INSTITUTIONAL AND POLICY ANALYSIS OF RIVER BASIN MANAGEMENT

The Guadalquivir River Basin, Spain[1]

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1. Background and Introduction

Integrated water resource management (IWRM) and organizing it primarily at the river basin level are two of the most common and widely repeated recommendations in the water resources literature of the last decade if not longer (Allee 1988; Galloway 1997; McDonald and Kay 1988; World Bank 1993). Basin management is often associated with the concept of decentralization, of managing water resources at the "lowest appropriate level." (See, e.g., International Conference on Water and the Environment 1992; Mody 2001). Several conceptual arguments have been presented in favor of decentralization in water resource management, and basin-level management in particular: that the whole array of resources and use patterns in the basin will be taken into account, public participation will be greater and broader, management decisions will be based on better knowledge of local conditions, and so on.

Empirical studies of river basin management systems provide opportunities to examine the claims made for basin-level integrated resources management, and to explore factors that appear to influence its implementation and outcomes. In this research project, with the support of the World Bank, the project team has searched for those factors and their relationships to river basin management in two ways: with a survey of river basin organizations throughout the world, and with case studies of eight river basins analyzed in greater detail. Some of those eight cases involve relatively new basin organizations such as the Regional Water Management Authority in the Warta River basin in Poland and the Coordinating Commission for the Rio Grande de Tarcoles in Costa Rica. Others, such as the Guadalquivir river basin in Spain and the Murray-Darling river basin in Australia, have long histories.

Spain has perhaps the longest history of any country in developing formal governmental authorities on the river basin scale, with the earliest ones dating from 1926. Although the river basin authorities in Spain (*confederaciones hidrograficas*, or CHs) have experienced many changes that have reduced and expanded their responsibilities and their participatory structures over the ensuing 75 or more years, they represent nonetheless a notably long-lived set of basin management institutions.

The basin authority for the Guadalquivir river (*Confederacion Hidrografica del Guadalquivir*, or CH Guadalquivir) is one of the oldest in Spain. The Guadalquivir basin was selected as a case study for this research project not only because of CH Guadalquivir's longevity, but because the basin faces the full array of water resource management problems (floods as well as drought, tensions between urban and agricultural water uses, water quality degradation and improvement, etc.) and is situated almost entirely within the Spanish region of Andalusia (thus minimizing some of the complications of trans-jurisdictional CHs in Spain).

Our study finds that the river basin authority appears to have been well suited to the tasks that dominated Spanish water policy from the time of its formation to about the 1980s—namely, the construction and operation of water supply and storage facilities with heavy central-government subsidies, to promote irrigation and hydropower development. As urbanization and industrialization have changed the population and economy of the basin, and as Spanish policy since the 1980s has elevated water demand management, quality protection, and ecosystem health to levels of priority equaling or approximating water supply augmentation, CH Guadalquivir has had difficulty making the transition.

Some of the difficulty appears to be inherent in the policy changes themselves: managing water for the simultaneous satisfaction of supply, quality, economic, and environmental values is significantly harder than managing for one of those values alone, and even the existence of a recognized river basin authority with considerable staff and revenues does not assure successful implementation and performance of this multifaceted mission. Some of the difficulty appears to be due to organizational inertia, as an agency that had one role for 60 years adjusts to new roles and in the meantime falls behind on some of its newly assigned tasks. Last but certainly not least, some of the difficulty appears to be due to patterns of stakeholder involvement and stakeholder relationships with basin authority personnel. The formal structure of the basin authority gives greater weight to the traditional irrigation constituency that is interested primarily in the authority's water supply augmentation functions, and the basin authority's decision making practices reinforce that constituency's favored position. Irrigators are a well organized set of water users in the basin who are quite clear about what they want, and know how to use the basin authority's organizational structures and decision making processes to get it. By contrast, public and private organizations serving or representing urban centers and environmental concerns, or promoting economic approaches to water management, appear to have less influence within the basin authority and have sought alternative means to pursue their goals. In these respects, the experience of the Guadalquivir basin appears to reflect trends and tendencies in Spain as a whole.

2. Analytical Framework

To analyze the data gathered for this project from the case studies and from the survey of river basin organizations, the project team has developed a framework that identifies a number of political and institutional factors which may be associated with the emergence, sustainability, and success or failure of decentralized approaches to integrated water resource management at the basin scale. These factors, and their hypothesized relationships with basin management in a country that has decentralized or is attempting to decentralize water resource management institutions, are derived from the institutional analysis literature relating to water or other natural resource management and to decentralized systems (especially Ostrom 1990, 1992; also Agrawal 2000; Alaerts 1999; Blomquist and Schlager 1999; Bromley 1989; Easter and Hearne 1993; Wunsch 1991).

Our information gathering and analysis focuses on the following sets of variables.

- Contextual factors and initial conditions
- Characteristics of the decentralization process
- Characteristics of central government/basin-level relationships and capacities
- The internal configuration of basin-level institutional arrangements
- Variables considered within each set are listed in the appendix. The Guadalquivir basin case is discussed in terms of these categories and variables in Section 9 below.

3. Methodology

We pursued a case study approach for this project in order to examine closely the processes of institutional change as well as the current situation. An expert in water

policy and management affairs in the Guadalquivir basin facilitated the site visit, arranging interviews and preparing a background paper on the basin prior to the visit (Giansante et al. 2002). Background papers for all case study visits are based on a common outline. During the site visit, team members met with and interviewed 12 individuals, including basin-level stakeholders, past and current regional and local government officials, and basin authority staff.[2] The interviews were focused on understanding the processes of institutional change and the performance of water management institutions at sub-basin, basin, and national scales, matters that were closely within the knowledge of the interviewees. After the visit, team members combined their notes from the interviews, revisited and revised the basin background paper, reviewed other materials, and composed this paper summarizing and analyzing the river basin management situation in the Guadalquivir basin.

The following analysis of the Guadalquivir basin case is therefore based on a combination of sources—documentary materials on Spain and the Guadalquivir basin, the background paper prepared for the visit, and the interviews conducted during the site visit. The findings and conclusions therefore do not represent the point of view of a single individual or organization, but emerge from a composite of data collected and reviewed by the research project team.

4. Guadalquivir Basin Water Management Issues

4.1 Physical Characteristics

The Guadalquivir River Basin[3] extends westerly across southern Spain, and nearly all (90.2%) of its 57,017 km^2 area lies within the region (*Communidad Autonoma*, or CA) of Andalucia. The entire 640-km main stem of the Guadalquivir River itself is located within the CA of Andalucia.

As is the case throughout southern (or Mediterranean) Spain, the Guadalquivir basin has a relatively small share of the nation's water resources, despite having a substantial share of Spain's population. The southern river basins of Guadalquivir, Guadiana, Sur, Segura, and Jucar contain 37% of Spain's population and represent 41% of the Spanish land surface, but receive 19% of the country's total precipitation and runoff.

[2] Organizations from which individuals were interviewed include the Confederacion Hidrografica del Guadalquivir; the Public Works and Transportation ministry of the Andalusian regional government; EMASESA, the municipal water supply utility for the city of Seville; Consorcio del Huesna, the water and wastewater service provider for several suburban portions of the Seville metropolitan area; the Conferacion Hidrografica del Tajo; the irrigation community of Valle Inferior del Guadalquivir; Feragua, the federation of irrigation communities in the Guadalaquivir basin; and the Spanish Ministry of the Environment.

[3] See map at the beginning of the paper.

Water users in the Guadalquivir basin have relied primarily upon surface water resources to supply their needs. There are 52 identified groundwater areas in the river basin (Giansante 2003), and groundwater overdrafting is an isolated rather than widespread problem in the basin. Precipitation is greatest in the mountains along the edges of the basin and lowest in the valley floor, where most of the population and irrigation are concentrated.

Precipitation and stream flows are highly variable, exposing residents to risks of flooding as well as drought. Mean annual precipitation is 596 mm, but this has ranged from as little as 300 mm during drought to as much as 1100 mm. Years of high or low precipitation have often clustered together, compounded their effects. Seasonal variability is also great, with most precipitation concentrated in the winter months and peak rainfall occurring from November through March. Long, dry summers follow, during which precipitation is virtually nil and evapo-transpiration soars.

4.2 Water Resource Issues and Problems

Water management challenges include flood control and drought protection to sustain the basin's substantial population and significant agricultural production. For the past century, management efforts have focused primarily on regulating river and tributary flows for both flood control and water supply purposes—to minimize the damage of wet periods and maximize water conservation and storage for dry periods.

Irrigation is the dominant consumptive water use in the basin, with 80-85% of water consumption. Municipal and industrial uses account for 12-15%, with the remaining 5-8% apportioned among environmental and other water needs. Irrigation's place as the foremost user of water is even more apparent when assessed on a per capita basis (Table 1).

Table 1. Water Use by Sector in the Guadalquivir Basin, 1998

Sector	Water demand (millions of cubic meters per year)	Percent of Total Water Demands	Per Capita Consumptive Water Demand (cubic meters per resident per year)
Irrigation	3,140	83.5	752
Urban	532	14.1	127
Industrial	88	2.4	22
Total	3760	100.0	901

Sources: Ministry of the Environment 2000.

Each category of water use is increasing, however, and projected to continue to do so, with little effect on the percentage distribution among uses. Agricultural use is projected to account for 78.4% in 2012 compared with 79.7% in 1992, municipal and industrial use for 11.7% in 2012 compared with 11.8% in 1992, and environmental and other uses for 9.9% in 2012 compared with 8.5% in 1992 (CH Guadalquivir 1995). Thus,

current water management authorities do not anticipate that growth of demand in one sector will be met by shifting consumption away from other sectors.

Irrigation areas in the basin were estimated in 1999 to cover 665,000 hectares (ha), and are concentrated along the Guadalquivir river stem (Giansante 2000). Irrigated land surface continues to grow in the basin, as lands on hillsides and farther from the river are brought under cultivation and as groundwater is used to a greater extent. Olive groves cover much of the land in the central portion of the basin, and represent a growing share of the region's agricultural production. Throughout the central and eastern portions of the basin, crop types are gradually shifting to higher-value produce such as fruits and vegetables in response to changing market signals, European Union (EU) subsidies and regulations, and the ability to use water more efficiently in irrigating orchards compared with field crops. In the lower Guadalquivir basin (known as Baja Guadalquivir) between Sevilla and the ocean, however, about 35,000 ha of rice paddies are cultivated, with an estimated water requirement of about 12,000 cubic meters per hectare. The largest irrigation canal in the basin, with a capacity of 90 cubic meters per second at the headworks, serves this area.

The region's population has been growing and its economic base changing. The basin now is home to approximately 4 million inhabitants, and experienced a 5.51% population growth from 1986 to 1996, compared with 3.1% growth for Spain overall. One-tenth of Spanish inhabitants live in the Guadalquivir basin. The basin includes all or part of Andalusia's four most populated provinces—Jaen, Cordoba, Grenada, and Sevilla. The population of the Sevilla province—the city of Sevilla and surrounding municipalities—is fast approaching 2 million (CH Guadalquivir 1995). Even as population growth is expected to slow in the early 21st century, the basin is expected to grow faster than the rest of the country.

Population expansion and the growth of urban centers such as Sevilla is connected with a regional economic shift. Service industries, recreation, and tourism have expanded as shares of the region's employment and economic product, especially during the 1990s. Reliance on agriculture as the region's sole defining economic pursuit is decreasing, and water use for the urban economy is rising at a pace equivalent to irrigation's.

The composition of water uses and the changes therein are linked to the basin's water management challenges:

- Flood risks are of greater consequence now that the basin contains 4 million inhabitants, including nearly 2 million in the downstream province of Sevilla. Industrial and commercial sites along the river further escalate the prospective economic losses from flooding. These changes have intensified the water management challenge of flood prevention, control, and response.
- Drought losses also are worsened by the development of water uses in the basin. The continued expansion of irrigated agriculture strains the basin's water resources during dry periods. Although the transition to higher-value crops grown in orchards and groves has beneficial effects on water-use efficiency, it creates an additional economic exposure to drought. Trees and vines represent a substantial capital investment for each farm, which magnifies the potential losses resulting from an extended drought.

- Growing municipal and industrial water use adds another dimension to the drought risk situation. While urban water demands are small compared with irrigation demands, they have a year-round character that is less variable than irrigation demands—certain levels of urban water service must be sustained for public health and sanitation despite temporal reductions in precipitation and stream flows. Also, urban water supplies have higher water-quality standards to meet, and droughts negatively affect water quality.

Taking all the above into account, and adding in flow requirements for hydroelectric facilities, the water management challenge in the Guadalquivir basin is substantial and complex. Maintaining adequate river flows to sustain irrigation demands and hydropower requirements in the central and eastern portions of the basin, urban water demands at various locations but especially in and around Sevilla, and agricultural water needs in the lower portion of the basin, proves particularly difficult. Water shortages appear to create zero-sum situations where meeting one sector's needs means failing to meet another's.[4]

Water users and water managers have described the basin's overall situation as one of "water deficit." The Andalusian Department of Public Works and Transport estimated the available water resources within the basin to be 3,357 Mm^3/yr, and total water demands to be 3,578 Mm^3/yr, yielding a balance of negative 241 Mm^3/yr. (COPyT 1997) Thus, even in an average year, water demands in the Guadalquivir basin exceed available supplies. In a drought, conditions are only worse.

Water quality problems in the basin are substantial. As agriculture has expanded in the basin, agricultural runoff (including irrigation tailwater) has contributed to water quality degradation tributaries and the main river stem. Industrial sites—manufacturing plants, food-processing facilities, etc.—have discharged chemical and other wastes to the river system. The growing urban population generates sewage and wastewater that is discharged to the river system as well.

Municipal and industrial pollution sources are now covered by national regulations and EU directives requiring pre-discharge treatment, but the construction and

[4] A striking illustration of those tradeoffs involves the water supply and water quality requirements of upper-basin and lower-basin irrigators. As mentioned earlier, one of the main irrigation water uses in the basin is for rice cultivation in the area of the lower Guadalquivir river and estuary, which has experienced an important increase in the past 15 years. With its low slope and coastal terminus, the Baja Guadalquivir area is influenced by tides all the way up to the Alcala del Rio dam, approximately 90 km inland. When flows across the dam fall below 40 m^3/sec, seawater (20 gr/l) penetrates the estuary between 9 and 15 km. Upstream of this point, in the interface between seawater and freshwater, a marked salinity gradient called *tapón salino* is established. The length, salinity concentrations, and movements of this *tapón salino* depend on the Guadalquivir river freshwater flow and the height of the tide.
The CH Guadalquivir has calculated that in order to maintain a salinity of about 0.8 gr./l in the area of estuary where water is diverted for irrigation (between 50 and 75 Km inland), flows of 25-30 m^3/sec should pass the Alcala del Rio dam. During the rice irrigation period, large amounts of water that were stored in upstream reservoirs during the winter must be released in order to maintain salinity requirements in the lower basin. These releases for the rice farmers, however, have consequences elsewhere in the basin where other irrigators wish to have priority given to permanent plantings such as the fruit orchards prior to annual herbaceous cultivation. Satisfying the upstream orchards, on the other hand, aggravates the "rice water shortage." Rice farmers have been pressing for the construction of a sluice on the estuary to avoid the entry of tidal water during the irrigation season of the rice cultivation areas.

operation of treatment facilities has not kept pace with the quantities of waste produced and discharged in the basin. According to the Guadalquivir Basin Plan (CH Guadalquivir 1995), only 50% of municipal wastewater received secondary treatment prior to discharge, and the vast majority of the other 50% received no treatment at all (47.56%, with the remaining 2.44% receiving primary treatment only).

5. The River Basin Authority (CH Guadalquivir) and Basin Stakeholders

5.1 The River Basin Authority, CH Guadalquivir

Details of the historical evolution of the Spanish *Confederaciones Hidrograficas* (CHs), and of the internal organization of the CH Guadalquivir, are presented in Giansante (2003). Created by the central government in 1927, CH Guadalquivir was, for much of its existence, a hydro-technical agency devoted to the construction of dams, reservoirs, and water conveyance facilities, while water law administration and management of water uses were handled by a separate agency. At times, however, the central government merged these functions into one basinwide authority. The principal eras of separation and integration are depicted in Figure 1. Since 1985 the CHs have had combined responsibility for physical infrastructure and water use management in the basins, and thus are currently supposed to function as integrated water resource management agencies at the river basin scale.

CHs are not autonomous. They are under the direction of the central government or regional governments (CAs), depending on whether they cover an inter-regional river basin or an intra-regional one. National water law adopted in 1985 (and an associated 1987 decree) recognized 13 CHs—9 in inter-regional and 4 in intra-regional basins. The intra-regional CHs were supposed be transferred to the regional governments. This has not occurred in all cases. For example, the CH for the Sur river basin, which lies entirely within the CA of Andalucia, has remained under control of the central government.

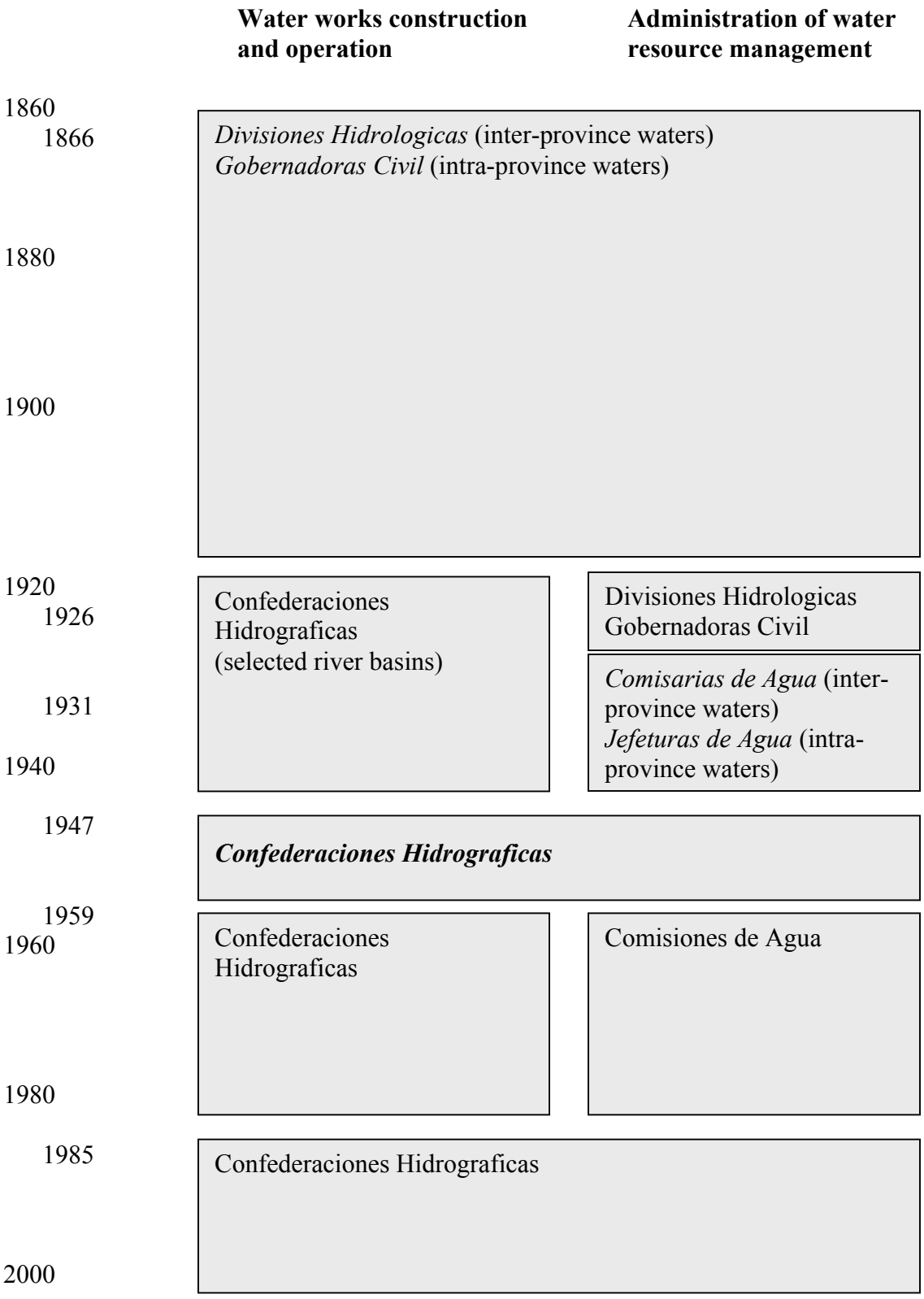
The principal responsibilities of CH Guadalquivir are established by the 1985 national water law and 1999 amendments to it, by the Guadalquivir Basin Plan and National Water Plan, and by EU regulations that are implemented at the river basin level.

Water works: the hydraulic works function has consistently been part of the CH's portfolio—construction, financing, and operation of dams and reservoirs for flow regulation and water storage. In the Guadalquivir basin, reservoir operations largely determine the surface water flows available to water users.

Water planning: CHs are responsible for developing basin plans and for other planning activities—collection and analysis of data about physical conditions of the basin and water uses, designation of sub-basin management units, and conformity of basin plans to national and EU guidelines. The most recent basin plans were submitted to the national government in 1995 for approval, were approved in 1998, and were integrated into the 2001 national water plan.

Monitoring of water resource conditions: the CH has responsibilities for monitoring river flows to anticipate and identify flooding or insufficiency, and for monitoring water quality throughout the river basin. Monitoring is performed by CH staff.

Figure 1. Changes in responsibilities of CHs and other bodies at the basin or provincial level, 1866-2003



Water licensing: CH staff are responsible for reviewing and approving applications for water concessions (licenses for use of water in the public domain). The granting of concessions must be consistent with basin plan priorities and objectives, however, and concessions for drinking water must adhere to regulations for drinking water quality. The procedure for granting a concession is as follows: 1) the prospective user files a request with the CH; 2) CH staff analyze the request for its technical feasibility, compatibility with the basin plan, and potential competition or conflict with other licensed or requested projects; 3) the request is published to allow for public review and comment, and in some instances review and comment are solicited from the CA and other interested stakeholders;[5] 4) the staff complete their technical report with a recommendation concerning the request; 5) the CH governing board decides whether to grant or deny the request. When a license is rejected, an applicant is provided information of the reason(s). In some cases, the applicant can modify and resubmit an application. In cases (thus far rare) where an application for a high-volume groundwater license is filed, the CH encourages the formation of a water user association. Once the association is set up, the license is granted to the association rather than the individual user. Thereafter, the CH deals with the association, and the association deals with the individual users. The CH is required by law to maintain a publicly accessible registry of authorized water users.

Water transfers: The CHs have the authority to approve transfers of water concessions between authorized and registered water users. This is a very new function, approved by amendments to the national water law in 1999.

Enforcement of Spanish and EU water regulations: Unless assigned specifically to another level or unit of government, enforcement falls to the CH.

Within their sphere of competence, the decisions of CHs are final. Challenges to a CH decision would have to be taken to court, with the challenge based on a claim that the CH has exceeded its legal authority. CHs also have the authority to enforce their decisions through the imposition of sanctions such as fines.

Internally, CH Guadalquivir is organized into staff offices plus a set of boards, councils, or commissions composed of basin stakeholder representatives and CH staff (Table 2). The CH president serves as head of the CH staff and chairs the advisory bodies. Thus, the president has a strong role in guiding the CH's activities. The president is appointed by the Council of Ministers and is effectively an official of the central government.

Table 2. Boards and Offices of the CH

Executive Bodies	
President, also referred to as Chairman	Appointed by the Council of Ministers at the proposal of Ministry of Environment.
Governing Board (Junta de Gobierno), also	Headed by the CH President, the board is in charge of financial matters, approves action plans, and defines aquifer

[5] For applications requesting a license for more than 8 liters per second, there is a process for notifying through official bulletin, so individuals or organizations with affected competing projects can present alternative or competing proposals.

referred to as Management Board	depletion and groundwater protection areas.
Management Bodies	
Operation Boards (Junta de Explotación)	There are several of these. They co-ordinate the management of hydraulic works and water resources in specific catchment areas and/or hydrogeological units. They are composed of representatives of the administration and of the water users (public and private water supply companies, irrigation associations, hydroelectric companies and industrial users). The 1985 Waters Act establishes the rate of representation of each sector on the boards, according to its importance in the basin.
Water Users' Assembly (Asamblea de Usuarios), also referred to as Assembly of Users	Headed by the CH President, it is composed of all users that are part of the Operation Boards. Its purpose is to make recommendations concerning CH policies for the coordinated management of hydraulic works and water resources throughout the basin.
Reservoir Releases Commission (Comisión de Desemblase), also referred to as the Dam Water Releases Commission	Headed by the CH President, it is responsible for making recommendations to the President concerning the appropriate amounts and timing for releasing water from the reservoirs, taking into account the rights of the different users and the aquifers located in the basin. The Water Users' Assembly proposes which users should be members of this Commission. A Permanent Committee of this commission is established to respond to emergency situations such as floods or drought which require unusual measures in relation to the release of water or filling up of reservoirs.
Water Works Commissions	These provide an opportunity for water users who will be served by a particular project to receive information and make recommendations about it.
Planning Bodies	
Basin Water Council (Consejo del Agua de cuenca)	Headed by the CH President, it is responsible for approval of the Basin Hydrological Plan, which is forwarded to the central Government. It is composed of representatives of different departments of central and regional governments, technical services, and basin stakeholders (at least 33% of council membership) including professional associations and environmental groups.
Planning Office (Oficina de Planificación)	This is a CH staff office headed by the Chief of Water Planning (Jefe de Planification) and is responsible for drafting, monitoring, and reviewing the Basin Hydrological Plan and providing technical support to the Basin Water Council.

Source: Giansante (2000).

CH administration and operations are funded by a combination of revenues from the central government and revenues generated by the CH itself. By law, CHs must cover their own expenditures. CH Guadalquivir reported a 2001 annual budget of US$115,800,000, with 35% coming from the central government, 30% from basin water users, and 35% from other sources. An important income source is tariffs and taxes on water users and residents within the basin, which fall into the following categories:

- tariffs on water users—this charge on the volume of water used is approved each year by the president after a review and comment period, and is intended to represent operation and maintenance expenses associated with hydraulic works in the basin, plus amortization of capital investments in those facilities, plus indirect costs;
- taxes on basin residents for benefits of CH services (e.g., flood control, water storage);
- fees on dischargers of treated water into the river;
- severance taxes on sand and gravel, or other extractive, industries within the basin; and
- a tax on hydroelectric power generated in the basin.

CH Guadalquivir retains 100% of these locally-generated revenues for use in the basin; none are distributed back to the central government. CH Guadalquivir reported the following tariff rates for 2001: irrigation users pay a tariff currently set at US$59.81 per hectare, industrial users pay a tariff of US$0.516 per cubic meter, domestic users pay a tariff of US$0.355 per cubic meter, and hydroelectric producers pay a tariff of US$0.76 per kwh. [6]

CHs also receive an annual appropriation from the central government, which is included in the budget for the Ministry of the Environment. The rationale for central government funding is that the CHs incur costs implementing and enforcing national law and regulations. Within CH Guadalquivir, these "water policing" functions are undertaken by 50 people whose salaries are paid with the central government appropriation. Central government funds also help CHs cover the costs of services that cannot be separated and assigned to any particular group of users within the basin (e.g., planning, monitoring, data collection).

The national government also passes some EU structural funds through to the CHs. Structural funds are EU appropriations to assist in economic development of poorer member states.

[6] The rates reported here are only those collected by CH Guadalquivir. They are not necessarily the full tariff paid by end users, because other tariffs may be added by irrigation communities or urban water suppliers to cover their costs as well.

5.2. Major Stakeholders in the Guadalquivir Basin

Irrigation water communities and users

The most prominent stakeholder group in the basin is the 1,000+ irrigation user communities (*comunidades de regantes*). Irrigation communities are groups of irrigators who 1) have a single water license and then apportion the licensed amount of water among themselves, 2) divert surface water by means of a single shared canal or intake and then distribute the water to individual irrigators' farms, or (3) both. They are also supposed to manage and maintain the irrigation infrastructure that is shared by their members.

Farmers started the first irrigation communities a century or longer ago. As irrigation became a cornerstone of Spanish national development policy in the early 1900s, irrigation communities became recognized and established in Spanish law. The current (1985) national water law states, "the users of water... of a same water uptake or concession should associate in a users' association. When the main use of the water is irrigation, they will be called Irrigation Communities (*Comunidades de Regantes*)" (article 73.1). Irrigation communities even have a niche in Spain's constitutional structure. Corporations in Spanish law are classified typically as either public or private, but irrigation communities are semi-public and semi-private.

The irrigation communities have also been incorporated formally into the institutional structure of river basin management. The by-laws, or formal rules, of irrigation communities have to be approved by the CHs. Irrigation communities pay a fee (*canon*) to the CH for its services (payment is enforced by the Ministry of Finance, treated with the seriousness of an income tax). Irrigation communities are represented on CH boards and commissions; in fact, the irrigation communities are reserved the position of second vice president on CH governing boards. Irrigation communities are thus both a means of water management and a means of user participation.

Although each community develops and administers its own system for distributing water, the internal organization of irrigation communities (Table 3) is nearly identical and is codified in the 1985 water law. Irrigation communities collect fees from members, regulate water use, and implement and enforce their own rules. Each community settles almost all problems regarding water resource management within its domain. Irrigation communities have "water police," and an irrigation court composed of the president of the community plus other members chosen by the general assembly. The ability of the community's members to monitor one another's behavior, enforce their own rules, and settle their own disputes has allowed the communities to persist across the decades. This conflict-resolution function was mentioned in interviews for this study as a particularly useful aspect of the irrigation communities; in the words of one, if the CHs and civil courts had to resolve every conflict among irrigators, they would collapse.

Table 3. Internal Structure of Irrigation User Communities

General Assembly (*Junta General o Asamblea*)	Composed of all members of the Irrigation Community. They elect the president, the management board, and the irrigation court, with votes based on farm size.
Management Board	Elected by the General Assembly., it is responsible for

(*Junta de Gobierno*)	implementing the Assembly's policies and decisions, and for general maintenance and monitoring. One member is appointed as Treasurer.
Irrigation Court (*Jurado de riego*)	It judges conflicts that may arise between users, imposes sanctions and defines compensations. Its practice is largely based on customary rules.

Source: Giansante (2000).

Water management methods vary substantially across irrigation communities. Some are quite modern, with pressure and drip irrigation system and electronic metering of use down to the individual farm level. Others operate aging gravity-flow systems and still allocate water based on area under cultivation, providing little incentive for farmers to conserve water or upgrade technology.

A common point among several irrigation communities is their membership in a basinwide association. The Guadalquivir Irrigation Farmers Union *(Federación de Regantes del Guadalquivir*), now known as Feragua, was created in 1994 and includes 85 irrigation communities in the basin. Its member communities tend to be among the larger ones in the basin, and together cover 240,000 hectares. Feragua's purpose is to present a unified position to CH Guadalquivir and CA Andalucia on irrigation communities' interests and concerns.

Feragua has gained in influence within CH Guadalquivir by coordinating the participation and influence of the irrigation communities. Feragua provides a forum in which irrigation communities decide upon their choices for the many irrigation positions on CH boards and commissions. Most important decisions of CH Guadalquivir are taken by consensus, so unity among irrigators can influence CH decisions in the direction favored by Feragua members.

Urban water suppliers

Organizations for municipal water services in Spain—drinking water supply, sanitation and wastewater treatment, etc.—are more varied than the irrigation communities. Water services may be performed directly by the city or town, or indirectly through other arrangements. Direct management typically involves water or wastewater service provided by public utilities owned entirely by a municipality or regional government, inter-communal associations (a group of several municipal authorities), or consortia (which can include provincial or regional government involvement in addition to local councils). Indirect management is based on services being contracted out, typically to a private enterprise, with the three most common systems being mixed enterprises, concessions, and leasing.[7]

An example of one type in the Guadalquivir basin is the large public utility EMASESA (*Empresa Municipal de Aguas de Sevilla, SA.*) which serves the city of Sevilla plus eleven surrounding municipalities. Another type is represented by Consortio

[7] In recent years many water supply systems have been transferred to some form of private management; private companies participate in water service provision in about 10% of Spanish municipalities, containing about 36% of the population.

del Huesna, serving several other municipalities in the Sevilla metropolitan area through a mixed public-private arrangement.

Urban water suppliers pay fees to CH Guadalquivir for its services in delivering supplies, regulating flows, and monitoring water resource conditions. Urban suppliers are also subject to CH decisions concerning water allocation in drought periods and flow releases during wet periods. Urban suppliers are represented on several of the CH boards and councils, though they have fewer representatives than the irrigators. Rules allocating representatives on operations boards, water works commissions, and the CH governing board give greater weight to the representation of land and water use (hence, agriculture) than to population (which would favor the urban suppliers).

The national government

The central government in Spain has played a very active role in the development and management of water resources since the late 1800s, and remains an influential stakeholder in the Guadalquivir and other river basins. The national government appoints the CH Guadalquivir president , provides about one-third of the CH's budget, and has representation on most of the CH boards and councils. Thus, the national government is in both form and fact a significant basin stakeholder.

For decades, the main responsibility for water management at the central government level resided with the Ministry of Public Works, Transport and Environment (MOPTMA). In 1996, the water management responsibilities of this Ministry were transferred to the newly created Ministry of the Environment (MIMAM), to which the inter-regional CHs relate. Within the Ministry of the Environment, responsibilities for water management lie primarily with the Directorate General of Hydraulic Works and Water Quality (State Secretary of Water and Coasts). The directorate prepares regulations related to all aspects concerning water resources, and is responsible for the design and implementation of hydraulic works of general interest. It also selects the nominees to serve as presidents (chairmen) of inter-regional CHs such as CH Guadalquivir.

Water-related responsibilities of other central government agencies are as follows.

- The National Water Council is a consultative body on water policy, which brings together representatives of the central, regional, and local administrations.
- The Ministry of Agriculture, Fisheries and Food remains responsible for irrigation planning and the development of irrigation improvement schemes.
- The Ministry of Industry and Energy is concerned with hydroelectricity and with mineral and thermal waters.
- The Centre of Studies and Experimentation (CEDEX), a public research-and-development organisation within the Ministry of Development, has an interest in water management and planning among other things.
- The Ministry of Health and Consumption deals with drinking (tap and bottled) and bathing water quality.
- The Civil Protection Directorate within the Ministry of the Interior is concerned with flood protection as part of its responsibilities for public safety.

Regional government (Junto de Andalucia).

Many analyses of water management in Spain have understandably focused on the CHs, with their long history and their river-basin boundaries. The current picture is less straightforward, since the 1978 constitution established the regional governments (CAs) in Spain with a wide range of policy making responsibilities. Those responsibilities include several aspects of natural resource management, environmental and public health protection, and economic development. Those policy areas overlap in several respects with the water management responsibilities of basin authorities such as CH Guadalquivir. Furthermore, the considerable geographic overlap between the boundaries of CA Andalucia and the Guadalquivir river basin mean that regional policies of the CA effectively cover the Guadalquivir basin.

Article 148 of the 1978 Constitution, and an ensuing Autonomy Act further defining the CAs' powers, gave them authority over:

- Public works of interest to the regional government within its own territory;
- Implementation of environmental protections;
- Planning, construction and operation of hydraulic works, canals and irrigation projects of interest to the regional government;
- Mineral and thermal waters;
- Fishing, with respect to shellfish, aquaculture, and fluvial (riverine) fish;
- Woodland and forestry issues.
- Agriculture and livestock farming, in accordance with general economic planning;
- Land-use planning; and
- Promotion of the economic development of the region within the objectives established by the national economic policy.

Several offices and departments of the Andalusian regional government have programs or responsibilities relating to water management in the Guadalquivir basin. They include the Water Secretariat, the Department of Agriculture and Fisheries, the Department of the Environment, and the Department of Health.

On the other hand, Article 149 establishes that the central government is responsible, among other things, for:

- Public works of general national interest;
- Water resources management in river basins shared by more than one region;
- Basic legislation on environmental protection; and
- Coordination of general economic planning.
- In addition, Article 132.1 places the central government in charge of the protection of public domain (including water resources) and common property, and Article 132.2 provides the central government's authority to declare natural resources as public domain.

Thus, the division of responsibilities concerning water management does not involve merely identifying inter-regional basins and intra-regional basins and associating the former with the central government and the latter with the CAs. Although the 1985 water law declared that CAs have primary responsibility for water management only in

intra-regional basins, it is also true that the CAs have authority with respects to some aspects of water resource management even in inter-regional basins such as Guadalquivir. Furthermore, CA representatives sit on some CH boards and commissions.

The most prominent example of CA Andalucia's interest in water resource management in the Guadalquivir basin is its establishment of the Andalusian Water Council in 1994, toward the end of the last severe drought in the basin. The Andalusian Water Council (AWC) continues to meet as a forum for public discussion and planning with respect to water (e.g., three times during 2002). The regional government's rationale for creation of the body is that the drought revealed serious water problems in the region that needed to be addressed regionally and in a participatory framework. The AWC includes a broad range of water stakeholders representing multiple interests and diverse policy views, and serves as a forum for them to converse and be informed. The AWC does not have formal decision making authority, but can make policy recommendations as it did in the "Andalusian agreement for water" published in 1994. During 2002, the AWC was considering the development of a regional position on the 2001 national water plan, which would likely recommend improved demand management, control of illegal water uses, and promotion of desalination as alternatives to the plan's proposed inter-basin water transfer project.[8]

The regional government's support of a forum such as the AWC appears to reflect a desire to develop a leadership role in water policy that the structure of Spanish water management neither explicitly confers nor explicitly forbids. Evidence of the regional government's intentions in this regard appears in its use of funding authority for intra-basin water projects. CA Andalucia has used funding to promote certain sub-basin level changes in water management practices. It has funded treatment plants for water quality improvement in the lower basin and near the coast. It has funded improvements for irrigation communities that have agreed to manage water supplies more carefully and control increases of water demand. It has funded projects for urban water suppliers conditioned on improvements to their management practices, changes in their rate structures to promote conservation, and reduction of flood risks through removal of structures from floodplains.[9]

An ultimate goal of the regional government appears to be the passage of its own regional water act. Of course, the 1985 national water law and its 1999 amendments could not be contradicted by anything passed at the regional level, but within those contours there remains considerable room for a regional government to express water policy priorities and adopt policies not currently covered by national law—drought management, for example.

The regional government has expressed a desire to have other functions explicitly transferred to it by the central government. Among those mentioned were licensing of

[8] Since a change of government in the March 2004 national elections, the central government has announced that it is abandoning the inter-basin transfer aspects of the national water plan, so this distinction between national government and CA policy recommendations is no longer as clear.

[9] For instance, when the city of Seville needed additional secondary wastewater treatment capacity, the Andalusian regional government funded and built the project, then transferred it to EMASESA to operate and maintain. The CA's participation was conditioned on EMASESA making improvements to its own works.

water uses, development of agreements among users for water transfers to deal with shortages, and establishing sub-basin management organizations (on the view that the river basins are in certain respects too big for effective participation and efficient management). The office of the Water Secretariat and the Andalusian Water Council would evolve to adopt and pursue some of these initiatives if the central government gave them the opportunity. This, of course, is the view from the regional government's perspective. Not all organizations in the basin shared the regional government's vision for its greater role in managing the basin's water resources.

Other

Although not a consumptive use, hydropower generation is a large non-consumptive user of water in the basin. Economic development and population growth expand the need for reliable and affordable electricity, much of which has been supplied by hydropower facilities sited on the tributaries and (in a few instances) the main stem of the Guadalquivir river. CH Guadalquivir's regulation of surface water flows has material ramifications for the hydroelectric industry, and the energy sector has representation on some CH boards.

6. Changes in Spanish Water Law and Policy Since the 1970s, and Their Implications for Guadalquivir Basin Management

This section describes some important transformations in national water law and policy that are essential to understanding the current functions and performance of water resource management institutions in the Guadalquivir river basin. Because the structures and responsibilities of CHs are established by the central government, a synopsis of these national policy changes is vital to an understanding of basin level management activities in the Guadalquivir basin. Details of the evolution of Spanish water law and policy before and after 1985 are available in Giansante (2003; see also del Moral and Sauri.1999).

The national water law prior to 1985 had been in place since 1879. It was badly outdated, reflecting priorities of a different era and failing to account for emerging concerns about water management and water quality. Regulations of new water demands and wastewater discharges had been pasted on to the existing system during the 1960s and 1970s without revision to the basic water law. As one set of observers characterized the situation, the scope of regulated water uses was rose but the coherence of water policy declined. (Costeja et al. 2002: 20)

In response to these and other circumstances, the 1985 water law represented a major reform of water policy in Spain. It was not a product of grass-roots reformism, however, having been designed primarily by expert personnel at the national level,. Four principles of the 1985 law were: 1) integrated management of water resources (surface water and groundwater, water quantity and water quality); 2) the river basin as the appropriate unit or scale of management; 3) user participation; and 4) reliance on water planning to balance social and economic development with ecological sustainability (Alcon Albertos 2002). These principles are intended to guide the fulfillment of the law's purposes, which were:

- Promoting water quality monitoring, protection, and improvement, and providing equitable and reliable mechanisms for funding those improvements;
- Bringing groundwater into the system of water use regulation along with surface water, shifting it from private-property to public-domain status;
- Incorporating economic techniques of water management, and implementing greater recovery of water costs from water users;
- Strengthening the CHs through integration of responsibilities at the river basin level;
- Enhancing representation and participation of water users and other stakeholders on the CHs; and,
- Instituting a more coordinated water planning approach, with river basin plans to be reconciled with a national water plan, which in turn would be reconciled with EU water regulations.

The 1985 law called for a new and comprehensive round of water plans. The central government was made responsible for drafting a National Water Plan, and for providing technical assistance to the CHs as they drafted Basin Water Plans. The plans must specify for 10-year and 20-year planning horizons the expected water demands and a program of action for meeting them. Demands and resources are to be allocated for each use sector (urban, environment, irrigation, industry, hydropower, fisheries and navigation). The basin plans must also establish surface water quality objectives for each water body in a basin. Plans are required to take into account other relevant policies and plans, such as those for land use, nature conservation, and agriculture (for instance, the EU Common Agricultural Policy).

The 1985 law broadened the definition of waters in the public domain to include essentially all surface waters and groundwater.[10] Uses that had previously been regarded as "private" therefore became public, and the government (primarily through the CHs) assumed responsibilities for regulating those uses through licensing and registration. Issuing water licenses and maintaining water registries represented a new role for the CHs, and reinforced their new mission as integrated water management agencies.

The new licensing requirements and procedures were accompanied by a new set of priorities among water uses, replacing those from the 1879 water law. Population supply remained first priority, but irrigation rose to second, and several uses not mentioned in the 1879 followed—hydropower was third, other industrial uses fourth, aquaculture fifth, and recreation sixth. Navigation, which had been included in the 1879 law, was seventh.

The 1985 law added economic tools for the regulation of water. It provided for water regulation rates and water discharge taxes for the use of water and the water domain. The water regulation rate is a payment designed to recover investments and cover operation and maintenance costs of state-funded dams and other water works. An occupation fee is an annual payment for the occupation of public water domain (e.g. river

[10] The inclusion of groundwater in the public domain represented a radical change in the status quo. In order to make it acceptable, some generous transitional provisions were included in the law, leaving water rights holders under the previous system the choice of whether they wanted to enroll in the Water Register or not.

banks). A discharge fee is an annual payment for the protection and improvement of the quality of rivers to which discharges are made. This tax is calculated by multiplying volume by polluting load. Although these rates and taxes have proved difficult to collect and insufficient to cover the costs of needed water works, their inclusion in the law represented a distinct and important policy change.

Other important developments included the assignment of water quality responsibilities and the recognition of instream flow needs. The 1985 water law conferred authority upon the CHs for the control of discharges to waters, and for the monitoring and management of river water quality. A decree accompanying the new water law recognized the importance of maintaining adequate instream flows for common uses (such as recreation), and for ecological and sanitation needs.

A set of amendments to the 1985 water law was adopted in December 1999. Although the 1999 amendments are nearly extensive enough to be a new water law, they remain within the 1985 law's general framework while adjusting to two important changes that had occurred during the intervening 14 years. One was the body of EU policies that had developed in the form of several regulations and ultimately the EU Water Framework Directive published in 1998. The 1999 amendments capture these changes by strengthening public control over water resources, tightening water quality requirements, and recognizing ecological values. The amendments also directed the CHs to take environmental protection and instream flow needs into account in making water allocation decisions, and to balance these values against the more traditional water uses that have had priority in Spanish policy.

The 1999 amendments also contained new guidelines for water pricing and new requirements for water metering to facilitate user-based water charges. CHs were authorized to encourage water conservation by imposing higher prices on water users who exceed their allocations and offering lower prices to those who stay within their allocations. Such a pricing system requires more precise measures of actual water use, so the 1999 amendments mandated that all users obtaining water licenses install water meters capable of measuring the volume used.[11] Also, because CHs had difficulty collecting the new charges authorized by the 1985 law, the 1999 amendments gave the collection function to the Ministry of Finance.

The 1999 amendments also gave holders of water licenses new options for water transfers. This change was intended to improve water use efficiency, especially in water-scarce locations and times, by allowing water to move from lower-valued uses to higher-valued uses in exchange for monetary compensation. To some extent, the authorization of transfers also balanced the tougher metering and pricing requirements the 1999 amendments imposed on water users.

The 1999 amendments did not alter the organizational structure of water management in Spain, but they exemplified the continued movement of Spanish water law and policy toward an integrated water resource management approach, strengthening public control over water use and the protection of water quality and environmental values, while adding economic incentives and some flexibility with regard to water

[11] Holders of existing licenses are not required retroactively to install meters; the requirement takes effect only if they apply for a change of water use, location, or amount. The effect of the requirement on the irrigation sector is therefore small, since most irrigation is performed with existing licenses.

demands and water uses. (Costeja et al. 2002: 20) The combination represents a continuation of Spanish water policy reform. The revised national water plan presented in 2001, which raised conservation targets, and the announcement of the newly elected government in 2004 that it would cancel a major inter-basin water conveyance project, also reflect the reform trend.

7. Participants' Motivations, Incentives and Actions

The historical motivations of national policy makers in creating the Spanish CHs were discussed earlier. The current relationship of the central government to the CHs indicates other motivations and incentives have come to the fore more recently. The international reputation of the CHs and the prestige associated with it (second only perhaps to the French river basin agencies or Australia's Murray-Darling Commission) are certainly one of the motivations to keep them in place. On a more pragmatic plane, the presence of the CHs and their evolving responsibilities for IWRM has aided Spain in receiving EU support for its environmental programs.

The near uniformity of organizational structures among the CHs also reflects central government officials' incentives and motivations. Establishing a system of river basin authorities does not have to mean specifying every detail of their internal composition (such as the number of seats for each water sector on each CH board and commission), but in Spain it does. Three reasons have contributed to the central government's desire to maintain a higher degree of regularity among the CHs. One, of course, is administrative simplicity for central government officials who interact with the CHs. Another is the fact that the national government provides substantial funding for the CHs, and officials who fund organizations often wish to exercise some control over them. Third, inter-basin water transfers have long been a centerpiece of Spanish water plans, abandoned only very recently. For a central government that plans (and would fund) movement of water from one river basin to another, there may be an understandable desire to harmonize the structure and functions of the river basin authorities that would be on the donor and recipient ends of such transfers.

The officials and staff of the CHS themselves have distinct but compatible motivations. Certainly maintaining the prestigious reputation of the CHs enhances the intrinsic value of their work, and would contribute to an understandable reluctance to loosen control of decision making. CH officials and staff might prefer to avoid heavy oversight and direction from Madrid with respect to implementation of water management policy, but some limitation of CH discretion is a worthwhile tradeoff for the central government's financial support. Being aligned with Madrid as organizations of the central government also gives CH officials and staff some autonomy from local and regional interests. At the same time, alliances with politically influential local groups (such as the irrigation communities and association in Guadalquivir) allow CH officials and staff to achieve a kind of "triangulation" between Madrid's direction and local interests, such that their relationship to each helps them maintain some distance from the other. Among local interests, irrigators are likely to be most influential, since the internal organization of CH Guadalquivir provides officials and staff less incentive to work closely with urban and environmental interests.

While irrigators at times have competing interests (e.g., upstream retention of reservoir water versus releases for downstream benefits), it is possible to identify

motivations they have in common as well. Irrigators undoubtedly want to maintain access to water subsidies, and to keep irrigation's high priority in Spanish policy governing water allocation. They also can be expected to resist mandates to improve efficiency, and have done so successfully thus far (even though some irrigation communities have invested in efficiency improvements). The legal recognition of irrigation communities allows them to police themselves and regulate their own internal conflicts, which is also a valued attribute that irrigators would want to maintain. Keeping a positive working relationship with the CHs can also provide irrigators with a buffer against regional or local government policy initiatives that might be more responsive to interests and concerns of urban and industrial water users or environmental groups.

Those regional and local governments have a different set of interests and motivations. In a semi-arid region, control of water is an important element of autonomy from the central government, and is perceived by some regional officials as an extension of democratization. At one time, the CHs might have been valuable to regional and local governments in water-scarce regions of Spain such as the Guadalquivir basin because the CHs financed and built water works and promoted inter-basin transfers, but these roles are declining in relevance. Instead the regional and local governments would prefer to see CHs more aggressively carry out their newer IWRM roles in water quality protection and demand management. River water quality is a greater concern for them, both because of its impact on needed (and costly) treatment prior to public consumption and because rivers and coastlines are an attractive amenity for the tourism and recreation industries that have grown in importance in Spain. Local government officials interviewed for this project also felt as though their efforts in implementing pricing, metering, and conservation measures have simply allowed irrigators to have a larger share of water at a lower cost, and the CH does little but facilitate that.

8. Performance Assessment

8.1 Enhancing Water Supply Reliability and Closing the "Water Deficit"

Although their other responsibilities have varied over time, a consistent mission of the CHs has been the construction and operation of water works. Even today, almost 20 years since the water works and management functions were re-combined in 1985, the water works function seems to be what CH Guadalquivir officials and staff are most interested in and comfortable with. It is also the function for which tangible results are most easily measured and achieved. The management functions—water licensing, demand management—have been performed with less vigor and with less positive results.

Most reservoirs in the basin were built to provide water for irrigation. Some more recently constructed reservoirs were built for urban supply. The combined capacity of the more than 60 reservoirs in the basin is 6,833 cubic Mm^3, which matches the total streamflow of the Guadalquivir basin. The regulation capacity or average annual regulated flow is 2,255 Mm^3. (COPyT 1998) CH Guadalquivir, like the other Spanish CHs, appears to have succeeded in planning, financing, building, and operating hydraulic works that reduce the water supply variability of the region.

Nevertheless, Guadalquivir's "water deficit" has not been erased, and exposure to droughts remains a principal problem. Each drought episode of the 20^{th} century was

followed by another round of reservoir construction. After the 1981-83 drought, for example, 18 additional reservoirs were built to provide a 40% increase in regulation capacity in the basin. Nevertheless, the 1992-95 drought left a million Sevilla residents and some irrigation communities in the basin short of water. That drought yielded the latest new reservoir project in the basin, being built to extend Sevilla's drought protection by a projected 1-1/2 years, but at high and rising costs.[12] CH Guadalquivir continues to maintain and promote a long list of additional construction projects within the basin.

The effectiveness of the structural approach to addressing supply-demand imbalances is now being called into question for a number of reasons.

- The storing efficiency of individual reservoirs appears to decrease as total reservoir capacity increases. Despite the huge addition to capacity after the drought of the early 1980s, 1979's record stored water volume (4,000 Mm^3) has been reached and exceeded only once.
- Siltation is already a significant problem in reservoirs, and eutrophication is a growing problem in reservoirs devoted to urban supply.
- According to CH Guadalquivir officials, several reservoirs need significant maintenance or refurbishment to address loss of capacity due to siltation and age. Furthermore, many irrigation canals and distribution systems are aging and in need of maintenance or replacement; likewise the distribution networks of several municipal supply systems.
- New water supply availability appears to have simply generated more water demand rather than satisfying the quantity demanded previously. Irrigated land surface has increased (some of it without authorized water use), cities have expanded, industries have grown—all faster than supply-augmentation projects could generate additional and reliable water supply.

Flooding also remains an occasional problem, despite the number of facilities that have been built. These facilities have lengthened the interval between damaging floods in the lower basin, but the structural approach has been accompanied by trends that threaten to undermine its success. Urban and agricultural development has encroached into floodplain areas, making the population and economic activities more vulnerable (del Moral and Giansante 2000: 100). New efforts to reduce flood damage are focusing on real-time information systems, flood zone designation, and dam safety measures.

8.2 Water Quality

Water policy reform added quality protection to the duties of water management agencies in Spain. Water quality objectives are based on intended uses, with quality standards for drinking water sources, for recreational water contact, and for aquatic species. With each river stretch assigned to one or more categories of use, it is possible to identify all river stretches that do not comply with their corresponding water quality objectives (Figure 2).

[12] The environmental mitigation measures affiliated with the construction of the dam and reservoir site are estimated at 60-70% of the total cost of the dam project.

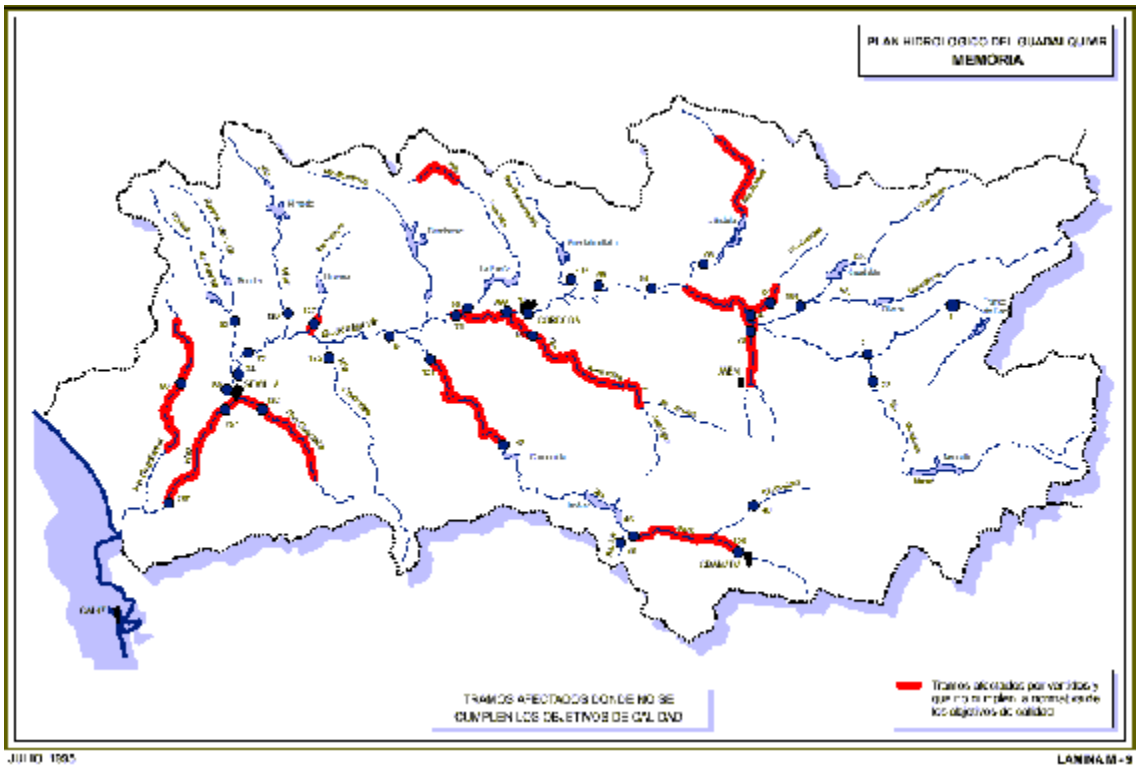


Figure 2. River Stretches Not Complying with Water Quality Objectives

Municipalities have primary responsibility for urban wastewater treatment. The Andalusian regional government (through the Directorate General for Waterworks in the Ministry of Public Works and Transport) supplies technical and financial assistance to municipalities, and has promoted the establishment of consortia (associations of municipalities) to improve the financial feasibility of building and operating treatment facilities for smaller municipalities. CH Guadalquivir's role has been limited to the collection of a discharge fee (*canon de vertidos*) from municipalities or businesses, based on the volume and pollution load discharged into rivers. This fee is intended to promote treatment prior to discharge, since the fee diminishes toward zero as effluents are treated. Despite sanctions, however, non-compliance with the discharge fee requirement has been high; in 1992, 30% of this tax was left uncollected (MIMAM 1998). The 1999 water law amendments transferred fee collection responsibility from the CHs to the Ministry of Finance in hopes of improving performance.

Industrial discharges are mainly concentrated at specific locations, with many related to the food-processing industry—notable examples being the effluents derived from the production of olives or olive oil. The olive growing and processing sectors have taken some steps to reduce their discharges to the river system, such as decantation pools or converting to a so-called dual oil pressing system.

Emerging water quality problems in the basin come from nonpoint sources, and thus are closely related to land and water use in the basin. For example, farming on hillsides aggravates water runoff and soil erosion, contributing to the deterioration of stream quality and the siltation of reservoirs. Agricultural runoff from livestock and

cropland is becoming a larger source of water quality problems than point sources, according to CH Guadalquivir staff. Agricultural runoff tends to be high in nitrates, which affect water quality in reservoirs and promote eutrophication. Nitrates in drinking water supplies have been linked to a potentially life-threatening illness among newborns. Thus far, no systematic efforts to reduce nonpoint pollution such as that coming from runoff have been implemented in the basin.

8.3 Incorporating Groundwater Management into the Surface Water System

Many problems have emerged in implementing the 1985 law's integration of groundwater pumping into the water licensing system, and integration remains a work in progress.[13] In the Guadalquivir basin, approximately 20,000 wells out of about 100,000 total remain to be settled. Since 400,000 wells nationwide have been filed for but not yet settled, CH Guadalquivir's backlog is not unique, and may even be comparatively small, but represents considerable unfinished business 20 years after the law was passed. In order for provisions of the 1999 amendments to work (especially the authorization of water transfers), CHs have to keep registries updated. The Ministry of the Environment has designated the completion and updating of registries as a priority and, if needed, will provide support for the information-technology tools to get the job done.

8.4 Demand Management and Water Use Efficiency

Agricultural water use remains comparatively inefficient. The low efficiency of irrigation water use, and the lack of incentives for irrigators to do anything about it, are reflected in the fact that irrigators are still using canals built by Civil War prisoners in the 1930s. The water yield is 70% due to losses inherent in canal use and overall inefficiency. Drip irrigation systems cut these losses but involve high conversion costs and ongoing operational costs (and may reduce the amount of groundwater recharge resulting from the "return flow" of irrigation water applied on overlying land). The persistence of inefficient water use in the irrigation sector is due partly to pricing practices. Most irrigation users pay water tariffs based on their land surface rather than water use, so the tariff does not provide a financial incentive to conserve. Furthermore, the tariff irrigators do pay works out to roughly 1/20 of the amount paid by urban users in the Guadalquivir basin[14]—a significant subsidy of irrigators' use of the water

[13] The 1985 law itself contained an exemption that presents ongoing problems in integrating groundwater use into the basin management regime. Wells pumping less than 7,000 cubic meters per year only need to inform the CH of their existence, without having to obtain a license. On the other hand, the CH is required to verify that those wells are pumping less than 7,000 cubic meters per year, which is a time-consuming task requiring significant personnel resources. CH Guadalquivir estimates that there were 27,000 such wells in the basin when the law was adopted in 1985, and there are 40,000 such wells in the basin now.

[14] Calculated as follows: water tariffs in irrigated areas within the basin range between 6 and 210 euros/ha, with the large variation reflecting different water sources and irrigation areas. The average price, including bulk water rates and irrigation community charges, is difficult to calculate but 120 euros/ha is a good approximation. If we take an average water allowance of 7,000 m^3/ha, the average price per m^3 would work out to around 0.02 euro/m^3, compared with an approximate average of 0.80 euro/m^3 paid by water users in municipal water systems in the basin. Since about half the cost paid by urban users is for sanitation

infrastructure. The 1985 Water Act required the payment of storage charges and rates in order to recover investments and cover operation and maintenance costs of state-constructed water works, but a high degree of subsidization remains and even the artificially low charges have proved difficult to collect.

Urban water suppliers within the basin, especially in the Sevilla metropolitan area, have moved more aggressively to use fees and charges for water demand management and drought response. Higher tariffs have not only limited the growth of water demand in urban areas, but provided revenue to upgrade inefficient or leaking distribution systems.

8.5 Strengthening Stakeholder Involvement and Participation

Effective implementation of integrated water resource management (IWRM) requires communication with and among stakeholders, and their participation in basin management decisions. Although stakeholder representation on the CH boards and councils was expanded in 1987 and 1989 central government decrees, the management structure and internal culture of CH Guadalquivir has been slow to change. If they were to meet regularly, the consultative boards and commissions can inform the process, but formal decision-making authority remains concentrated in the hands of the CH president and board.

Irrigators in the Guadalquivir basin enjoy a favored position. They receive a disproportionately large share of water, and at a subsidized rate, which poses a problem in periods of water scarcity when cities have insufficient amounts for their populations. This situation has endured partly because formal and informal practices give irrigators a larger share of influence and interaction with CH staff than urban water suppliers and other interests enjoy. A specific example is that on CH Operation Boards, a large Irrigation Community (> 60,000 ha) can have 6 representatives, but the largest of cities (>100,000 inhabitants) can have no more than 4. Thus even Sevilla, with more than a million inhabitants, will be limited to no more than 4 representatives on an Operation Board, while irrigators can appoint more. Since representation on the Operation Boards is translated into representation on the Governing Board, irrigators' interests are systematically weighted more heavily and other interests less so.

Informal relationships and practices reinforce this dominance. Interview findings clearly indicated that the CH boards and commissions which have the broadest stakeholder representation, including the Water Users Assembly, meet infrequently. Between meetings, however, irrigator representatives such as Feragua maintain close and frequent contact with CH staff and officials. The urban water suppliers and regional government representatives did not appear to enjoy similar relationships of easy informal access to CH decision makers, and expressed frustration at feeling relatively cut off from the CH and its decisions. At present, there are different levels of interaction and coordination between a municipal supplier like EMASESA and the CH Guadalquivir. At the technical staff level, with respect to management functions such as reservoir releases and the operation of hydropower plants, the interaction and coordination is virtually on a

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and wastewater treatment, which are services not needed by irrigators, a fairer comparison would with urban water costs of about 0.40 euro/m^3. The 1/20 ratio comes from comparing 0.02 with 0.40 euro/m^3.

daily basis. With respect to higher-level policy setting, however, interaction and coordination is reportedly less smooth.

The 1985 Water Act can be considered an experiment that opened a far-reaching debate, which has included at times a high degree of conflict. Increased conflict is not necessarily an indicator of failure of the system, since open debate (about water or anything else) had been muffled in Spain for decades. The current conflicts concerning water management appear to be taking place outside the CHs, however, rather than finding expression within them. Basin authorities such as CH Guadalquivir may still be perceived as a relatively closed agency serving irrigators' interests, and is not yet the forum within which a broader range of basin stakeholders express their views and determine basin policy direction.

9. Applying the Analytical Framework

The observations in the preceding sections relate to the analytical framework with which the case studies in the research project are being conducted. In this section, we return to that framework to draw the connections more explicitly.

9.1 Initial Conditions and Contextual Factors

Some contextual factors and initial conditions have affected the emergence and performance of river basin management in the Guadalquivir markedly, others less so. Water management issues and their resolution in the Guadalquivir case do not appear to have been driven by ethnic, religious, or class divisions in Andalusian society. On the other hand, the economic development of the nation and of the region have had notable effects. The very establishment of the CHs, with an emphasis on the construction of water works to promote land development, emanated from national policies to bolster economic development by promoting first the expansion of agriculture and later the expansion of industry. The Guadalquivir basin in particular was poorer and more rural than most of the rest of the country, and these conditions contributed to an emphasis on the expansion and protection of irrigated agriculture as the central element of the region's economic and social life. These contextual factors have shaped the perceptions of many Guadalquivir basin stakeholders and the CH staff about the principal purposes and appropriate focus of river basin management.

9.2 Decentralization Process

The CHs were created by the central government for its own purposes—neither because of local-level demands for greater autonomy nor because of a central-government desire to shed water management responsibilities, but as an organizational device for executing central government policy one river basin at a time. The CHs nonetheless provided a means for stakeholder participation through representation on boards and commissions. The establishment of basin management institutions in Spain thus carried the potential for greater water user involvement, but that was not the principal reason for which they were created. The CHs are best understood as central government agencies with representative components, with the balance between central control and user participation varying over

time. Central government officials have established, diminished, and resurrected the user representation components over the life of the CHs.

Having been established and reconstituted from time to time by the central government, these basin-scale institutions enjoy the recognition of central government officials as legitimate water resource management entities. Such recognition has not been accompanied by an extensive devolution of authority, though. The organization, responsibilities, and policy direction of CHs such as the one in Guadalquivir are established primarily by direction from Madrid.

It is equally clear from the 75+ year history of CHs such as the one in Guadalquivir that the central government's policy commitments to decentralization, IWRM, and stakeholder participation have not been consistent through central government transitions. As indicated briefly in this paper and in detail in Giansante (2003), the roles, priorities, and structure of CHs in Spain have varied considerably, from the pre-dictatorship to the dictatorship periods and in the post-dictatorship period.

9.3 Central-Local Relationships and Capacities

Water resource management is not the only service or function to have gone through decentralization reforms in Spain during the 20th century and into the 21st. While federalism in Spain is a fairly recent phenomenon, it has emerged quite rapidly since the 1970s with regional and local governments responsible for an array of services including sanitation, land use regulation, and transportation.

With respect to the question of whether devolution of authority to the river basin level has been real or merely rhetorical, the only clear answer in the Guadalquivir case is that it has been some of each. Basin level entities such as CH Guadalquivir construct basin level plans, but basin plans must be submitted for national approval and be consistent with the national water plan. CHs collect revenue of their own for some of the services they provide, and do not have to turn it over to the central government, but they also rely on central government funding for functions established and determined by central government officials. CHs have several advisory bodies composed of stakeholder representatives, but several of those councils also have central government representatives and the CH president is still a central government designee.

The Guadalquivir case is plainly not one where the central government has recognized basin-level organizations and then abandoned any further commitment to or responsibility for water management. If anything, central government policy reforms since the 1970s have broadened the CHs' portfolio of IWRM responsibilities in ways that CH Guadalquivir staff have found difficult to sustain. CH Guadalquivir has better financial resources and autonomy than basin organizations in some of the other cases in this study, to be sure, although CH staff indicated there are not enough personnel to perform all the required functions in the basin.

The central government's new water rights regime (begun in 1985 and modified somewhat in 1999) is certainly beneficial from an IWRM standpoint—bringing more users into the system (through the expanded definition of "public domain"), quantifying licenses, maintaining a registry of users, and creating opportunities for trading. The new regime's actual effects on IWRM in the Guadalquivir basin or any other Spanish river

basin will depend on its implementation and enforcement, which have been delegated to the CHs.

It does not appear that basin-level participants can alter basin management institutions, at least not the CHs. As noted, their structures and responsibilities are set by national laws and decrees. This limits the flexibility and adaptiveness of the institutional arrangements to varying basin conditions and circumstances. In the Guadalquivir case, this lack of flexibility and adaptiveness is best reflected in failure to adjust the representation of basin stakeholders on CH boards and councils, for example to reflect the basin's rapid and substantial urbanization over the past three decades. The central government remains free to alter the governance structure or decision making processes of the CHs (and appoint its leadership) with as much or as little stakeholder consultation as it chooses, but the basin stakeholders do not possess a comparable ability to tailor the institutions to their perceptions of needed or appropriate arrangements.

It is possible of course for basin stakeholders to seek change from the national government, a prospect that brings us to the distribution of national-level political power among basin stakeholders. In Spain, irrigators have organizational clout and know how to use it at the national level to protect their rents. The CHs' water works function has been heavily subsidized, creating an artificially cheap production factor for water users. As irrigation is by far the largest water use, irrigators have been the principal beneficiaries of this subsidization. As would be expected, they have organized to promote and protect their advantages. With the active (but not always overt) cooperation of the CHs, irrigators have managed to make the old system persist well past the point when the national government's stated policy shifted away from subsidization and toward full cost recovery. Urban water customers are by far the largest number, industrial water users contribute more to national output, and regional-government policy makers have a major stake in the sustainable use of the basin's water resources, but at least in Andalucia these stakeholders have had less influence on basin-scale water resource management decisions. It is possible that this situation will change with the shift in party control of the national government in the elections of March 15, 2004, but it is too early at this point to tell.

A final question with respect to central-local relationships is whether the national government's reforms and the basin institutions have had sufficient time to implement and adapt basin management activities and assess performance. At least with respect to 1985 law, the answer would seem to be yes, so failure to have an adequate registry of water licenses or control of illegal water uses cannot be attributed to lack of time. On the other hand, the 1999 reforms (encouraging demand management and allowing water transfers) had probably not had a long enough period of implementation to assess by the time this visit was conducted in 2002.

9.4 Internal Basin-Level Institutional Arrangements

Basin-level governance institutions do exist in this case, and correspond with the geographic boundaries of the river basin. For most of the time from 1927 to the present, however, the river basin authority was primarily a water works construction and operation agency. CH Guadalquivir did not function as a basin governance entity through much of its existence. Changes in the responsibilities and the structure of the

CHs in 1985 and 1987 appear to have been intended to change them into basin governance organizations.

While geographic boundaries are fitted well, institutional boundaries have become unclear. As noted, the Guadalquivir river basin overlaps considerably with the boundaries of the Andalusian regional government, and reasonable persons can and do disagree about the dividing lines between the basin management responsibilities of the former and the economic development, public health, environmental protection, and natural resource management responsibilities of the latter. The allocation of authority to regional government in the 1970s leaves plenty of room for interpretation about who is responsible for what or who can do what, and the changes in the CHs' roles/responsibilities from the 1930s through the mid-1980s broadened (but did not necessarily sharpen) the understanding of what they may, must, or must not do.

The potential for conflict between CA policies and CH policies is heightened by social and political factors. The CH's representation and governance structure gives greatest weight to irrigation users, and the larger irrigation communities have strengthened their influence further by speaking and acting collectively through Feragua. The regional government, on the other hand, is elected on a one person-one vote system and therefore its voting base reflects the region's increasingly urban population and economy. To the extent that irrigation and urban water interests concerning basin management clash, those differences may be expressed as divergent views and policies from the CH and the CA. Furthermore, there may be an aggravating partisan factor: the central government (which provides a considerable share of CH funding, appoints the CH president, and has significant representation on the CH boards) was a Popular Party (PP) government from 1996 to 2004, while the Socialist Party (PSOE) prevailed in Andalusian regional government. Individuals interviewed for this project disagreed over the *extent* to which this difference of party control mattered to water management in the Guadalquivir basin, but the existence of the difference was mentioned several times.

The basin-level institutional arrangements in the Guadalquivir case do recognize sub-watershed communities of interest within the basin. Only one set of sub-watershed communities has formal recognition in both national law and the CH organizational structure, however, and that is the irrigation user communities. These communities have substantial authority to govern their internal water allocation, use, and disputes. Other sub-watershed communities clearly do exist in the basin, but their recognition and representation in the basin-level structures is not on a par with that of the irrigation communities.

Basin-level institutional arrangements are structured to provide forums for information sharing and communication among basin stakeholders and between stakeholders and CH staff. The effectiveness of these structures depends upon their utilization. It appears that meetings of the Water Users' Assembly, for example, are few and rather far between. Operations boards and the CH governing board meet more regularly but their representation is not as broad. At the regional level, the Andalusian Water Council appears to have met regularly and has a broad representative structure, but is not coordinated with the river basin authority. At the sub-basin level, users' assemblies in the irrigation user communities may draw greater rates of participation but this varies a great deal across the hundreds of communities in the basin.

A related question concerns the availability of conflict resolution mechanisms within the river basin. The irrigation communities have irrigation courts to resolve disagreements among water users, but no comparable forum exists on the river basin scale. Water users who wish to challenge a decision taken by CH Guadalquivir can go to the constitutional court, but as mentioned earlier such a challenge can address only whether the CH has exceeded its granted authority, not disagreements over policy direction, resource allocation, and so on.

Monitoring of water deliveries, water use, and water quality occurs in the basin, with water quality monitoring performed principally by CH Guadalquivir and by urban water suppliers. Water use by license holders is monitored inconsistently since the water user registry is not complete, and most of the individuals interviewed for this study acknowledged a substantial problem with illegal water uses continuing in the basin. With respect to irrigation water use, the CH monitors what goes into and comes out of irrigation communities, but monitoring of use by individual irrigators occurs within the irrigation communities and it is impossible to draw sound conclusions across the hundreds of communities about how effectively this is done. With respect to urban water use, the larger suppliers (such as those in the Seville metropolitan area) meter water usage, but in many multi-family buildings such metering does not go all the way down to the individual water user level.

10. Concluding Remarks

In some respects, Spain is no different from any other country—integrated river basin management in the new water policy environment is genuinely difficult, and it is not clear that any country is doing it especially well. Shortcomings observed in Guadalquivir are witnessed in other places too. In many ways, Spain is further along than almost anyone else in pursuing IWRM with a river basin focus, but Spain's experience also demonstrates that the establishment of river basin authorities in and of itself is not a solution. Even under such favorable organizational circumstances, political, economic, legal, and historical factors complicate the development and implementation of IWRM at the river basin scale. Vast changes in the Spanish political system are intertwined, chronologically and substantively, with the development of current water institutions and policies.

The central government in Spain made an effort starting 75 years ago to establish basin-scale structures and use them for water development, water planning, and certain aspects of water management. Equally clearly, this was a "top-down" creation of basin organizations by the central government rather than a "bottom-up" process initiated by local water users. The basin organizations in Spain remain tied to the central government. Even with internal structures providing for stakeholder representation, CHs were established as agencies of the central government and remain so today (at least the inter-regional ones).

The end of the Franco dictatorship in the 1970s brought about a significant decentralization of the whole political system, including not only democratized national-level politics but also the creation of a new level of regional government, the CAs. The devolution of powers to those regional governments included water-related authorities and responsibilities that further decentralize water management in Spain, but not to the river basin scale per se. Thus, it is clear that several aspects of water management in

Spain have been decentralized, but this does not coincide in all respects with river basin management.

Furthermore, the reform of Spanish water law in the 1980s occurred simultaneously with developments at the supranational scale. The year of the new water law, 1985, was also the year when Spain entered the European Community, now the EU. The EU has added a new layer of water regulations and other policies (e.g., regarding agriculture) with important implications for water resources. Whatever else may be said of EU policies, they can hardly be described as a form of decentralization.

Overall, decentralization in the Spanish water arena has been gradual and complex, with several different components. If one takes the 1978-1985 period as the principal decentralization reform landmark, several changes in that period contributed to the current configuration of river basin management, both in terms of regional devolution and of participation in policy making:

- the transition to democracy and the approval of the Spanish Constitution in 1978;
- the creation of regional governments (*Communidades Autonomas*) with differing degrees of responsibilities in water management;
- the issuance of the 1985 decree re-uniting hydraulic and water resource management into the functional responsibilities of the CHs;
- the approval of the 1985 Water Act, establishing a modern framework of water management, linking surface and groundwater, encouraging user participation, and conferring a central role to water planning; and
- the 1987 decree restructuring the internal composition of the CHs and their boards and commissions.

Thereafter, the Spanish river basin management regime generally, and the Guadalquivir basin regime in particular, have been called to respond to a broader and often more conflictual policy environment of competing water demands and more stringent water and environmental regulations, at the same time operating in a context of restrained public finances and a growing resistance to traditional forms of water supply development. The 1985 water law, 1999 amendments, and 2001 national water plan, combined with the EU Water Framework Directive, plainly have moved Spanish water policy away from a sole emphasis on supply augmentation and toward the incorporation of additional goals of water quality improvement, water demand management, water use efficiency, and environmental protection. At a system-wide level, Spanish water policy in 2004 much more closely resembles an IWRM approach than it did 20 years earlier. In the Guadalquivir basin, these changes have been accompanied by greater friction between urban and irrigation water constituencies (particularly during and after the 1992-95 drought), and the growing interest of the Andalusian regional government in providing an alternative forum for water policy making.

The transition to democracy provided an opening of the policy window for many aspects of Spanish life, with a newly open and competitive electoral arena at the national level and new institutional alternatives in the regional governments. Spanish membership in the EU and the EU's involvement in fiscal and water policies also have provided leverage for reformers wanting to break the old structural approach of dam-building and water subsidies. The CHs remain central figures of river basin management in Spain, but

reformers have challenged them through other policy making arenas and by creating alternative structures such as the Andalusian Water Council.

Water policy reform in Spain--particularly the movement toward IWRM at the river basin scale—has resulted mainly in the addition of new and different responsibilities to the CHs, and some involvement of regional and local governments in water policy and politics, but not a transformation of the organizational approach to river basin management. The national government has remained committed thus far to the CHs (which are a subject of considerable pride in Spain) as the principal institutions for water management, and the CHs are understandably reluctant to cede control over any part of the public water domain now that they have it. As the CHs' water management portfolio has broadened, they have not performed the new functions as well as their traditional ones, and this contributed to some of the performance outcomes.

Involvement of other stakeholders and the shift to IWRM have fragmented the configuration of water management organizations and their roles. Costeja et al. (2002: 18-21) have described the fragmentation as both horizontal and vertical. The horizontal fragmentation has to do with the dispersion of water policy across more agencies with water-related responsibilities More specifically, they contend that new aspects of water policy (e.g., environmental protection, water quality) have spurred the development of new agencies and/or the assignment of new responsibilities to others. At the national level, in addition to the CHs there are at least seven entities (ministries, councils, etc.) with significant water-related responsibilities. The water-related responsibilities of the Andalusian regional government are distributed among at least five entities (departments, councils, etc.).

The regional governments are also an element of what Costeja et al. (2002) have called the vertical fragmentation of Spanish water resource policy and management. In the pre-reform era, for better or worse, the national government was the dominant water resource policy maker. In the post-reform era, water policy has become a matter of subnational (CA) and supranational (EU) involvement as well, and the national government is no longer the sole director. The array of subjects that are included in water policy considerations has changed in the direction of IWRM, but the formation of water policy and the conduct of water management are spread across a larger number of entities at different governmental levels.

These changes have certainly challenged the dominance of the traditional water policy community in Spain and helped overcome the exclusion of other constituencies and considerations from meaningful participation. In that respect, it is possible to say that basin management has moved in directions of both decentralization and integration. But the transformation of the Spanish political system, the addition of EU policies and regulations, and the dispersion of responsibilities into overlapping agencies and levels of government have made for an uncertain transition and, at least in the Guadalquivir basin, generated a mixed record of institutional performance thus far.

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Appendix: Variables in the Analytical Framework

As noted in Section 2, the analytical framework used for this research project entails several variables hypothesized to be related to the success or failure of river basin management institutions, grouped into four categories.

Contextual factors and initial conditions

The literature on decentralized water resource management indicates that successful decentralization is at least partly a function of the initial conditions that prevail at the time a decentralization initiative is attempted. These initial conditions are elements of the social context of the decentralization effort. They include

- Economic development of the nation;
- Economic development of the basin area;
- Initial distribution of resources among basin stakeholders; and
- Class, religious, or other social/cultural distinctions among basin stakeholders.

Characteristics of the decentralization process

In countries that have attempted to decentralize water resource management to the basin level, characteristics of the decentralization process itself will affect the prospects for successful implementation. Two necessary conditions of a decentralization initiative are (a) devolution of authority and responsibility from the center, and (b) acceptance of that authority and responsibility by the local or regional units. Whether (a) and (b) occur will depend in part upon why and how the decentralization takes place. Important factors include

- Whether basin-level management was a local initiative to assume management responsibilities, a devolution that was mutually desired by local stakeholders and central government officials, or a decision by central government officials to shed water resource management responsibilities regardless of whether basin stakeholders wanted to assume them;
- The extent of central-government recognition of local-level basin governance; and,
- Whether central government officials maintained a policy commitment to decentralization and basin management through transitions in central government administration.

Characteristics of central government/basin-level relationships and capacities

Because successful decentralization requires complementary actions at the central government and local levels, other aspects of the central-local relationship can be expected to condition that success. Political and institutional variables should be

explored that relate to the respective capacities of the central government and the basin-level stakeholders, and the relationship between them. Key factors include

- The extent to which devolution of water management responsibilities from central government to basin institutions has been real or merely rhetorical, and whether devolution has been handled as a supportive transition to basin management or as an abrupt abandonment of central government authority;
- The financial resources available to basin-level institutions, and the extent of their financial autonomy;
- Basin management participants' ability to create and modify institutional arrangements that are tailored to their needs and circumstances;
- The extent of other experience at the local or regional level within the country with self-governance and service provision;
- The distribution (particularly asymmetries) of national-level political influence among basin stakeholders;
- Characteristics of the water rights system in the country which facilitate or hinder basin management efforts; and
- Whether basin-level institutions have had adequate time for implementation and adaptation of basin management activities.

The internal configuration of basin-level institutional arrangements

Successful implementation of decentralized water resource management will also depend on features of the basin-level arrangements created by stakeholders and/or central government officials. Important ones include

- The presence of basin-level governance institutions;
- The extent of clarity of institutional boundaries, and their match with basin boundaries;
- Whether and to what extent basin-level institutional arrangements recognize sub-watershed communities of interest;
- The availability of forums for information sharing and communication among basin stakeholders;
- The ability to make, monitor, and enforce contingent contracts whereby basin stakeholders can agree to contribute to improvements in basin conditions;
- The institutionalization of regular monitoring of basin conditions by means that are trusted by water users; and
- The availability of forums for conflict resolution.

Certainly, these factors will not all apply with equal significance in all cases. In each case, the emergence and path of river basin management will be affected profoundly by some of these variables, affected slightly by others, and not at all by some. Institutional analysis in a case-study setting consists largely in determining which institutional factors in what combination appear to have been linked to outcomes. Furthermore, many of the variables listed above have subjective components, and will be

assessed differently by different participants and observers. It is therefore essential in these case studies that team members interview individuals with a variety of perspectives.