POLICY EVOLUTION AND LEARNING IN CALIFORNIA WATER DISPUTES: THE VALLEY DRAIN CONTROVERSY

by

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POLICY EVOLUTION AND LEARNING IN CALIFORNIA
WATER DISPUTES: THE VALLEY DRAIN CONTROVERSY
by
John Frederic Ruston
Submitted to the Department of Urban Studies and Planning on May 27, 1986 in partial fulfillment of the requirements for the Degree of Master of City Planning.

ABSTRACT
The evolution of public policy on a major California water project, from 1956 to the present, is analyzed. This project, a concrete ditch called the Valley Drain, was designed to remove waste water from farms in the San Joaquin Valley. The effluent was to be discharged into the San Joaquin-Sacramento River Delta, outside of San Francisco Bay. In implementing out their plans, the proponents of the drain (the U.S. Bureau of Reclamation and the California Department of Water Resources) faced a difficult political battle, and the drain was only one-third completed.

The analysis scrutinizes the roles of several actors and issues in the drain controversy. Among these actors are water-supply agencies, farmers' organizations, and environmental groups. Three issues in the conflict which were important to the formulation and development of public policy are emphasized. These are, the difficulty of finding workable finance mechanisms, the use of scientific evidence in a politicized setting, and the search for alternatives to the drain.

As a tool for interpreting the evolution of policy in the case of the drain, the thesis relies on a theoretical framework developed by Paul Sabatier (1985). A main feature of the framework is its elucidation of the importance of "policy learning" as a result of the interaction of advocacy coalitions, deeply-held beliefs about a problem area, and a shifting political environment. The thesis concludes that Sabatier's framework is a generally useful explanatory device, but that the nuances of experience in the drain conflict suggest some revision.

Thesis Supervisor: Dr. Martin Rein
Title: Professor of Sociology
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CHAPTER 1.
INTRODUCTION AND OVERVIEW

This thesis is built around two major queries. The first is, what drives the evolution of public policy over long periods of time? The second question reflects one aspect of the first; what makes organizations politically effective? Specifically, I want to understand how advocacy groups define and achieve (or alter) their goals, and how this affects the overall evolution of policy, especially in shifting, complicated environments.

In this thesis, the answers to my questions are based on an analysis of the policy evolution of a deeply controversial California agricultural water project. The project, the San Joaquin Valley Drain, was proposed thirty years ago by the U.S. Bureau of Reclamation (USBR) and the California Department of Water Resources (DWR), and is currently one of the most divisive water quality and agricultural issues in the state. Very briefly, the drain was designed to remove a type of waste water produced on farms in California's enormously productive central valley. The waste water was to be discharged 50 to 290 miles away, at the confluence of the Sacramento and San Joaquin Rivers, which empty into San Francisco Bay.

By 1990, it is likely that well over $100 million will have been spent on the drain, for planning, environmental studies and construction (work on the drain stopped when it was one-third finished; about $40 million was spent before 1975). Despite all this expenditure, however, resolution of the conflict remains elusive.
The arguments against the drain center on cost and environmental effects. However, without some way of removing the waste water, large amounts of farmland may be forced out of production.

In 1984, the confirmation that the slowly accumulating drainage water was more toxic than anyone had previously known shook the framework of the entire debate. The finding that flows from the drain were poisoning much of the fauna at Kesterson Reservoir, a valley wildlife refuge, removed the possibility that the drain would be built to the river delta. The discovery set all the major parties scrambling for alternative solutions to the problem, in the process calling into question fundamental assumptions about water supply and farming in the valley.

A. Achieving Effectiveness

Beyond the standard political tools of money and access to the power and media, I am interested in three closely-related factors which I hypothesize will help interest groups to be effective. The first, and most encompassing, of these is the ability to undergo policy learning, eg., to adapt within a changing environment, develop effective new strategies, and avoid repeating old mistakes. The second reflects an aspect of the first, and is the ability to prevail in important negotiations, to analyze their dynamics, and especially, to engage in integrative bargaining (ie., overcome stalemates and solve problems by jointly developing innovative solutions). Third, also related to policy learning, I think groups will be successful if
they understand the role of technical and scientific evidence in public disputes, and pick the technical analyses they promote in their arguments carefully.

In the case of the San Luis Drain, there are many examples of effective and ineffective pursuit of strategies in these three categories. To reduce the analysis to a manageable size, I will assess the actions of three pairs of organizations which have been especially influential in shaping public policy.

1. The water-supply agencies

The first pair includes the agencies which proposed the project, USBR and DWR. The Bureau of Reclamation is a powerful force in the development of major dams and irrigation projects in the West, and has been incredibly tenacious in its pursuit of the drain. However, the Bureau has not been successful in getting the drain built, and has not been especially innovative in pursuing strategies which would better achieve its purpose. Recently, the actions of the Bureau, and its parent agency, the Department of Interior, have been especially damaging to the agency's public credibility.

I will argue that the source of the Bureau's tenacity and its ineffectiveness are the same: an entrenched ideological and bureaucratic commitment to a fixed pattern of operation. In the past, the Bureau has been extremely effective as a construction and engineering-oriented institution. However, the political and natural environment in which the Bureau functions has undergone major changes. Politically, many more actors are involved in setting policy on the projects the Bureau promotes and maintains,
and their interests less often align with the Bureau's. In the natural environment, the costs of USBR activity are increasing. The good dam sites in the West have been taken, and competition for water is increasing. The severity and complexity of environmental problems associated with the Valley Drain are beyond anything the Bureau would have forseen even ten years ago.

The Bureau of Reclamation is not especially good at joint problem solving, and does not easily learn from its mistakes. In some ways, the Bureau has been fairly crafty in its use of scientific arguments, but also has alienated the much of the scientific community involved in research on the drain and related environmental problems. The Bureau has a tendency to use scientific research to build its public credibility, which has not been healthy for either the quality of its research or public perceptions.

The second of the water agencies, the Department of Water Resources, has been generally as influential as USBR in California water development, with some subtle but important differences. However, DWR has not been as committed to the drain, and has been more flexible in its search for alternatives. DWR has also been less willing to provide subsidized, ultra-cheap water to farmers than the Bureau. This difference will become increasingly important as the politics of California water allocation shift from a north/south confrontation to an urban/rural clash (despite the fact that California has a population of 22 million, agriculture accounts for 85 percent of water use in the state).
If it had been given the opportunity, DWR may have pursued the drain as vigorously as the Bureau, but has faced greater constraints on its resources than the federal agency. DWR has also been subjected to greater internal and external pressures for change. Many of these have to do with shifts in state administration and battles over other water supply projects, like the Peripheral Canal.

2. The environmental interest groups

The strategies of the two environmental groups I am analyzing belong to the Environmental Defense Fund (EDF) and the Natural Resources Defense Council (NRDC). Both of these groups were created in the early seventies, and their general approach to California water issues was shaped by the same individuals. However, EDF has been involved in the drain case much longer than NRDC.

In its opposition to the drain, EDF has conciously sought, analyzed, and fought for alternatives to the project which will help solve the wastewater problem faced by farmers. Because of the discovery of wastewater toxicity, EDF is now in a position to capitalize on its long investment in research and analysis. In an unusual but positive turn in the controversy, EDF and the Westlands Water District (which serves farmers in the valley), may soon pursue cooperative research on solutions to the wastewater problem. The research is based on EDF's ideas, a federal loan, and Westlands' land and common interest.

It is unlikely that NRDC will find itself in a similarly cooperative position vis-a-vis agricultural interests. NRDC's
main activity in the drain conflict has been to file and coordinate lawsuits against government agencies, to force action on the Kesterson problem. This has hardened NRDC's positions in the type of informal negotiations which led to the EDF/Westlands agreement, but has also increased its visibility in the press and served an important purpose in environmental groups' approach to the drain.

Both EDF and NRDC are on the forefront of an evolving economic critique of government agricultural water policy in California, which most likely will become an important component of future policy debates. From the standpoint of the entire environmental/water reform movement, the division of labor between the two advocacy groups (EDF offering the carrot, NRDC wielding the stick) is a flexible, well-designed strategy.

3. The growers' organizations

Farmers throughout the valley have taken varying positions of support or neutrality on the Valley Drain, and these have fluctuated over time. Two growers' organizations have played especially important roles, the Westlands Water District, and the Community Alliance for a Responsible Water Policy.

The Westlands Water District is a public agency which receives about 1,150,000 acre-feet (af.) of irrigation water annually from USBR (Westlands is officially a political jurisdiction of the state). Westlands acts as a kind of water wholesaler and distributor to about 290 users in the district, who farm approximately 568,000 acres. Westlands also represents
the political and legal interests of the growers it serves, who farm large acreages and are generally very wealthy. The Westlands Water District is an important institution in state politics, and is well-financed and well-connected. It hires the best lawyers and lobbyists and its staff are top experts in their fields.

Westlands' political strategies usually involve using the lobbying and legal power of the district before trying other approaches. However, though Westlands is a politically conservative institution, it is also very flexible in doing what is necessary to meet the needs its growers.

Measured in terms of gross receipts, the Westlands farmlands are among the richest in the world. The District has been very effective at protecting and enhancing its interests, which include federally-subsidized water supplies and limited enforcement of acreage limitation laws for lands receiving subsidized water. As demonstrated in the case of the Valley Drain, the Westlands WD has a high capacity for policy learning, is effective in many types of negotiations, and at least compared to USBR, does not overextend the political use of technical arguments. These attributes are both precursors and products of the numerous resources which the district commands.

The Community Alliance for a Responsible Water Policy is a grassroots organization of growers who own farms on a 42,000 acre section of the territory covered by the Westlands WD. Since 1984, the farmers who started the Community Alliance have been especially hard hit by the soil drainage problems the Valley Drain was originally intended to solve. The Department of
Interior has threatened to shut off their irrigation water supplies, and the on-farm pipe systems which convey waste water to the drain are currently being plugged by the Westlands WD. The implications of these actions are that farmers of the Community Alliance are may have to abandon their lands within the next few years.

The Community Alliance has only been organized for two years, and does not have resources comparable to Westlands. The Alliance has been able to garner a good deal of sympathetic press coverage, and their predicament carries a lot of symbolic weight. The strategies of the Community Alliance, which include lawsuits, legislative lobbying, attempts to join important negotiations, and high-visibility public protests, are good choices for a bad situation, but may not salvage farmers' interests in the long run.

If their position worsens, there are in theory ways that the farmers could recapture the value of their lost farms (e.g., sell their water entitlements to Los Angeles, for a large profit). Whether these strategies are reasonable for a group of farmers to consider remains to be seen.

B. An Overview of the Thesis

Chapters 2-5 describe the Valley Drain and the background and evolution of the conflict over its implementation. In keeping with the themes of the thesis, the focus is on analysis and description of institutional activities and potential areas of policy learning. The increasing level of scientific understanding
about the drain's environmental impacts and the growing numbers of actors in the dispute are also highlighted. The appendices contain greater detail on technical issues and political participation.

The roles and strategies of the actors described above are analyzed in the remaining chapters. Three issues which cut across the activities of all the parties are emphasized; the problem of financing the drain, the role of scientific evidence, and the search for alternative solutions.

The concluding chapters view these facets of the dispute in terms of a highly developed theoretical framework, constructed by Sabatier (1985), which links policy learning and evolution. The framework also focuses on the role of values and beliefs of important players as a driving force in their interaction.
C. List of Acronyms and Abbreviations

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABAG</td>
<td>Association of Bay Area Governments</td>
</tr>
<tr>
<td>af.</td>
<td>acre-feet</td>
</tr>
<tr>
<td>BCDC</td>
<td>S. F. Bay Conservation and Development Commission</td>
</tr>
<tr>
<td>CCCWA</td>
<td>Contra Costa County Water Agency</td>
</tr>
<tr>
<td>CDFG</td>
<td>California Department of Fish and Game</td>
</tr>
<tr>
<td>CDF</td>
<td>California Department of Food and Agriculture</td>
</tr>
<tr>
<td>CVP</td>
<td>Central Valley Project</td>
</tr>
<tr>
<td>DOI</td>
<td>U.S. Department of the Interior</td>
</tr>
<tr>
<td>DWR</td>
<td>California Department of Water Resources</td>
</tr>
<tr>
<td>EDF</td>
<td>Environmental Defense Fund</td>
</tr>
<tr>
<td>EPA</td>
<td>U.S. Environmental Protection Agency</td>
</tr>
<tr>
<td>FWS</td>
<td>U.S. Fish and Wildlife Service</td>
</tr>
<tr>
<td>MWD</td>
<td>L.A. Metropolitan Water District</td>
</tr>
<tr>
<td>NPDES</td>
<td>National Pollution Discharge Elimination System</td>
</tr>
<tr>
<td>NRDC</td>
<td>Natural Resources Defense Council, Inc.</td>
</tr>
<tr>
<td>RWQCB</td>
<td>Regional Water Quality Control Board</td>
</tr>
<tr>
<td>ppb</td>
<td>parts per billion</td>
</tr>
<tr>
<td>ppm</td>
<td>parts per million</td>
</tr>
<tr>
<td>SWP</td>
<td>State Water Project</td>
</tr>
<tr>
<td>SWRCB</td>
<td>California State Water Resources Control Board</td>
</tr>
<tr>
<td>TDS</td>
<td>total dissolved solids</td>
</tr>
<tr>
<td>USBR</td>
<td>U.S. Bureau of Reclamation</td>
</tr>
<tr>
<td>USGS</td>
<td>U.S. Geological Survey</td>
</tr>
<tr>
<td>WD</td>
<td>Water District</td>
</tr>
</tbody>
</table>
CHAPTER 2.
AGRICULTURE, WATER, AND SOIL SALINIZATION IN THE SAN JOAQUIN VALLEY

A. The Role of Government Water Projects In California Agriculture

The conflict over the Valley Drain takes place against the backdrop of California's enormous agricultural industry, which produced $13 billion in gross receipts in 1981, more than any other state. Irrigation is a critical part of this picture—10 million acres of land in the state are irrigated. The most productive of these include 4.5 million acres in the San Joaquin Valley, in the central part of the state, roughly between Sacramento and Bakersfield (Goodenough, 1985).

The success of San Joaquin Valley agriculture depends on several factors: a long growing season, cheap migrant labor, available transportation to eastern markets, advanced mechanization, the use of fertilizer and pesticides, and the high mineral content of the soils (the valley is very arid, so rains have not leached minerals out of the earth). Most importantly, San Joaquin Valley farming is the result of the import of vast amounts of irrigation water into what used to be a desert.

Though California water delivery and allocation is very complicated, the basic facts of water use in the state are fairly simple. Most of the rain and snowfall in California is in the north, in the Sierra and Trinity Mountains. Most of the farmland is in the central part of the state, and most of the population is in the south. To collect water where it falls and deliver it
to where it is used, government agencies have built a network of over 140 reservoirs and 2000 miles of canals (Goodenough, 1985).

The design and construction of these facilities is the province of three large government agencies, the U.S. Bureau of Reclamation, the Army Corps of Engineers, and the state Department of Water Resources. Of all the activities of these agencies, two projects, the largest of their kind in the world, stand out.

The first is the Central Valley Project (CVP), built by the Bureau of Reclamation in the 1960s and '70s, and paid for by the state and federal governments (Figure 1). The second is the State Water Project, conceived by the Department of Water Resources; Figure 2.

Both of these projects trap spring runoff behind dams in northern California, and over the year regulate its release into the Sacramento River. Flowing from the north and south, the Sacramento and San Joaquin Rivers meet in an extensive delta, outside San Francisco Bay. At the southern end of the delta, giant pumps lift water into a set of canals and reservoirs, initiating the transfer from north to south. This water flows to the federal San Luis Unit, 600,000 acres of farmland on the west side of the San Joaquin Valley, which contains the Westlands Water District. Beyond the San Luis Unit, DWR's California Aqueduct carries water to farms in Kern County, in the southern part of the valley. At the bottom of the valley, 300,000-horsepower pumps push the water over the Tehachapi Mountains, to Los Angeles and the Metropolitan Water District.
Figure 2. The State Water Project
source: DWR
Two final aspects of the CVP and SWP are important to the drain controversy. The first is the impacts of the projects on the Sacramento-San Joaquin River Delta, a resource of much importance to the cities of the Bay Area. The Delta provides drinking and industrial water for Contra Costa County, which faces the eastern edge of the bay. It also supports wildlife, an important sport fishery and other recreational uses, as well as 500,000 acres of farms which have been developed behind levees in the Delta's rich bottom land.

Because the water projects take so much water out of the Delta that would normally flow to San Francisco Bay, sea water from the bay frequently intrudes up Delta channels, threatening the positive uses of the area. The debate over USBR and DWR's obligations to protect the Delta from saline intrusion, and to guarantee that outflows are great enough to maintain beneficial uses is one of the most contentious issue in California water policy. Delta water planning has been the subject of two statewide referenda, and interminable study and argument (Jackson and Paterson, 1977). A key player in this policy area is the State Water Resources Control Board (SWRCB), which sets environmental standards and allocation rules for water use, focusing on the Delta especially.

The second aspect of the water projects which surfaces in the analysis of the drain is the way in which they have been financed and repaid. This is especially important for the CVP, which was financed by bonds with a 50-year repayment period. Because of the way USBR has interpreted the repayment requirements for the CVP, farmers receive water at an extreme
rate of subsidy, estimated by USBR critics at 90 percent of total water costs (the average price for water supplied by the CVP is $6.15 per acre-foot (af.); the cost of providing the water is estimated at $66.82 per af.; LeVeen and King, NRDC, 1985).

B. The Hydrology of Soil Salinization

Beneath the gently sloping alluvial soils of the San Joaquin Valley's western side lies an impermeable layer of clay, which runs in a 300-mile crescent between Tracy and Bakersfield. In parts of the valley, this clay layer sits between five and twenty feet below the soil surface (see Figure 3). The clay prevents irrigation water from draining through the soil deep into the valley's main aquifer or the San Joaquin River. Instead, the water slowly accumulates beneath farmland, resulting in a "perched" water table close to the soil's surface.

As subsurface water levels slowly rises, the action of plants and evaporation deposits layers of salt near the surface of the soil. As salt builds up in the root zone, it inhibits the ability of plants to absorb moisture and oxygen, stunting growth or killing plants entirely (Figure 4). This phenomenon, soil salinization, has been a major problem in the history of agricultural civilisations. Soil salinization was noticed in Mesopotamia around 2400 B.C., and is thought to have been a primary cause of the decline of the Sumerian Empire and the desertification of the Egyptian Nile Valley (IDP, 1979b:3-1 to 3-6, 6-1).

C. Soil Salinization Impacts and Responses
Figure 3. Drainage Problem Areas

Source: IDP, 1979

DRAINAGE PROGRAM STUDY AREAS
SAN JOAQUIN VALLEY

LEGEND

- Drainage Problem Areas (present and potential)
- Edge of Valley Floor
- Study Area Boundaries

Scale of Miles

Scale of Kilometres
Figure 4. Salinization in a Sugar Beet Field

source: California Agriculture, October, 1984
photo by W.E. Wildman
In response to salinization and soil drainage problems, California farmers and water supply agencies have installed tile drains, rows of perforated pipe set about eight feet below the soil surface at 250-300 foot intervals. Tile drains are designed to remove irrigation runoff from beneath farmland and deliver it to a network of collector pipes. The collector network would in turn discharge to a proposed Valley Drain running north to the San Joaquin-Sacramento River Delta (Figure 5; IDP, 1979b:3-3, 3-4). The implementation of this proposed drain is the focus of this paper.

Estimates of the potential damages of soil salinization have been a major part of the justification for the drain, and have varied over time. A major assessment of current and future problems was conducted between 1975 and 1979 by the San Joaquin Valley Interagency Drainage Program (IDP), which was sponsored by USBR, DWR, and the SWRCB. The IDP's projection of drainage problem areas is shown in Table 1.

The IDP's estimate of net farm benefits associated with its Valley Drain proposal was set at an annual equivalent value of $40,680,000, a figure calculated for a 100-year time span at a 6 7/8ths percent discount rate. (IPD, 1979:E-2). An estimate of current crop production losses not diffracted by the IDP's net-present-value calculation is $32 million per year, which might increase to $321 million per year by 2000 (Beck, 1979).
Figure 5. Proposed Drain Outfall in the Western Delta  
source: USBR, 1984

PROPOSED SAN LUIS DRAIN (Northern Segment)
Table 1. IDP Projections of Drainage Problem Areas and Drain Water Quantities, 1985-2085 (IDP, 1979b:6-4).

<table>
<thead>
<tr>
<th>Year</th>
<th>Maximum Area Requiring Drainage (acres)</th>
<th>Area Actually Drained (acres)</th>
<th>Quantities of Drainage Effluent (acre-feet)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985</td>
<td>294,000</td>
<td>56,000</td>
<td>57,000</td>
</tr>
<tr>
<td>1995</td>
<td>462,000</td>
<td>346,000</td>
<td>310,000</td>
</tr>
<tr>
<td>2005</td>
<td>586,000</td>
<td>507,000</td>
<td>424,000</td>
</tr>
<tr>
<td>2015</td>
<td>693,000</td>
<td>623,000</td>
<td>484,000</td>
</tr>
<tr>
<td>2025</td>
<td>792,000</td>
<td>720,000</td>
<td>518,000</td>
</tr>
<tr>
<td>2035</td>
<td>867,000</td>
<td>807,000</td>
<td>566,000</td>
</tr>
<tr>
<td>2045</td>
<td>925,000</td>
<td>876,000</td>
<td>575,000</td>
</tr>
<tr>
<td>2085</td>
<td>1,040,000</td>
<td>1,023,000</td>
<td>668,000</td>
</tr>
</tbody>
</table>

*from "Area Actually Drained"
Agriculture is estimated to provide 27.4 percent of the valley's employment, and supports a total business activity of over $30 billion (Beck, 1979). Hence, the indirect effects of soil salinization are potentially substantial.

Seepage of subsurface irrigation waters that do not remain in perched water tables generally causes damage in other locations. Such seepage is blamed for nitrate contamination of wells drawing from underground aquifers in Tulare and Kern Counties, in the southern valley (Sac. Bee, 1980c; L.A. Times, 1979), and also contributes to salinity problems in the San Joaquin River. Drainage flows contaminated with selenium are currently poisoning wildlife in the valley, a problem discussed in depth in Chapter 5.
CHAPTER 3.
CONFLICT OVER THE DRAIN DURING THE WATER AGENCIES' PRIME, 1956-67

After salinity problems in the valley increased in the 1950s, both DWR and USBR made proposals to construct a drain, and detailed planning progressed through the early 1960s. By 1964, opposition to the drain among Delta interests had coalesced, focusing on the effects of drainage effluent on water quality in the Delta and San Francisco Bay.

Conflicting technical opinions on the drain's impacts were presented in state and federal legislative hearings in 1964 and 1965. However, in these years, environmental arguments couldn't stop the drain; the consensus of these sessions was to proceed with construction and further studies simultaneously. With plans and funding for drain construction nearing final approval in late 1966, flaws in the financing mechanism for the drain emerged, and the momentum of the project ebbed, preparing the stage for the increasingly complicated conflicts and technical arguments which have evolved to the present.


In various forms, problems with saline water have recurred in the valley since dryland farming began in the 1890s (Kelley and Nye, 1984). One of the first major indications that the big water supply projects would create new problems with salinity occurred in the early 1950s, when farmers noticed that irrigation water taken from the San Joaquin River was getting saltier. (When
crops are irrigated with relatively saline water, the total water requirement is increased. This is due to the fact that as plant roots extract water from the soils around them, salts precipitate out. To keep these salts from eventually damaging the crop, more water must be applied to flush them out of the root zone. This is known as leaching; for a further discussion of leaching and water conservation issues, see Chapter 7).

The salinity problems in the San Joaquin River were investigated by DWR and west-side water companies and irrigation districts. These studies determined that the source of this salinity was the Mendota Pool, which collects comparatively saline agricultural runoff from farms supplied by the Delta-Mendota Canal (built by USBR in 1951) and releases it into the river on a scheduled basis (Jackson and Patterson, 1977:136).

High water tables and drainage conditions themselves were emphasized in hearings held by the California Legislature's Joint Commission on Water Problems in 1956. Here, the argument for a valley drain took what would soon become a familiar form. According to the Committee, "[our] investigation shows the immediate need for . . . the formulation of a comprehensive master drainage works system if the valley's farm economy is to be saved from general collapse" (DWR, 1967a:2)

1. USBR and DWR planning in the early 1960s

The late 1950s were also the years of conception for USBR's San Luis Unit and DWR's State Water Project, both of which anticipated the need for the drain. DWR's proposal for the California Water Plan briefly described the purpose of a "San
Joaquin waste conduit." Two months after the release of the Water Plan, the California Legislature authorized the San Joaquin Valley Drainage Investigation, to continue assessment and planning for the drain (DWR, 1967a).

The San Luis Unit was proposed by the USBR in 1955, and four years of Congressional authorization hearings began a year later. During these, the Director of DWR testified in support of the USBR, and when the San Luis Unit was authorized in 1960, construction was made contingent on provision of a drain to the Delta, either by the USBR or the state (DWR, 1974:3). In 1959, the Burns-Porter Act was passed, authorizing funds for the State Water Project, and also containing a provision for DWR to construct drainage facilities.

In the valley, recognition of salinity problems increased, as dry years between 1959 and 1961 pushed the salinity of the San Joaquin River over two times earlier peak levels (DWR, 1956:5; DWR, 1960:116). In 1963, Warren Schoonover, a salinity expert working as a consultant for the USBR, quantified the additional irrigation costs to farmers during these years as between $5.00 and $15.00 per acre, due to increased purchases of water for leaching, pumping of moderately saline groundwater, and lab testing for irrigation management (Schoonover, 1963).

Increasing the pressure on USBR to build a drain, in December of 1962, a group of valley landowners and irrigation district representatives filed suit against the Bureau, claiming that irrigation provided without drainage would damage their lands due to salt build-up. The USBR argued that it was still
studying alternative drain routes and discharge points, and DWR filed a friend-of-the-court brief in its favor. Federal Judge M.D. Crocker ruled in favor of the USBR, but established that the plaintiffs could renew their suit if the drain wasn't constructed and their land was threatened (Calif. State Water Res. Comm., 1966:17). The suit was renewed in 1967; USBR restated its intent to build a drain, and the case was eventually dropped in 1973 (Jackson and Paterson, 1977).

In June of 1961, DWR informed USBR that its planning wasn't advanced enough to guarantee a state drain from the federal service area, and advised the USBR to go ahead with its own drain (DWR, 1967a). In 1963, the USBR announced that construction of a San Luis Interceptor Drain would begin in 1966 and be completed by 1968 (Jackson and Paterson, 1977).

After two years of planning, DWR changed its position and joined a drainage task force with USBR. In November of 1963, this task force met with a "Delta Counties Consulting Board" in Stockton, to state that because of timing requirements imposed on the Bureau by the San Luis Unit Authorizing Act and Judge Crocker, separate federal and state drains would be constructed. As the nucleus of an emerging coalition against the drain, government agencies and officials from the Delta and Bay Area vigorously protested the proposals for dual drains (DWR, 1967a).

These plans and protests led the meetings in California and Washington, D.C. in March of 1964, which included Assistant Secretary of the Interior Kenneth Holum, representatives of California's two senators, congressmen from Contra Costa County and the valley, and the Directors of DWR and USBR's Mid-Pacific
Region. In Washington, it was agreed that the water agencies would try to construct a single drain, and the first alternatives to the drain were proposed. At Holum's request, USBR was designated to prepare three plans for storing drainage effluent in ponds and discharging it into the San Joaquin River during peak flow periods. However, these plans were not warmly met by USBR staff and valley interests, and were not seriously pursued (California State Senate Water Resources Committee, 1966).

After a one-year delay to combine plans, in June of 1964, DWR Director William Warne made a formal statement that a master drain constructed by the state, with federal planning and financial assistance, would meet the requirements of the San Luis Unit (DWR, 1967a). The first stage of the drain, from Kettleman City to the Delta, was scheduled for completion in 1970. In the spring of 1965, the Bureau went to Congress to request supplemental funds for construction The first draft of a joint-use contract was completed soon afterward and finalized in December (DWR, 1967a).

2. Concern over the drain's impacts and the emergence of the Delta coalition

As the DWR-USBR task force presented its situation to elected officials and agency staff from the Delta and Bay Area in November of 1963, concern over the drain's impact on water quality in the Delta and San Francisco Bay grew. Requests were made that the terminus of the drain be placed as far west, toward the bay, as possible, and consultants were hired to bring technical evidence to the dispute.
In June of 1963, the U.S. Public Health Service released a minor investigation of Delta water quality issues pertaining to California's agricultural water projects, which had been requested by USBR a year earlier. The study didn't have a prominent role in later debates, but presaged the fears of the Delta coalition that siting a drain outfall in the Delta would set a precedent for expansion of the drain southward into the state service area. Important questions were also raised about harms caused by pesticides carried in drainage effluent, impacts on anadromous fish species, and biostimulation (growth of algae caused by increased concentrations of nutrients, such as fertilizer-derived nitrogen carried by the drain; U.S. Public Health Service, 1963).

In April of 1964, the Contra Costa County Water Agency (CCCWA), which takes its drinking water supply from the Delta, issued its own "emergency report." This claimed that the fresh waters of the Delta were "gravely threatened" by the drain (Jackson and Paterson, 1977:140).

Held in the valley town of Los Banos and dominated by legislators from the region, in October of 1964, the California Senate Fact-Finding Committee on Water Resources convened an acrimonious set of hearings on the drain. Supporters of the drain argued "there is no alternative to draining the San Joaquin Valley except its eventual ruin, and that a lot sooner than some might think" (Calif. Senate Water Res. Comm, 1966:13).

Politicians from the Contra Costa County area, representatives from the Association of Bay Area Governments (ABAG), the CCCWA, and the San Francisco Regional Water Quality
Control Board all came out to protest the drain. This group pressed for a five-year delay in order to conduct a comprehensive study of Bay Area water pollution, to which the drain was considered a potential contributor. The CCCWA also presented a report from the engineering firm Metcalf and Eddy, quantifying large reductions in the value of Delta recreation and increased costs for treatment of industrial water sources.

At this time, the primary environmental issue was the salinity of the drainage flows. In defense of their proposal, USBR and DWR claimed that after accumulated salts in the soil were leached out, the salinity of drainage waters would only be about 2,500 ppm TDS (parts per million of total dissolved solids). As a response to all possible objections, the water agencies also argued that the drain's staged construction schedule would allow many opportunities for mitigating adverse impacts which might arise. (Calif. Senate Water Res. Comm., 1966:13-16).

With Senator George Miller (of Contra Costa County) dissenting, the committee concluded:

The evidence before this committee indicates that the discharge of the proposed joint drain into the bay area will probably, at the worst, be a relatively minor addition to the bay area's pollution problem, and, at best, a negligible one. Furthermore, the bay area is presently receiving about two-thirds of the agricultural waste water from the Central Valley, and the initial discharge of the drain in quantity does not equal that of one oil refinery in the Richmond District.

At the moment, no more than mere possibilities of significant damage to the quality of the receiving waters appear to exist, and even at full capacity 20 years hence the discharge of the drain cannot be considered as a probable cause of pollution in the bay area.

... in the committee's opinion, the wisest and soundest
course for both state and federal governments would be to press forward with all possible speed in the immediate construction of the joint drain with appropriate safeguards for the delta receiving waters and also with the immediate initiation of comprehensive studies of the total bay-delta pollution problem (Calif. Senate Water Res. Com., 1966:8-9).

By January of 1965, John Baldwin and other Bay Area congressional representatives successfully took their attack on the drain to the federal level, in the form of an amendment to the annual USBR appropriations bill. The Baldwin Amendment required that the drain not "be operated so as to discharge waters which are harmful or deleterious" to the bay and Delta, that impacts of the drainage effluent be monitored by the Department of the Interior, HEW, and the state, and that the Secretary of HEW retain the authority to halt harmful discharges (Calif. Senate Water Res. Comm, 1966:59; Swain, 1983).

Because a similar bill had failed the year before, supporters of the Baldwin Amendment also convinced President Lyndon B. Johnson to cut drain construction funds from the federal budget. In the process, $300,000 was allocated for another study by the U.S. Public Health Service on drainage effluent impacts (S. F. Chronicle, 1965b:14).

This study was delegated to the Federal Water Pollution Control Administration (FWPCA). Following the "general agreement that a drainage project will be required to permit the important agricultural economy of the San Joaquin Valley to continue to prosper," the FWPCA completed the research in one year, in order to avoid "unnecessary project delay" (FWPCA, 1967:1).

The FWPCA report was supposed to address a broad spectrum of
water quality issues and contingencies for the Delta over a 40 year period, and was completed in late 1966, recommending that construction should proceed (FWPCA, 1967:16). The study concluded that pollution control measures and nitrogen removal operations would protect the Delta from harmful effluent impacts, and that the drain would not increase pesticide concentrations in the Delta, except in the case of Toxaphene, which was in declining use in the valley (FWPCA, 1967:65-66).

During the same years, less important hearings on the drain were held by the California Water Commission and the U.S. Senate Air and Water Pollution Subcommittee. In both of these cases, the final recommendation was to proceed with construction and impact studies simultaneously. (Jackson and Paterson, 1977:142).

3. Finance and repayment as the critical barriers to construction

By December of 1966, with planning coordinated, joint-use contracts signed, and a major study in support of the drain's safety, construction was imminent. In the first weeks of 1967, however, problems developed in DWR's plans for financing the drain, and DWR was forced to withdraw from the project. As the momentum which had brought the Valley Drain so close to implementation slipped away, a new phase in the conflict emerged.

Problems in financing DWR's effort first arose in 1963, when dual drains were being considered by USBR and DWR. USBR had the authority to attach a $.50 per af. surcharge to its water deliveries throughout the San Luis Unit service area in order to assure partial repayment from beneficiaries of the drain, and
eventually contracted with westside growers to do this (Calif. Senate Water Res. Comm., 1965:73-74; 1966, 33-34). DWR lacked this ability, and realized that a straight user fee levied solely for disposal of drainage effluent would be too high for growers to support. Instead, DWR proposed the creation of special tax districts in the valley, justified by the indirect benefits which valley communities receive from agriculture (DWR, 1967a:7). However, bills introduced to meet this purpose in the state legislature in 1961, 1963, and 1965 either died in committee or were referred to study with no subsequent action (DWR, 1967).

To overcome these barriers, a two-stage financing plan was proposed. The initial stage of drain construction would be 60 percent federally funded, deferring the need for special tax districts. Of the remaining state share, 75 percent would be paid by user fees, and 25 percent would be derived from state water bonds (Gardner, 1966). Later extension of the drain southward, further into the state service area, would require local taxation and possibly "public education programs" to generate support (Calif. Senate Water Res. Comm., 1966:33-34).

In the absence of a special tax district plan, in mid-1965, DWR director Warne offered potential drainage contractors a contract for full repayment of the costs of providing drainage service ($15 to $18 per af.) This contract provided that unanticipated future costs which might arise (such as treatment plants) could be added to the basic user fee. Local irrigation agencies rejected this contract unanimously (DWR, 1967a:8).

In response, USBR, DWR, and potential contractors negotiated an interim contract, designed to initiate construction and
recover part of the cost to the state, explicitly deferring the need for special taxing districts. With user fees at $6.00 per af. of effluent discharged into the drain, irrigation districts were enthusiastic and supportive; these agencies signed contracts reserving 110 percent of the available first-stage drainage capacity by late 1966 (Warne, 1966a, DWR, 1967a).

In mid-December, 1966, the final draft of the USBR-DWR contract was forwarded to Washington, to obtain the signature of the Secretary of the Interior. Though "the agreement had been approved by Secretary Udall and found satisfactory by the Bureau of Reclamation," the contract was held at the Bureau of the Budget, waiting for a clearance that supposedly could not be made until President Johnson returned from Texas, after January 1, 1967 (Warne, 1966b).

On January 2, 1967, the administration of newly-elected Governor Ronald Reagan took office, and William Gianelli replaced Warne as Director of Water Resources. Gianelli's view of the interim drain finance arrangement was considerably less sanguine than his predecessor's. In a January 2, 1967 memo, he wrote, "while many local districts have indicated their desire to utilize the state's capacity in the proposed drain, I have not detected a willingness by these parties to pay for the state's share of the costs of these facilities" (Gianelli, 1967b).

Gianelli questioned Warne's authority to initiate drain construction under the 75 percent user fee, 25 percent water bond, state share finance proposal. He noted that the administrative precedent for this policy applied to state costs
of a different type of project; and didn't cover jointly-financed projects. He also argued that there was no assurance of recovery of state capital costs in either case (Gianelli, 1967b; 1967c).

As Warne had done, Gianelli offered 28 valley irrigation districts an opportunity to sign drainage agreements at $16.00 to $20.00 per af. of effluent, and as before, they declined. In March, DWR withdrew from the project, and Gianelli urged that the Bureau begin construction of its own drain from the San Luis Service area (Gianelli, 1967a).

As the USBR began construction on the middle part of the drain in 1968, DWR started phasing out its drainage studies, except for analyses of effluent from previously installed west-side tile drains conducted with USBR. In June of 1969, Kaiser Engineers released another major study done for USBR on the Bay-Delta water quality control program. The report concluded that chlorides and other dissolved solids in the drain would create no significant harmful impacts in the Delta, and would even have a slightly beneficial effect at low Delta outflow levels. The study also found that nitrogen was not a limiting factor in Delta algal blooms, implying that the drain would not increase biostimulation (Kaiser Engineers, 1969).

However, by the time the study was released, the possibility that the USBR would be able to extend the drain to the Delta was rapidly slipping away.
CHAPTER 4
THE CONFLICT FROM 1969 TO 1983; USBR'S ATTEMPT AT METHODICAL CONCENSUS-BUILDING, AND THE NPDES PERMIT PROCESS

Though USBR kept the middle section of the drain under construction between 1968 and 1975, it was never very likely that the drain would be extended to the Delta. During this time, the debate over the drain shifted out of committee hearings and political meetings, and instead became the province of administrative action. During the 1970s, the political climate surrounding the drain changed as well, setting the stage for the reintensification of the controversy that would begin in 1980.

A. Changes in the Political and Scientific Climate

The growth of the environmental movement and associated regulations and research had wide-ranging external effects on the conflict. For example, the passage of the National Environmental Policy Act and the California Environmental Quality Act brought the environmental effects of USBR's projects into public scrutiny, and increased the procedural requirements for scoping and hearings associated with agency plans.

As scientific understanding of water quality and ecological issues increased, the issues broadened in number and became more complicated. The number of actors involved in the debate, directly and indirectly, also increased.

For example, the Environmental Protection Agency's (EPA) growing expertise in the field of water quality impacts affected the discussion indirectly. The EPA offered the longest and most
cogent criticisms of the USBR's 1972 Environmental Statement on the drain and the San Luis Unit (USBR, 1972b). EPA hazardous substances research provided part of the basis for drainage effluent toxicity studies required of USBR by SWRCB in the 1980s. Finally, EPA's investigation of water conservation and salinity control methods in the Colorado River Basin's Grand Valley was exemplary of research on agricultural practices conducted outside traditional agricultural agencies (EPA, 1978a, 1978b, 1978c, 1978d).

Following the passage of the Porter-Cologne Act in 1968, the SWRCB gradually consolidated its authority to set Delta water quality standards (SWRCB, 1978b:4-7). This process was complemented by the development of a lengthy EIR for the SWRCB's water quality control plan for the Delta (SWRCB, 1978a) as well as other studies of Delta water quality (SWRCB, 1974, 1980).

Because of the overall impact of the Central Valley Project and the State Water Project on water levels in the Delta, DWR and USBR also increased their ecological and water quality monitoring programs in the area (DWR, 1975a; USBR, 1972a). New studies were done on the Delta's entrapment zone, an area at the fresh water/sea water tidal interface, containing high levels of suspended nutrients and biota (Arthur and Ball, 1978; USBR, 1980). The California Department of Fish and Game did related research, as did the U.S. Fish and Wildlife Service (Calif. Dept. of Fish and Game, 1972).
B. Events in the Implementation of the Drain from 1967 to 1975

USBR construction on the middle stretch of the San Luis Drain began in 1968, but was slowed by funding limits and slack demand for drainage services. By 1979, 82 miles of the drain had been completed between Kesterson Reservoir, near Los Banos, and Laguna Ave., in southern Fresno County (see Figure 6). The reservoir, which was designed to hold effluent until the drain was extended to the Delta and to serve as a wildlife refuge, was only a third of its planned size by 1979. At the same time, five percent of the regional collector system was completed, and subsurface drainage systems had been installed on only about 1,500 acres (Jackson and Paterson, 1977:144; IDP, 1979b:4-5).

Between 1969 and 1974, DWR slowly phased out its drainage investigations, except for cooperative monitoring of drain water from westside on-farm systems (Beck, 1983; DWR, 1981b). During the same period, USBR planning activity continued at a relatively low level. As required by NEPA, in October of 1972, the Bureau released an Environmental Statement (ES) for the entire San Luis Unit. The ES partially focused on the drain, but wasn't capable of accelerating the drain's implementation.

At the time the statement was released, the only major San Luis Unit facilities which had not been completed were 65 percent of the local irrigation distribution system, one pumping plant, a 12-mile canal, and the San Luis Drain and drainage collection system (USBR, 1972b:5-8). Hence, much of the statement rather pointlessly described the environmental impacts and economic justification for a project that was mostly in place (USBR,
Figure 6. The San Luis Drain and Kesterson Reservoir

source: USBR, February, 1984
Like many environmental statements written in the early 1970s, the 44-page San Luis Unit ES was very brief and lacking in detail. Twelve pages of text were devoted to the drain, including three pages of evaluation of eight alternatives to drain construction. The alternatives to completion of the unit were found to be too expensive, ineffectual, or economically unsound (USBR, 1972b:34-40).

Most of the comments on the ES had little to do with environmental impacts; the most lucid critique was made by the EPA, which focused on the document's paucity of information. A letter from the Contra Costa County Water Agency referred the USBR to the earlier report by Metcalf and Eddy, and the Audobon Society generally questioned repayment schemes (USRB, 1972b).

In late 1975, the Contra Costa County Water Agency sued the Secretary of the Interior over the adequacy of the ES. A year and a half later, USBR agreed that a new supplemental EIS would be prepared (San Luis Task Force, 1979).

C. The Interagency Drainage Program, 1975-79

Frustrated by its experiences with the San Luis Unit ES, in 1974 USBR proposed a new "appraisal level" investigation of the drainage problem (Swain, 1983). At the same time, DWR faced an expansion of the salinity problem in its service area, which prompted an interest in reviewing previous work and matching interim drainage solutions to drainage problems to long-term disposal plans (Beck, 1983). The result of these developments was
the San Joaquin Valley Interagency Drainage Program (IDP), which was specifically designed to bring more actors into the formal planning process.

Funded by USBR, DWR, and SWRCB, the IDP operated as a quasi-autonomous agency from 1975 to 1979, with general guidance from its sponsoring agencies. The small IDP staff was assisted by specialists from the parent agencies, EPA, the U.S. Soil Conservation Service, the California Department of Fish and Game, the U.S. Fish and Wildlife Service, and private consultants (IDP, 1979b:5-2).

Overall, IDP research efforts cost roughly one million dollars, with about a million more being spent for in-house drainage research by the sponsors (Beck, 1983). According to an informal division of this work, environmental research and formulation of a new EIR was done by SWRCB staff, the Bureau was responsible for engineering and economic studies, and DWR handled financing, "institutional concerns," and engineering as well (IDP, 1979b:5-3).

The IDP was geared for public participation. For example, a "Public Advisory Committee," representing over thirty interest groups affected by the drain committee, held nineteen meetings during the IDP's existence. In addition, twenty-eight public hearings were held in the valley and Bay Area.

1. The IDP's Recommended Plan

After four years of work, the IDP produced a "Recommended Plan" for the drain, along with a new "first-stage" EIR. According to this plan, the drain would empty into the Delta at
Chipps Island in Suisun Bay, and would be built in stages. The existing 82-mile segment of the San Luis Drain, would serve as the first, middle section of the drain system. Five years after this segment was completed, an additional 26 miles would be added to the drain's southern end. Six years after that, the drain would be extended north to Suisun Bay. If further studies indicated that drainage effluent would cause no unacceptable effects in the Delta, the drain would eventually be extended to the DWR service area at the southern end of the valley trough (IDP, 1979b:10-3, 10-6).

A relatively major innovation in the plan involved the use of wildlife refuges, brackish marshes, and holding ponds as reservoirs for regulating the flow of water in the drain. Of a total of 64,300 acres of marsh created, 45,300 acres would serve as wildlife habitat, as part of the Pacific Flyway for migratory birds (IDP, 1979b:10-7). The marshes would be flooded from October to January, would discharge during high runoff periods in the late winter and early spring, and, if possible, would be farmed during the summer. The marshes were designed to allow flexibility in discharging saline effluent into the Delta during times when Delta flows available for dilution were at high levels, both on an annual and year-to-year basis.

The marshes were also significant in that they garnered some support from the U.S. Fish and Wildlife Service, the California Department of Fish and Game, and valley Audobon Societies. Further, because they were considered "environmental enhancement features," the marshes could be excluded from regulations
governing repayment of the project by its users (IDP, 1979b:13-2).

Total undiscounted capital costs for the Recommended Plan, including interest during construction, were set at a total of $1,260 million in 1979 dollars, or, discounted at 6-7/8ths percent, $679.6 million (IDP, 1979b:11-4, 11-5). Forty-two percent of the discounted costs would be paid the state, and fifty-eight percent would be carried by the federal government (IDP, 1979b:12-4).

On-farm drainage systems would be paid for by individual landowners. To secure repayment for the drainage system itself, state and federal agencies would establish contracts with local irrigation and drainage districts. The contracts would include a surcharge on effluent received at collector drains, and also on water applied to upslope farmland, which contributes to drainage problems downslope.

Modifying the approach of the 1960s, the amount of repayment required from local entities in areas served by state water contracts would be determined by a per-unit levy on water discharged into the drain. Thus, the user fee would be low in the initial years of the project and would rise over time (IDP, 1979b:13-2). As will be discussed in Chapter 7, this proposal did not necessarily reduce the financial ambiguity that has contributed to farmers' reluctance to join the program.

2. Alternatives considered

In producing the plan, a large set of alternatives suggested at early public meetings were screened, leaving five general
"conceptual plans." These were compared to on-farm measures and effluent reuse.

Of the conceptual plans, a proposal to drain farm lands to evaporation ponds in lieu of the Valley Drain was considered, but rejected because it would only localize and postpone salination problems, while threatening groundwater around the ponds and consuming enormous amounts of land. Damage to wildlife areas, danger of salt-laden floods, and possible precipitation of earthquakes were also given as reasons against implementing the evaporation ponds scheme (IDP, 1977:9).

The possibility of draining farm lands and discharging effluent into the San Joaquin River, for eventual transport to the ocean, was rejected because of the damage such a project would do to the river and the high cost of diluting saline water prior to release. Though regarded as the most ecologically sound of all the alternatives, a plan to collect and pump saline drainage water across the Coast Range, to a site on the Pacific Ocean near Cayucos or Monterey, was rejected because of its enormous cost (IDP, 1976a:17-19).

A suggestion to reuse drain water after various desalination, marsh management, aquaculture, and salt reclamation programs were applied was rejected because of high costs and problems in disposing of the highly concentrated brine generated by desalination (IDP, 1979b:8-3, 8-6). By the mid 1970s, environmental groups, especially the Environmental Defense Fund (EDF) were beginning to argue that on-farm conservation of irrigation water would reduce the quantity of waste water flowing
beneath fields, thus reducing the necessary size of the drain. In one page, the plan rejected these approaches, arguing that they wouldn't have much effect and didn't address the real problem, which was getting the salt out of the valley (IDP,1978:7-3). (The water conservation and management alternatives gained increasing prominence in the 1980s, and are analyzed in greater detail in Chapter 7).

3. Environmental effects of the Recommended Plan

Compared to the environmental analysis of the 1960s, the "first stage" EIR published with the Recommended Plan was a qualitative leap forward in breadth and detail. The main points of the analysis are presented in Appendix B, and summarized below.

To predict the impacts of the drain on the Delta as it would be operating around 2000, the EIR was essentially based on a DWR computer model. From the model, the EIR concluded that the drain's overall impacts on Delta salinity would not be very significant, due to the flexible storage capacity of the drain and the location of the discharge point. The EIR did suggest that the CCCWA might occasionally have to alter its pumping practices to maintain compliance with drinking water quality standards (IDP, 1979b:15-28).

In trying to determine the drain's impact on algal growth and eutrophication in the Delta, the model used by the IDP was far more sophisticated than earlier analyses, but still contained significant uncertainty. Though the drain wasn't expected to cause major biostimulation, nitrogen-removal facilities were
included as a plan contingency (IDP, 1979b:15-29 to 15-34).

The EIR also considered the drain's possible impacts on the entrapment zone, the shifting suspension of nutrients and biota at the Delta's fresh water/salt water interface. The entrapment zone is suspected to be a critical component of the ecology of the Delta, especially for striped bass fingerlings, and happens to be located close to the drain's proposed discharge point. Uncertainty in this analysis was high; nitrogen removal and relocation of the discharge outlet farther west in the Delta were given as general mitigation measures against negative impacts (IDP, 1979b:15-34, 15-35).

The formation of trihalomethane (a suspected carcinogenic product of chlorides or bromides and organic compounds which forms during the chlorination of municipal water supplies) was considered a potentially harmful impact of the drain. Among several options, extension of the Contra Costa Canal (part of the CCCWA water supply system) to a point further away from the drain's outfall was seen as a preferable mitigation measure for the trihalomethane problem (IDP, 1979b:15-35).

In evaluating the possible effects of toxic substances (pesticides and metallic elements contained in valley soils) on aquatic life in the Delta, the IDP proposed its work as preliminary, to be followed up in the early 1980s.

Compared to the USBR's 1972 San Luis Unit Environmental Statement, the volume, breadth, and expertise reflected in the comments section of the IDP's EIR were markedly greater. The most detailed criticisms were levied by Bay Area governmental bodies;
the Bay Conservation and Development Commission, the Association of Bay Area Governments, the Contra Costa County Water Agency, and the CCCWA's consultant on estuarine hydrology and sedimentation, Dr. Ray Krone, a civil engineering professor from UC Davis.

D. The NPDES Discharge Permit Process, 1979-1984

Following completion of the IDP's analysis in 1979, post-Proposition 13 state budget cutbacks forced DWR to significantly reduce drainage-related investigations, and the IDP was dissolved. USBR again assumed the role of lead agency in the development of the San Luis Drain (the name for the drain from the federal service area), the implementation of which became the essential first step in the completion of the entire Valley Drain system (Swain, 1983).

Seeking an NPDES (National Pollutant Discharge Elimination System) permit to discharge drainage effluent into the Delta, USBR first turned to the EPA, which has regulatory jurisdiction over non-point source discharges under Section 208 of the Federal Water Pollution Control Act. As expected, the EPA delegated responsibility for a drainage discharge permit to the SWRCB, which retains its authority under the Porter-Cologne Act and Decision 1485, and section 402 of the Federal Water Pollution Control Amendments of 1972 (Beck, 1983; Sac. Bee, 1980c:18).

(Since 1980, DWR has cooperated with USBR in drainage effluent monitoring, but has otherwise pursued independent projects. Problems in meeting long-term water supply contracts are more pressing for the Department, and drainage work has
consisted mostly of interim coordination of local irrigation agencies to ensure that short-term relief efforts match long-term plans (Beck, 1983)).

1. The SWRCB Environmental Study Requirements

In order to adopt waste discharge requirements "that are both realistic and ensure protection of the beneficial uses in the San Francisco Bay-Delta estuary," the SWRCB required USBR to complete another extensive series of studies on the drain's environmental impacts, as inputs to its decision on USBR's permit application (SWRCB, 1981a:1). In May of 1981, the SWRCB released a twenty-three page outline of specific topics and acceptable methodologies for these studies (SWRCB, 1981a), as well as sixteen pages of "interim guidance" describing the form the SWRCB's final permit might take, and the monitoring requirements that might be associated with the permit (SWRCB, 1981b).

The studies required by the SWRCB were very similar to those recommended by the IDP, and were originally expected to be completed by the Bureau by late 1984, at a cost of about $4 million (Swain, 1983). The permit approval process called for public hearings on USBR's published study plans. In these hearings, the repartee over the impacts of the drain grew to new levels of technical complexity. Both the Bureau and groups opposing the drain or seeking more information on its impacts hired scientific consultants and increased in-house analysis. Compared to earlier studies, the SWRCB requirements reflected new concerns, especially that the drain might deliver a
range of toxic metals to the Delta, along with pesticides and salt. This hypothesis was based on the unknown trace concentrations of elements like boron, cadmium, molybdenum, and arsenic in the soil served by the drain. SWRCB scientists' fears were that the leaching and evaporation effects of the drain would concentrate these elements.

1. Responses to the Bureau's study plans

In September, 1981, May, 1982, and January, 1983, the USBR published reports on its study plans (USBR, 1982b, 1983a, 1983c). Public hearings were held by the SWRCB concerning the first and third of these reports, with the Bureau publishing comments and responses (USBR, 1982a, 1983a).

Both the Bureau's progress reports and the comments on its study plans contained a highly technical focus. Only fifteen agencies, groups, and individuals issued comments on the September, 1981 status report, and though eleven commentators were present at the February, 1983 public meeting, only seven made comments on the Bureau's toxicity and monitoring programs.

Most of the comments published by the USBR on its study plans came from the SWRCB, the Regional Water Quality Control Board (RWQCB), the Central Valley RWQCB, the San Francisco RWQCB, and the Contra Costa County Water District. The comments from the former four agencies were made partially to keep the USBR informed as to what it was expected to accomplish in its studies, as well as to critique specific study requirements (Roefs, 1983).

Of the environmental groups involved in the drain dispute, only EDF and NRDC invested the time and money to develop a level
of expertise great enough to allow credible criticism of the USBR's study plans.
CHAPTER 5
PLANS GO AWRY: THE DISCOVERY OF SELENIUM AT KESTERSON RESERVIOR

The Bureau had initially hoped to complete its studies and submit a draft NPDES permit application to the SWRCB by January of 1984, with public meetings to discuss the document following (Roefs, 1983). Along with completion of the San Luis Drain, the accompanying environmental statement was intended to cover plans to increase the long-term commitment of water from the San Luis Unit to the Westlands Water District (USBR, 1983b). Following completion of this document, the Bureau planned to ask Congress for reauthorization of the San Luis Unit, procure new appropriations, and have the San Luis Drain completed by the mid-1990s (Swain, 1983).

However, by early 1985, the discovery of selenium-related wildlife death at Kesterson Reservoir had derailed USBR's plans completely. The problem at Kesterson put the Bureau on the defensive, galvanized its critics, and provided an opportunity for environmental forces to reframe the entire debate. From Kesterson, news of dying and deformed waterfowl found its way to CBS's "60 Minutes" in the spring of 1985, as well as Time, Newsweek, and major newspapers.

A. Initial Discoveries of Wildlife Poisoning

The first recent indications that selenium might be a problem turned up in 1981, when USBR scientists detected levels of 400 parts per million (ppm) in the waters of the existing San Luis Drain (Carter, 1985f). (The Bureau and the Department of the
Interior have been criticized for ignoring denying, and covering-up the evidence of selenium and its harms, allegations discussed in Chapter 7).

Selenium is an element contained in trace amounts in valley soils. It is about as widely distributed in the earth's crust as gold, and about ten times as toxic as arsenic. The distribution of selenium throughout the valley was hardly studied until recently; it is now understood that the selenium in Kesterson Reservoir comes from the Panoche Fan, a nearly flat, conical section of soil from the eroded Coast Range, distributed over time by local creeks (Figure 7).

In minute quantities, selenium is considered valuable in human and livestock nutrition. However, through the leaching and concentrating action of drainage systems discharging into the reservoir, selenium began building up in Kesterson in relatively large quantities. In the reservoir, selenium enters the food chain through microorganisms living in the mud in the bottom of the pond. Like many toxic metals, selenium bioaccumulates as it moves through plants and up the food chain (Carter, 1985f).

Prior to 1981, the Kesterson Wildlife Refuge was fed by fresh water. The effect of selenium on fauna at Kesterson was first noticed in 1982 by the U.S. Department of Fish and Wildlife. Prior to receiving drainage effluent, Kesterson reservoir supported largemouth and striped bass, catfish, carp, and mosquito fish. Currently only mosquito fish survive, and they containing 100 times the normal level of selenium (Bullock and Meyer, 1984).
Figure 7. Kesterson Reservoir
source: USBR, February, 1984
In 1982 also, Fish and Wildlife biologist Harry Ohlendorf began what became the most widely-publicized work on Kesterson. In 1983, Ohlendorf surveyed eggs in 350 nests of ducks, coots and other migratory waterfowl, finding deformity rates of 17 percent and embryonic death rates of 40 percent. The deformities were particularly grotesque, including multiple beaks, and missing eyes and legs (Harris, 1984a). Though he had discovered 100 coot nests in 1983, he found none a year later. Ohlendorf found that the weight of birds shot at Kesterson was 24% below that of birds in a control group, and had selenium concentrations ten times the average. The quantity of selenium in birds doubled between 1983 and 1984, by which time it was 25-34 ppm (Ohlendorf, 1985).

In other tests conducted in September of 1983, the Department of Fish and Wildlife found that full-strength drainage effluent was toxic to test fish in two days and invertebrates in one day (Bullock and Meyer, 1984). Further research in 1984 confirmed that selenium was responsible for the deaths and mutations, and by mid-1985, the problems at Kesterson were driving the conflict over agricultural drainage to new extremes.

B. Initial Policy Responses

Because one meal from a duck killed at Kesterson contained thirty times the estimated safe daily dose of selenium, in 1983 the California Department of Fish and Game recommended eating restrictions for local hunters and their families (Harris, 1984b). As the evidence got worse, in November of 1985, the California Dept. of Health Services issued a more stringent warning. Fearing for the health of immigrants from Southeast
Asia, who forage for clams and crayfish in the area, in March of 1985 the Merced County Health Dept. began conducting blood tests for selenium levels among local residents (Kane, 1985).

Between October of 1984 and April of 1985, three major events generated by the Kesterson crisis which rearranged the entire drainage debate. The first of these was the growth of scientific studies on Kesterson and selenium, which removed control of research on the technical aspects of the problem from USBR's hands more completely than ever before. Second, lawsuits and complaints from ranchers living near the reservoir forced the SWRCB to take action, eventually issuing an order requiring USBR to close and clean up Kesterson. After trying to prevent the SWRCB's action, the Department of Interior suddenly announced that it was terminating delivery of irrigation water to 42,000 acres contributing drainage to the reservoir, throwing the proceedings into greater chaos. These events are described in sequence below.

C. The Explosion of Research on Kesterson and Selenium, and its Implications

As the situation unfolded in 1984, the Bureau first made plans to extend its NPDES study plans two more years, and then backed away from the permit process entirely. Searching for "hot spots," and an understanding of selenium distribution in soils throughout the valley, the U.S. Geological Service (USGS) started a major research program, and the Department of Fish and Wildlife expanded its research.

Scientists in California's major agricultural research
universities (UC Davis, UC Berkeley, and Cal. State University Fresno) were caught unawares by the problem. They quickly began to organize conferences on selenium, bringing together the exponentially growing number of chemists, soil scientists, biologists, doctors, toxicologists, economists and the like working on the problem in universities, government agencies, consulting firms, and interest groups. Major conferences in May of 1985 and March of 1986 were widely covered in the California media. By 1985, it was estimated that 127 different studies were being done on the effects of selenium (Davoren, 1986b).

As research on selenium grew, fears about Kesterson and its policy implications spread to areas previously unconsidered. In May of 1985, DOI asked the EPA to review its selenium standard for water containing aquatic life, which had been set at 35 ppb in 1980. Considering bioaccumulative effects, biologists were now considering a supplemental standard for drainage water between 2 and 5 ppb.

1. Selenium in the Grasslands Water District

By the summer of 1985, it seemed possible that other parts of the valley could be in for a disaster of proportions equal to or greater than Kesterson. First among these areas was the Grasslands Water District, a 52,000-acre seasonal wetlands north of Kesterson. During the summer, much of Grasslands is dry, and used for cattle pasture. Most of the land is leased or owned by 150 duck clubs, who pay the state user fees and hunt waterfowl as they land in the marshes in the winter, migrating along the
Pacific Flyway.

The water which keeps Grasslands wet comes from purchased fresh irrigation flows, surface irrigation runoff, and subsurface drainage water. These flows are generated on 94,480 acres in western Merced and Fresno counties, of which more than half have subsurface drainage systems. As at Kesterson, the water flowing into Grasslands contains selenium, at an average concentration of 39 ppb, or a total amount estimated at 9,222 pounds per year (Carter, 1985f).

Preliminary studies of Grasslands wildlife indicated that the selenium may be bioaccumulating, possibly at a rate which puts the evolution of problems one or more years behind Kesterson (Hergessell, 1985). Tissue from 14 stilts tested in the district contained 9.7 to 53 ppm of selenium, 5 avocets contained 47 to 85 ppm, 12 coots contained 3.3 to 30 ppm, and six gallinules contained 6.4 to 44 ppm (Fresno Bee, 1985).

Another study argued that selenium levels of 4 to 5 ppm may be enough to poison fish, and showed levels as high as 6.5 ppm in fish from the San Joaquin River and 8 ppm in fish from nearby sloughs. In Grasslands fish, selenium levels were measured at 10 to 14 ppm, and at 57 to 64 ppm in the San Luis Drain itself (Sakai, presented at CSUF; Carter, 1985g).

Because of the potential size, complexity, and controversy of the Grasslands problem, agencies have been reluctant to even approach it (Hergessell, 1985). In response to the emerging studies, in May of 1985, the Deputy Regional Director of FWS explained "We're not sure what we're seeing at grasslands," but that the service is "relatively confident we're not sending them
into a death trap" (Fresno Bee, 1985). Environmental groups were skeptical about this view, and charged that upper levels of FWS are dragging their feet on the Grasslands problem (Fresno Bee, 1985).

In May of 1985, the California Department of Fish and Game announced that it wouldn't use drainage water in wildlife refuges. If no other water were available, biologists feared that this would provoke a crowding and disease problem among nesting birds. Further, agency scientists began making off-the-record comments about how drainage water which used to be filtered by Grasslands marshes would now be flowing directly to the San Joaquin River, resulting in even higher concentrations (Carter, 1985g).

2. Research in other areas

Other findings on selenium were especially troubling to field scientists working on the issue. For example, USGS scientists are trying to understand the implications of the first finding of high concentrations of selenium 1,900 ft deep in the aquifer (Carter, 1985g). There are more than 17,000 acres of evaporation ponds built by farmers in the Tulare Lake basin, and questions are beginning to be raised about how they compare to Kesterson. During 1985 and 1986, research on selenium spread to a widening variety of topics, listed in Table 2.

Table 2. Summaries of Selenium Studies and their Policy Implications.
Nesting in Kesterson

As many ducks nested in Kesterson in 1985 as in 1984, suggesting that the hazing program had failed. Five other species of migratory birds are still nesting in the ponds (Ohlendorf study; Harris, 1986).

Small mammals at Kesterson

Small Mammals in the Kesterson area have selenium levels up to 1,000 times higher than a nearby control area. Tests on large mammals and hawks are pending (Carter, 1985g). Selenium in the area is threatening small mammals, and through bioaccumulation could threaten raccoons, coyotes and the endangered San Joaquin kit fox. Donald Clark (Harris, March 22, 1986).

Fish in the Delta, San Francisco Bay Estuary, and San Joaquin River

Selenium testing is in progress for ten species of fish and shell fish taken from the Bay-Delta estuary below Antioch, including herring, crabs and shrimp. Tests of a single sturgeon (a long-lived bottom dweller) caught in the estuary indicated levels of 8ppm in liver tissue and 2.3 ppm in the flesh, enough to put a three-ounce serving over the 200 microgram recommended daily allowance for adults established by the National Academy of Sciences. Tests of striped-bass liver tissue from the Delta were 1.7 ppm in 1984, and 2.32 ppm in 1985, with one bass showing a level of 8.5ppm. Selenium levels in bass in the San Joaquin River were 1.77 ppm in 1984, and 1.93 ppm in 1985 (California Dept. of Fish and Game study; Carter, 1986).

Threshold toxicity in humans

Not much is known about the toxic effects of selenium on humans at low levels. According to Arthur Kilness, an M.D. who worked in areas of South Dakota which high soil selenium levels, "cattle that eat selenium-rich weeds often stagger, push their heads against solid walls, develop skin lesions, lose the ability to swallow, and, in many cases, die within 24 hours." UC Berkeley conference, March, 1986 (Clemings, 1985c).
Table 2, continued.

Selenium in the air around Kesterson

Traces of selenium are found in the air around Kesterson, but at levels below state public health standards (USBR, Nov 1984). Local ranchers claim 15-20 cattle have died in the last three years, due to an "airborne, white dust that covers everything" (Kane, Mar 19, 1985). A USGS geologist hypothesizes that on hot days, a chemical reaction in Kesterson ponds could raise the selenium level in the air to hazardous levels—"I would be hesitant to live there because you're living in a selenium environment. It is essentially a polluted environment." (CSUF Conference; Clemings, 1985c).

Food grown in high-selenium soil

In theory, it is unlikely that selenium could poison crops grown for human consumption, because people's food comes from a large number of sources. Only people who continuously eat vegetables grown in home gardens with high levels of selenium in the soil or well water would have a problem (UC Davis team).

A $420,000 study of selenium in crops and livestock conducted by the California Dept. of Food and Agriculture was rejected by the USBR. The study had severe problems with conflicting lab results, due to errors in uncomparable, highly sensitive lab testing methods. compounds (Carter, 1985d). The study also tested for chromium, nickel, and other metals. It indicated average levels of selenium of 570 ppb in cantalope, 11 times the national average, but didn't tie this finding to any level of public risk. The study also suggested that selenium levels in livestock and dairy products did not threaten public health. State Senate President Pro-tem, David Roberti (D-Hollywood) called the study "useless, bungled, and a travesty of scientific review" (Dufur, 1985).

Selenium concentrations in wells, soil, and rivers in the general Kesterson area

The average concentrations of selenium in the 220,000 acre Panoche Fan range from 2 to 2.5 ppm, reaching a high of 4.5 ppm. (USGS) According to selenium expert Dr. Arthur Kilness, soils in South Dakota with similar concentrations caused illness and death in livestock which ate toxic plants. (Carter, 1985g)
Table 2, continued.

Selenium levels of 120 ppb were found in a 1,900 ft. irrigation well in western Fresno County, far higher than anything previously detected. (USGS) (Carter, Mar 13, 1985) The practice of packing porous gravel around the caseings of valley wells may be allowing shallow, contaminated ground water to drain deeper into the deeper drinking water aquifer (USGS) (Carter, 1985f).

Selenium concentrations in Mud Slough, which funnels drain water into the San Joaquin River averaged 21 ppm, while TDS was 1,425 ppm. Selenium levels in the San Joaquin River near Newman reached 8 ppb in June of 1985 (EPA drinking water standard is 10 ppb). (Carter, 1985f)

Distribution of selenium beyond the Panoche Fan area

The Sacramento Bee newspaper uncovered potential selenium problems in wildlife refuges at 17-18 sites in six other western states. The Bee's study consisted of looking over old government maps and reports, consultation with biologists and geologists, and collection of 40 water samples which were analyzed by a private lab (Harris 1985b). This prompted a DOI study of the same phenomenon, essentially an audit of the Bee's work. DOI found selenium levels of 15 to 75 ppm in duck rivers in the Imperial Valley, an important farming area in southern California near the Mexico border. The Imperial Valley also has salinity problems, there, tile drains discharge into the Salton Sea (Harris, 1985b).

Selenium levels in western Kern County soils (in the southern end of the valley) range from .7 to 1.5 ppm. (Carter, 1985g). Selenium traces were also found in the McCloud river in Northern California (UPI, 1985).
D. The SWRCB Cleanup Order

Provoked by the complaints and eventual lawsuit of a landowner near Kesterson, in 1984 the SWRCB began exert its regulatory authority. The SWRCB also had authority over Kesterson through the Toxic Pits Cleanup Act, sponsored by Richard Katz (D-Sepulveda--Los Angeles). The under the Toxic Pits Act, Kesterson could be declared a toxic waste dump, bringing in a rubric of SWRCB cleanup and abatement powers.

Acting under the Toxic Pits Act and Jim Claus' petition, by late December, 1984, the SWRCB had released a draft proposal for the cleanup of Kesterson. The proposed order required the Bureau to double-line the ponds with layers of clay and plastic, which the Board estimated would cost between $37 and $78 million. If the Bureau didn't make progress toward cleaning up Kesterson in three months, the SWRCB would order it to shut down the drainage system entirely. A subdivision of thw SWRCB, the Central California Regional Water Quality Control Board, would be given two years to develop a long-term plan for solving the region's drainage problems (Jones, 1984).

Hearings on the SWRCB's proposal were long, large, and acrimonious, filled with farmers bussed in from the valley. Under more pressure than they'd ever felt in lobbying for the drain twenty years earlier, officials from farm organizations said the SWRCB order could be the beginning of a showdown over the future of as much as 500,000 acres of farmland in the valley which were eventually scheduled for drainage (Jones, 1984).
The Bureau repeated arguments from its study documents, downplaying the health threat posed by Kesterson. The bureau also emphasized the progress of its studies on proposed solutions, which were supposed to be completed by 1989, at a cost of about $30 million (DOI, 1984a, 1984b, 1985a, 1985b, 1985c).

Environmental groups supported the SWRCB's order, antagonizing the farmers. At a hearing held by the State Board of Food and Agriculture, a Sierra Club spokesperson argued that the SWRCB order to close Kesterson was necessary to attack the soil salination problem, and that over the long term, drainage and water price incentives should be set to keep only the best lands in production. In response Board members asked him if it was "incumbent to take positions like this aimed against agriculture to keep your group going" through donations (Rodriguez, 1985).

The State Board of Food and Agriculture, the Fresno County Board of Supervisors, and the Bureau asked that the SWRCB delay its hearing on the final Kesterson decision, but the Board resisted, and made its decision on January 8. Under the Board's order, USBR was given six months to submit it plans to double-line the reservoir with clay, monitor potential leaks to groundwater, and keep birds and fish away from Kesterson. The USBR was given an extra two years to implement its plans; if Kesterson couldn't be made safe by then, it would be shut down and irrigation deliveries would be reduced to end the need for drainage. The SWRCB order also set deadlines for alternative drainage water disposal plans.

Following the SWRCB's decision, the Westlands WD filed suit to overturn the cleanup order, in Merced County Superior Court.
The basis of the suit was Westlands' contention that the SWRCB was incorrect in classifying Kesterson water as hazardous waste under the Toxic Pits Cleanup Act. Westlands also argued that scientific evidence proved that Kesterson was not causing or threatening to cause water pollution or nuisance. In the process of filing its case, Westlands officials claimed that closing Kesterson would force 49,000 acres of farmland which currently or potentially drain into the refuge out of production (Fresno Bee, 1985).

E. The Department of Interior's Decision to Cut Off Irrigation

On March 15, the Department of the Interior (DOI, which contains the Bureau of Reclamation, the Fish and Wildlife Service, and the U.S. Geological Survey, among others) jolted all the parties in the conflict with a surprise announcement on Kesterson. Ostensibly afraid of prosecution under a migratory-bird protection law, DOI announced that it was shutting off the water supply to 44,000 acres of west-side farm land, which drain into Kesterson. Farmers were outraged, politicians were stunned that DOI hadn't consulted with them, and everyone else was suspicious of DOI's motives. Three days after the announcement, negotiations began which eventually modified its harsher terms, but still left farmers under considerable pressure.

1. The terms of the announcement

The announcement was made at a hearing in the valley town of Los Banos, which had been scheduled by congressman George Miller
Jr. to criticize the federal government for its handling of the Kesterson situation (Miller is the son of the State Senator from Contra Costa County who criticized the drain in the 1960s, and is chair of the appropriations committee which oversees the Bureau). The hearing was intended to be a big event, and was attended by seven members of Congress and the State Legislature, as well as farmers, government officials, and interest groups (Salzman, 1985).

The day before the announcement, top DOI officials met to discuss the next day's testimony, and a question about violating the Migratory Bird Treaty Act of 1917 (MBTA) came up. (The MBTA was signed by the U.S., Canada, and Mexico, and provides for misdemeanor penalties against killing birds which migrate along the Pacific Flyway). In previous discussions, DOI attorneys had maintained that the MBTA was not being violated at Kesterson (Soiffer and Fogarty, 1985). However, that afternoon, DOI Secretary Donald Hodel asked top solicitor Frank Richardson about the issue. After a quick study, Richardson responded, "I can't in all judgement tell you your employees are not in violation of the Migratory Bird Treaty," and the suprise announcement began to take form (Salzman, 1985).

In California, at 5:15 the next morning, Carol Hallett, Hodel's western representative, got a call from Hodel as she was getting out of the shower. Last-minute changes in the text were made in Los Banos, leaving no time to brief anyone (Salzman, 1985). Hallett's basic message was that Kesterson would not be shut down in three years, as the SWRCB had required, but immediately. This would be done by terminating federal water
deliveries to 42,000 acres of farmland, which directly or indirectly are served by the drains which empty into Kesterson.

2. Response to the announcement

Waiting to give their testimony in criticism of the Bureau, the announcement caught the entire hearing off guard. Hodel's statement came just after farmers had planted their 1985 crops, taking out major loans for seed and fertilizer.

Without water, an estimated $47 million worth of cotton, tomatoes, and cantalopes would be lost. One grower testified, "my name is Jim Gramis, ex-farmer as of about an hour and a half ago. We're literally out of business. I expect the first phone call when I return home is going to be from my banker" (Clemings, 1985a).

Hallett, a popular Republican and ally of California farmers, left the hearing under armed guard. Upon returning to Sacramento, she began phoning bankers, urging them not to panic, and to wait a few days until the problems were solved (Salzman, 1985). However, as predicted, local banks quickly put holds on all loans for the affected growers (Flinn, 1985).

The announcement made the front page of the New York Times and the Boston Globe, and estimates of the economic damage soon appeared everywhere. The Assistant Secretary of the Interior put the loss to the local economy at as much as $70 million and 1450 jobs (Soiffer and Fogarty, 1985).

Politicians joined in a frenzy of criticism. Tony Coelho, representing Fresno and Merced counties (and the likely House
whip after Tip O'Neill's retirement) was most prominent. He called the decision "insensitive," a "convenient cover," and "a direct attempt to try to divert attention" from a federal investigation of allegations that the Bureau had supressed evidence on the damage at Kesterson (discussed below in Chapter 7; Borba, 1985c; Clemings, 1985c). State Assembly member Rusty Areias (D-Los Banos) said "They dropped a real time bomb here today" (Clemings, 1985a). Senator Alan Cranston called for an independent set of studies, and Assembly member Jim Costa (D-Fresno) alleged that the closure "will destroy the economy of western Fresno County" (Clemings, 1985a).

Environmentalists were suspicious of DOI's motives. About the MBTA, Hal Candee of the NRDC said, "The bureau has known about that issue for a long time, and they should have been able to bring it up for public discussion by now." Jim Claus' attorney explained the basis of everyone's skepticism; "we have discussed the migratory bird treaty act with the bureau over and over again in the last year and a half, and they have always said it didn't apply. So I was shocked to hear them this morning" (Clemings, 1985a).

Summing up the political impact of the announcement, the Fresno Bee editorialized:

[DOI's decision caused] outrage and despair among farmers on the San Joaquin Valley's west side and destroyed whatever credibility the Department had with those on both sides of the issue. ...One can't help concluding that the initial heavy-handness of the department's order had something to do with its desire to shift the terms of the debate. The Bureau of Reclamation is besieged by critics and lawsuits. Its competence and good faith have been challenged, with good reason. ...It's as if the federal officials were dramatizing the conflicting pressures on them by saying, in effect: Look you want chaos? We'll show you chaos. We'll follow the law.
right out the window. Now tell us what you want to do about it" (Fresno Bee, 1985a).

3. Negotiating a way out

DOI's announcement set off a scramble search for a way out of the problem. About one-half of the farmers in the affected 44,000 acres have wells for pumping groundwater, but this didn't fix their relationship with the banks. Local politicians suggested that the Governor declare the land a disaster area, but couldn't say how farmers would pay back the low-interest loans this strategy would make available (Flinn, 1985).

Addressing the underlying drainage problem, other politicians bandied about the possibility of shipping the waste water south to Kern County. There it could to be transformed to steam and injected into oil wells, to aid extraction. When USBR began asking for $200,000 for a feasibility study, it became clear that this was not a ready available alternative (Raimundo, 1985).

The real push for a way out of the straits DOI had created came from the Westlands Water District. Following the announcement, Westlands attorneys worked through the weekend, in three days putting together a lawsuit against the government. The suit asked for a 30-day restraining order, to be followed by a permanent injunction. Fearing that the suit would also be used to unravel the SWRCB's order, the NRDC came out in opposition. The motivation, according to Hal Candee, was that "We're not just talking about a technical violation of one federal statute--the Migratory Bird Treaty Act--what we're talking about is an
ongoing, serious threat to wildlife and the public health." (Clemings, 1985).

After five hours of talks in Sacramento on March 18, attorneys for Westlands and DOI announced that they might be able to negotiate continued irrigation deliveries (Borba, 1985b). Under an oath of silence, the talks continued in Washington for a week and a half, as Coelho made positive announcements and the press speculated about what was going on (Johnson, 1985a).

At the outset of the talks, the Sierra Club, NRDC, Consumers Union and California Rural Legal Assistance sent letters and telegrams to Hodel, asking that the irrigation water be kept flowing. The also indicated they wanted to be part of the negotiations, but were kept on the outside (Borba, 1985a).

On March 28, two weeks after DOI's announcement, the high-level group of negotiators reached an agreement. The settlement was that the Westlands WD would help its growers to somehow reduce their flows to Kesterson by 20 percent every two months, and that the reservoir itself would be shut down completely by July of 1986, two years before the SWRCB deadline. In addition, the Justice Department agreed not to prosecute DOI officials under the Migratory Bird Treaty Act. (Johnson, 1985a)

One plan for the disposal of the drainage flows called for the purchase of 5,000 acres of extra land on the west side, where fresh water would be mixed with drain water, and used to grow salt-resistant forage crops. If this plan did not work, the collector drains would be plugged at their source, meaning that irrigation water would eventually resurface (Johnson, 1985a).

The dynamics of the negotiations can be reconstructed from
statements made by a Fresno lawyer, Kendall Manock, a participant who represented several Westlands farmers and lending institutions. The role of water contracts as a binding force between Westlands and the federal government, was a key issue. According to Manock, "Our position to them was that, if there is no integrity in the contract, then no one will buy your water." Just as important was DOI's perception that shutting off the irrigation water was necessary to stop flows to Kesterson (Borba, 1985d)

According to Mannock,

"They were not willing to separate the two issues until the last two days of the negotiation. ... the key to the negotiation was separating those issues. It finally turned into a discussion about engineering, and Jerry Butchert [Westlands General Manager] was the only engineer involved in the decision. He told them that the only way the drainage flows could be stopped would be to physically put plugs in the whole drainage system ... that they couldn't shut off the drainage by shutting off the irrigation water, because the drainage is not just from the 42,000 acres (Borba, 1985d)

DOI solicitor Frank Richardson, a former California Supreme Court justice, played the role of a mediator, keeping the negotiations going. According to Mannock, "There were very strong feelings on both sides, but there was always the desire to get it done, to get an agreement (Borba, 1985d)

The agreement with the Justice Department was the last hurdle (Johnson, 1985a). Even after this part of the agreement was ironed out, questions about the treaty remained, including suggestions that Congress would have to modify the treaty to apply to Kesterson, or that Hodel himself had the regulatory authority to issue regulations covering the conflict. (Borba,
4. An analysis of DOI's actions

Even after the negotiated agreement, it remained unclear what had provoked DOI into what was at best a highly questionable political strategy. As the Bee commented,

"After years of depreciating the problems connected with contaminated irrigation waste water, of brushing aside the growing evidence that its drainage arrangements were a dangerous failure, the Department of Interior unaccountably made a 180-degree turn last week" (Fresno Bee, 1985a).

The notion that the Migratory Bird Treaty Act drove the decision is barely tenable. The enforcement penalties in the Act are not severe, a maximum of $500 in fines and 6 months in jail. (Raimundo, 1985). Further, according to Tony Coelho, Article 7 of the Act allows the Interior Secretary to prevent adverse effects of the Act on agriculture, which could have left Hodel a regulatory out (Borba, 1985c).

Two weeks after the suprise announcement, Hodel said he recognized this possibility. In a written opinion of May 31, Solicitor Richardson said he could find no previous case in which a federal official had been "prosecuted for conducting otherwise lawful activities." Richardson confirmed that Hodel has the authority to "adopt suitable regulations permitting and governing" the "killing... of any birds," though still could not provide "the assurance" that employees would not be prosecuted (Raimundo, 1985).

F. The Bureau makes Plans for the Kesterson Cleanup

In compliance with the SWRCB order, in early April, USBR
released a four-part proposal for cleaning up Kesterson at an estimated cost of $1.1 million. The Bureau first proposed to kill some of the remaining fish and algae, by lacing the ponds with rotenone. The Bureau would also spray vegetation around the pond with wide-range herbicides (rodeo, diquat, and dalpon) and then burn it. A chain-link fence would be built to deter foraging Southeast Asian immigrants. In addition, the remaining drain waters would be concentrated in four of Kesterson's twelve separate ponds (USBR, 1986).

The severity of the Bureau's plans met immediate opposition from the USGS, who felt that concentrating the drain water would increase the rate of flow to groundwater. Further, altering the biological filtering system of algae and sediments on the bottom of each pond was suspected to increase the concentration of selenium in the pond water itself. Burning the selenium-laden vegetation would require permits from the County and the state Air Resources Board; if local pollution levels from this activity were too high, the Bureau proposed shipping the dead plants to Fresno for incineration. Local ranchers also felt that the fences would be ineffective, since the people foraging in the area would simply climb over them (Carter, 1985c).

In a meeting of staff from the Bureau, the USGS, the Fish and Wildlife Service, and the Regional Office of DOI, a new set of alternatives for cleaning up Kesterson was agreed upon. These included increasing public education and hazing efforts, harvesting plant life from the ponds' surface (which birds feed on), gradually drying up the ponds with the highest rates of
groundwater flow, and killing everything in one pond and using it for experimentation. Some birds and nests would be removed to safer areas. (Stammer, 1985; Carter, 1985d).

Released in late April, the final form of the Bureau's program for beginning the cleanup of Kesterson reflected the suggestions from the other agencies, as well as a provision for the supply of 18,900 af. of fresh water for wildlife habitat in Grasslands WD, and surface and groundwater monitoring. The second stage of the Bureau's plan is the reduction of deliveries to Kesterson by mid-1986 as agreed with Westlands (described below). The final stage, removal of vegetation and pond sediment, is awaiting approval from the SWRCB (according the USBR tests, selenium concentrations in at least one pond exceed the level defined as "hazardous waste"; USBR, 1986).

Estimates of the cost of this plan started at a minimum of $2.9 million, which would escalate to somewhere between $37.3 million and $195.3 million if more extensive measures were necessary. The main focus of this plan was halting drain water flows to Kesterson, letting the ponds dry up, and possibly covering the contaminated soil. The Bureau remained committed to burning vegetation in place, but would use incinerators to prevent air quality problems, if necessary. The possibilities of hauling the pond sediment to another disposal site, and pumping contaminated groundwater back into the pond for evaporation were also forseen (USBR, 1986).
CHAPTER 6

POLICY-ORIENTED LEARNING; A FRAMEWORK AND METHOD FOR UNDERSTANDING POLICY EVOLUTION

In the introduction of this paper, I suggested that the evolution of the conflict over the drain has something to do with how the participants have "learned" over time. This chapter defines and clarifies this concept further, and tests theories on policy-oriented learning against the empirical lessons of the drainage case.

One type of learning relates to individual organizations. Complicated political environments like the one surrounding the drain offer numerous opportunities for achieving or frustrating groups' goals. For example, the discovery of selenium at Kesterson gave environmental groups a major new opportunity to press their case against the Bureau. Many of the strategic possibilities in a policy conflict take a less obvious form--the ability of organizations to interpret evidence around them, to discover and exploit these possibilities, is one manifestation of policy learning.

A slightly different, but related, form of policy learning is described in Heclo's study of changes in social policy in Britain and Sweden from 1900-1950 (Heclo, 1974). Heclo found that demographics, economic conditions, and major changes in political administration were responsible for only part of the evolution of social policy during this period. Experimentation, competition, and interaction among specialized groups involved in social policy also produced important changes. In a sense, this was the result of an accumulation of knowledge, or learning,
across a policy system--not just within one group.

(As applied to organizations, "learning" is a metaphor. To be more precise, individuals learn, and transmit their knowledge to other individuals they are associated with; see Argyris and Schon, 1978, pp. 18-20).

The phenomena of learning within organizations and across policy systems has been studied by several authors (Heclo, 1974; Argyris and Schon, 1978; Etheredge, 1981; Freedman and Freedman, 1981). The most clearly-defined model this phenomena, which can be tested against the empirical history of the drain controversy, has been developed by Paul Sabatier (1985).

Hence, the next chapters rest on, and critique, Sabatier's model. Sabatier has synthesized the work of the authors above, as well as a broad literature on political psychology, policy implementation, the role of analysis within bureaucracies, etc., into a theoretical framework.

A. Sabatier's Policy Learning Framework--A Brief Description

Sabatier's framework essentially treats learning as an important facet of policy evolution. As the aggregate unit of analysis, the emphasis of Sabatier's framework is on activity within policy subsystems. These are the collection of parties "who are actively--or potentially--concerned with a policy problem" (Sabatier, 1985, p. 15; see Figure 8 for an overview of the framework).

Events within subsystems are affected by both internal and external forces. Some of the external forces which drive or
Figure 8. General Overview of Framework of Policy Change
(Sabatier, 1985)
constrain subsystems may be relatively unalterable over long periods of time. For example, the much of the basic character of the drainage controversy is a result of the distribution of perched water tables in the valley. Other external forces, such as the leadership of important politicians like George Miller or Tony Coehlo, are subject to more rapid fluctuation.

Inside subsystems, the key agents of change are "advocacy coalitions," which are essentially groups of actors who share common points of view, like the environmental and civic groups in the Bay Area. The central premise of Sabatier's framework is that the interaction of advocacy coalitions—who respond to each others' activities as well as constraints and opportunities from the outside—is what drives the process of policy formulation and evolution. In turn, Sabatier sees individual advocacy coalitions as motivated by their values and ideology. For example, the Bureau's ideology is one of "making the deserts bloom;" its acts by constructing water delivery systems.

At the heart of the framework, then, are belief systems, which Sabatier elaborately describes and gives structure (drawing from March and Simon, 1958; Lakatos, 1971; Axelrod, 1976; Putnam, 1976; and Ajzen and Fishbein, 1980, among others). Sabatier divides the belief systems of advocacy groups into three parts, outlined in Table 2.

The most fundamental, "deep core" beliefs include basic, normative assumptions about society, nature, and the commonweal. Among environmentalists who oppose the drain, deep core beliefs might include the theme that water resources offer a wide range of human and ecological benefits. Environmentalists feel that
Table 2. Structure of Belief Systems of Policy Elites  
(Sabatier, 1985)

<table>
<thead>
<tr>
<th>Defining characteristics</th>
<th>Deep (Normative) Core</th>
<th>Near (Policy) Core</th>
<th>Secondary Aspects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Defining characteristics</strong></td>
<td>Fundamental normative and ontological axioms</td>
<td>Fundamental policy positions concerning the basic strategies for achieving normative axioms of deep core.</td>
<td>Instrumental decisions and information searches necessary to implement core policy positions</td>
</tr>
<tr>
<td><strong>Susceptibility to change</strong></td>
<td>Very difficult; akin to a religious conversion.</td>
<td>Difficult, but can occur if experience reveals serious anomalies.</td>
<td>Moderately easy; this is the topic of most administrative and even legislative policy-making.</td>
</tr>
</tbody>
</table>
| **Illustrative components** | 1) The nature of man  
   i) Inherently evil vs. socially redeemable  
   ii) Part of nature vs. dominion over nature  
   iii) Narrow egoists vs. contractarians  
2) Relative priority of various ultimate values: freedom, security, power, knowledge, health, love, beauty, etc.  
3) Basic criteria of distributive justice: Whose welfare counts? Relative weights of self, primary groups, all people, future generations, non-human beings, etc. | 1) Ability of society to solve problems  
   i) Zero-sum competition vs. potential for mutual accommodation  
   ii) Technological optimism vs. pessimism  
2) Identification of social groups whose welfare is most threatened/critical  
3) Proper scope of governmental (vs. market) activity in general  
4) Proper distribution of authority among various units (e.g. levels) of government  
5) Orientation on basic policy conflicts e.g. environmental protection vs. economic development  
6) Basic choices concerning policy instruments, e.g. coercion vs. inducements vs. persuasion  
7) Desirability of participation by various segments of society  
8) Inference rules concerning general seriousness of the problem | 1) Most decisions concerning administrative rules, budgetary allocations, disposition of cases, statutory interpretation, and even statutory revision  
2) Information concerning program performance, the seriousness of the problems, etc. |

These categories apply both to the general beliefs of policy elites and to their beliefs concerning the specific policy area in question. Our focus, however, is on the latter. The two need not be entirely symmetrical, i.e. it is conceivable that a coalition will hold that, while the market is generally preferable to governmental activity, in cases of market failure (e.g. externalities) that precept should be relaxed.

This links a specific world state (e.g. high atmosphere concentrations of oxidant in many cities) to serious adverse effects on priority values and thus to a willingness to adopt policy strategies which may impose significant costs.
because of the intricate, interconnected character of natural systems, coopting these benefits in favor of a single use is not in the public interest. (Belief systems for each of the groups covered in this paper are discussed in detail in the next chapter).

The "near core" of beliefs are about basic policies and strategies for attaining values held in the deep core. In the working world of policy debates, the near core is what fuels the actions of groups and advocacy coalitions. For the Delta interests, near core beliefs would encompass the need for careful government regulation, and open, thorough study of projects which alter flows in the Delta.

Finally, the "secondary aspects" of belief systems are those which suggest the tools necessary to implement concepts from the near core. For some environmental groups (ie., NRDC), filing lawsuits and commenting on regulations might be indicated by secondary aspects of a belief system. For another environmental groups (EDF), secondary beliefs may inspire limited cooperation with farmers, and research on alternatives to drain construction.

Because advocacy coalition interaction is based on belief, it is important to Sabatier's framework that belief systems remain stable over time. Sabatier takes a neutral position in the debate over the causes of this stability, which could be economic self-interest, ideology, or some mutually-reinforcing combination of the two (this position is important, and we will return to it). Once a belief system has been established, Sabatier recognizes that powerful psychological forces predispose an
organization to defend it. This impulse can lead to selective recruitment and perception, manipulation of scientific analysis, etc. (Schiff, 1962; Primack and von Hippel, 1974; Argyris and Schon, 1978; Janis, 1983).

B. Beliefs and Advocacy Coalition Interaction--the Bases of Policy Learning

Compared to more diffuse explanations of policy evolution (Heclo, 1978, Kingdon, 1984), Sabatier's framework is firmly grounded in his explication of what motivates advocacy coalitions, that is, their belief systems. To clarify the seemingly complex and even chaotic process of policy evolution, Sabatier organizes his hypothesis around the assumption that advocacy coalitions act to attain and defend their beliefs. The distinction between core and secondary beliefs leads to specific hypotheses about what form this action will take, and under which circumstances competition between belief systems leads to policy learning.

In general, as they attempt to attain their beliefs, advocacy coalitions do many things. They try to recruit new members, political support and resources. They attempt to learn more about the basic attributes of the problems they face (like the distribution of selenium in valley soils), and are continually coping with changes in their political surroundings. At the same time, they are attacking each other's assumptions and proposals. In this process, scientific and technical analysis is used both to better understand the nature of a problem, and also as a weapon to discredit other groups and gain resources.
To show how beliefs influence the behavior of advocacy coalitions, Sabatier posits nine hypotheses, supported by many references to the literature. In defining how beliefs relate to learning and advocacy coalition activity, six of Sabatier's hypotheses are most important to this study. The first two focus on the role of beliefs in shaping the behavior of advocacy coalitions and single actors:

1. Actors within an advocacy coalition will show substantial concensus on issues pertaining to the policy core, although less so on secondary aspects.

2. An actor (or coalition) will give up secondary aspects of its belief system before acknowledging weaknesses in the policy core.

The final four hypotheses are derived from the first two, and describe the systemic effects of competition between opposing belief systems, and the conditions under which this competition generates policy learning:

3. Policy-oriented learning across belief systems is most likely when there is an intermediate level of informed conflict between the advocacy coalitions. This requires that:
   a) Each have the technical resources to engage in such a debate, and that;
   b) The conflict be between secondary aspects of one belief system and core elements or the other, or, alternatively, between important secondary aspects of the two belief systems.

4. Policy-oriented learning across belief systems is most likely when there exists a forum which is:
   a) prestigious enough to force professionals from different coalitions to participate; and
   b) dominated by professional norms.

5. Policy-oriented learning across belief systems is most likely when there is an intermediate level of conflict between the two. This requires that:
a) Each have the technical resources to engage in such a debate; and that

b) The conflict be between secondary aspects of one belief system and core elements of the other or, alternatively, between important secondary aspects of the two belief systems.

6. When change in a governmental action program cannot be restricted to the secondary aspects, one might wish to hypothesize that adherents will seek to modify the core in the following sequence: First, add a portion of the opposing coalition's core; second, delete a portion of the existing core; third, arrange a synthesis of the two cores; and, finally, acquiesce to a replacement of one's core by the challenger's, but try to get portions of [the old, defeated] core incorporated into the new secondary aspects. [This hypothesis is actually given in a footnote, p. 46, but is one of Sabatier's strongest statements about the relative difficulty of changing core and secondary beliefs, and deserves to be tested].

The concept of policy learning is implicitly defined by these hypotheses—it is based on the force of competition among advocacy coalitions and their beliefs. From the perspective of an organization or coalition seeking to attain or revise its beliefs, learning can be about a variety of things (Sabatier, 1985):

1. Improving one's understanding of the state of variables defined as important by one's belief system (or, secondarily, by competing belief systems—an example of this would be the Bureau's research on the toxic effects of drainage constituents on fish in the Delta).

2. Refining one's understanding of logical and causal relationships internal to a belief system. (For example, in the early 1980s, EDF tried to get the Bureau to incorporate an econometric model into the Bureau's study plans. The model would have predicted how farmers' water conservation response to drainage effluent charges.

3. Identifying and responding to challenges to one's belief system (such as growers' response to threats of irrigation shut-off imposed by Kesterson).
C. A Method for Testing the Framework

The test of Sabatier's framework has three steps. Because beliefs are the basis of interaction, the first step is to describe these beliefs, for major groups involved in the drain conflict. The nature of water politics in California makes it important to specify precisely the advocacy coalitions involved in the drain debate; this is part of the process of specifying belief systems.

The second step is to take a closer look at the events which have validated beliefs, or put them under pressure. In the case of the drain, these fall under a variety of categories, which are described. Finally, the paper examines individual groups' responses to the challenges they have faced, commenting on the degree of learning which has taken place within groups, and the ways in which beliefs have been modified. This notion of revision and modification of beliefs, as reflected in the real experiences of groups involved with the drain, is compared to Sabatier's hypotheses, and points of revision or clarification are specified.
A. Subsystems and Advocacy Coalitions--Comparing Theory and Experience

This section takes the ideas about beliefs and learning from the last chapter, and applies them to the case at hand. The first step in doing this is to describe the advocacy coalitions; then I describe their beliefs.

According to Sabatier, advocacy coalitions will be held together by common beliefs (values), and will be quite stable over periods of about a decade. Advocacy coalitions will show more agreement on core beliefs than secondary ones, and "coalitions of convenience" across advocacy coalitions will be infrequent (Sabatier, 1985).

1. California water politics--broad advocacy coalitions with shifting membership on specific issues

It is easy to delineate two advocacy coalitions in the case of the drain, but it is difficult to describe their boundaries. This is because the key themes and issues of the drain conflict share much in common with other California water controversies. (This is akin to a typical problem in environmental disputes, where the problem overlaps several political jurisdictions; Susskind and Weinstein, 1981).

The two obvious advocacy coalitions are the water supply agencies and the environmental/Delta protection coalition. However, these coalitions battle over far more than the drain, and the actual participants on each issue vary in subtle but
important ways.

This point can be highlighted by introducing more of the cast in California water politics. Among environmental groups, the Friends of the Earth haven't been significantly involved in the drainage dispute, but played a major role in the battle over the Peripheral Canal, described below. The Sierra Club has been involved in the drainage issue since Kesterson, but in northern California pays more attention to conventional water pollution issues and the Peripheral Canal.

The Bay Institute of San Francisco monitors public agencies who are supposed to protect environmental quality in the Bay and Delta. It also does limited scientific analysis, and has recently been working at publishing and disseminating information from the university selenium conferences. Many more groups are active on toxic waste and groundwater contamination, preservation of wild and scenic rivers, and on specifically local water issues.

The SWRCB, while acting as a reluctant political broker over the Kesterson crisis and the Bureau's NPDES permit, has other functions. It controls both water rights in the Delta and San Francisco Bay, and is also responsible for environmental quality regulations in those areas. Its regional boards exercise similar functions for other watersheds, in San Francisco holding authority over permits for toxic waste tanks and bay infilling. The Bay Conservation and Development Commission is a large, intergovernmental body, which controls permits for filling and dredging in San Francisco Bay.

Aside from water districts like Westlands, California
growers exercise their power through the California Farm Bureau, private lobbyists, and a large number of trade organizations (Blanton, 1982).

The work of a few key legislators, like George Miller Jr. and Tony Coehlo in the House of Representatives, and Richard Katz in the State Assembly have already been mentioned. Finally, an important client of DWR's State Water Project is the Metropolitan Water District of Southern California (MWD), which coordinates supplies and contracts for 27 water agencies around Los Angeles and San Diego. Because southern California reps. control the state legislature, the MWD is an important lobbying force.

The point of this list is that, a priori, it is not always easy to tell who will be most active in a water policy dispute like the drain. Further, as discussed in Chapter 8, environmental/protectionist interests since the late 1970s have been modifying their working philosophy about resource policy, which makes beliefs harder to specify. The changes reflect the idea that natural resources should not be subsidized, but priced at their "real" value to society, for more efficient use and environmental protection.

The primary theoretical work on the use of markets as regulators of resource use was done by Resources for the Future in the 1960s and 1970s (Kneese and Bower, 1968). However, as a tool of environmental activism and analysis, many others groups have adopted this view, at differing rates. As discussed below, EDF has been an especially strong and successful proponent of the market approach in California water policy (Willey, 1986).

Applying Sabatier's theory to the drainage dispute, this
leaves the environmental/Delta protection coalition fuzzy around the edges. This is even more the case for a third possible advocacy coalition, valley growers. As will be discussed in a section below, growers' support for the drain has varied substantially, depending on the size and location of their properties, and their relation to federal agencies and water supplies. Thus, while growers form explicit advocacy coalitions around other issues, they usually haven't in the case of the drain, or at least until the Kesterson shut-down threatened their interests.

2. Defining belief systems

Despite the ambiguity of advocacy coalition boundaries, it is useful to set out belief systems explicitly. In doing this, I haven't had the resources to do a content analysis, cognitive mapping exercise, or convene a panel of experts, as Sabatier and other suggest (Axelrod, 1976, Sabatier, 1985). Instead, I used my judgement to make the lists, and simply asked experienced people I interviewed what they thought, particularly about belief systems other than their own. Tables 3, 4 and 5 display the outcome of this exercise.
Table 3. Water Supply Agencies' Belief System

Deep (normative) core:

Water supply agencies help farmers face natural adversity by delivering water, for the benefit of society.

Engineering planning can harness water resources for more productive use by human society.

Near (policy) core:

Agencies should be oriented to large scale projects and long-range system planning, incrementally drawing water supply sources into a regional distribution network.

The best way to convince Congress to support projects is through showing of local need and interest.

Agriculture in the San Joaquin Valley plays an important role in feeding the nation and maintaining the economy of the region, and should be protected from soil salination. Salts should be removed via a drain to the ocean, "the ultimate salt sink."

The Delta is an important resource, but careful planning and regulation of drainage flows can minimize harmful impacts.

In-valley alternatives to the drain are not feasible. In the long term, they do not remove salts from the valley, will not have a significant effect on the problem, and are too costly, both in economic and environmental terms.

Secondary Aspects:

Drain design features: placement of marshes, location of drain outfall, construction of treatment plants. Also, content of impact studies.
Table 4. Belief System for Environmental/Protectionist Coalition

Deep Core:

Water resources have many values, which are subtly and intricately connected to essential human and natural needs. Diverting water resources for a singular purpose, without recognizing these connections, is shortsighted and not in the greater public interest.

Near Core:

The Delta is a unique natural resource furnishing a wide variety of benefits to a great number of people. It should be protected against harm from pollution sources which might be individually small but have a large aggregate impact. It is important to recognize the interconnected ecological character of Delta resources.

The salts, metals, nutrients, elements, and other chemicals contained in drainage effluent will do major damage to the Delta ecosystem.

USBR and DWR, who built the California water projects and want to build the Peripheral Canal, pay more attention to their agricultural constituents and self interest than to the Delta. Information on drainage impacts and careful regulation is required.

In-valley alternatives to the drain are more feasible and economical than the agencies concede, and should be fully tested.

The drain should not represent an inequitably broad subsidy to valley agriculture, which already exports large volumes from the Delta.

Secondary Aspects:

Details on in-valley alternatives (conservation, solar ponds, etc.). Differences in strategies, eg., lawsuits, economic analysis, cooperation with growers, disseminating information, working in the legislature, grassroots organizing.
Table 4. Farmer's Belief System

Deep Core:

Working between an array of only partially predictable natural forces and a set of consumers who don't really understand the scale or difficulty of agriculture, farmers work hard and successfully feed the nation and a good part of the world.

Near Core:

Farmers deserve subsidies to buffer natural and market perturbations, to assure a steady food supply and meet the needs of consumers.

Farmers have to use modern industrial methods (chemicals, specialized equipment, large holdings, large water projects, big packing houses, an enormous marketing and distribution network) and a labor force willing to do difficult work if they are to produce a large volume of crops.

Farmers should only be required to pay a fraction of drainage costs. Should salination be a problem and the public not be willing to support the costs of a drain, over the short and medium term, farmers will use other alternatives, if they are available and economical.

Decisions about use of farm inputs should be left in the hands of individual growers, or their local representatives. If economic interests are threatened by natural or technological problems, growers should innovate in proportion to the threat. If interests are threatened by political forces, growers should organize in proportion to the threat. Usually, this will mean letting existing insitutions (like Westlands and the Farm Bureau) represent farmers' interests. If problems are severe enough, or neglected by existing institutions, growers should organize at whatever level they are capable.

Secondary Aspects:

Willingness to support the drain, depending on how much it costs. Use of evaporation ponds, water recycling, discharge into the San Joaquin River, etc., as means of coping with salination in the absence of a drain.
Part of this paper's consideration of organizational learning is based on how the groups studied here have responded to three important issues (i.e., challenges to attaining their beliefs). These issues have repeatedly surfaced, in changing forms, through the course of the controversy. The first reflects the inability of DWR or USBR to arrange suitable finance mechanisms. The second relates to the accumulation of scientific evidence against the drain, especially after selenium was discovered at Kesterson. The third is about the search for alternatives to the drain, especially as promoted by environmental groups.

B. The Continuing Problem of Drain Finance

Historically, demonstrations of local support in legislative hearings have been a key element of DWR and USBR's strategy for obtaining funds. The relationship is reciprocal; because water pricing laws in the valley are structured so that municipal users subsidize owners of large, unimproved tracts, incentives exist for farmers to lobby for larger water projects. Coupled with the fact that key appropriations subcommittees used to be dominated by western and valley legislators, this "iron triangle" provided a potent means of getting funds.

However, one of the fundamental facets of the drain case is that farmers' support for the drain has been intermittent, at best. In a speech before the California Alfalfa Symposium, DWR's Louis Beck explained that "a solution to the drainage problem has been slow because no single group has pressured state and federal agencies, and because the necessary 'salt sink' is something no
one wants" (Bryant, 1983). The water agencies' continued inability to solve, or even come to grips with this problem is an important gauge of their ability to learn (elaborated below).

According to the IDP's estimates, the maximum area requiring drainage will approximately double between now and 2000, and will double again by 2085 (see Table 1). This long-term character of returns on drainage investment is somewhat obscured by the one-hundred year discounted projections of drainage benefits used in the IDP's report (IDP, 1979b:E-2). Even if valley growers are experiencing $35 million per year in salt-related losses, the development of San Joaquin Valley agriculture has not exactly been crippled by salination since the problem was noticed in 1955. Hence, up until Kesterson, though some growers might experience increases in yields from installing tile drains, for most growers, the immediate onus of drain financing has apparently outweighed the more distant ramifications of soil salination. In comparison, Delta interests have always wanted to stop the drain from being constructed at all, believing that even if initial volumes of drainage effluent were small, once the drain is built, long-term increases in pollution will be difficult to prevent.

Farmers' attitude on the drain have also varied according to the cost and availability of medium-term alternatives. When the Westlands Water District was expanded to include the 150,000 acre Westplains Water District, Westplains users were willing to pay for drainage in return for assurance of irrigation supply. In the northern valley, where existing tile drain systems empty into
the San Joaquin River, the drain is opposed because it would raise costs for a service some farmers already receive for free. In the southern valley, openended contracts for discharge into the drain proposed by the IDP caused fear among growers that initial charges of $20 per acre for discharge would grow to $250 per acre in twenty years (Beck, 1983). Many growers in the southern valley are using evaporation ponds to relieve salination problems over the next 15 to 20 years.

C. Controversy Over the Drain's Impacts--The Partisan Use of Scientific Analysis

As described in Tables 3 and 4, the core beliefs of the water supply agencies and the environmental/Delta protection coalition are in direct conflict on the issue of environmental impacts of the drain. In analyzing how this has affected coalition interaction, this section first sifts through the literature on science and public policy. This literature survey predicts treatment of scientific and technical issues in a way which corroborates Sabatier's framework, as does my interpretation of how groups involved in the drain conflict have actually acted.

1. Some definitions

By scientific analysis, I refer to research and analysis originating in the physical or natural sciences on the basic attributes of a policy problem. In the case of the drain, the most important of these branches of the sciences include biology, toxicology, hydrology, chemistry, soil science, and geology. An
example of scientific research on the drain's impacts would be Harry Ohlendorf's study of waterfowl deformities in Kesterson Reservoir. Scientific analysis is more encompassing, and includes synthesis and interpretation of findings from more than one piece of research. An example of this type of analysis would be the Bureau's attempts from 1980 to 1983 to project the toxic effects of drainage effluent on aquatic life in the Delta.

Technical analysis refers to engineering and economic study of the attributes or feasibility of a project. This type of analysis can also imply narrowly-focused research, or a broader interpretation of technical possibilities. Westlands' study of whether local evaporation ponds could affordably meet the demand for drainage discharge produced by the closure of Kesterson is an example of this type of analysis (which is discussed further below).

Policy analysis implies information directed at decision makers and other interested parties, which describes alternatives and weighs impacts of different policy proposals. Such analysis may be highly quantitative, and in theory will account for impacts of a proposal along different dimensions of value, such as equity, economic efficiency, environmental effects, impacts over the long and short term, and possibilities for implementation.

From these definitions, the key point is that scientific and technical analysis reflect the efforts of highly-trained specialists. The results of this analysis are one of several factors which influence policy decisions.
2. Perspectives on science, policy analysis, and politics

Scientific and technical analysis has played a major role in the dispute over the drain. The drain itself and the irrigation projects which brought water to the valley are the result of extensive work in civil engineering. The steadily growing list of fears about impacts in the Delta and from selenium at Kesterson have had an obvious effect in galvanizing opposition. As will be discussed in the next chapter, technical and economic appraisals of alternatives to the drain will be an important determinant of farmers' eventual fate.

However, even in cases where scientific and technical issues are critical in understanding a topic, policy decisions will clearly reflect more than the scientific content of an issue. Policy analysis, and the push and pull of interest politics are at least as important in the formulation of public policy. Many debates on science policy are not immediately about technical issues, but who participates in making decisions where technical issues are involved (Nelkin, 1979). The interaction of science, policy analysis, and politics is the subject of a large volume of research, which I will briefly interpret before turning back to the drain (Schooler, 1971; Schmandt, 1984; Jenkins-Smith, 1985).

Most of the major works on science and policy address a variety of issues (Primack and von Hippel, 1974; Nelkin, 1979). Though policy disputes containing technical content are not so nicely packaged in reality, it will help here to separate clearly different dimensions of these disputes.

A portion of the literature is about "science policy,
strictly construed. The emphasis is on how to fit the process of
government regulation or intervention to programs which are based
on scientific research and invention, such as genetic engineering
(Bereano, 1984). On the whole, the story of the drain (as
agricultural economic development) is broader than this.

A major portion of the literature centers on the means of
integrating scientific and technical analysis into the broader
practice of policy analysis and decision-making. Almost all of
this work takes into account the role of politics and
bureaucracy, but from different perspectives.

Some authors emphasize methodological issues, such as the
role of cost-benefit analysis or computer simulation modeling
(Fischoff, 1978). The use of uncertainty or risk assessment in
designing policies which have a wide range of justifications and
impacts is another common topic (Lowrance, 1974).

Basic communication between experts and policy makers can be
problematic in and of itself (Brooks, 1984). This is typically
the case when credible experts disagree on the technical
underpinnings of a problem, or on the policy implications of
technical evidence, but no one else knows how to interpret the
experts' differing opinions (Ozawa and Susskind, 1985).

Rein and White (1977), and Wildavsky (1979) treat the role
of policy analysis which may have a high technical content in
broader, conceptual and institutional terms. Among other things,
these authors describe the swirl of political and bureaucratic
forces which surround the would-be "objective" analyst. So that
practitioners can cope with these pressures, and learn to tailor
complicated analyses so they will receive the attention they
deserve, other authors recommend the best ways to "speak truth to power" (Enthoven, 1971; Lehman and Nelson, 1981).

3. The partisan use of scientific analysis--expectations for the drain case

The purpose of setting out all these variations in perspective on science and policy is to distinguish them from the ideas which are most important in the case of the drain. These come from a final set of literature, which describes the stark landscape beyond science policy, beyond the balance of scientific evidence and policy analysis, beyond means by which the well-intentioned analyst can reckon with institutional reality. In this harsh terrain, politics and bureaucratic concerns dominate all the other reasons for conducting scientific analysis (Rushevsky, 1984).

The partisan use of scientific information partially derives from decision makers' thinking on highly controversial issues. For example, one congressman, asked if he considered scientific advice in making policy decisions replied: "We don't. That's ridiculous. You have a general posture, you use the scientist's evidence as ammunition. The idea that a guy starts with a clean slate and weighs the evidence is absurd" (Kingdon, 1973, quoted in Jenkins-Smith, 1985).

Struggles for resources within and among agencies lead to other pressures to politicize science (Downs, 1967). Offering advice for staffing agency technical units under these conditions, Margolis (1974, pp. 33-34) suggests:

(1) Seek to formulate the overall issue so that the problems
on which you can speak with the greatest authority are critical.

(2) Seek to frame the technical issues in a way which supports your policy position.

(3) Do not give away information which does not support your policy position; insofar as possible, avoid complying with requests for information which is likely to be used against your position.

(4) Assume all representatives of viewpoints other than your own reflect some appropriate combination of bias, ignorance, or incompetence.

(5) Act on the assumption that other participants in the process are either (a) operating according to these rules, or (b) do not understand what is going on.

(...to be taken "in reasonable dosage").

In support of their "Ten Commandments for Policy Economists," Lehman and Nelson (1981) suggest that Margolis' advice is taken seriously in the Department of the Interior. The authors' recommendations ("discount for political demand," "dare to be quick and dirty," "think like a manager," etc.) were based on their experience work in DOI's Office of Policy Analysis. (The office was established in 1973 to increase economic analysis of bidding systems, fair market value, leasing systems, and rates of resource production, to the management of federal energy, land, and water resources).

According to Lehman and Nelson, agencies within DOI often base their policies on measures of physical or biological output, not economic costs and benefits. For example, when the Forest Service finally applied economic analysis to its timber sale policies, it found that 22 percent of sales failed to cover their costs (Lehman and Nelson, 1981:98).

Major planning and evaluation exercises were done in the

Most relevant to this study, the Bureau of Reclamation "for years turned out benefit-cost studies that seemed suspiciously favorable" to its institutional interests (Lehman and Nelson, 1981, p. 106; Hanke and Walker, 1976). Prior to the Carter Administration's attempts to reform water policies in 1977;

[Despite the fact that] large scale dams and other water projects would appear to provide good subjects for economic analysis. ...between 1974 and 1976, the Office of Policy Analysis came to the conclusion that analysis in the water resources area was largely a waste of time; water decisions by long tradition had been so charged politically that economic analysis had a low payoff. (Lehman and Nelson, 1981, p. 101)

4. Partisan use of scientific analysis--responding to opportunity, packaging ideas, and suppressing evidence.

High controversy and institutional self-interest are both integral features of the evolution of policy on the drain. We suspect that in this case, organizations may try to use scientific analysis for their own ends in a number of ways. These include drawing the overall boundaries of analysis in a favorable way, controlling the methods of analysis, altering results, and suppressing or attacking research by competitors. I will make the case that this has been the Bureau of Reclamation's policy, as a response to threats to its core beliefs posed by the actions of environmental and regulatory groups (like the SWRCB) trying to
realize their core beliefs.

Organizations which are in conflict with groups who may be using these strategies will not be able to simply reply with better science. As the drain conflict shows, they must market and package their analyses, to be convincing and palatable to those they are trying to convince. I will argue in the following section, and in Chapter 8, that the Environmental Defense Fund has been best at doing this. NRDC's use of technical analysis has been more antagonistic toward farmers and water agencies, and has served a different political purpose. I will show that this is also a reflection of core beliefs, EDF being more oriented toward economic analysis (in this case), and NRDC being more adversarial, and concerned with turning public opinion against the Bureau.

Sabatier implicitly argues, and I agree, that groups seeking to reduce the political use of scientific argument should force competitors into forums where scientific work can be closely scrutinized by their peers. This has happened in the Selenium I, II, and III conferences held by the University of California. In these conferences, the U.S. Geological Survey especially has had an opportunity to criticize the Bureau. This was not so much the case during the SWRCB discharge permit study process, which was more closed and adversarial.

5. Evidence of misuse of scientific analysis by the Bureau

Many scientists in other agencies (as well as conservative engineering consultants I've interviewed) were suspicious of the Bureau's fastpaced study plans for the NPDES permit process.
Later, as the first studies were being done at Kesterson, the Bureau insisted on using its own data on concentrations of selenium and other metals. It held this posture until the USGS issued a harsh critique of its methodology (Davoren, 1986a). USBR officials first detected selenium levels of 400 ppm in June of 1981, in the studies which were to be presented to the SWRCB in 1984. However, the official who conducted this part of the study, since retired, says that a study of the literature on selenium didn't yield any information that would have predicted the problems that arose, and that figures for average levels of selenium in drainage waters throughout the valley hid the high concentrations at Kesterson (Carter, 1985e).

A longrunning controversy over these issues emerged in 1983, provoked by Felix Smith, a staff scientist for the U.S. Fish and Wildlife Service, which is also part of DOI. In September of that year, Smith tipped a Fresno Bee reporter to the discovery of wildlife deformities at Kesterson. In May of 1984, he also told reporters about a secret meeting held by the Westlands WD and the Bureau. At Smith's suggestion, the Fresno Bee used the Freedom of Information Act to obtain previously unreleased documents. He also turned over documents to reps. George Miller and Robert Matsui (D-Sacramento). He alleges that these memos show that the DOI Solicitor's office was trying to suppress the results of studies by FWS employees (Smith, 1986). Under many threats to be transferred to Oregon, in late 1985, Smith was granted federal "whistleblower" protections by Congress. That year, Smith also received the prestigious Stephen T. Mather award from the
National Parks and Conservation Association (Carter, 1985k).

Before Smith, another FWS appraiser working in the Grasslands WD in the late 1970s and early 1980s had resigned. He complained that his superiors had told him to "develop amnesia" over Grasslands' problems (Carter, 1986d).

The head of the UC College of Natural Resources, who organized the three selenium conferences, in March of 1986 again argued that high-level officials in FWS were suppressing reports by Ohlendorf and Sakai (Harris, 1986).

A congressionally-authorized study of the Bureau's alleged coverup was conducted by DOI's Inspector General's office. The study was critical of the Bureau and DOI's treatment of the FWS studies on Kesterson, and found "enormous conflict" among federal officials. However, it found no actual conspiracy to suppress the FWS evidence.

D. Water Conservation, Solar Ponds, and Water Marketing as Alternatives to the Drain.

As described in Chapters 2-4, alternatives to the drain were not given serious consideration by either DWR or USBR during the 1960s and most of the 1970s. The argument against proposals to somehow deal with drainage effluent in the valley (eg., with evaporation ponds like Kesterson) was very straightforward. According to the water supply agencies, salts were being imported into the plant root zone, from both the soil and irrigation water. These salts were accumulating at such a rate (1 million tons a year over the whole valley), that transporting them to the sea, "the ultimate salt sink" was the only possible solution.
During the mid-1970s, Zach Willey, an EDF economist specializing in water issues, began making the argument that water conservation and other on-farm measures could certainly reduce the projected size of the drain, and might make the drain unnecessary (Willey, 1983).

Over the course of the 1970s, environmental groups' emphasis on conservation grew. The debate over the possibilities for increased conservation on California farms is touchy and complicated. Conservation is an important issue not just with respect to the drain, but because California is a drought-prone state, and urban demands for water are increasing.

The conservation debate cuts deep into farmers' feelings about their work. Because water is extremely cheap for many farmers (costing at least nine times less than paid by the Southern California Metropolitan Water District for SWP water), a basic assumption of many water reform groups is that growers are likely to waste it (Reisner, 1977).

Thus, the argument over water conservation also reflects conflicts in core values. However, unlike the Bureau's position over drainage effluent impacts, farmers have ultimately been more accepting of water conservation and marketing, when they have to be in order to remain economically viable.

1. The terms of the debate

The main area of controversy in this argument is about the feasibility of reducing the "leaching fraction" for valley farms. The basis of the leaching fraction is that plants take water from the soil, they leave behind an accumulation of salts, which were
present in the applied irrigation water. These salt deposits must be flushed out with additional irrigation water, water not specifically needed for plant growth. Defined as a percentage of the gross requirement for irrigation, this additional water is the leaching fraction. The leaching fraction varies by soil type, the salt-tolerance of the crop, quality of applied water, and the efficiency of irrigation systems (Davenport and Hagen, 1982).

The amount of water needed for leaching is also a function of the total amount applied. By reducing the leaching requirement and finding ways to minimize unnecessary application of water, the volume of subsurface irrigation water running into tile drains might be reduced. This would allow tile drains to be spaced further apart, and might reduce the necessary size of the valley drain.

The general soundness of the theory of reducing the leaching requirement in order to increase the efficiency of irrigation has been demonstrated in several studies (California Water Resources Center, 1976; O'Connor and Cull, 1976). In an eight-year study of irrigation practices in the Grand Valley in Colorado, the EPA found that fifty-five percent of the water that enters the water table from agricultural irrigation escapes from canals surrounding fields, rather than from cultivated soil itself (EPA, 1978a). Hence, relatively inexpensive lining of canals with plastic sheeting was found to dramatically reduce the amount of water necessary to irrigate crops. (Unlike most areas, water in Westlands is delivered in subsurface clay pipe, so this argument doesn't apply). Several other innovations, such as changes in
irrigation scheduling and restructuring water prices to reflect water quality were shown to have a slightly less substantial impact (EPA, 1978c, 1978d, 1978e).

By conserving water and keeping the soil continuously moist, avoiding the wet/dry cycle that causes salts to precipitate out of solution, drip irrigation techniques have been shown to minimize salt damage to plants. Modification of seed placement on the soil ridges of furrowed row crops has also been shown to help plants resist salt damage, especially in the germination and seedling stages, when plants are most susceptible to salinity.

Three sources cited in the IDP's 1979 report estimated that the lowest average leaching fraction obtainable in drainage problem areas is currently 15 percent (IDP, 1979b:7-3). DWR has estimated that using extremely high efficiency systems, one-hundred year projections suggest that the average leaching fraction for San Joaquin Valley fields could be reduced to about 13 percent (Beck, 1983). These are averages for a total fields; on some sections of a field, the leaching fraction may be as low as 5 percent. The use of lateral-move sprinklers with computer controls to regulate the rate of flow for each sprinkler might exploit this feature of valley soils to reduce the leaching requirement to about 10 percent in some areas (Beck, 1983).

2. Conservation advocated as a drain alternative

In its evaluation of alternatives to the drain, the IDP admitted that tile drains are expensive, may require an increase in applied water to function properly, and that the valley is experiencing a trend toward more water conservation (IDP,
In spite of this reality, in its final report, the IDP devoted only one page to an explanation that "non-structural" measures would not change the need for a drain significantly. In support of its position, the IDP claimed that potential water conservation programs would have to be examined on a farm-by-farm basis, and that conservation methods usually incur start-up costs and increase energy consumption great enough to offset their water conservation advantages (IDP, 1979b).

On the other hand, the Director of the U.S. National Salinity Lab has stated that "improvements in irrigation systems are likely to result in better crop yields, reduced expenses, and increased returns, while also conserving water and energy" (California Water Resources Center, 1976).

Instead of asking that the USBR prove the need for a drain per se, in the context of increasing water conservation, EDF argued in the late 1970s and early 1980s that the Bureau is obligated to provide more information directly relating the size and construction schedule of the drain to the potential for water conservation investments that might be made by farmers considering putting in tile drains. The EDF's assumption is that the "axiom of water development" in the valley is that because large water projects create both demand for, and availability of, irrigation for intensive agriculture, agricultural water (or drainage) use will grow to meet the capacity of a given project (Young, 1983).

As an analytical tool to estimate the demand for drainage and hence the required size of the drain, the EDF argued that
USBR should employ a particular mathematical model designed to project the irrigation system options growers will choose under different crop loss circumstances (Young, 1983). The model was originally developed by the EPA for study of non-point source pollution (e.g. surface irrigation runoff).

Gerald Horner, the UC Davis Agricultural Economics professor who co-designed the model, thinks the model may show that conservation measures will have an effect on the size and construction schedule for the drain (Horner, 1983). The USBR defends its decision to not use the model by stating that it was not designed for the use EDF intends for it, that the model's developers are not groundwater specialists, that in trying to predict the aggregate behavior of individual farmers, the model requires too much data, and that USBR analysis shows that conservation will have little effect on the size of the drain in any case (Swain, 1983).

Horner replies that his partner in developing the model is a civil engineer, and that the Bureau is essentially uninterested in committing itself to a rigorous analysis of the conservation question (Horner, 1983).

In its January, 1983 San Luis Drain status report, the USBR presented another analysis of the potential effects of water conservation, drawing on earlier USBR and DWR work, and on the research of David Davenport and Robert Hagan of the UC Davis Department of Land, Air, and Water Resources (28). Here, the Bureau claimed that water in the San Joaquin Valley is already being used too efficiently to allow more that a 2 to 3 percent increase in reuse, another measure of conservation.
The final argument for a drain built large enough to operate below total capacity for many years is that such a drain affords a tool for greater flexibility in managing effluent discharges to match high Delta outflow periods (mitigating impacts in the Delta; Beck, 1983).

3. Solar ponds; a more sophisticated alternative

During the early 1980s, EDF's case for in-valley alternatives to the drain grew increasingly complicated and thorough. After the discovery of selenium at Kesterson and DOI's threat to cut off irrigation supplies, EDF was in a prime position to market its ideas. When the Westlands Water District began its intensive, rapid search for alternatives to the drain, it contacted EDF. In November of 1985, the two groups negotiated an agreement to test EDF's ideas on Westlands land, backed by a $3.2 million federal loan, which DOI subsequently blocked release of.

EDF's proposal is based on an eclectic combination of resource recovery, reuse, and water marketing plans, described in Figure 6. Aside from solving the drainage disposal problem, the appeal of EDF's proposal is that it might generate net earnings, over the period 1990-2020, from sale of water for reuse, recovered elements, and electricity (Willey, 1986).

The use of solar ponds, which were developed and operate economically in Israel, is an especially novel part of the research. In the first phase of the solar pond process, saline drainage water is stored in a pond filled with vegetation,
Salt from irrigation water builds up in farm soil along with naturally-occurring salts and trace elements like selenium. Hence, the subsurface runoff from irrigation is salty and polluted. EDF’s plan first reduces amounts of polluted drainage water by giving farmers economic incentives to improve irrigation efficiency, letting them market the river water they can save. Existing desalinization technology is used to produce valuable fresh water, the salty byproducts are then used to produce electricity in solar ponds. Selenium and other marketable trace elements can also be removed and possibly resold.

1. On-Farm efficiency measures reduce river water use and reduce polluted runoff.

2. Reverse osmosis plant separates salts to produce saleable fresh water and salty brine.

3. Sun’s heat creates temperature differential in solar pond, which drives heat exchanger to power turbine.

4. Selenium and other trace elements are removed from salty brine and resold, depending on market conditions.
simulating the effect of a marsh in removing large solids. Salts are then removed, and the water is chlorinated to kill bacteria, and then dechlorinated. Water from the desalting phase is available for reuse, and the remaining brine, concentrated to 150 ppm of salt (about five times the concentration of seawater) is used in the solar pond (see Appendix A for a more detailed description).

A layer of brine lies about twelve to fifteen feet deep in a solar pond, covered by a layer of brackish water, covered by a chemical layer used to retard evaporation. Because the density of the brine prevents a convection current from forming, solar heat is retained in the bottom of the pond, heating the brine to about 180 degrees F. Transferred to lowboiling point liquids, this heat is used to turn turbines which produce electricity (Smith, 1981).

4. Water marketing

Another recent proposal for solving the financial problems of the farmers around Kesterson is to simply let their fields go fallow, and allow them to sell their water entitlements to the MWD. As with conservation, water marketing has broad applications to California water policy, and is even more contentious.

To appreciate the concept of water marketing, several facets of water supply and pricing in California are important. The first involves the nature of the subsidies which are built into the supply of USBR water.

Under the "rolling repayment" scheme for the Central Valley Project, whenever a new facility or unit is added to the CVP, the
repayment period for the entire project is extended to 50 years from the inservice date of the most recently completed facility. As a result, repayment for the San Luis Unit began in 1968 and, under current proposals, would extend to 2030, an interest-free period of 72 years. According to the USBR, the interest subsidy for the San Luis Unit is about $1422 per acre, out of an actual cost of $1679 per acre (in 1978 dollars). In other words, project users pay only about 15% of project costs (USBR, 1981; Wahl, 1985).

In contrast to growers who receive inexpensive, subsidized water from the federal CVP, cities in southern California receiving state-supplied water pay much higher rates. For existing contracts, water agencies in the MWD pay at least $90.05 per af., and water costs for new contractors can run as high as $269.18 per af. Further, the MWD, which uses 1,560,000 af. per year, will soon lose 400,000 af. of its entitlement to Colorado River water, which will be diverted to the new Central Arizona Project (Wahl, 1985)

The MWD projects annual deficits of 140,000 af. during normal years by the year 2000, and deficits between 600,000 to 1,200,000 af. during periods of drought (MWD, 1983). The marginal costs of developing new water supplies (DWR's proposed dam on Cottonwood Creek in northern California) is at least $20 per af. higher than existing contracts (Wahl, 1985)

Finally, according to an analysis by the NRDC, farmers in the San Luis Service area now receive an average of $290 in net income per acre for their crops (LeVeen and King, 1985). At the prices paid for water by the MWD, the average value of the water
applied to these fields is $180 per acre. Hence, from an economic standpoint, conditions exist which would easily allow farmers to trade surplus water (or all of their water) to users in southern California.

Though there are imposing legislative and institutional barriers to overcome, EDF is pushing water marketing especially hard as a means to pay for in-valley alternatives. Like the finance issue, water marketing and other drain alternatives provide a common measure by which perceptions of interest and response can be gauged. As discussed in the next chapter, in my opinion, this represents a major area of both organizational and, potentially cross-system learning.
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Pages 102, 103, 104
CHAPTER 8
CONFLICT, LEARNING, AND REVISION OF BELIEFS

This section compares the results of conflict in beliefs, as predicted by Sabatier's theoretical framework, with the experiences recorded in the drainage case. The focus for this analysis is on individual organizations; DWR, USBR, EDF, NRDC, and Westlands. At the end of the Chapter, some of the ambiguities and circularities in Sabatier's framework are addressed, and points of revision or clarification suggested.

A. The Department of Water Resources--Learning and Change as a Result of Internal and External Pressure

An evaluation of DWR's strategic performance on issues besides the drain would fill another entire thesis. However, DWR's overall experience does offer a number of bases for comparison with the Bureau of Reclamation. Like the Bureau, DWR has historically been an engineering agency, devoted to large dam and diversion projects. The director of DWR under the Reagan administration (1967-1975) was a strong proponent of water development, as were previous directors.

Like the Bureau, DWR projects serve powerful interests. Among these are the huge and politically potent Boswell-Salyer land companies in Kern County. Another powerful client of DWR's is the Metropolitan Water District of Southern California, which fields an effective lobbying staff in the state legislature, as well as highly qualified teams of engineers and planners.

Also like the Bureau, DWR has been embroiled in serious political controversy over its projects, the Peripheral Canal.
Especially in northern California, the Peripheral Canal has been castigated as a means for wasteful cities and farms in southern California and to take more water from the Delta, at the expense of local uses.

However, unlike the Bureau, DWR has in recent years undertaken programs which suggest some degree of organizational learning. For example, since 1971 DWR has funded a pilot research project on desalinization and solar ponds, located in Los Banos. The project has faced some difficult technical questions, but has pushed DWR 15 years along the learning curve (DWR, 1983, Smith et al., 1984).

Another DWR pilot project, the California Irrigation Management System, though still in the R&D phase, has met growing interest in the agricultural community (as suggested by the current, pro-development Director of DWR; Munro, 1985).

In another situation involving soil salination and water marketing, DWR has shown considerable flexibility. This is in the Imperial Valley, in the far southern part of California, on the border of Mexico and Arizona. The Imperial Valley is another very hot, dry desert area, with long growing seasons and agricultural drainage problems. In the Imperial Valley, tile drains empty into the Salton Sea, a saline, artificial lake formed in the 1920s when a major canal broke and poured Colorado River water into a previously dry depression.

The Salton Sea also receives surface agricultural runoff, like the Grasslands Water District. In close similarity to Jim Claus' action at Kesterson, DWR's actions were prompted by the
complaint of a local landowner. In 1980 John Elmore, a farmer who owns land near the Salton Sea, complained to DWR that the wasteful practices of the Imperial Irrigation District (IID) were threatening to inundate his land.

DWR actually conducted an investigation of potential conservation practices in the IID, and coupled its findings with a water marketing scheme. The DWR study found that the IID could save up to 438,000 af. of water per year through better management. Also, "if the water... were available to the MWD, the [IID] could reduce its purchase of SWP water by the same amount, temporarily reducing demands on the SWP system" (Bradford, 1984).

A few months before the DWR announcement, the Environmental Defense Fund released a 198-page study which supported the concept of conservation and water transfers in analytical and empirical detail. According to the EDF, conservation improvements in the Imperial Valley would cost between $20 and $170 per af. of water saved. Compared to its subsidized cost of water, this was expensive from the standpoint of the IID. However, since the MWD was paying $264 per a.f. for its water, it could quite rationally pay the IID to implement conservation improvements in exchange for surplus water. This exchange would also allow the IID to circumvent the numerous legal obstacles to sale of state-supplied water for profit (Willey, 1986).

Based on the DWR study, the SWRCB ordered the IID to implement a tailwater monitoring program, repair and maintain tailwater structures, develop a water accounting program, and submit a schedule for the construction of regulatory reserviors (Bradford, 1984). Out of their mutual self-interest, MWD and IID
began talks about putting the conservation and water transfer scheme into place. However, the talks have recently stalled over the details and priorities of the conservation program.

In summary, the activities of DWR suggest that large, engineering-centered bureaucracies can move to incorporate ideas from other belief systems into their activities. This movement is rarely swift and fluid, but has also been suggested in the case of the Army Corps of Engineers (though this case was presented as an exception to the rule; Mazmanian and Nienaber, 1980).

It is difficult to judge whether DWR would have pressed for the drain more tenaciously if it hadn't encountered financing problems. It is clear, however, that part of the reason DWR hasn't been as insistent about constructing the drain as the Bureau is because it realized the inconsistency of grower support (Beck, 1983). DWR has maintained drainage-related activities, but these are oriented at coordinating local efforts, like evaporation ponds in Kern County, in support of long-term objectives.

In my opinion, the major reason for these differences between USBR and DWR orientation is that DWR has been forced (and chosen) to consider the play of interests among many parties in state water politics. This has been especially true in the case of the Peripheral Canal controversy.

1. Forces for reform inside and outside DWR--the Peripheral Canal Referendum

In California water policy, coalitions of convenience happen
with some frequency. The most spectacular of these occurred in 1982, when environmental groups and large, wealthy farm corporations teamed up to defeat a public referendum on the Peripheral Canal. The history of the Peripheral Canal is important enough to describe briefly, because it explains in part why DWR and USBR differ on their capacity for organizational learning.

The Peripheral Canal is a very large earthen ditch, proposed by DWR to carry water from the Sacramento River around the eastern edge of the Delta, and deliver it to DWR pumps in the southern Delta. By circumventing the network of Delta cross-channels, the canal would allow DWR and USBR to divert larger quantities of water to the valley and southern California. The ballot initiative was the result of an artful legislative compromise engineered by governor Edmund G. Brown Jr., and his Director of DWR, Ronald Robie. The MWD fronted lobbying efforts for the legislative version of the initiative, and helped put together a strong centerist coalition, with wide participation by the affected parties.

The legislative bill was essentially an attempt to incrementally bring protectionist ideas (like water marketing and conservation) to the pre-Brown pro-water development regime. As such, its construction represented the use of "classic rational-analytic decisionmaking procedures to identify a water policy package which optimized on several value dimensions" (Munro, 1984).

However, in the public referendum, environmental and consumer groups teamed up against the canal with their enemies,
the wealthy and powerful Kern County (southern valley) Boswell-Salyer combine. The environmental groups felt that the efficient use and Delta protection provisions weren't enough, and supplied the intellectual energy for the anticanal campaign. The Kern County growers felt the conservation provisions were too stringent, and supplied the money for the battle.

The high cost of the canal was used by environmental groups as tool to educate the public about conservation and marketing, less costly ways to increase the supply of water. The referendum was resoundingly defeated in northern California, and not well supported in Los Angeles either, and it went down to defeat at the polls.

B. The Bureau Of Reclamation--Unchanging Beliefs, Unyielding Behavior

In its tenacious struggle to build the San Luis Drain, the Bureau has been inflexible and largely incapable of learning on issues which do not closely correlate with its ideological perception. It has alienated even its supporters and arguably damaged its own selfinterest. This section suggests why this has the Bureau has behaved this way, in reference to its beliefs.

1. A predisposition to overbuilding

Before a critique of the Bureau begins, the accomplishments of the Central Valley Project should be put in perspective. The CVP has undoubtedly been a major force in the economic development of the valley, though not quite as much as original proponents had projected. The CVP generates $1.8 billion in net
crop revenues per year, employs 128,000 people, and contributes $400 million per year in federal, state, and local taxes (Milliken, 1979).

However, when the Bureau planned the CVP, there were several indications that it would be unwise to bring water to the Panoche Fan area (where selenium originates). These include a 1939 U.S. Geological Survey which showed the presence of selenium in certain San Joaquin Valley soils, at concentrations high enough to make irrigation inadvisable. The report was ignored, but resurfaced in 1985 (Harris, 1985b).

Studies in the 1960s raised the potential issue of overproduction of crops. The point is not that these should have been accepted as predictors of the future, but that the Bureau should have looked at the consumer and producer benefits of its programs more carefully in future analyses, and especially consider the quality of lands being slated for irrigation. One of these suggested some soils might contain levels of salt and boron which would be hazardous to crops (as some soils in the Kesterson area are, which makes farmers reluctant to recycle water; UC Water Resources Center, 1961, 1966).

In planning the CVP, the Bureau didn't base its analysis of the timing of water delivery, pricing levels, and project size on sound economic principals; it simply built the largest project Congress would authorize. Once the concrete for any project was poured, the project had to be paid for, under terms which may not have been completely understood when they were signed into law, but have been difficult to reform because of the interests which
were created (Riesner, 1977).

This strategy worked on projects built before 1967, but the Bureau didn't alter its behavior after it had become clear to everyone else that there were a much greater number of players in the drainage dispute. The build-now, pay-later approach was particularly unsound in the case of the Panoche Fan, where it was likely that marginal lands would not be profitable to farm unless water were highly subsidized and drainage were provided promptly.

2. An unsophisticated response to the growing number of actors

Even in late 1984 and early 1985, when selenium problems had awakened and alarmed public officials, university scientists, and staff at other agencies, the Bureau was still talking about Kesterson as a part of the drain, which would be built as soon as studies had sorted out the problem. This was most notable in a series of "public participation workshops" the Bureau held in December of 1984 (USBR, 1985).

Along the same lines of political insensitivity, but in greater magnitude, were DOI Secretary Hodel's decision to shut off irrigation water, and DOI's delay of the fasttrack loan to EDF and Westlands. Both of these brought DOI an enormous amount of bad publicity.

This is not to say that USBR hasn't undergone learning in the secondary aspects of its belief system. For example, compared to the drain planning process of the 1960s and the 1972 EIS, the Bureau's efforts to include public participation seem much more advanced. These include the extensive hearings and meetings
during the IDP program, as well as the 1984 workshops mentioned above.

However, none of these programs reflected any kind of change in the Bureau's core beliefs about the necessity for the drain and the infeasibility of alternatives. In fact, they can be more aptly seen as efforts to build the drain's public credibility.

This is most evident in the way the Bureau treated scientific analysis, as part of the SWRCB's process of making what everyone knew would be a political decision on the drain and its NPDES permit. In this light, the IDP program was clearly meant to give the SWRCB a stake in supporting a decision which it had previously worked on. The Bureau's research program during the NPDES permit studies also involved the participation of other federal and state agencies. Meaningful participation by elected officials and the general public was excluded from this process, because of the technical level of argument. This is in contrast to the Bureau's actions on Kesterson, when scientific analysis began to intrude on its core beliefs, as described in the preceding chapter.

C. The Environmental Groups--Similar Core Beliefs, Different Tactics, Different Results

1. The Environmental Defense Fund--environmental protection through economics, cooperative behavior

EDF's deal with Westlands, and its IID study have clearly put it in the forefront of groups promoting water marketing in California. EDF is exploring more options for working with growers in conservation and water marketing, and if the state
turns to water marketing seriously, will be in a key position to affect legislation. EDF's efforts were the subject of recent, glowing editorials in the Fresno Bee, Los Angeles Times, and New York Times.

EDF's position is the result of insight by a fairly small group of people, including Tom Graff, a lawyer who founded EDF's Berkeley office in 1971, and Zach Willey, an economist who has done most of the analysis.

It should be noted that EDF has benefitted from growing concerns over water shortages and the Kesterson problem. In 1979, when it suggested to the IDP that conservation and onfarm measures be studied, the response was that EDF should do the analysis themselves (Willey, 1986). EDF was similarly unsuccessful in its attempt to get the Bureau to use Gerald Horner's econometric model in its studies for the SWRCB.

The investment of time and resources into these studies paid off quite well after Kesterson. EDF's current report (in draft form) on alternative uses of drainage water is closely tailored to growers' needs and investment horizons. EDF has been equally sophisticated in its studies of water marketing possibilities.

With respect to farmers, EDF has followed a fairly cooperative strategy. The philosophy of the Berkeley EDF water group is to only use lawsuits as a last resort, and EDF has never brought any suits over the drain. In my interview with Zach Willey, he mentioned many of the disadvantages to lawsuits described by the advocates of mediation in environmental disputes (Susskind and Weinstein, 1981).

Willey's personal contacts with farmers and irrigation
management consulting firms, stemming from his graduate research at UC Berkeley, have been very important in uncovering areas of common interest. For example, when a valley trade group of irrigation supply firms began expanding their planning horizons in 1975, they decided to bring in Willey as new member of the Board of Directors. Through informal channels, these contacts eventually led to the agreement with Westlands (Willey, 1986).

Economic analysis has not been the only part of EDF's strategy. Like NRDC, EDF hired scientists to comment on the Bureau's NPDES study plans in the early 1980s, making it one of the few environmental groups to do so.

2. The Natural Resources Defense Council--lawsuits and antagonistic analysis

NRDC has taken a very different approach to the drain conflict than EDF. This is despite the fact that boths groups' water strategies were plotted by the same people, Tom Graff and John Leshy, in the early 1970s. However, in 1977, Leshy and most of NRDC's San Francisco water staff were recruited to the DOI solicitor's office by the Carter Administration. NRDC didn't get involved in the drain dispute until 1982, when it issued comments on the Bureau's study plans.

Since then, NRDC has been active in bringing and coordinating several lawsuits against the Bureau, Westlands, and the SWRCB. The primary goal of these actions is to keep up the pressure to close Kesterson. NRDC feared, probably correctly, that the negotiated agreement between Westlands and DOI could be broken, because there were no counter-balancing interests to
enforce it. Part of NRDC's strategy has been to assist local landowners and municipalities in the legal actions, rather than bringing suits on its own.

Because of its legal activity, NRDC gets more newspaper quotes than any other groups, but is very unlikely to share a relationship with growers like EDF. Aside from legal work, NRDC also has issued a steady stream of comments on the Bureau's Kesterson studies and cleanup plans.

Like EDF, NRDC is also heavily involved in economic analysis of water projects. However, NRDC's main approach is critical, rather than suggestive of immediate solutions. This is typified by its most major report, *Turning Off the Tap on Federal Water Subsidies* (LeVeen and King, 1985). This report quantifies the large legal and illegal (unintended) subsidies to the CVP, estimated at $3 billion per year. It is highly critical of the Bureau of Reclamation, offering strong evidence that the CVP has not helped family farmers, has contributed to crop overproduction problem, and has possibly exacerbated the agricultural depression in other parts of the state. The most powerful argument in *Turning Off the Tap* (which is also made by many critics of the Bureau and DWR, most notably George Miller Jr.), is that large percentages of the lands irrigated by the project are used to grow nonfood, surplus crops, like cotton and alfalfa.

There is some question over how much of the policy recommendations of in *Turning Off the Tap* will be immediately suggested for implementation. This is because the Bureau's water pricing policies were altered by the Reclamation Reform Act of
1982, after a long political battle, and these reforms are now slowly being implemented.

However, in the longer term, it is clear that the activities of George Miller, along with Gramm-Rudman-type budgetary pressures, will bring management of USBR projects into increasing scrutiny. In this context, the clear, straightforward presentation in *Turning Off the Tap* will help NRDC educate journalists, politicians, and the public (Rogers, 1986).

The overall picture of the activities of EDF and NRDC is that of two groups taking advantage of events like Kesterson and George Miller's activism to add force to focussed, high-leverage analysis. In my opinion, from the standpoint of the environmental/water protection movement as a whole, the coincidental division of labor between EDF and NRDC is a good strategy.

Though it has chosen not to, in general, NRDC is certainly capable of doing analysis like EDF's; the most obvious example is NRDC's work to get the Bonneville Power Administration in the northwestern U.S. to implement electricity conservation measures, in lieu of building new power plants (the parallels between conflicts in water and electricity supply and marketing are quite strong). In fact, the primary reason NRDC is doing the legal work in the drain case is because no other environmental groups were willing to (Candee, 1986).

D. Farmers and the Westlands Water District--Flexibility as Necessity

As suggested by the beliefs described in Table 5, growers
and their representatives have supported the hegemony of the Bureau over water policy, and have strongly resisted efforts to bring their practices under regulatory control. However, when necessary to protect their economic interests, growers, and especially the Westlands Water District, have been flexible and innovative.

Despite their strong positions in the muddled debate over water conservation, when it became clear that Kesterson would no longer be available as a sink for drainage effluent, Westlands began a vigorous program of water conservation education (Westlands, 1985). Similarly, when it became clear that solutions to the Kesterson problem had left the Bureau's immediate control, Westlands rapidly began searching for other solutions, such as evaporation ponds (CH2M Hill, Inc., 1985).

Finally, after the March, 1985 negotiations with DOI, Westlands stuck to their agreement to plug the drains, though they could have tried to change the terms. Westlands took this action despite the highly visible protests of farmers in the area. These included standing in the fields around one of the drain sites, holding hands to block digging equipment, as well as a lawsuit (Carter, 1986a, 1986c).

E. Assessing Sabatier’s Framework

As a general template or set of "file folders" with which to sort and categorize the evolution of policy in the case of the drain, Sabatier's framework works well. Sabatier has been absolutely correct about the role of scientific fora in increasing understanding of policy problems. (Though the
university selenium conferences did reflect professional norms, they couldn't be called entirely "depoliticized"). However, there are nuances of conflict and policy in this case which the general framework cannot predict, and these suggest ways in which the framework could be improved.

1. Subsystem boundaries

The first evidence of possible revisions in the framework derives from the difficulty of setting the boundaries of the drainage policy subsystem. This subsystem could be described as simply the actors who have been involved in policy-making on the drain. However, in order to understand the roles of these actors, it is necessary to compare them to other players in the larger water policy subsystem. Further, it is clear that ideas from the water policy subsystem have been forced into the drainage debate, and vice versa.

By considering the relevant policy subsystem as all the actors involved in California water policy, the possibilities of recognizing multiple-issue solutions are increased (and the researcher has to do much more work). The multiple-issue perspective is important, because it suggests conditions under which some aspects of core belief systems (which have several parts) may be overridden--without the extreme resistance predicted by Sabatier (and shown by the Bureau).

The theoretical origins of this argument come from the literature on negotiation and conflict resolution. As suggested by Raiffa (1982), multiple-party, multiple-issue disputes offer
the participants the opportunity for solutions which would improve their positions, relative to bargains which would be struck issue-by-issue. The key to this style of "integrative bargaining," or creation of "joint gains," is trading across issues of differing value among several participants. In sections below, I will suggest that this in fact happens in California water policy.

There is strong evidence that several of the players in the drain case think from a multiple-issue orientation. For example, the Westlands Water District currently faces several important conflicts over its use of federally-subsidized water. These include in-progress negotiations with the Bureau over its water contracts, and a long-standing lawsuit over the legality of Westlands' annexation of 150,000 acres in the former Westplains Water District. Westlands also has a major stake in the enforcement of the "hammer clause" in the 1982 Reclamation Reform Act, which will set standards and increase the price of water for growers with large acreages.

2. Interests, beliefs, and "integrative" compromise

The history of California water policy has been full of coalitions of convenience, and may be entering into an era of integrative bargaining and compromise (as suggested by the emergence of "win-win" issues like water marketing). An example of legislation which integrated the priorities of many parties was the Peripheral Canal bill, SB 200 (which was altered then defeated by a coalition of convenience). EDF and Westlands' agreement was clearly the result of common interest. The SWRCB's
3-year deadline to close and clean up Kesterson has elements of compromise as well.

The most prominent example of integrative compromise in the case of the drain is a federal bill proposed by George Miller in late May, 1986. The bill is clearly an attempt to reach across several issues for a solution to the drainage problem. Its major features include:

--a $100 million fund to establish a new drainage system in valley;

--a new California Water Exchange, to market surplus water, with proceeds going to federal purchase of selenium-contaminated land and restoration of wildlife refuges;

--$30 million for research into drainage problems;

--legal recognition of Westlands' expansion into Westplains;

--government purchase of farmland, in cases where farms produced contaminated wastewater, or were forced out of production by selenium contamination and lack of drainage;

--penalties for the use of government subsidized water to grow surplus crops, like cotton;

--prohibition of further construction of the San Luis Drain;

--forgiving Westlands from having to repay a $42 million federal loan (Johnson, 1986).

Simply looking at the beliefs outlined in Tables 3-5 and considering the wide play of internal and external forces on the drainage/water policy subsystem would not predict this type of legislation (regardless of its changes for success, which are significant). This suggests one of the shortcomings of the general and belief-centered Sabatier framework. Though the framework recognizes all the important factors in policy evolution, and suggests a hierarchy for competition among
beliefs, it doesn't offer any means of sorting out the relative impact of beliefs and learning relative to integrative compromise, and a very large variety of "external events."

Sabatier might reply that this is an example of learning across systems, which is true. However, it may be an example of learning as a result of a clash between core beliefs, leavened by the crisis at Kesterson and recognition that stalemate is in no one's interest. It is probably not a core/secondary conflict, where Sabatier says more learning will occur (Hypotheses 3, 4, and 5 from Chapter 6).

Furthermore, one of the lessons of the drain case is that belief systems have several components. This would allow for compromises across core beliefs, like those contained in Miller's bill, a complication not entirely predicted by Hypothesis 6.

3. Beliefs versus self-interest--the importance of distinction

To me, the section above suggests that the major contribution of the Sabatier framework will be in its explication of the role of beliefs in influencing policy change in cases where beliefs are an overriding factor. This has been most clearly been true for the Bureau of Reclamation.

Compared to another politically conservative player, the Westlands WD, USBR has been incredibly inflexible in seeking alternatives to the drain. This may be related to the origins of beliefs for private versus public actors. That is, the purpose of the Westlands Water District is to reflect the economic and water interests of its members. Within certain constraints, Westlands
exercizes all kinds of tactical flexibility in promoting its interests. Ideology is important, but not overriding. Compared to a fully public agency like the Bureau, it is easy to portray the virtues of private enterprise, especially farming. There is no need for an elaborate belief structure of self-justification.

This is not the case with the Bureau of Reclamation. The reasons for this difference are described by Downs (1967). Bureaus are empowered with providing resources where the market cannot, and are dependent on public and congressional support for their existence. Bureau officials are aware that they must compete for funding, and that few politicians or members of the public can be expected to master the technical details of their performance and purpose. (For the Bureau of Reclamation, this has recently changed). In response to this situation, bureau officials develop qualitative descriptions of the importance of their mission; these become the bureau's "ideology." According to Downs, bureaucratic ideologies can have a life of their own, ending up as substitutes for other kinds of policy analysis.

This distinction between ideology and economic self-interest may serve as an important guide to the feasibility of "integrative compromises" like that described above. However, it is perceived interest which is important--this may account for the different postures of the Bureau and DWR.

DWR serves as an more valid comparison to the Bureau than Westlands. However, unlike USBR, DWR has learned that dam-and-diversion agencies devoted to engineering can retain resources and influence within a greater breadth of agency purpose. This is most likely the result of internal and external pressures on DWR.
during the 1970s. Though the Carter administration put tried to prevent the Bureau from building "porkbarrel" water projects, DWR faced greater forces for change--its director during the Brown administration was an environmental lawyer.

4. Focusing on beliefs as a circular argument

To use Sabatier's framework, one must be able to make statements about beliefs. The best way to understand actors' beliefs is to look at how they behave first, then observe the statements they make to justify their actions. In light of the fact that agencies don't often make statements about core beliefs in the general course of setting policy, there are not many other alternatives. This orientation is different from a content analysis approach, which may over-emphasize stated beliefs (intentions), compared to actual behavior.

However, any means of defining beliefs explicitly encounters a problem of circular argument. Sabatier's Hypotheses 1 and 2 are also definitions of the core/secondary distinction. Beliefs which actors are willing to fight over are defined as the core. Thus, any major battle in the course of evolution of policy becomes a clash between core beliefs. Sabatier suggests in Hypotheses 3, 4, and 5 that a clash between core beliefs will generate "more heat than light," and not result in as much policy learning as would otherwise be possible.

There are other factors which can mediate the effect of a clash between beliefs. Sometimes the confluence of "problems, policy and politics" (as thoughtfully considered by Kingdon,
1984) can make it obvious to an advocacy coalition that a defense of certain core beliefs will be fruitless. In this case, energy which would have been spent in an entrenched political and analytical battle is diverted to finding solutions which are in harmony with other core beliefs.

This is my interpretation of the discovery of Selenium at Kesterson. Despite periods of intense controversy over the Peripheral Canal, my perception is that most farmers in the valley understand that the era of new projects and ultra-subsidized water is over. Thus, they are looking for other ways to continue farming profitably, exploring terrain that was left uncovered in earlier years.

(I also believe that Kesterson should not be treated as the kind of surprise which is not likely to happen in other kinds of policy disputes. On the contrary, most policies which involve advanced technology and natural resources will have this character. In valley agriculture, there have been a long series of highly visible problems with pests and pesticides. These include the Medfly outbreak and spraying of the early 1980s; illnesses caused by pesticide-contaminated watermelons in 1985; an outbreak of the Japanese beetle and spraying in Sacramento neighborhoods the year before; and the discovery of nitrate-contaminated wells in Kern County. Problems in toxic waste, nuclear power, space programs and perhaps industrial plant closings may have the same "surprising" character. In fact, we may come to see the ability to plan for surprise as one measure of organizational learning itself).
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Appendix A: Components of Desalinization Process

source: Brian Smith, DWR
DESALTING FACILITY
Conceptual Process Flowsheet

- Marshes and Ponds
- Filtration
- Ion Exchange (Softening)
- Chlorination
- Desalting Units
- Product Water

- Solid Reactor Clarifier
- Evaporation Ponds
- Solar Ponds
- Power Generation

- Waste Brine
- Brine for Regeneration
- "Cold" Water
- "Hot" Water

From Drain

SAW LUIS DRAIN
The building in front of your houses the chemical laboratory. The laboratory is set up to analyze all of the parameters that are critical to the operation of the Demonstration Desalting Facility.

The purpose of having a chemical laboratory on-site is to avoid lengthy turn around times when samples must be sent elsewhere for analysis. Most constituents that are monitored on the site can be analyzed in less than 12 hours, allowing personnel to make immediate decisions on how well the plant is operating.

The laboratory is equipped with several sophisticated instruments, such as a Total Organic Analyzer, an Atomic Adsorption Spectrophotometer and Ultra-Violet Spectrophotometer. Also housed in the laboratory are two microscopes (a compound and a dissecting) for evaluation of the biological pretreatment system.

Not Open to tour
MARSH PONDS

Thirty marshponds along Highway 152 make up the biological pretreatment system. Each 430 foot long by 35 foot wide pond is planted with alkali bulrush, a native aquatic plant.

The drain water is pumped into the south end of each pond and flows by gravity to individual weir boxes at the north end. The alkali bulrush acts as a natural filtration network, reducing suspended solids and shading the water to inhibit green algae growth. At the same time, the plants provide a place for diatoms, a different type of algae, to grow. The diatoms are unique in that they take up silica, a troublesome mineral that can damage the reverse-osmosis units.

By adjusting flow rates and depths, an optimum operating mode will be determined for maximum removal rates of suspended solids and silica.

After leaving the marshponds, the water is routed to the gravity filters for further treatment.
The large, cylindrical structure in front of you is the solids reactor-clarifier. Drain water is pumped into the clarifier through an inlet on the side, while at the same time special chemicals such as alum and lime are added from the top. These chemicals are mixed and pumped from the chemical feed shed to your left.

The drain water/chemical mixture is slowly mixed by an agitator resembling a giant eggbeater. The agitation results in the chemicals causing clumping of the suspended solids that are in the drain water. The heavier combined particles then sink to the bottom of the clarifier while the lighter combined particles float to the top. These fine particles and the treated water are then carried to the gravity filter where the remaining particles are removed. Upon leaving the clarifier, sulfuric acid is added to the water to reduce the alkalinity to a neutral level (pH 7).
This small building holds the chlorination system. This system is very important to the overall operation in that chlorine gas is used as a disinfectant, killing algae and bacteria that are harmful to the desalting units.

From here, chlorine gas is combined with water, creating a mixture that is piped to various chlorination points in the facility. The first place this mixture is used is at the solids reactor-clarifier. The chlorine mixture is also added prior to marshpond water entering Gravity Filters 3 and 4.

Additionally, the chlorine-water mixture is added prior to Clearwells 1, 2, 3, 4, 5 and 6. This assures that, just prior to entering each RO unit, the feedwater will be free of algae and bacteria which may cause clogging of the desalting units.
The large, rectangular structure in front of you contains four gravity filters. Numbered from left to right, the first two filters (1 and 2) receive water from the marshponds. Filters 3 and 4 receive water from the solids reactor-clarifier. Filters 1 and 3 differ slightly from 2 and 4 by having different filtering media. Filters 2 and 4 have anthracite media with gravel while Filters 1 and 3 have a combination of sand and anthracite coal media with gravel. This will allow us to determine the best media for our particular needs.

The water enters the filters from the top, percolates down through the filter media and then through a surge tank and finally is stored in two tanks called clearwells. The filters must be backwashed periodically to clean the filter media. This is done by pumping some filtered water up through the filters, stirring the bed and releasing the solids that clog the filter. The backwash and clearwell system are located behind the filters.
REVERSE OSMOSIS UNITS

The large building you are about to enter contains the three reverse-osmosis (RO) desalting units. The units will work in series, each one operating at a different pressure and flow rate.

RO Unit 1 contains newly developed low pressure membrane units. Its product water capacity is 230,000 gallons per day and it operates at 250 pounds per square inch (psi).

RO Unit 2 contains conventional reverse-osmosis membranes and operates at 400 psi. The feedwater for Unit 2 is the leftover brine from Unit 1. Unit 2 will produce 76,000 gallons per day of fresh water.

RO Unit 3 contains seawater reverse-osmosis membranes and operates at 800 psi. As before, the feedwater for Unit 3 is the leftover brine from Unit 2. Unit 3 will produce 38,000 gallons per day of fresh water. The leftover brine is that used to regenerate the ion-exchange system.

Adding the product water capacities of the three units gives 344,000 gallons per day of fresh water. This is 90 percent of the 382,000 gallons per day which is introduced into RO Unit 1 at the head of the system. The use of stages operating at different pressures allows this system to use much less energy than conventionally designed reverse-osmosis systems.

At various points in the system, the feedwater to each unit is treated with various chemicals, including chlorine and acid and precipitation inhibitors.

These units have automated data collection systems, allowing the plant's data acquisition system to record the performance of the systems continuously.
The two units in front of you comprise the ion-exchange system. The system is actually two independent units, each capable of treating 200,000 gallons of water per day.

Each unit is basically a very large water softener. The drain water is very high in hardness, meaning there are lots of calcium and magnesium ions. If this water were passed through the RO membranes, calcium sulfate would precipitate and foul the membranes. This hardness problem is eliminated by the ion-exchange system. The drain water is pumped through the large blue tanks containing a bed of resin beads that have sodium and potassium ions attached to them. This resin has a higher affinity for the calcium and magnesium, so an exchange takes place, leaving sodium and potassium ions in place of the calcium and magnesium ions. The sodium and potassium ions pose no problems for the RO membranes.

The ion exchange units can be operated manually or by computer. Each unit has several flow and electrical conductivity meters connected at various stages of the process for ease in detecting possible problems.

The water to be "exchanged" or softened will come from Clearwells 1 and 2 (filtered solids reactor-clarifier and filtered marshpond water, respectively). The water leaving Clearwells 1 and 2 is dechlorinated to prevent damage to the resin. After softening, the water is stored in Clearwells 3 and 4 where it is chlorinated.

Eventually, the units must be regenerated to replace the previously absorbed calcium and magnesium with sodium and potassium. This will be done with the brine resulting from the desalting process which contains the sodium and potassium previously exchanged. This is a unique method of regeneration which allows the desalting plant to turn 90 percent of the feedwater into fresh water.
SOLAR PONDS

SALT-GRADIENT SOLAR POND SYSTEM

In the distance is the salt gradient solar pond system, still under construction. It consists of two half-acre solar ponds, two half-acre evaporation ponds, an operations building and office trailer and associated pumps, piping, and tanks.

This system will take the reject brine from the desalting process, concentrate it to a salinity of about six times that of seawater, and use it to convert solar energy into electrical power.

Salt-gradient solar ponds have a very salty (and therefore dense) bottom layer, covered by another layer of water that decreases in salinity from bottom to top. This gradient layer allows sunlight to penetrate to the bottom of the pond and heat the lower layer. Because each level in the gradient layer is heavier than the water above it, the layer can have no convection currents and thus insulates the bottom layer, trapping the solar energy stored there.

The hot brine in the bottom layer — about 185 degrees Fahrenheit — will be used to vaporize a fluid with a low boiling point, which will then spin a turbine connected to a generator.

In a full-scale desalting plant, solar ponds such as these would provide energy to operate the desalter and at the same time usefully dispose of the briny byproduct of the desalting process.

While most solar ponds in this country have been built for research purposes, the technology has advanced in Israel to the point where commercially usable quantities of electrical power are being produced at ponds near the Dead Sea.

The Los Banos pond system will demonstrate, among other things, the feasibility of using the salts found in the reject desalting brine in this innovative solar energy application.

Not Open to tour