Walter Huppert, Mark Svendsen, David Cone

Shifting Public and Private Roles in Maintenance Service Provision: California´s Central Valley

Division 45
Rural Development

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Table of Acronyms

BWD	Broadview District
CVP	Central Valley Project
CWP	California Water Project
DL	Delivery (Service)
DMC	Delta Mendota Canal
FWS	U.S. Fish and Wildlife Service
IMT	Irrigation Management Transfer
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
O&M	Operation and Maintenance
PI	Provision of Infrastructure
SLDMWA	San Luis and Delta-Mendota Water Association
USBR	United States Bureau of Reclamation

1 Introduction

1.1 Study purpose

Irrigation is a critically important contributor to the world's food supply. Without it hunger and famine would be even greater scourges than at present, and pressure on fragile lands and ecosystems would be more intense. And yet it is not an unmixed blessing. Irrigation is the world's largest single consumer of water and has a number of undesirable consequences. It is perceived to deplete soils, to induce waterlogging and salinization, to deplete groundwater, and to pollute aquifers and rivers with drainage effluents containing chemical pollutants from fertilizers, herbicides, and pesticides. Yet irrigation cannot simply be abolished or even substantially reduced. Sixty percent of the increase in grain supply needed to feed the world population in 2025 is expected to come from irrigated agriculture. Our only real option then, is to find ways to minimize the negative impacts of irrigated agriculture while employing it to produce the food needed by a still expanding world population.

Moving in parallel with the growing awareness of the negative environmental consequences of irrigated agriculture has been a shift from public to private sector management of irrigation service delivery. This steady withdrawal of government agencies from the irrigation management arena has created a critical but under-recognized need for public regulation of private irrigation management. Regulation is needed to constrain actions in irrigation practice that harm the present or future public welfare, with specific inclusion of the natural environment.

In spite of this obvious and growing need, is comes as a surprise that the topic of *regulation* and its consequences for irrigation have hardly been touched upon in the literature on irrigation management. In other fields in which private utilities provide a monopoly service, regulation is a central feature of the governance environment, as with private electricity suppliers. However, regulation has not become a central topic in the irrigation debate, particularly with regard to developing country irrigation.

In part this is because the debate about regulation in general has been dominated by legal studies and by political analysis, with some specialized contributions from economists concerned with the costs and benefits of deviations from a free market model (e.g. Armstrong et al 1994; Bishop et al 1995). Specialists in organization and management have been outside this discussion and as a result the topic has not made its way into irrigation discussions (Morgan and Engwall 1999).

This paper has three main purposes – first to illustrate a methodology for systematically describing and analyzing an institutional framework for irrigation service provision, second to document and illuminate the dramatic on-going evolution of water management institutions in California's Central

Valley, and third to raise awareness of the importance of regulation in irrigation management. The paper does so by looking at irrigation as a set of services exchanged among various actors and regards regulation as one of several mechanisms that govern the interaction between these actors.

The paper is one of a set of case studies prepared by the MAINTAIN project of GTZ. This project intends to provide conceptual and methodological approaches for the analysis of institutional arrangements in service provision for irrigation maintenance. The present case study uses and extends this framework, provides links to some of the recent literature on regulation, and illustrates its approach by pointing out the effects of certain regulatory interventions in the irrigation of the Central Valley of California.

1.2 Why California?

There are several reasons for selecting California as a case study site. First, California comprises a sophisticated economic environment in which primary mechanisms for change are managerial and institutional. Technology is important but responds to planning and economics and does not typically lead change. This simplifies the task of understanding the relationship between institutional frameworks and system performance.

Second, intense competition over water has emerged in what Seckler (1996) would call a *closed water system* – one in which there is little new water left to develop. This competition includes agricultural, municipal and industrial (M&I), and environmental interests and is driving rapid change in the institutions which allocate, regulate, convey, and use water.

Third, the responses to changing public priorities have been characterized by pragmatic problem-solving behavior. This has made California a virtual laboratory for innovative solutions to problems of water reallocation and management, environmental quality, efficient water use, and water quality management.

Fourth, environmental regulation has become a core issue in irrigated agriculture in California. Over the last decade, environmental concerns have led to rules and regulations on water use and allocation that place heavy burdens on irrigated agriculture. In the process, the landscape of groups and organizations involved in irrigation has changed, as have the roles and functions of many of these actors.

Fifth, as a result of the first four factors, lessons learned from studying change and responses to change in California can serve as a valuable source of innovative ideas for developing new institutional configurations in the face of increasing regulation in other settings. As always, such ideas must be evaluated in the new context and adapted to it.

1.3 Study approach

The methodology applied is relatively new and still evolving. It is being developed by the GTZ project 'Maintain', through original research and adaptation of concepts from other fields of study.[1] A number of core concepts of this approach are applied in this study. These include those of service relationships, multi-actor systems, governance mechanisms, and regulatory processes.

The study approach employed has five central features.

- It recognizes that a number of different actors are involved in operating and maintaining irrigation systems and that a useful understanding of O&M processes requires considering these multiple actors.
- It focuses on the interactions among these multiple actors rather than on their organizational structures and static interconnections.
- It examines the service relationships among actors at several different points in time to highlight changes, both in the set of actors involved and in their roles, powers, and actions.
- It gives particular attention to the governance mechanisms connecting and regulating the parties involved in service relationships.
- It focuses on the importance of external regulation in safeguarding external interests and conceptualizes regulation as a service provided to the general public.

To carry out the study, a team of two, a management specialist and an engineer, spent a week in the Central Valley interviewing stakeholders, reviewing documents, and visiting the field. A subsequent follow-up visit was made to clarify points that were still hazy. The approach required first identifying relevant stakeholders and then developing diagrams of service delivery systems representing the service interactions of the actors for different purposes and at different times. The services of primary interest were irrigation water delivery and system maintenance. However, understanding how these services are provided necessarily involved also analyzing revenue collection systems, governance mechanisms, and external regulation.

[1] See Huppert, 1997a; Huppert, 1997b; Huppert and Urban, 1998.

1.4 Preview of paper

The following section of the paper discusses concepts that are important in understanding irrigation from a service perspective. This is followed by a section giving an overview of the California water and agriculture situation. The next section describes the principal institutional actors involved in irrigation maintenance in the study setting. The following two sections deal with the services being exchanged and the service relationships by means of which the services are arranged, provided, and paid for. The final section presents two sets of conclusions – one set related to the case itself, and a second related to the study methodology.

2 Concepts

2.1 Services in irrigation

2.1.1 Overview

Operation and Maintenance (O&M) of irrigation infrastructure have long been looked upon exclusively as *tasks* or *functions* to be fulfilled by an irrigation organization. This still-common perception dates to the time when most large irrigation schemes where “managed” in their totality by a government agency. In such cases, the managers would plan and assign tasks to staff members and make sure that they were implemented accordingly to ensure effective and efficient O&M. However, the persistently poor performance of many agency-managed systems gradually raised questions with respect to such an “inward looking” perspective. The realization then grew that irrigation systems are more than just technical plants that, once properly designed, will function in an efficient way. The understanding that irrigation systems are supposed to provide particular *services* to farmers slowly gained ground. This position was reinforced by the attempt of many governments to reduce their role in irrigation management and transfer the provision of the related services to other service providers or totally to the farmers themselves.

Concentrating on *services* rather than focusing solely on tasks and functions adds an important dimension to the understanding of irrigation management. The question as to *how* to achieve good O&M is supplemented by the questions of *“by whom”* and *“for whom”* a certain service is supposed to be provided. What seemed to be a purely technical, financial and logistical matter suddenly takes on additionally the characteristics of a human interaction -- a relationship between a provider and a receiver, or, put differently, an exchange or transaction between two parties, each of which may be an individual, a group, or an organization.

Changing to such a perception of service provision in irrigation has several consequences.
First, it becomes apparent that operation and maintenance are not the principal services provided. Rather, it is infrastructure provision and irrigation water delivery that are the primary services.
Operation and maintenance are secondary activities which enable proper provision of the respective primary services. *Second*, policy decisions regarding irrigation management transfer (IMT) will have to consider the various services that appear after unbundling the “service package” described above. Only then will it be possible to identify and discuss the institutional requirements involved in devolving a particular service to new organizational entities, be they user-based or corporate.

Irrigation can be thought of in terms of four broad categories of services.

- Infrastructure provision services

- Delivery services
- Support services
- Third party services

These are described in the following sections.

2.1.2 Infrastructure provision services

The first service in time consists of making the infrastructure available for use, the *provision of infrastructure* (PI) service. For example, a road might be built by government for use by all motor vehicles, or a satellite might be launched by a private company to provide communication channels to those who wish to lease them. In some cases PI services may be divided into subsets. For example, one PI service provider might construct a railway, while another makes available rolling stock. PI services in road transport might include provision of the roadways themselves, provision of trucks, and provision of goods containers which the trucks carry.

2.1.3 Delivery services

Creation of infrastructure makes possible a second class of services, *delivery (DL) services*. These services comprise the delivery of a commodity or an intangible good according to a certain schedule by means of the created infrastructure. For example, delivery of drinking water by means of a buried pipe system, delivery of electrical current through a net of transmission line, or delivery of irrigation water by means of a network of irrigation canals are all delivery services.

Narrowing the focus to services provided by agricultural water control infrastructure, important DL services include irrigation water delivery, drainage water removal, and local flood protection. For analysis, these services can be broken down into component activities. For example, irrigation water delivery includes such activities as maintenance, water measurement, recordkeeping, gate operation, and demand assessment.

In such a context, maintenance[2] can be perceived as a service to the supplier of the infrastructure, since maintenance is required to keep the infrastructure in good condition so that it can be used to deliver a service to clients. Alternatively, maintenance may also be perceived as a service to the user of the infrastructure, enabling the user to deliver a certain good by employing this infrastructure. Whether maintenance is a service to the IP agent or to the DL providers is

[2] The term „maintenance“ in this context, if used in isolation, is meant to refer to maintenance, rehabilitation and modernization of infrastructure.

determined by the property rights associated with the infrastructure and by the terms of the agreement between these two parties. This opens the possibility that maintenance obligations may be split; the supplier of the IP service may remain responsible for maintenance related to the long-term preservation of the infrastructure asset, while the provider of the DL service may be responsible for maintenance related to day-to-day operation of the infrastructure facility.

In any case, maintenance may be perceived of as a component of the IP service, the DL service, or both. Maintenance may be either an internal service provided by the IP or DL provider itself, or it may be an external service supplied by an outside contractor. The level and quality of the IP and DL services are strongly influenced by the level and quality of the associated maintenance services.

2.1.4 Support Services

Generally, a number of other services are required to enable and facilitate the primary IP and DL services described above. These include engineering design, contracting, billing, budgeting, financial management, coordinating with other actors, public relations, and so on. We term these supporting services and distinguish them from delivery services in terms of the directness of their relationship with the process of arranging and providing the irrigation water to clients. While measurement of water flows is an integral part of delivering irrigation service, preparing bills for the service is only indirectly related and is considered a supporting service. External organizations and groups are sometimes called upon to provide these supporting services, though they can be supplied internally as well.

These considerations show that a wide range of different types of services are required to produce a single DL service, such as irrigation water supply. These can be seen as chains of services; infrastructure provided by one service provider (IP service) enables the supply of particular delivery services to clients (DL services) which may, in turn, requires certain supporting services (SP) in their provision.

2.1.5 Third party services

There is a third group of services that are – as odd as it may sound - not demanded at all by those whom they target. Such services aim to induce a change of behavior in the target group, and in so doing provide a service to a third party. In general this third party, the real client, is the public. If we think of police activities as a service provided to the general public, then a particular police action, e.g. issuing a ticket to a driver who has exceeded a speed limit, aims to bring about a change of

behavior (in this case the behavior of the driver of the car) that is desirable from the point of view of the public at large, which is the client. Such third party services hence involve not just a service provider and a client but are aimed at a target group (the third party) whose behavior is to be changed by the service intervention. The concept of third party, or "influencing", services[3] is an important one when we consider service provision in the realm of environmental protection. Such "environmental services" are generally provided for the public and for future generations while the provision itself is geared to change the behavior of particular actors that may cause harm to the environment.

2.2 Governance Mechanisms

While the terms "irrigation management" and "water management" are still widely used, their meaning has become blurred in recent years. The term "management" makes sense when looking at single organizations, however it looses its descriptive rational when referring to chains or networks of independent organizations or organizational units. When there is no common management to set overall goals and to assign tasks and resources, the question arises who or what can substitute for "management" and coordinating leadership. The answer is that exchange processes between two or more independent organizations require *governance mechanisms* to provide the rules of the game. In this sense, governance mechanisms are understood to be laws, rules, regulations, procedures and common practices that influence and control the interaction between individuals or organizations in exchange relationships.

It is useful to differentiate between *internal* and *external* governance mechanisms. When we speak of *internal* governance mechanisms, we refer to rules, procedures, processes and common practices that are based on formal or informal agreements or contracts between the two exchange partners. For example, if a water utility provides water to a user group, the internal governance mechanism that guides this service provision may consist of a detailed formal contract that specifies on one hand the discharges and volumes to be delivered, the points and times of delivery, and other agreed upon conditions relating to water delivery. On the other hand, this contract might define the water pricing scheme, e.g. increasing block rates, conditions of payment, and ways of resolving conflicts.

External governance mechanisms, by contrast, are imposed by external actors on one or both exchange partners. In the example of the water utility, an external governance mechanism might consist of a limitation set by a regional water authority on the permissible level of groundwater extraction by the utility.

[3] See Huppert et al (1998)

2.3 Regulation

The external governance mechanism of particular interest in this study is *regulation*. As mentioned in the introduction, the topic of regulation has been widely neglected when dealing with issues of irrigation management. *Morgan and Engwall*, who point out that there are but a few articles on regulation in the main journals on organization and management in the UK and the USA, note the following.

"There is clearly a failure to develop a common research agenda or conceptual framework which enables the theme of regulation to be made directly meaningful to the field of organizations and management." (Morgan and Engwall, 1999)

When we look for definitions on regulation, the most common understanding of regulation is probably the following.

"Regulation is usually defined as the government...directly prescribing and proscribing what private sector agents can and cannot do, so that their actions do not contradict the ‚public interest' " (Chang, 1997).

A more progressive concept of regulation is presented by *Morgan and Engwall (1999)*. Their understanding of regulation is fruitful to studies of organization and management and can easily be used in the context of the service delivery framework presented here. They draw attention particularly to two points. The **first** is the importance of seeing regulation as a process with an output defined as *"the impact which regulation has on social, economic and political relationships."* The **second** point they emphasize is that regulation is *"a process involving various actors in attempting to create orderly relationships between firms, markets and organizations…."*

Translated into the terms of the service delivery framework presented here, these statements mean two things. First, regulation needs to be understood as a "third party service" as defined in section 2.1.5 above. Such a service is a process with the desired output of changing behaviors, and hence relationships, such that they correspond more closely than before to a specific notion of public interest. Second, regulation can be understood to be a governance mechanism in the sense described above, i.e. a mechanism that helps to create „orderly relationships" between the parties involved in a service interaction.

The concept of regulation for Morgan and Engwall, though, is comprehensive. *„The broad concept of regulation can be understood as referring to all the formal and informal norms and expectations which social actors generate about how to act in particular contexts. It also refers to the*

mechanisms which are generated to monitor conformance with expectations and the rewards and disciplinary systems developed to ensure conformity." (Morgan and Engwall, 1999)

In their usage, the term „regulation" encompasses the whole range of governance mechanisms touched upon previously. For our purposes, we restrict the meaning of the term to *external* governance mechanisms introduced by government action. However, the notion of these authors reminds us to keep in mind the two aspects of regulation: its function as a governance mechanism and its service delivery function in providing a third party service to the public.

3 Overview of California irrigation

3.1 Hydrology

California possesses abundant water resources. However, most of the state's precipitation falls in the northern part of the state, while two-thirds of present demand is concentrated in the South. Most of the precipitation falls as snow in the mountains of Northern California and in the Sierra Nevada range, which comprises the high backbone of the state running from north to south along its eastern flank (map 1). A second range of much smaller hills, the Coastal Range, fronts the narrow coastal plane in the West creating a broad alluvial valley between the two ranges. This Central Valley is an area of rich soils and favorable growing conditions for a wide variety of crops.

Snowmelt gives rise to two major river systems in the Central Valley, the Sacramento River draining the north, and the San Joaquin River draining the south. The two rivers meet in the Sacramento-San Joaquin Delta (the Delta), an inland extension of San Francisco Bay.

Rainfall in the Central Valley itself ranges from 5 inches (127 mm) in the southern end to more than 30 inches (762 mm) in the north. Three-quarters of this rainfall occurs in the five months between December and April when evapotranspirative demand is low.

3.2 Water projects

The fact that two-thirds of California's water is in the north, while the bulk of agricultural land and the largest population centers are in the south has led to two massive engineering projects designed to transport water from north to south. These are the Central Valley Project (CVP) and the California Water Project (CWP).

The CVP was constructed by the Bureau of Reclamation, the federal irrigation construction agency, in the 1940s. It began life as a comprehensive water resource development plan for the Central Valley put together by the State of California and approved by the state legislature in 1933 but remained unfunded due to the onset of the great depression. It was picked up by the federal government in 1935 as a part of the massive depression-era public works program.

The project is anchored by Shasta dam in the Cascade Mountains in Northern California, which stores water for use to the south. Construction on Shasta was begun in 1938 and completed in 1945. Water from Shasta and several smaller dams is routed down the Sacramento River to the Delta, which it crosses in the Cross Delta Channel. Some of the water is used to irrigate land along the Sacramento River to the north, but most crosses the Delta to be lifted 197 feet (60 meters) by the Tracy Pumping Plant into the Delta-Mendota Canal (DMC). The Tracy Plant, completed in 1951, contains six centrifugal pumps, each 84 inches (213 centimeters) in diameter and powered

by a 22,500 horsepower electric motor. Together, these pumps can lift 4,900 ft^3/s (130 m^3/s) to the canal head about 1 mile (1.6 km) away. Power to operate the pumps is available from Shasta and three other CVP dams through three 230 KV transmission lines.

The DMC, also completed in 1951, is a contour canal carrying the lifted water 117 miles (188 km) to the south along the Coastal Range foothills where it empties into the Mendota Pool of the San Joaquin River. At the 70-mile point of the canal, an off-take for a large pump storage facility, the San Luis Reservoir, allows for additional storage and power generation. All but the final 18 miles of the DMC is concrete lined[4]. The initial capacity of the canal is 4,600 ft^3/s (126 m^3/s). Radial gate check structures control water elevations at approximate 5-mile intervals along the canal for irrigation operations along the canal's route. The DMC supplies water to 32 irrigation districts in the San Joaquin Valley. On average, the CVP supplies just over 6 million acre-feet (7.4 billion m^3) of water each year to irrigated agriculture.

The second project, the CWP, was developed by the State of California. It parallels the DMC initially before continuing on to southern California. Its primary purpose is to transport M&I water to desert cities in the south, principally the greater Los Angeles area.

3.3 Agriculture

These two projects, particularly the CVP, have helped make California one of the most productive agricultural areas in the world. The state produces more than 300 agricultural commodities and agriculture generates more than $100 billion in economic activity annually. Eight of the nation's top 10 agricultural counties are in California, and six of these are in the Central Valley. About 30 percent of California's 29 million acres (8.7 million hectares) of farmland is irrigated, and this land produces 81 percent of the state's agricultural revenue.

3.4 Shifting Priorities

From the earliest days of California's discovery and settlement by European explorers and colonists, livelihoods were based on the state's rich natural resources. In the agricultural arena, waters were diverted, rivers contained with levees, and lands cleared, plowed, and put to producing crops for local and distant markets. Since that time, the state's population has grown to more than 32 million, and the value of the goods and services that it produces exceeds that of all but the largest of the world's countries. In spite of the productivity of its agriculture, only a small fraction of the state's population is currently engaged in agriculture, or any other natural resource-based pursuit, and the great majority live in large urban concentrations. Moreover the extensive modification of the natural environment by human activity, from mining, to agriculture, to

[4] This 18-mile section runs through an area of expansive clays which make concrete lining infeasible, and a compacted earth lining is used instead.

constructing urban mega-cities, has put very significant pressure on the natural resource base of the state. This has lead to a significant shift in public priorities relating to the state's natural environment and pressure towards reallocating water to new uses – notably urban water supply and the environment.

4 Principal Actors

4.1 Broadview Water District

There are two basic types of districts providing irrigation service to agriculture – irrigation districts and water districts[5]. A key difference between the two is the composition of the membership group. In a water district, memberships consists of landowners, while in an irrigation district, the members of the district are the cultivators. Both types are common throughout the state. The Broadview Water District (BWD) was formed in 1955 under California statue to provide irrigation water to 10,000 acres (4,000 hectares) of rich flat farmland near Fresno. The area had formerly been a part of the neighboring Westlands Water District, but separated itself to gain access to new water supplies from the recently-completed Delta-Mendota Canal. New water supply and conveyance facilities for Broadview were constructed by the BWD using the proceeds from a sale of tax-exempt bonds. The system was enlarged in the late 1960s with zero-interest financing obtained from the Bureau of Reclamation. An outlet for the drainage system was constructed in the early 1980s using funds from advance payments by some landowners and the sale of additional tax-exempt bonds. Periodic rehabilitation and improvements have been financed from bond sales and special assessments charged to farmers (Cone and Wichelns 1998).

The district has a water supply contract with USBR for 33.3 million m^3 of surface water per year, though it may receive less than this amount in the event of state-wide water shortages or environmental restrictions. This gives the district a nominal water duty of 833 mm/year. This water is lifted from the DMC by a district-owned pumping plant on canal-side land leased from the federal government. Groundwater underlying BWD is not suitable for irrigation due to high concentrations of naturally occurring salt and boron. Shallow groundwater is saline and farmers have installed subsurface drainage systems under about three-quarters of the district to remove saline water from the root zone. Drained water, combined with surface drainage, is discharged into the San Joaquin River. Since 1987 BWD, along with other CV irrigation districts, has been required to incrementally reduce drainage discharges to the river by state environmental regulators (Wichelns et al, 1995).

The water distribution system layout consists of a single main canal just over 4 miles (2.4 km) long running up-grade, with water lifted at six pumping stations into level reaches above each station (Map xx). Fields, most of which are laid out as uniformly-sized squares one-half mile on a side[6], are supplied from 8 laterals, the longest of which extends for 4.5 miles (2.8 km). Laterals are laid

[5] A third type, the utility district, generally provides water to urban consumers.

[6] These are called quarter-sections, where a section is one square mile. A section contains 640 acres and a quarter section hence contains 160 acres (65 hectares).

out at right angles to the main canal, and while the overall system is irregular in outline, its internal structure is rectilinear. Water is delivered to farm turnouts by gravity flow.

Major crops in the district include cotton, processing tomatoes, cantaloupes, seed alfalfa, and wheat. Average rainfall is just 203 mm and most of this falls during the cool season between October and March. Average seasonal water requirements for the crops grown range from 305 mm for cantaloupes to 993 mm for seed alfalfa, and nearly full irrigation is essential for cultivation (Wichelns et al, 1995). The average value of crops grown in the district is about $12 million. There are 18 farmers in the district, operating farms that range in size from 238 acres (96 hectares) to 1,280 acres (518 hectares). Most farmers lease land from one or more of the area landowners. Seventeen of the 18 also farm land in other districts (Cone and Wichelns 1998).

The BWD is governed by a 5-member board, elected from among the 28 landowners in the district[7]. Board members serve without pay or other compensation. The board meets monthly and sets operating policies; approves plans, budgets, and assessments; approves financial operations; and hires the district manager. The district employs a manger and a staff of 6 to provide water delivery, maintenance, and other services. An organizational chart is shown in Figure1 in chapter 6.1.1. The annual budget of the district is approximately $1.4 million.

4.2 U S Bureau of Reclamation

In 1902 the U S congress passed the Reclamation Act, establishing the United States Reclamation Service, later renamed the Bureau of Reclamation. Its mission was to stimulate Western growth and development by constructing a system of irrigation works for the storage, diversion, and development of Western[8] water resources. By this means, the arid west would be “reclaimed” or made useful for settlement and habitation and would yield livelihoods for the new settlers. The economic depression of the 1930s was the stimulus for a huge acceleration in the pace of Western water development. The New Deal programs of President Franklin Roosevelt, introduced soon after his taking office in 1933, led to massive increases in storage capacity available to supply water for irrigation in the West. By the end of the 1970s, the area irrigated by Bureau facilities had grown to nearly 5 million hectares.

The Bureau of Reclamation is an organizational unit of the Department of the Interior and is responsible to the Assistant Secretary for Water and Science, who reports to the Secretary of the Interior. It is headed by a *Commissioner*, who is appointed by the White House, subject to Senate confirmation. Funding for the Bureau is contained in the annual appropriations act passed by the

[7] Only 5 of these landowners are farmers. The remainder lease their land to others to farm.

[8] The West is defined as the 17 continental states lying largely west of the 100th meridian and is the Bureau’s assigned area of responsibility. This corresponds roughly with the portion of the United States in which agriculture is risky or impossible without the benefit of irrigation.

US Congress. In the West, the Bureau is organized into 5 regions, but substantial power has been delegated to a larger number of area offices. The regional office nearest to the Broadview Water District is located in Fresno, 40 miles (67 km) to the east.

For the first 80 years of its existence, the Bureau of Reclamation was an organization focused tightly on planning, designing, and constructing irrigation projects and multi-purpose projects with major irrigation components. So complete was this focus, that from the beginning, reclamation policy has been to create farmer-controlled irrigation districts prior to system construction and to transfer operation and maintenance responsibility to the districts soon after completing construction. The Bureau has thus never been extensively involved in managing irrigation systems, as have the irrigation agencies in many countries. The Bureau has often continued to manage major impoundment and primary conveyance facilities, however, delivering bulk water supplies to irrigation districts and other users. In addition, along with the recent virtual elimination of its earlier role of designing and building major water resource projects, the Bureau is increasingly cast as a regulator of the locally-controlled entities established to manage and operate Reclamation-built facilities.

4.3 San Luis & Delta-Mendota Water Authority

The San Luis and Delta-Mendota Water Authority (the Authority) was established in January 1992 by 32 water agencies which supply water to about 2.1 million acres (850,000 hectares) of land, primarily in the western San Joaquin Valley. The agency's purpose in establishing the Authority was to assume operation and maintenance responsibilities for certain Central Valley Project (CVP) facilities from the Bureau of Reclamation. The motive was the belief that the Authority could operate the facilities at a lower cost that did the Bureau, a cost that was being borne by the founding water agencies. Districts also believed that they could better assure the long-term reliability of the facilities. In October 1992, the Authority entered into a phased cooperative agreement with the Bureau under which it assumed progressively greater responsibility for CVP facilities.

In addition, the Authority has assumed representative and informational responsibilities on behalf of its member agencies. It develops and provides information to legislative, administrative, and judicial bodies relative to water quality and volume issues, development, conservation, utilization and drainage, contractual rights, conjunctive surface and groundwater management, and other common interests of the member agencies. It also represents the interests of its district members in regulatory and legal proceedings.

The Authority is governed by a 19-member board comprising elected board members or appointed staff members of the component water agencies. The overall service area of the Authority is divided into 5 divisions, with a proportional number of board members selected from within each

division. The Authority began operating with 25 full-time employees in October 1992 and currently employs 88 regular full-time staff members. Its annual budget is approximately $10 million.

4.4 Supporting Actors

4.4.1 Central Valley Project Water Association

This is an association comprising all of the districts receiving CVP water supplies in both the Sacramento and San Joaquin Valleys. It is governed by a 16-member board representing specific regions within the CVP service area and meets monthly to address current water supply and policy issues. A primary function is to represent agricultural districts in discussions and negotiations with the Bureau of Reclamation (Cone and Wichelns 1998).

4.4.2 San Luis and Delta-Mendota Water Association

This was the predecessor organization to the Authority. It was an informally organized group of water districts which met monthly to exchange information and a lunch. Its character changed significantly when it was reconstituted as a joint-powers Authority to manage the Delta-Mendota Canal.

4.4.3 National Marine Fisheries Service

The National Marine Fisheries Service (NMFS) is part of the National Oceanic and Atmospheric Administration (NOAA) within the U. S. Department of Commerce. It was established in 1871 to try to reverse food-fish declines in the Atlantic Ocean off the New England coast and today has a variety of roles related to managing and sustaining living marine resources and their habitat in U. S. coastal waters. Its responsibilities include researching the biology and habitat of marine animals, protecting endangered and threatened marine species and their habitats, and enforcing fisheries laws.

NMFS is important to water resource managers in the West because of the long and continuing decline in many salmon stocks in the region. Salmon are known as anadromous fish, hatching in fresh water but making their way to the sea to mature and then returning to fresh water to spawn. It is because of this marine sojourn that they fall under the mandate of NMFS. A variety of human-caused changes in their freshwater habitat, including the construction and operation of storage reservoirs and water withdrawals for irrigated agriculture, is partially responsible for the declines.

4.4.4 Fish and Wildlife Service

The U. S. Fish and Wildlife Service (FWS), as is the Bureau of Reclamation, is a part of the Interior Department. Among its key functions are enforcing federal wildlife laws, protection endangered species, managing migratory birds, restoring fresh-water fisheries, and conserving and restoring

wetlands and other wildlife habitat. It has responsibility for enforcing provisions of the ESA relating to species other than salmon.

5 Services

The California political and institutional environment is a complex one and there are a great many services centered around water which are provided and exchanged. In this case study we will focus on the primary services of water supply and facilities maintenance, bringing into the analysis other supporting services as appropriate.

5.1 Infrastructure Provision

The infrastructure allowing provision of irrigation service to BWD farmers falls into four categories. In the first category are the facilities which capture and store seasonal runoff in the northern California Cascades and convey it southward to the Delta. These include Shasta, Trinity, and Keswick Dams and the Sacramento River and its controlling works. These facilities were constructed by the USBR in the 1930s and 1940s.

The second category consists of facilities which convey the water southward to the agricultural lands of the San Joaquin Valley. These facilities comprises the Cross Delta Canal, which carries water across the Delta from the Sacramento River, the Tracy pumping plant which lifts it out of the Delta, the Delta-Mendota Canal which carries the water southward. The facilities were also constructed by the Bureau of Reclamation and completed in the early 1950s.

The third category comprises facilities, authorized in 1960, that provide off-line storage for both DMC and California Aqueduct water behind San Luis reservoir in the coastal range on the west side of the Valley. These facilities were constructed jointly by California and the Federal Government, the latter represented by the Bureau of Reclamation.

The fourth category of facilities comprises those that lift water from the DMC and deliver it to BWD farmers. These facilities were constructed by the BWD in the 1950s and financed by the sale of tax-exempt bonds.

As is evident, the facilities which provide irrigation service to Broadview farmers have a complex history and were provided by several different parties. However the broad outlines of the overall plan were envisioned in the Central Valley Project design, which was undertaken by the State of California. The Bureau of Reclamation was involved in providing all four categories of facilities to a greater or lesser degree, by providing variously planning, design, construction, and financing services. The Bureau role in providing DWD facilities, though, was quite limited.

5.2 Delivery Service

The primary delivery service provided employing the infrastructure described above is timed and measured volumes of water delivered to specified hand-over points in the conveyance system. In association with this primary service, maintenance services preserve the ability of these facilities to provide the water delivery service.

Delivery services are provided by different actors indifferent portions of the system. Capture and storage facilities in the north are operated and maintained by the Bureau. Conveyance facilities which supply BWD and other districts in the San Joaquin Valley are operated and maintained by the SLDMWA. The BWD supplies water distribution services to its members and maintains associated facilities. Although the outlines of this division of responsibility are clear, there are exceptional cases where operation and maintenance of particular facilities are the responsibility of different actors and where complicated cost and responsibility sharing arrangements are in place, as with the operation of the San Luis reservoir. Relationships are generally governed by formal contracts among the involved parties, a topic discussed in greater detail under *Service Relationships*. These relationships continue to change with time, with increasing responsibility shifting to locally controlled organizations such as the Water Districts and the SLDMWA.

Another delivery service supplied by collective actors is drainage. The BWD provides collector drainage service to individual farmers and a collector drain outfall to the San Joaquin River. The Authority maintains the San Luis Drain, which collects drainage outflows from a portion of the command area.

5.3 Support Services

Support services related to two locally controlled organizations (BWD and SLDMWA) can be divided into two groups. The first comprises specialized hired-in services which cannot be economically provided internally. In most cases, the organizations hire such services to supplement their own efforts to provide a broader and more inclusive service to their members. This group includes electrical service and other utilities purchased by the two organizations, insurance coverage, representation, and specialized construction services[9]. A list of the hired-in construction services used by the Authority in recent years is shown in an Annex.

The second group comprises supplementary supporting services provided by the two organizations to their members – farmers and landowners in the case of the BWD and districts in the case of the Authority. The most important of these are information and representation services.

The information and representational services provided by the Authority to its 32 member districts is of increasing importance. These services include recordkeeping and filing submissions with the Bureau and other regulators on behalf of the districts, monitoring legislative and regulatory actions and keeping districts informed of changes and impending

[9] A variety of other standardized goods and services procured through ordinary market mechanisms are not discussed here.

changes, and legal representation in proceedings which affect the districts as a group. These functions now consume about 50% of the total Authority budget.

BWD provides an information exchange service by organizing workshops for farmers and landowners. For example, in recent years the District has conducted numerous drainage management workshops to discuss changes in federal and state water quality criteria which affect the ability of BWD farmers to discharge drainage water into regional ditches. Workshops are typically well attended and also provide a valuable source of information on problems and possible solutions to the board and the district manager (Cone and Wichelns 1998).

5.4 Third party services: regulation

Regulation by public agencies can be considered to be third party services provided to the general public, as outlined above. Prime examples of this type of service are protections provided to endangered species of plants and animals by federal and state government agencies. Farmers may benefit from these services in their roles as members of society but not necessarily in their roles as water users. As water users, though, they may be affected by the provisions of regulations which intend to change their behavior. Other types of regulation, such as rules that govern water quality, may provide direct benefits to water users by, for example, limiting industrial and municipal waste discharges into waters used by downstream irrigators.

Water-related regulations often require responses from water users and cause them to bear certain costs. Because the burden of regulation is a cost that society imposes on those who practice irrigated agriculture, responding to regulatory requirements on its farmers' behalf can be considered a service provided by service delivery organizations to their members. This service is chained to the regulatory service provided by state and federal government entities and provided to the public at large.

Considering the Central Valley as a whole and the Broadview Water District in particular, current regulation relates to two types of environmental externalities. First, regulations under the Endangered Species Act aim for modified reservoir operation rules and result in a reduced water supply to irrigating farmers in the San Joaquin Valley. Second, federal and state agencies regulate closely the quality of surface and subsurface drainage from irrigated land to waterways or groundwater. Untranspired irrigation water passing through a crop root zone picks up agricultural chemicals, such as pesticides, herbicides and fertilizers, and transports them downward to groundwater or into drains, streams and rivers. Such flows can also mobilize and transport naturally occurring elements in the soil. This last item is the case in the Broadview District, where natural boron contaminates drainage effluents. Government regulation limits the amounts of boron that may be discharged in a certain time span. This in turn creates pressure to reduce water application, as this is one of the least expensive ways of reducing contaminant loads in drainage return flows.

In the case presented here, the San Luis & Delta-Mendota Water Authority is the body charged with responsibility for monitoring and mitigating drainage quantity and quality problems. This devolution of responsibility is effective because fines levied on the Authority by regulatory authorities have the effect of increasing the cost of water to each individual farmer in the involved Districts. The Authority and the associated Districts are not so large that free-riding, in terms of flouting association policies and requirements, can be successful.

6 Changing Service Relationships

Service relationships have undergone some significant changes since BWD began operating in 1956. Three different periods in its history can be identified, differentiated on the basis of relationships linking the major actors in providing water delivery and maintenance services. In addition a fourth configuration represents the desired future situation for which BWD and its fellow districts are currently aiming. Each of these periods is represented by a diagram in which services are shown by arrows and governance mechanisms by numbered squares. The width of the service arrows represents their approximate importance in each period.

The driving force for these changes has been the shifting role of the US Bureau of Reclamation from an organization focused on planning, designing, and constructing irrigation and multi-purpose projects to a two-part role as a service provider. The first part of this new role is the provision of bulk water supplies to "wholesaling" entities such as SLDMWA. The second part is a regulatory service provided to the general public and directed at the Water Districts. The general effect of this evolutionary path has been to simplify arrangements among the parties and increase transparency and accountability. Because the larger operating environment has become vastly more complex in the course of these changes, however, the task of providing water delivery and maintenance services is far more challenging now than it was in earlier years.

6.1 Period One: 1956 to 1992

During this period, service relationships were relatively stable, with the BWD's primary external partner being the Bureau of Reclamation. Environmental issues had yet to have a major impact on water operations in California and the Bureau performed in its traditional role of bulk wholesaler of water to water districts. It operated and maintained water supply facilities from Shasta Dam to the BWD intake and received a payment from the district in return.

Payments to the Bureau from water districts included components for operating costs and for capital cost reimbursement. Capital repayments were for the portion of the cost of major water control and distribution works which were allocated to irrigation and for any federal funds which Districts might have borrowed to develop facilities within their districts. Although other funding flows have changed during subsequent periods, capital cost repayments by the districts have continued to flow to the Federal Treasury via the Bureau of Reclamation.

6.1.1 Relationship 1

The basis of the relationship between BWD and the Bureau, as shown in Figure 1[10], was a negotiated agreement, marked with a square and the number 1 in the figure, termed a water service agreement. This 25-year agreement for water service to the district specifies the terms of service to be provided and the payment required. The service provided by the Bureau was the delivery of water to the District intake. Since the Bureau owned and operated the different parts of the infrastructure itself, maintenance of the associated storage and conveyance facilities at that time was an internal service of the Bureau. Payments for water delivery (f_1) were made by the District to the Bureau, but significantly, these payments were passed directly on by the Bureau to the United States Treasury where they became a part of general public funds. The Bureau received its operating budget annually in a congressional appropriation unrelated to payments received under water service agreements. A primary accountability linkage between the Bureau as a service supplier and the BWD as a user of this service was thus incomplete.

The water service agreement was undergirded by the standard set of federal laws governing contracts which constitute supplementary governance mechanisms. Discussions were usually sufficient to resolve differences, however threats of legal action were a fall-back mechanism for resolving differences on both sides.

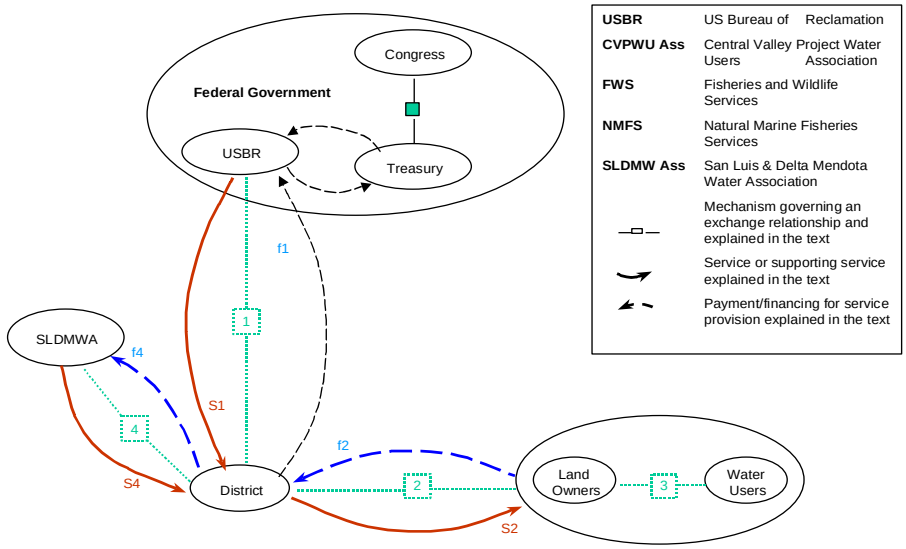

Figure 1: Exchange Relationships in Period 1

[10] This and subsequent drawings show only payments for operating costs, leaving aside capital cost repayment flows in the interests of simplicity.

6.1.2 Relationships 2 and 3

The second relationship was that between the District, on one the hand, and landowners and water users on the other. The terms of the law under which the District was formed specify that the district is formed by, and facilities created belong to, the landowners of the district. The value of the district's water right and its facilities are thus capitalized into land values. Landowners were responsible for repaying bond indebtedness and loans taken out to improve the system, as these are improvements attached to land. Farmers who rent the land and use the water, on the other hand, are responsible for paying the costs associated with providing the irrigation service. Payment included both operating and maintenance costs. Mechanism number 2, therefore includes two parts. The first part comprises the agreement which formed the district and which ties ownership and control of district facilities and its water supply to the land. Payments for infrastructure creation (f_2) flow from the landowners to the District. The second part of mechanism 2 comprises the annual agreements for water service between the District and farmers who operate land within the District, which are unwritten but nonetheless clear and explicit.

The relationship between the BWD and its clients also includes mechanism 3, which comprises the lease agreements between landowners and farmers. Lease agreements generally specify that farmers must pay for irrigation service in addition to paying land rent to the landowner. In addition to water supply and maintenance services, the District also provided information and representation services to landowners and farmers as well as main drainage service[11]. Mechanisms 2 and 3 thus work together. Primary and support services are provided to both landowners and farmers. Payments are made by both parties, but district governance is provided by landowners through the elected governing board. Relevant provisions of state law and the state court system create the governance context in which the agreements operate. These paired relationships have remained stable and constant throughout all three periods analyzed here.

6.1.3 Relationship 4

Mechanism 4, the relation between the district and the San Luis and Delta-Mendota Water Association was a relatively simple one during this period, with the Association simply providing a forum for exchanging information. Dues were relatively low, and the executive director, who was also the head of one of the member districts, served on a voluntary basis. Informal social ties provided the necessary governance mechanism. District managers and some board members would gather about once a month for lunch and informal discussion. Sometimes politicians or government administrators would be invited to make presentations, as when the Commissioner of the Bureau of Reclamation visited and was invited to address the group.

[11] Until 1983 all drained water was recycled. In 1982, the district completed a drainage outfall, which allowed the export of low quality drainage water.

6.2 Period Two: 1992 to 1998

In this period significant changes took place in the organizational setup. The driving force for these changes was a major restructuring of the Bureau of Reclamation. These reforms, started already in 1987/88 and carried on in 1993/94, were based on the premise that the Bureau would have to cease being a water resource *development agency* and remodel itself into a water resource *management* agency. The cumulative effect of these reforms was a 25% reduction in Bureau staff, a simplified and "flattened" organizational structure, a drastic simplification of administrative and review processes, delegation of greater authority to the field, and a new, flexible, and financially-conscious operational mode within the various branches of the Bureau, particularly its central technical wing (Svendsen, 1997).

Concomitant with these changes, the Bureau was required to expand its role as a regulator and overseer. Around this same time, the regulatory role of the National Marine Fisheries Service (NMFS) with respect to central valley water districts became more important. The immediate cause of this was the listing of winter run Sacramento River salmon as endangered under the federal Endangered Species Act. Under this act, when an endangered species, in this case the run of salmon, is affected by a "discretionary action" of a federal agency, the agency must consult with the appropriate federal service responsible for that species, in this case NMFS. In the event that the Bureau, following informal negotiations, cannot agree with NMFS or FWS over a proposed Bureau decision such as reservoir release patterns, the decision is referred to a high-level Endangered Species Committee which includes the Secretaries of the Interior and Commerce among others. In the present case, this consultation led to changes in Shasta reservoir operating rules and resulted in a reduced water supply to San Joaquin Valley farmers in most years.

Although there is no direct agreement between the Bureau and the NMFS, the provisions of the Endangered Species Act link the two together through a discretionary actions taken by the Bureau which might affect listed species. Thus, though there was no formal change in the relationship between the two agencies, regular additions to the list of endangered species have increased their level of interaction significantly (mechanism 5). Using the terminology we have introduced in the conceptual part of this paper, this meant that the NMFS provided a third party service to the public by forcing the Bureau to take on a regulatory role. This role included significantly restricting the quantity of water delivered to irrigated agriculture. In the eyes of the irrigation districts, the Bureau, which in the past had represented their interests, now began to serve other clients -- the public and the environmental community.

This change of role by the Bureau gave further momentum to the ongoing evolution of the SLDMW Association into an Authority with important management powers and responsibilities. The newly constituted Authority took over from the Bureau responsibility for operating and maintaining most of the bulk water delivery facilities between the Delta and the intakes of its member districts. The way for this shift had been paved by the assumption of management responsibilities for the DMC by the Central California Water District in 1988. This district, one of

the 32 which went on to form the Authority, operated the canal, and other facilities until 1992 when responsibility was assumed by the new Authority. It did this under a contract with the Bureau which specified operational rules and maintenance protocols.

The Authority was established in 1992 under a governing board made up of district representatives as described earlier. In October of that year, it entered into a phased cooperative agreement with the Bureau to operate and maintain various facilities comprising the southern part of the Central Valley Project. Over the next four years facilities were gradually added to its mandate until, by 1996, virtually all of the CVP water conveyance and control facilities south of the delta were under its charge, including the pumping plants.

This transformation radically altered the relationships between the districts and the Association/Authority and between the Authority and the Bureau. What had been a very informal low-key governance relationship (mechanism 4) between the District and the Association now became formalized into a set of important governance mechanisms. The key was the charter which created the Authority and established its governing board. This was supplemented with a number of working committees made up of district board members or managers, including ones for Water Resources, Finance and Administration, and Operations and Maintenance. These committees generally consider and act on issues such as budgets, staffing patterns, and maintenance plans falling into these categories or make recommendations for action by the board.

The Authority also established a formal relationship with the Bureau through a cooperative agreement which established their operating responsibilities (mechanism 6). The Bureau maintained a role of quality assurance for facilities maintenance and budget allocation. Over time the Authority has assumed greater control over its budget and operating plans as it has developed competence and experience. Disagreements between the Bureau and the Authority are resolved through discussion or, if that fails, through legal action. A detailed *Performance Work Statement*, which specifies maintenance standards, forms the technical body of the agreement. Because the terms of this statement are somewhat idealized and must be adjusted and interpreted in light of real operating conditions. The Authority videotaped all of the facilities which were being turned over to them to manage at the time of transfer to document their condition as received in anticipation of any future questions or challenges.

During this period, financing for Authority activities followed two pathways. Payments for standard water delivery and maintenance services were made to the Bureau as was the case prior to 1992 (f_1) and the Bureau forwarded the collections on to the U. S. Treasury. The Authority determined O&M needs and worked out a budget with the Bureau, which the Bureau submitted to Congress for approval. Payment was then made from the Treasury to the Authority. However because Congressional approval was largely a formality, the funding pathway in Figure 2 is shown as proceeding directly from the Bureau to the Authority (f_6). Payments were also made directly by the districts to the Authority (f_4) to fund information and representational activities. In the mid-1990s this portion of the Authority budget was about 25

percent of the total. The Bureau also continued to provide bulk water delivery service to the Authority at the Tracy Pumping Plant in the Delta.

When operational responsibility for the Delta-Mendota Canal was shifted to the Authority, the Bureau's responsibility for the implications of its "discretionary actions" under the Endangered Species Act was expanded to include actions of the Authority. The rationale for this was that the Bureau still maintained a financial relationship with the Authority and its decisions to transfer payments constituted discretionary action. The service package S_6 provided by the Bureau in this period thus contained four elements. First, the infrastructure between the Delta and the district intakes was made available for use by the Authority (PI service). Second, the Bureau delivered water to the Delta from its reservoirs upstream (DL service). Third, it played limited supervisory and budget allocation roles for rehabilitation, maintenance, and modernization works related to the main system infrastructure. Fourth, the Bureau, in line with the regulations under the Endangered Species Act, provided the third party service to the public by complying with NMFS directives and limiting the quantity of water delivered to the Authority in line with the regulatory prescriptions.

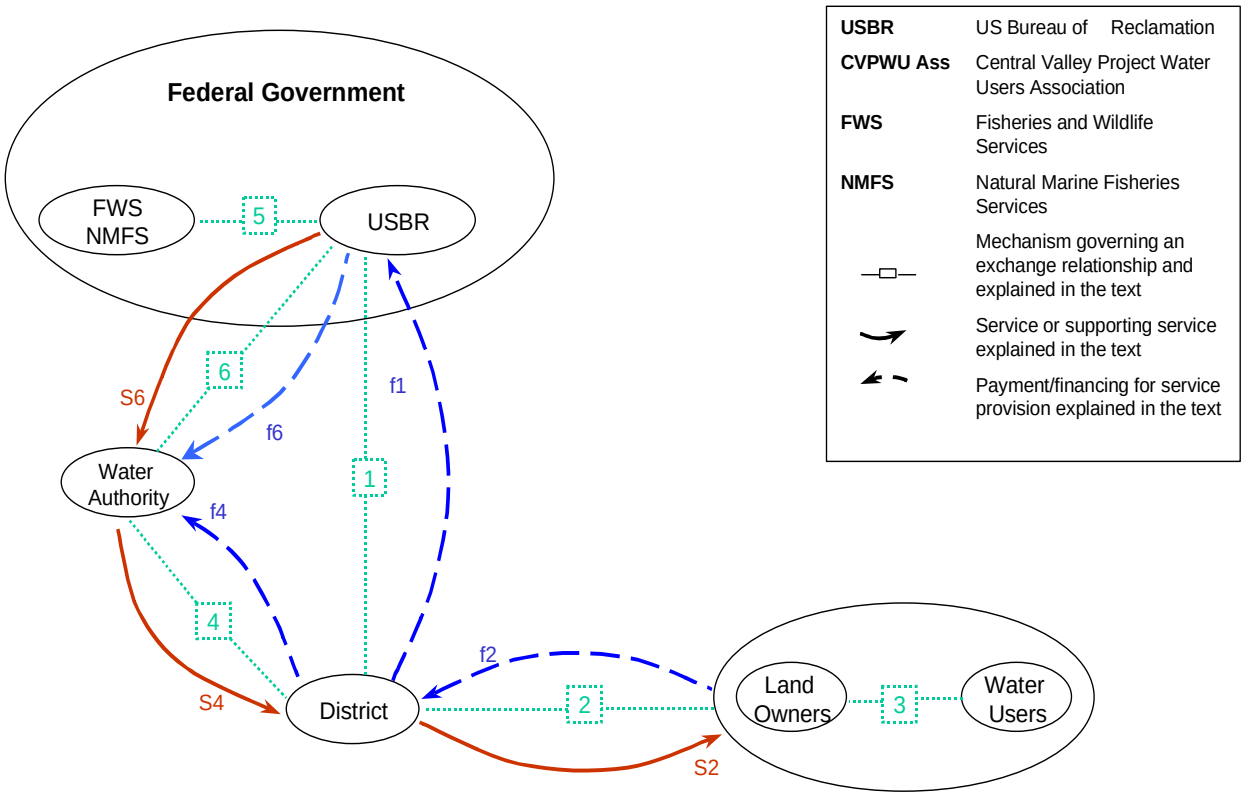

Figure 2: Exchange Relationships in Period 2 (1992 – March 1998)

6.3 Period Three: 1998 to present

In March of 1998 an additional change was made in these arrangements which closed completely the financial loop connecting the district to its bulk water service provider, the Bureau. Beginning in 1998, the Bureau was removed entirely from pathway for payments for water supply and maintenance services, which now flowed directly to the Authority from the districts, apportioned according to their water allocation. Under governance mechanism number 1 then, the financial flow f_1 was eliminated and the funds redirected to pathway f_4. Services provided remained as before but the proportion of information and representational services continued to increase in response to the growing list of environmental and water resource issues which must be addressed collectively by the irrigators. Under mechanism 6, the Bureau continues to provide bulk water delivery service to the Authority at the Tracy Pumping Plant, and in exchange the Authority makes payments to the Bureau. The Bureau pays the Authority to perform certain major maintenance items with Congressionally appropriated funds. The Bureau also retains ownership of the DMC and related facilities on behalf of the federal government and retains a limited supervisory role with respect to maintenance.

This change in financial flows has modified the Bureau's role as intermediary between the ESA (as well as NMFS and FWS) and the Authority. Since the Bureau no longer transmits funds from Districts to the Authority, it no longer undertakes "discretionary action" with respect to the DMC and is thus not responsible for regulating it under the ESA. Regulation must now be undertaken directly by lFWS and NMFS. This interpretation of "discretionary action" is disputed, however and regulatory responsibilities remain somewhat up in the air.

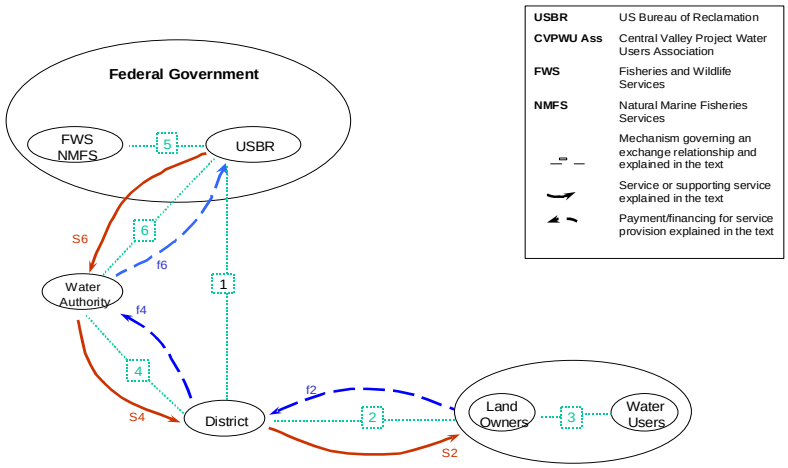

Figure 3: Exchange Relationships in Period 3 (March 1998 – Present)

6.4 Period Four: Future

The districts ultimately envision the complete transfer of the Central Valley Project facilities to a new agency which would be based on the existing CVPWU Association. This association has

evolved over the years from a low-key informal entity to a professional organization, partially staffed with ex-Bureau employees, which represents the interests of the water users, both north and south of the delta. The districts would like to see this association transformed into an authority which would operate the entire project, much as the SLDMW Authority now operates the Delta-Mendota Canal. The envisioned transfer would involve not just operating responsibility, but facilities ownership as well, and would involve capital payments from the Authority to the Treasury. Negotiations on the final stage of transfer are stalled at present in the face of strong opposition from environmental groups who believe that the transfer from federal control would weaken their ability to influence federal environmental regulatory actions. This demonstrates how the establishment and evolution of governance mechanisms is influenced by the interests of a variety to stakeholders.

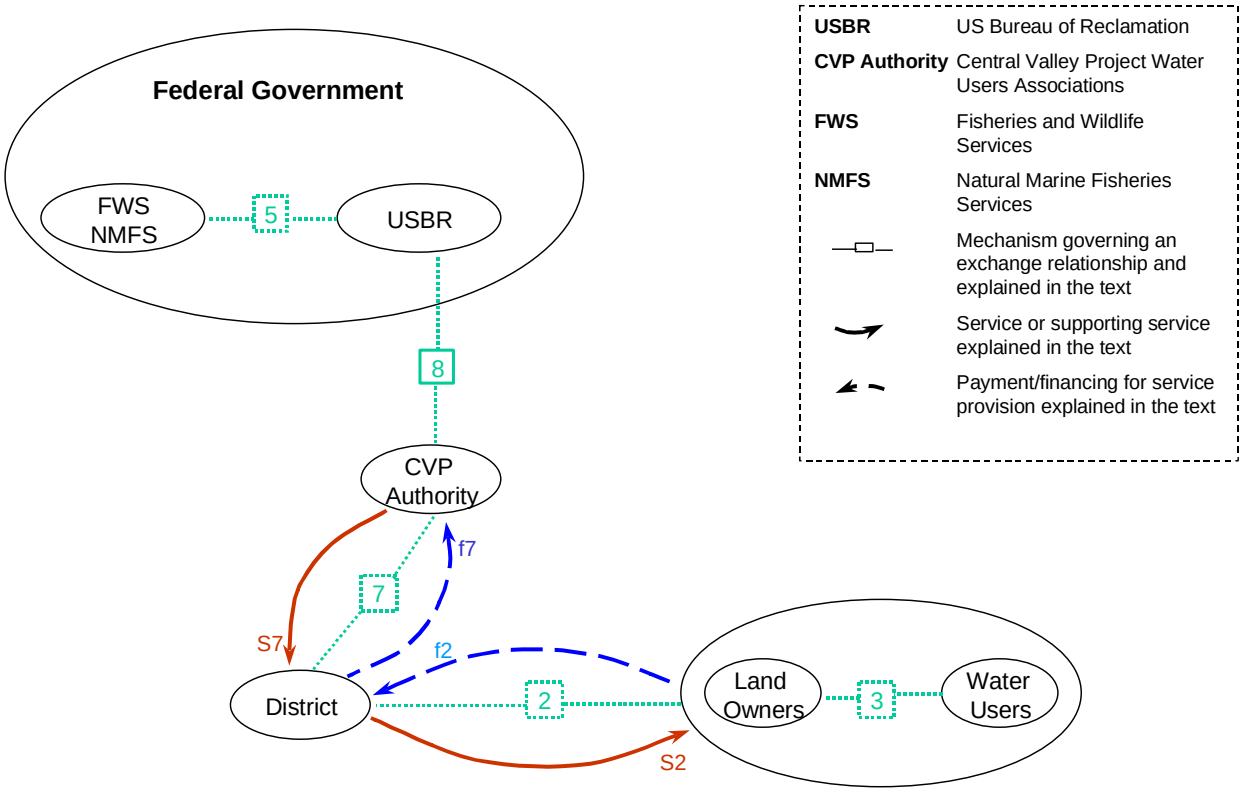

Figure 4: Exchange Relationships in Period 4 (Future)

An additional development has emerged in recent months which affects the future of the Broadview District, though not the overall setup outlined above. In response to the rising cost of meeting water quality regulations, the landowners of the district have advertised to offer all of the land comprising the district and the associated water rights for sale. The results of the advertisement are not known as of this writing, but the fact of the offer demonstrates the

powerful impact of environmentally-based regulation on agriculture and its ability to indirectly influence the allocation of water rights and land ownership.

7 Conclusions

7.1 Changing roles

The case demonstrates the complexity of modern governance mechanisms in a mature water economy. The number of involved actors and stakeholders is large and growing, and the task of managing a natural resource-based economic activity is extremely complex. The study shows the dynamic and evolutionary nature of governance in the considered part of the California Central Valley Project. It also highlights the influence regulation, as an external governance mechanism, can have on the interrelationships among the actors involved in irrigation service delivery.

The evolution of relationships among these actors is illuminating. Over the past 20 years, the number of players has grown significantly, and roles have changed. The operational role of the federal government has diminished, while its regulatory role has burgeoned. The Bureau of Reclamation, the lead federal water agency in this setting, has relinquished control over major portions of the Central Valley Project, which it built more than 50 years ago, though it retains ownership of all main facilities. At the same time it has taken on more regulatory responsibilities, though its overall role is considerably diminished. Simultaneously federal regulatory agencies -- the Environmental Protection Agency, the Fish and Wildlife Service, and the National Marine Fisheries Service -- have become powerful influences on water allocation and operational planning at both main system and district level.

Agricultural water users have reacted to these developments. They have associated themselves into collective groups which have taken on an increasing share of responsibility for water supply and facilities maintenance. These new organizations have often begun as informal associations, and then evolved into structured agencies with formal governance mechanisms and paid professional staff. Most relationships are governed by written agreements or contracts and parties resort freely to the legal system to resolve differences. The notable exception is the agreement between the Broadview Water District and farmers regarding water service, which is informal, but based on a clear and specific understanding.

Water users would like to continue to extend these collective organizations to assume ownership and control of the entire Central Valley Project. These aspirations are opposed by environmental interests which fear a weakening of regulatory control as a result.

The growing complexity of the regulatory environment and the pressures for reallocating water among competing uses is evidenced by water users' rising informational and representational expenses. The share of Authority budget devoted to such activities has grown from 25 percent

in the early 1990s to nearly 50% today. Unit costs of water are rising and will continue to rise in response to such increases in expenses and reduced supplies. The pressure of environmental regulation is seen even more convincingly in the recently advertised offer of BWD landowners to sell both their land and their water right if a satisfactory bid is forthcoming.

The evolution of service relationships in the Central Valley has been marked by a shift toward greater accountability and transparency. Financial flows are now explicitly associated with particular services and are no longer intermingled with other federal funds. There are now closed financial accountability loops between all major parties involved water delivery service and facilities maintenance. All finances are subject to standard mandated practices of open disclosure and regular external audits.

Non-financial accountability linkages resulting from federal regulation are less clear. The continuing responsibility of the USBR to enforce environmental regulations on behalf of the NMFS and the FWS is in dispute. Moreover, although individual regulatory changes are discussed and implemented in a transparent manner, the rapid continuing evolution of environmental standards and criteria lead to a highly uncertain operating environment for agricultural water users. The effect, from their point of view, is a lack of transparency, since it is impossible for them to predict the future regulatory requirements they will face.

7.2 Study methodology

The methodology applied here – viewing an irrigation system as a service delivery system – opens possibilities for discussion on relationships in a multi-actor system. With such a perspective the importance of the interactions between the different actors come to the fore, along with the crucial role played by the mechanisms that govern such interactions. Considering the governance mechanism of external regulation, the methodology used in this study allows one to demonstrate and visualize the effects brought about by new and expanded regulatory roles. The disaggregation of infrastructure provision services and delivery services provides a useful way to view financial responsibilities and ownership rights. This was particularly useful in examining the changing role of the Bureau of Reclamation as it withdraws from operational responsibilities while retaining ownership of the facilities it constructed.

The unbundling of property rights to water and facilities at the district level provided interesting insights into the complicated relationship between landowners and farmers. While landowners own and pay for water distribution facilities and govern the organization which delivers water, farmers, many of whom rent the land they farm, are the recipients and users of the water delivery service. They also pay for the service, but not for the facilities themselves. The implicit value of the right to water is attached to land and facilities ownership and is capitalized into higher land values.

Analysis of regulatory services is complex. Most regulatory services are provided to the general public and result only in costs to water users. The relationship is thus three-cornered and not

bilateral as are the other service relationships represented in the framework. Payment is in the form of additional transaction and operating costs and not as explicit financial transfers. Additional work is required to expand the present conceptual framework to describe and understand the regulatory process more fully.

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