on existing water rights and estimates of anticipated water resources. This effort would mark an attempt to better integrate theoretical estimates of river and delta systems with water use statistics and delivery requirements.

  1 Associate Water Resource Control Engineer

  1 Water Resource Control Engineer (B)

- Database management. One modeler would be focussed on database administration in support of the other modelers' analytical functions. There are two aspects to this function: management of large matrix datasets comprising observations and calculations of modeling systems (anticipated eventually to total several gigabytes of data) and development of linkages between model databases and other, external spatial and tabular database systems. A portion of this person's time would be to gather data on water use from the AWRIS.

  1 Staff Information Systems Analyst (Spec)

- o System administration. One position would be required for computer systems administration, including hardware/software configuration, user accounting, operations, software installation and maintenance, and networking.

  1 Associate Programmer Analyst (Spec)

- o Consultant services. In addition to regular system administration staff, it is expected that two person months of consultant work will be required for initial system and network configuration. This is estimated to cost $20,000.

4.2. Management Schedule

The implementation schedule for the Modeling Enhancement Program, including staffing, hardware/software acquisition, and contracting, is shown below. Staffing is likely to be the most time-consuming aspect of the program, due to the relatively few numbers of qualified engineers and associated professionals to perform modeling. All positions are anticipated to be filled within one year of approval of the BCP.

Jan 91 FSR/BCP Approved

Jun 91 Engineer positions announced, with duties and qualifications required.

Jul 91 Funds become available for hiring and purchase.
Existing staff redirected into modeling support unit.
Consultant retained to develop system specifications.
Computer hardware procurement started.

Aug 91 Info Systems Analyst hired.
Two engineers hired (subsequently, engineers and specialists hired at average rate of one per month).

Sep 91 Network hardware installed.
SDSC/Teale contracts initiated.
Staff begin process of obtaining relevant model code for selected hardware.

Nov 91 Server/workstations installed and configured.
Network software loaded and systems interconnected.

Jan 92 Initial models ported, tested, and running.

Jul 92 Unit becomes fully operational with analyses performed for Bay-Delta activities.
Development work begun on system integration with AWRIS, GIS, and other Division and Board information systems.

Jul 93 Transfer of most model development activities from contractors to Division/Unit staff.