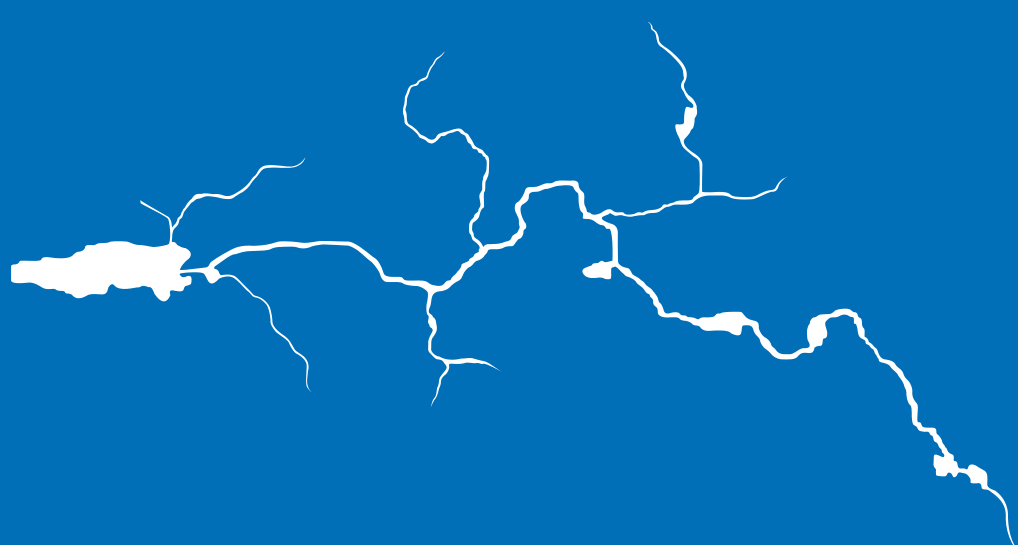

SHEDDING THE WATERS

PHILIPPUS WESTER

SHEDDING THE WATERS

INSTITUTIONAL CHANGE AND WATER CONTROL IN THE LERMA-CHAPALA BASIN, MEXICO

PHILIPPUS WESTER

PROPOSITIONS

1. As hydrocracies engage in their institutional reproduction through the articulation of water reforms they will resist reforms that are perceived to weaken their position. (this thesis)

2. The continued decline of groundwater levels in the state of Guanajuato is the result of a political will that is largely informed by the voice of money and not due to the "lack of political will". (this thesis)

3. The hydraulic mission has a long pedigree, as brought out by an edict of emperor Wu Ti published in 111 BC, which stated that as agriculture is the basic occupation in the world and springs and rivers make possible the cultivation of the five grains, the government must cut canals and ditches, drain rivers and build dikes and water tanks to prevent drought. Quoted in Chi (1936) *Key Economic Areas in Chinese History As Revealed in the Development of Public Works for Water-Control*.

4. The common ground needed for "getting past no" can be created by broadening definitions and recasting agendas to include something of everything. However, the resolution of a conflict always involves making a choice.

5. To understand policy processes it is illuminating if the word policy making is taken literally and the definition of policy makers is widened to cover all the policy actors involved in making or breaking a policy.

6. When managers and politicians emphasize that something is not the case, for example that proposed changes are not a cost cutting measure, they usually mean the opposite.

7. Freedom of thought is the highest good, especially when you have stopped thinking.

8. As Gustave Flaubert once said about writing history, writing a thesis is like drinking an ocean to produce a cupful.

Propositions attached to the thesis:
Shedding the Waters:
Institutional Change and Water Control in the Lerma-Chapala Basin, Mexico

Philippus Wester
Wageningen University, 19 March 2008

SHEDDING THE WATERS

Institutional Change and Water Control in the Lerma-Chapala Basin, Mexico

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SHEDDING THE WATERS

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Philippus Wester

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Contents

List of Figures

List of Tables

Abbreviations and Acronyms

AEL	Annual Energy Limit
ANT	Actor-Network Theory
ARLID	Alto Río Lerma Irrigation District (*Distrito de Riego Alto Río Lerma* also referred to as *Distrito de Riego 011*)
CC	*Consejo Consultivo de Evaluación y Seguimiento* (Consultative Council for Monitoring and Evaluation)
CdC	Consejo de Cuenca (River Basin Council)
CEAG	*Comisión Estatal del Agua de Guanajuato* (Guanajuato State Water Commission)
CEASG	*Comisión Estatal del Agua y Saneamiento de Guanajuato* (Guanajuato State Water and Sanitation Commission)
CEAS-Jalisco	*Comisión Estatal del Agua y Saneamiento de Jalisco* (Jalisco State Water and Sanitation Commission)
CEH	Consejo Estatal Hidráulico
CESEACH	*Consejo Estatal de Seguimiento y Evaluación del Acuerdo de Chapala* (State Council for the Monitoring and Evaluation of the Chapala Agreement)
CFE	Comisión Federal de Electricidad (Federal Elecricity Commission)
CH	*Comité Hidráulico* (Hydraulic Committee)
CMA	Catchment Management Agency
CNA	*Comisión Nacional del Agua* (National Water Commission)
CNI	*Comisión Nacional de Irrigación* (Nacional Irrigation Comission)
COTAS	*Consejos Técnicos de Aguas* (Technical Water Councils) or *Comités Técnicos de Aguas Subterráneas* (Technical Committees for Groundwater)
DG	Director General
DWAF	Department of Water Affairs and Forestry
GOD	*Grupo de Ordenamiento y Distribución* (Ordering and Distribution Group)
GTEPAI	*Grupo de Trabajo Especializado en Planeación Agrícola Integral* (Specialized Working Group on Comprehensive Agricultural Planning)
GWP	Global Water Partnership
IMT	Irrigation Management Transfer.
IMTA	*Instituto Mexicano de Tecnología del Agua* (Mexican Institute of Water Technology)
IRBM	Integrated River Basin Management
IWMI	International Water Management Institute
IWRAM	Integrated Water Resources Allocation and Management
IWRM	Integrated Water Resources Management
MEG	Monitoring and Evaluation Group
NAFTA	North American Free Trade Agreement.
O&M	Operation and Maintenance (of irrigation districts)
ORA	*Organizaciones Regionales del Agua* (Regional Water Organizations)
PAN	*Partido Acción Nacional* (National Action Party)
PNH	*Plan Nacional Hidráulico* (National Hydraulic Plan)

POC	*Política Óptima Conjunta* (Joint Optimal Policy)
PRD	*Partido de la Revolución Democrática* (Party of the Democratic Revolution)
PRI	*Partido Revolucionario Institucional* (Revolutionary Institutional Party)
PRODERITH	*Programa de Desarrollo Rural Integrado del Trópico Húmedo* (Program for the Integrated Rural Development of the Humid Tropics)
RBC	River Basin Council
REPDA	*Registro Público de Derechos de Agua.* (Public Registry of Water Rights).
SAyF	*Secretaría de Agricultura y Fomento* (Ministry of Agriculture and Development)
SAG	*Secretaría de Agricultura* (Ministry of Agriculture)
SAGAR	*Secretaría de Agricultura, Ganadería y Desarrollo Rural* (Ministry of Agriculture, Livestock and Rural Development).
SARH	*Secretaría de Agricultura y Recursos Hidráulicos (*Ministry of Agriculture and Hydraulic Resources).
SAGARPA	*Secretaría de Agricultura, Ganadería, Desarrollo Rural y Pesca* (Ministry of Agriculture, Livestock, Rural Development and Fisheries).
SDAyR	*Secretaría de Desarrollo Agropecuario y Rural* (Ministry of Agricultural and Rural Development)
SEMARNAP	*Secretaría de Medio Ambiente, Recursos Naturales y Pesca* (Ministry of the Environment, Natural Resources and Fisheries)
SEMARNAT	*Secretaría de Medio Ambiente y Recursos Naturales* (Ministry of the Environment and Natural Resources)
SHINO	*Sistema Hidráulico Interconectado del Noroeste* (Interconnected North-western Hydraulic System)
SRG	Surface Runoff Generated
SRH	*Secretaría de Recursos Hidráulicos* (Ministry of Hydraulic Resources)
SRL	*Sociedad de Responsabilidad Limitada* (Limited Responsibility Society).
SPP	*Secretaría de Programación y Presupuesto* (Ministry of Programming and Budget)
TVA	Tennessee Valley Authority
TWG	Technical Working Group
VA	Volume Allocated
WUA	Water User Association. In the context of Mexican irrigation districts often referred to as Civil Associations of Agricultural Producers *(Asociaciones Civiles de Productores Agrícolas*), or simply module (*módulo*).

Photo Credits

Photo Chapter 1: The downstream curtain of the Solís dam in the state of Guanajuato (Photographer unknown).

Photo Chapter 2: The logo of SRH as contained on the inauguration plaque of the Blas Balcarcel diversion weir on the Río Lerma, upstream of Yurécuaro (Flip Wester, October 2004).

Photo Chapter 3: Destroyed gated control works on the Río Santiago in front of the Ocotlán pumping station to control the inflows of Río Zula to Lake Chapala (Rubén Borge, October 2004).

Photo Chapter 4: Canal Antonio Coria, the largest canal of the Alto Río Lerma irrigation district (Flip Wester, November 2006).

Photo Chapter 5: Lake Chapala in 1972 and 2003 showing the pier of the town of Chapala (Fortino Almade for 1972, photographer for 2003 unknown).

Photo Chapter 6: Farmers in Salamanca protesting against the water transfers from Solís dam to Lake Chapala (Photographer unknown).

Photo Chapter 7: The drilling of a new well in the Jaral de Berrios aquifer, Guanajuato (Jaime Hoogesteger, November 2006).

Photo Chapter 8: Inauguration of a buried pipe irrigation system in the Huanímaro module of the Alto Río Lerma irrigation district (Photographer unknown).

Photo Chapter 9: Sunset over Lake Chapala (Flip Wester, October 2004).

Acknowledgments

There is an inviting, mystical quality to the word watershed that grabbed my attention the first time I heard the word used. It was on a hill somewhere in Tunisia in 1988 when the person I was with remarked that we were walking on the watershed. I was deeply intrigued by this remark and clueless as to what he meant. As far as I could see there was not a shed in sight, let alone one consisting of water. The explanation that followed when I asked him what he meant remains etched in my mind and in part explains my fascination for the multiple meanings of the word watershed. Since then I have learned that a watershed can be any of the following: a defining event or period in history representing a major change, a geophysical feature (usually a ridge) that forms the divide between adjacent drainage basins and thus determines into which basin fallen rain will flow, or the area of land drained by a river and its tributaries, more commonly called a river basin, or sometimes a catchment. The Spanish term *parteaguas* is even more beautiful, suggesting the physical act of parting or dividing the waters, as Moses is reputed to have done. From here it's a small step to the title of this thesis: *Shedding the Waters*. What intrigues me about watersheds is that they are boundaries, drawn by nature, that influence the flow of water. This thesis explores what happens when people use this notion to define water management policies.

Writing this thesis turned out to be more difficult than I thought it would be. Conducting research over an extended period of time while being professionally employed creates its own tensions and it frequently seemed that there were more interesting and important things to do than work on the thesis. However, my main challenge has been to free my mind and to write without fear of consequences. To do so, I have received help from many quarters. I am deeply grateful to Joost Oorthuizen, who has been a superb writing coach. Through his encouragement and advice he helped me to actually write and the sessions with him brought a momentum to the writing that was sorely needed. I am also very thankful to Houkje Berger for giving me Rowena Murray's book *How to Write a Thesis* in early 2007, which gave me the tools and courage to believe I could write the thesis in a year. Her unflinching support and encouragement kept me on track, while her ironic and at times provocative style of coaching where exactly what I needed (well, most of the time). Thanks to the coaching by Joost and Houkje writing this thesis became fun again and in the end was very rewarding, not least because it provided me with a better insight into my motivations and constraining thoughts.

Edwin Rap, Alex Bolding and Margreet Zwarteveen have been very supportive in many different ways, not least by reading drafts of several of the chapters and motivating me to finish. To Edwin I owe a large intellectual debt, as our combined research in Mexico in 1999 on the articulation of water reforms and our continued discussions and collaborative writing since have strongly influenced the content and analysis contained in this thesis. The same is true for the discussions with Alex and Margreet that started in 2000 and the examples they set in their own theses. Their exacting standards and uncompromising commitment to good research motivated me to try harder and to dig deeper. Maurits Ertsen provided very good comments on Chapter 2, as did Ricardo Sandoval on Chapter 7 that challenged me to rethink the arguments and content of those chapters. I am also thankful to Gerardo van Halsema for his comments on Chapter 1 as well as his overall support to my thesis during its long gestation period. To Jeroen Warner I owe a special debt for introducing me to the concept of "wicked problems" and to Nigel Watson for providing me with good articles on collaboration. Similarly, I am indebted to François Molle and Bruce Lankford for their work on river basin management, which has strongly shaped my own thinking.

Although Umberto Eco advises against thanking your supervisors, as they are "just doing their job", I strongly disagree with him. Both Linden Vincent, my promotor, and Gabriel Torres, my co-promotor, deserve many words of praise. I thank them for providing me with the freedom to write what I needed to write, for correcting me when necessary, for challenging me to do better and for the very fast and thorough comments on chapter drafts. I also thank the members of my examination committee for their detailed comments on my thesis that helped to improve it further.

The arguments this thesis makes would have been much thinner without the great help I received during my various periods of fieldwork in Mexico, stretching from 1998 to 2007. I am deeply indebted to Gabriela Monsalvo and Sergio Vargas, who opened many doors for me that otherwise would have remained closed and immensely enriched my understanding of water politics in Mexico. I hold very dear memories of the long drives through the Lerma-Chapala Basin with Gaby to attend meetings and hold interviews and look forward to continuing that tradition. At one of those meetings we met Raul Medina de Wit, a farmer from the shores of Lake Chapala, who became a good friend. His attempts to give farmers a voice in river basin management was inspirational and taught me much about collaborative processes. The many discussions I held with Sergio Vargas and his writings on the Lerma-Chapala Basin strongly contributed to my understanding of the Basin and I thank him for his open and critical attitude. I am also deeply indebted to Paula Silva, with whom I worked closely from 2002 to 2006. Her deft ability to ferret out hard to find data and documents strongly improved the quality of this thesis, as did her analysis of the water balance of the Basin. I thoroughly enjoyed our times together in Guadalajara and will never forget her wedding party on the slopes of the Colima volcano. Another Mexican researcher to who I am very grateful is Gabriel Torres. I met him by chance in October 2002 during a conference on the Lerma-Chapala-Santiago Basin, but it quickly became apparent we shared many interests in common. I want to thank him for agreeing to become my co-promotor and for the many documents and inside information he provided me with. Research frequently consists of encounters at the interface and I'm very happy one of those encounters was with Gabriel.

From 1998 to 2000 I lived in Mexico and worked for the International Water Management Institute (IWMI). I want to thank IWMI, and in particular Doug Merrey, Carlos Garcés, Chris Scott and Gil Levine, for providing me with the opportunity for doing research in Mexico and for shaping my understanding of river basin management. I also want to thank David Seckler, David Molden and Mark Svendsen for their intellectual input to my research while I was at IWMI and for their continued friendship. In early 2000 Martin Burton came to Mexico for several weeks to work with me on the Lerma-Chapala Basin. His enthusiasm and methodical approach were inspiring and I highly appreciated working with him. I am also grateful to him for introducing me to the amazing English word "gobsmacked". While working in Mexico I interviewed many hydrocrats, farmers and researchers, too numerous to list here. I want to thank all of them for the time they graciously gave to me and for their insights. In particular I want to thank Eduardo Mestre for his enthusiasm for my thesis and for openly sharing his experiences with reforming water governance in the Lerma-Chapala Basin. I am also very fortunate that I met Ricardo Sandoval while living in Mexico and thank him for his hospitality and our ongoing discussions on water politics in the Basin. Lastly, my research benefited from the work by Rubén Borge, Hans Paters and Jaime Hoogesteger who as M.Sc. students did interesting research on the Lerma-Chapala Basin. I thank them for sharpening my understanding of the Basin and for becoming friends.

At times writing a thesis is like running a marathon and then finding that the finish line has moved. This happened to me after I had handed in the thesis to the examination committee, but still needed to take care of some final details, such as writing the summary. I am very thankful to Alex Bolding for translating the summary into Dutch and to Wytske Dijkstra for her corrections of the Dutch summary. Jaime Hoogesteger and Enrique Díaz's help with translating the summary into Spanish is also highly appreciated. Without their collective help the stress of the past couple of weeks would have been close to unbearable. Similarly, I am very thankful to Erik Nobbe for his help with some ArcGIS problems and for producing an improved version of the map of the Basin and to my father for his help with several of the other figures.

Throughout the research and writing process I have been supported by my wider community of colleagues, friends and family. I am very grateful to the staff members of the Irrigation and Water Engineering group for their support and in particular to Margreet Zwarteveen for taking over some of my teaching responsibilities. Thank you Gerda for the many different ways you have helped me in the past seven years and for keeping people at a distance while I was writing and thank you Maria for reminding me that not every day is Tuesday. I thank my friends Arjen During, Peter Dohme, Pjotr Prins and Elco Schwartz, my brothers and sisters, and Cees Berger, my father-in-law, for their interest, words of encouragement and perspectives on life. I look forward to being able to spend more time with you now that the thesis is done. I thank my parents, Flip and Sieda, for the values they taught me by example and for giving me an interesting youth by taking me to Papua New Guinea. Their unwavering belief in my abilities and unconditional love provided me with the solid foundation that made this thesis possible. I cannot begin to express my gratitude to Houkje Berger, my partner, whose support has been of tremendous value. She is more important to me and has helped me in more ways than I can fully comprehend. She went with me to Bangladesh and Mexico and then endured the seven years it took me to finish the thesis with great wisdom and humor. Although we had great fun together, this thesis also cost her more than I care to admit. I hope to find ways to make up for that in the coming years. Lastly, I want to thank Meta Nauta-Berger for showing me the value of living life to the fullest and for teaching me the lesson that in the end only love and knowledge matter. It is a blessing that I can share my life with her daughter.

1

Introduction

The above photograph shows the downstream curtain of the Solís dam located on the Río Lerma in the state of Guanajuato, Mexico. The road marks the old crest level of the dam that was constructed in the 1940s. Between 1976 and 1982 the dam's crest was elevated to its current level, increasing the storage capacity of the dam by 50%. While not a particularly large dam, it has strongly influenced water management in the Lerma-Chapala Basin in the past sixty years and has frequently stood at the center of water allocation controversies. This photo was taken in 2003 while water was being transferred from the dam to Lake Chapala. The farmers of the area strongly protested against this transfer, as it was the fourth time since 1999 that "their" water was being "stolen", and they occupied the local office of the federal hydraulic bureaucracy to force the closure of the dam's release valve. The hydraulic bureaucracy had decided to transfer water to Lake Chapala as it had nearly dried up. This was not because it had suddenly become ecologically minded, but because the Lake provides Guadalajara, Mexico's second largest city, with 65% of its water supply. This thesis tells the story of these actors and their interactions, showing why the Lake nearly dried up. It does so with the objective to better understand water reform processes, the struggles in river basin management and the challenges posed by water overexploitation.

1.1 Introduction

This thesis investigates the histories and relationships between water overexploitation, water reforms and institutional transformations in the Lerma-Chapala Basin in central Mexico. Internationally, Mexico is well known for its Irrigation Management Transfer (IMT) program that has been propagated widely as a policy model for other countries to follow (Gorriz *et al.*, 1995; Rap, 2006). Its attempts to move towards Integrated River Basin Management (IRBM) and to improve groundwater management have also received increasing attention (Mestre, 1997; Sandoval, 2004a; Wester *et al.*, 2003). This thesis analyzes the role of the hydraulic bureaucracy, the successive federal government agencies responsible for the construction and management of hydraulic infrastructure and water allocation and management, in the creation of water overexploitation and in the articulation of water reforms in the Lerma-Chapala Basin. It shows how the reforms have reordered modes of water control and transformed domains of water governance in the Lerma-Chapala Basin, but have not led to a reduction of water overexploitation.

The scope of Mexico's water reforms makes it worthwhile to understand how these changes were effectuated. However, few studies focus on the political and bureaucratic processes that defined and sustained the water reforms in Mexico. In the case of IMT, the literature singles out the presence of strong political will and the creation of appropriate legal and institutional frameworks as explanations for the origin and success of IMT (Gorriz *et al.*, 1995; Groenfeldt, 1998; Johnson, 1997a). How, and in which arenas, this commitment was created and by which actors is not analyzed, with the exception of Rap *et al.* (2004) and Rap (2004). The literature presents the occurrence of IMT in Mexico as an inevitable outcome of the economic crisis of the 1980s. The argument goes that this crisis led to a decrease in government funding for irrigation and a reduction in the payment of water fees by water users, resulting in a poor performance of the publicly managed irrigation districts and widespread deterioration of the irrigation infrastructure. The irrigation reforms are portrayed as an inevitable and necessary response of the Mexican government to this state of affairs (Gorriz *et al.*, 1995; Johnson, 1997a, 1997b).

Stating that policies are "necessary" and "inevitable" is a powerful speech form that depoliticizes policies. It renders the hard work and political choices that make reforms a reality invisible and absolves politicians and policy makers of responsibility for policy effects. In contrast, this thesis conceives of water reforms as sociopolitical processes and analyses the historical, political and bureaucratic processes that engender and sustain water reforms. Such an analysis, which centers on policy actors and policy articulation, clarifies why water reforms are effectuated and how alliances are negotiated through which reforms gather momentum, or are made to fail. Grounded in the notion that water resources management is politically contested (Mollinga, 2001; Rap, 2004) and that policies embody the governing ambitions of bureaucracies (Rose and Miller, 1992), this thesis argues that water reforms are not "inevitable". Rather, they are produced by particular constellations and have particular effects, such as reordering modes of water control. To understand the making of water overexploitation and the articulation of water reforms it is necessary to analyze the histories of the relationships between water users, water technologies and the government agencies mediating water control. The spatial and material dimensions of water-networks (Bolding, 2004) form an integral part of these histories. Such a sociotechnical perspective on water reforms is applied in this thesis to analyze changes in water governance in the Lerma-Chapala Basin.

From a water perspective, the Lerma-Chapala Basin is in serious trouble, with water use at unsustainable levels. It provides a striking example of the complexities of water reforms in closed river basins, where consumptive water use is close to or even exceeds the level of renewable water availability (Keller *et al.*, 1996; Seckler, 1996). It is also a basin in which many of the policy prescriptions emphasized in international water debates, such as IMT, IRBM and increasing stakeholder participation in water management, have been applied. However, in contrast to many other countries, the water reforms pursued in Mexico and the Lerma-Chapala Basin were largely context-specific and process based. Nonetheless, the Basin is still faced with water overexploitation and a complicated transition from centralized water management to one in which states and water users have a larger say.

This thesis contributes to increasing the understanding of water reforms as sociopolitical processes. It sets out to elucidate the apparent contradiction between sustained attempts at context-specific, process based and strategic water reforms and continued water overexploitation and environmental degradation. This is necessary as little research has focused on water reforms as sociopolitical processes and is important for understanding how environmental sustainability and social equity can become priorities in water reforms (Boelens and Zwarteveen, 2005; Merrey *et al.*, 2007). This thesis shows that the answer lies in the inherently political and contentious nature of water reforms. It also shows how, through the interactions between policy actors such as hydrocrats,[1] water users and politicians, as well as infrastructure and rainfall, water reforms are made to succeed or fail.

The above has sketched the main lines of argument of this thesis, developed in more detail in the following chapters. This chapter introduces the Lerma-Chapala Basin in section 1.2, while the three main research themes this thesis contributes to are detailed in section 1.3. Section 1.4 outlines the research question and focus of the thesis, with section 1.5 detailing the main concepts used in this thesis. The research methodology is presented in section 1.6 and the structure of the thesis in section 1.7.

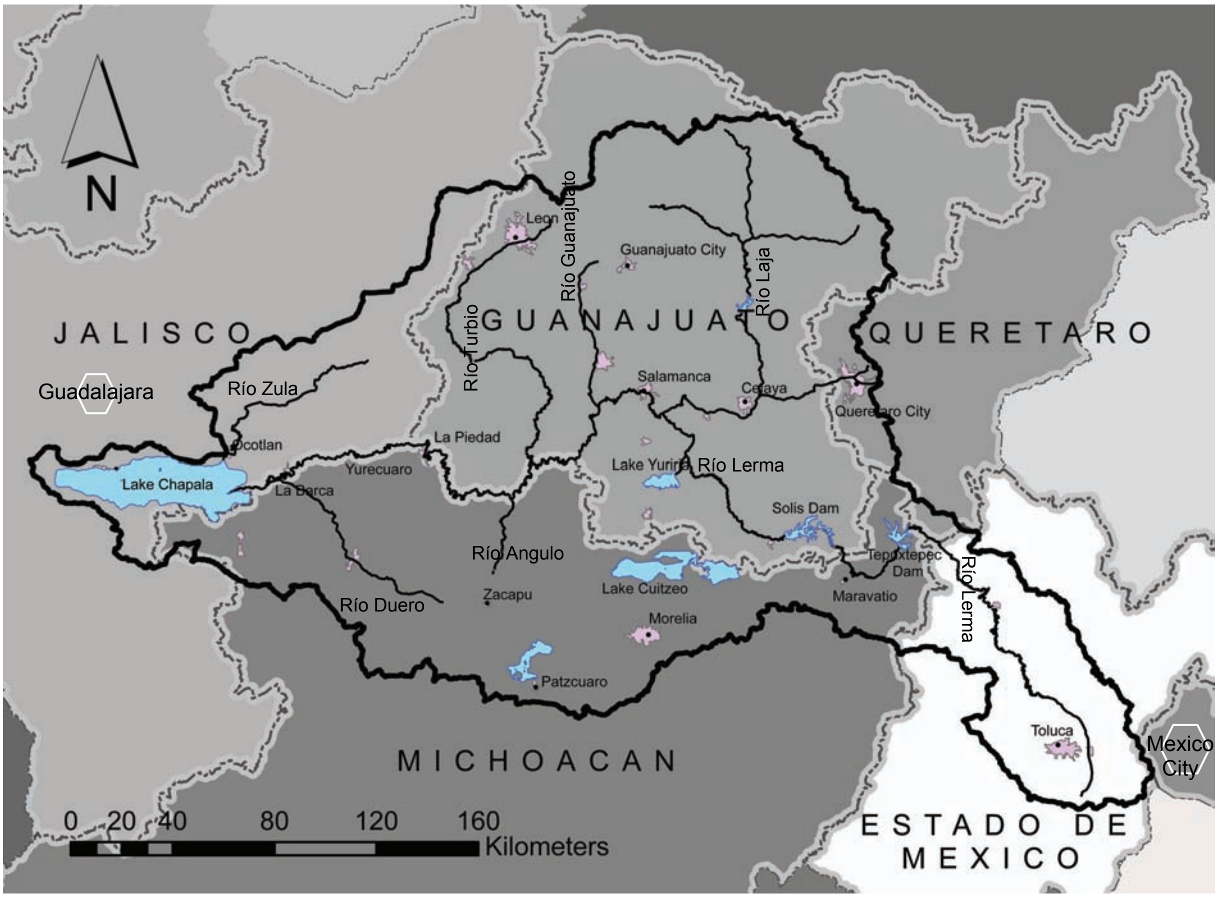
1.2 Introducing the Lerma-Chapala Basin

The Lerma-Chapala Basin is named after its main river, the Río Lerma, and the Lake into which this river drains, Lake Chapala (see Figure 1.1). Lying between Mexico City and Guadalajara, the Basin crosses five states: Querétaro (covering 5% of the Basin), Guanajuato (44%), Michoacán (28%), México (10%) and Jalisco (13%). The area of the Basin is around 55,000 km^2, nearly 3% of Mexico's total surface area (CNA/MW 1999). Although the average annual runoff in the Basin of 5,513 cubic hectometer (hm^3) is only some 1% of Mexico's total runoff (CNA, 1999a; Diario Oficial, 2003), the Basin is the

[1] This term is a contraction of hydraulic bureaucrats and refers to professionals, generally hydraulic engineers, working in hydraulic bureaucracies (hydrocracies). I thank Alex Bolding for suggesting this term, first used by McCully (1996: 26).

source of water for around 15% of Mexico's population.[2] Located in the geographic and historical heart of Mexico, the Basin is an important agricultural and industrial area, containing 13% of the irrigated area in the country[3] and generating 9% of Mexico's GNP.

Figure 1.1. States, regions and rivers in the Lerma-Chapala Basin



The headwaters of the Río Lerma rise in the east of the Basin near the city of Toluca (some 55 km west of Mexico City) at an elevation of 2,600 m.a.s.l., to discharge into Lake Chapala in the west at an elevation of 1,525 m.a.s.l. The Río Lerma is 705 km long and has five major tributaries (Río Laja, Río Guanajuato, Río Turbio, Río Angulo and Río Duero). When full, Lake Chapala discharges into the Río Santiago that flows in a north-westerly direction to drop to the Pacific Ocean after some 520 km. Since the 1980s hardly any water has flowed naturally from Lake Chapala to the Río Santiago, due to dropping Lake levels, and the Lerma-Chapala Basin has in effect become a hydrologically closed basin. While the Lerma-Chapala-Santiago Basin is the correct biophysical boundary for the overall Basin, this thesis only focuses on the Lerma-Chapala Basin. First, the

[2] A cubic hectometer is one million cubic meters, which equals a column of 100 meters of water on one hectare (100 by 100 meters), being 1,000,000,000 liters.

[3] Irrigation has been practiced in Mexico since pre-Hispanic times, and by 1919 some 800,000 ha were irrigated. At present, some 6.1 million ha are irrigable, of which 3.3 million ha are contained in 81 irrigation districts, constructed and until recently managed by the state, while 2.8 million ha are either in private or farmer-managed irrigation systems.

contribution of the outflow of Lake Chapala to the flow of the Río Santiago was always minor in comparison to its other tributaries. While the lack of outflows of the past 30 years has negatively impacted water quality in the upper reach of the Río Santiago, water users further downstream have hardly been impacted by lower water availability. Second, although the Lerma-Chapala-Santiago Basin was used in the 1950s by the hydrocracy as a unit for comprehensive river basin development, it mainly focused on the Lerma-Chapala Basin and treated the Santiago as a separate Basin. At present this is still the case, although attempts were made in the late 1990s to include the Santiago in the Lerma-Chapala river basin council. In the end a separate council was formed for the Santiago Basin because the issues and challenges in the two large sub-basins were so disparate.

The climate in the Basin is semi-arid to sub-humid, with 90% of the rains falling from May to October. Rainfall is highly variable, with an average of 722 mm/year between 1925-2001, a minimum of 494 mm in 1999 and a maximum of 1,022 mm in 1958 (IMTA, 2002a). Average monthly temperatures vary from 14.6°C in January to 21.3°C in May; thus a range of crops can be grown throughout the year. The potential evapotranspiration mirrors the temperature variation, with a peak in May, and an average annual total of 1,900 mm. In every month except July and August there is a deficit between rainfall and potential evapotranspiration, indicating the importance of irrigation.

Irrigated agriculture, covering some 795,000 ha (13% of the Basin's area), is the main water user in the Basin. Eight irrigation districts (formerly state-managed) cover around 285,000 ha, while some 16,000 farmer-managed or private irrigation systems (termed "irrigation units" in Mexico) cover 510,000 ha. Twenty-seven reservoirs provide 235,000 ha in the irrigation districts with surface water while around 1,500 smaller reservoirs serve 180,000 ha in the units. An estimated 17,500 tubewells provide around 380,000 ha in the Basin with groundwater, of which 47,000 ha is located in irrigation districts (CNA, 1993a; CNA/MW, 1999). In the irrigation districts there are an estimated 88,000 water users compared to 100,000 water users in the irrigation units (CNA/MW, 1999).

This thesis distinguishes between three regions in the Lerma-Chapala Basin, namely the Upper, Middle and Lower Lerma. These regions consist of valleys interspersed with volcanic cones and are separated by geological faults, in effect forming three large steps that the Río Lerma descends on its way to Lake Chapala. The Upper Lerma comprises the highland region around Toluca City (from 1,900 m.a.s.l. to 2,600 m.a.s.l.) and covers the area drained by the Río Lerma from its origin to the Solís dam in Guanajuato. Historically a densely populated area, this hilly region saw little irrigation development except in the Toluca Valley. The Middle Lerma region (from 1,600 m.a.s.l. and 1,900 m.a.s.l.) covers the area drained by the Río Lerma below the Solís dam to the gauging station near Yurécuaro. It coincides with the region known as El Bajío (The Lowlands), an extensive valley richly endowed with fertile soils and rivers. Covering most of Guanajuato, and parts of Querétaro and Michoacán, the Bajío has historically been the main agricultural region of the Basin and continues to be so. The Lower Lerma region is situated around Lake Chapala (from 1,500 m.a.s.l. to 1,600 m.a.s.l.) and covers the area drained by the Río Lerma below Yurécuaro to the exit of Lake Chapala at the Poncitlán barrage. Until the late 19th century it was an area of *haciendas* specializing in dairy livestock.

Since the early 1980s, water in the Basin has been overexploited. Although average rainfall from 1990 to 2001, at 679 mm, was only 6% below the historical average of 722 mm (IMTA, 2002a), the amount of water depleted in the Basin exceeded annual renewable water by 9% on average during this period, with no allocations for environmental flows (Wester *et al.*, 2005). To use more water than is renewably available, groundwater is being mined, with declines in static aquifer levels of one to five meters per year (SEMARNAT, 2001), while the consumptive use of surface water exceeds supply in all but the wettest years. Consequently, water levels in Lake Chapala dropped precipitously between 1994 and 2002, nearly leading to the demise of the Lake.

Lake Chapala, with a length of 77 km and a maximum width of 23 km, is Mexico's largest natural lake. At maximum capacity the Lake holds 8,125 hm^3, nearly twice the annual surface runoff in the interconnected Basin,[4] and covers an area of 1,154 km^2 (Guzmán, 2003: 110). When full, the average depth of the Lake is 7.2 m while at its deepest it is 16 m, making it one of the world's largest shallow lakes (Lind and Dávalos-Lind, 2001). To illustrate this, on a scale of 1:10,000 the Lake is less than 1 mm deep and 7.7 m long by 2.3 m wide. The shallow depth of the Lake results in net evaporation levels of around 10% of storage when the Lake is full and increasing to 30 to 40% when Lake levels are low.

Lake Chapala is highly valued by the inhabitants of Jalisco State, where the Lake is located, as well as some 30,000 foreigners living on its shores. It generates significant tourism flows, with an average of 760,000 tourists visiting the Lake per year between 1990 and 2000 (Guzmán, 2003: 44). In addition, it provides Guadalajara, Mexico's second largest city with 3.6 million inhabitants, with 65% of its urban water supply (Guzmán *et al.*, 2000: 58). Besides negatively effecting tourism and urban water supply, the drying up of Lake Chapala would entail a significant ecological loss. The Lake is a sanctuary for migratory aquatic birds and has increased in importance with the decimation of wetlands and lakes in the Mexican central plateau. The Lake is also home to 39 species of fish, of which 27 are native (Guzmán, 2003: 45). However, fish stocks have decreased in the past twenty years and eight of the endemic species, of which two are unique to Lake Chapala, are feared to be extinct (Moncayo and Buelna, 2001).

In the Lerma-Chapala Basin many attempts have been made to improve water governance, through changes such as IMT, increasing stakeholder participation in water governance, defining water allocation mechanisms and managing water on the basis of river basins. Concern about water quantity and quality issues in the Basin increased in the 1980s, when the water level in Lake Chapala started to drop after a period of high Lake levels in the 1960s and 70s. The prospects for change improved after 1988, when the newly elected president of Mexico, Carlos Salinas, gave high priority to water issues and decentralization (Rap *et al.*, 2004), evidenced by the creation of the *Comisión Nacional del Agua* (CNA; National Water Commission)[5] in 1989. In the early 1990s, the Mexican

[4] The interconnected Lerma-Chapala Basin consists of the sub-basins that discharge into the Río Lerma or Lake Chapala. This excludes the endoreic sub-basins of Cuitzeo and Pátzcuaro that are part of the Lerma-Chapala Basin but do not discharge into the Lerma River. Runoff in the interconnected Basin is 4,907 hm^3 a^{-1}(Diario Oficial, 2003).

[5] Throughout the text Spanish words are italicized and Mexican acronyms are used.

federal government initiated water reforms consisting of extensive organizational and legal changes. This included the creation of water users associations (WUAs) in irrigation districts as part of the IMT program from 1989 onwards, the formation of State Water Commissions from 1991 onwards and the creation of a River Basin Council for the Lerma-Chapala Basin in early 1993 (Wester *et al.*, 2003). The reforms occurred in a context of increasing civil society involvement in environmental policies, as well as the emergence of social movements for water. New interest groups – such as agribusiness, commercial farmers and real-estate developers – also became influential in basin level decision-making, in marked contrast to the older, corporatist structures for the representation of interests in water management. However, this is getting ahead of the story. First, this chapter turns to the "what" of water reforms and the assumption that river basins are the natural units for water management.

1.3 Water Reforms, River Basins and Hydrocracies

Rivers running empty and lakes falling dry are increasingly common signs of a hydraulic mission seriously gone awry. What sounded like a good idea, namely the full utilization of water resources to produce hydroelectricity, protect against floods and irrigate vast tracts of land to grow enough food, has had serious negative consequences. In recent years, a global water crisis narrative has been constructed based on credible warnings of water scarcity and an impending water crisis (Gleick, 1993; Cosgrove and Rijsberman, 2000). The debate in the 1990s focused on water scarcity (Postel, 1992; Gleick, 1993), including alarmist writing on "water wars" (Starr, 1991; Bulloch and Darwish, 1993) and larger work on environmental security (Homer-Dixon, 1999). Recently, a discourse shift has occurred that emphasizes that the water crisis is a crisis of governance and not of water scarcity. For example, the World Water Vision of 2000 stated that "There is a water crisis today. But the crisis is not about having too little water to satisfy our needs. It is a crisis of managing water so badly that billions of people – and the environment – suffer badly" (Cosgrove and Rijsberman, 2000: xviii). In its framework for action to achieve the World Water Vision, the Global Water Partnership (GWP) concurred that "The water crisis is mainly a crisis of governance. The present threat to water security lies in the failure of societies to respond to the challenge of reconciling the various needs for and uses of water" (GWP, 2000a: 23).

The "water crisis" narrative espouses three policy prescriptions, namely: 1) increase stakeholder participation in water management, 2) treat water as an economic good, and 3) manage water based on river basins, all under the framework of Integrated Water Resources Management (IWRM) (Cosgrove and Rijsberman, 2000; GWP, 2000b). However, the focus on governance and crisis suggests that managerial solutions are necessary and possible, bringing with it a fetishism for organizational models and an overemphasis on river basins as the natural units for water management (Wester and Warner, 2002). This leaves little room for understanding structural water scarcities, that is scarcities caused by resource capture and unequal access to water, the struggles for access to water and the power and histories of hydrocracies in water management. As the water crisis is multi-variable, non-linear and deeply rooted in modernity, a critical research approach is needed for understanding changing modes of water control and the politics of water reforms. In this thesis such an approach is developed based on three main research themes, namely: 1) the links between the hydraulic mission, hydrocracies and river basin closure, 2) water reforms and decentralization, and 3) water allocation and river basin politics. Underlying these three themes are the larger questions of equity and social justice, access to water and democracy. The following introduces these three themes, while section 1.5 discusses the main concepts used in this thesis to analyze these themes.

The hydraulic mission, hydrocracies and river basin closure

Water resources development has led to water overexploitation in many river basins around the world. This has happened because of the "overbuilding" of water infrastructure in river basins for the extraction of surface and groundwater, to the point that more water is consumed by agriculture, industry and humans than is renewably available (Molle *et al.*, 2007). This process has been termed river basin closure, a term coined by Seckler (1996) to characterize river basins with no utilizable outflows. This means that the use of water that renders it unavailable for further use (water depletion) is approaching or equal to the level of annual renewable water (cf. Keller *et al.*, 1996; Molden *et al.*, 2001).[6] Rivers no longer reaching the sea or contracting lakes are the most visible signs of basin closure, as exemplified by the Colorado River, the Aral Sea and the Dead Sea. Basin closure occurs through the over-commitment of water resources for urban, industrial and agricultural growth and a disregard for environmental water requirements (Molle *et al.*, 2007).

Several heuristic devices have been developed to portray river basin closure.[7] Molden *et al.* (2001) posit that river basins pass through three phases as more water is withdrawn by humans (development, utilization and reallocation) and argue that institutions need to adapt to these different phases. Figure 1.2 schematically portrays river basin closure, showing how over time the development of facilities to abstract water allows human water use to approach the total annual renewable water available in a basin.[8] The fraction of water that can be used under existing economic and technological constraints is generally less than the total annual renewable water available. For example, a large part of floods generally flows to the sea, or groundwater may be too deep to extract economically. But water depletion may be higher than availability in river basins where dams can capture all or most of the runoff and aquifers are overexploited (Molle *et al.*, 2007).

Turton and Ohlsson (1999) further developed the river basin closure concept by positing that water scarcity *per se* is not the key issue, but rather whether a society has the adaptive capacity to cope with the challenges water scarcity poses. They argue that two institutional transitions occur as more water is used for human purposes; the first when water abundance turns to water shortage due to withdrawals and the second when water shortage turns to water overexploitation. The first transition entails the construction of significant

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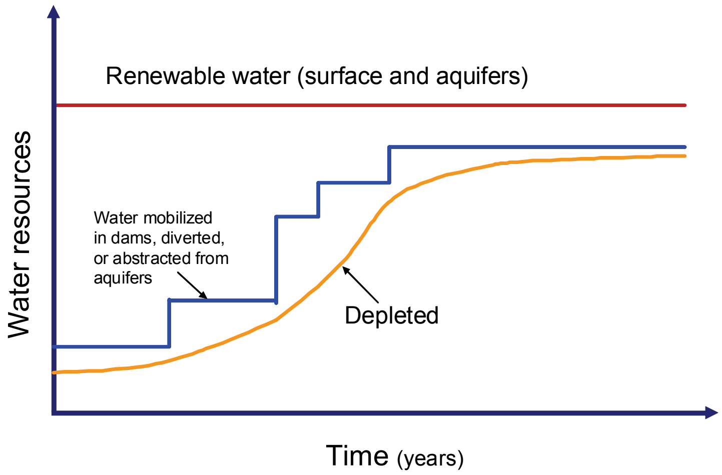
6 This definition differs from the hydrological definition of a closed, or endoreic, basin, where there are outflows but these go only to internal seas, lakes or other sinks.

7 Conceptualizations of basin closure have been developed by Keller *et al.* (1998), Molden *et al.* (2001), Molle (2003) and Ohlsson and Turton (1999).

8 Total annual renewable water in a basin is defined as the total runoff in a basin plus the safe yield of the aquifer where the safe yield is the level of abstraction whose consequences, in average reduction in groundwater stocks and base flow, are considered acceptable (Molle *et al.*, 2007).

hydraulic infrastructure by government agencies to capture more water. Based on the work of Reisner (1993) and Swyngedouw (1999) they refer to this transition to water resources development as the birth of the hydraulic mission, embodied in a central government agency consisting of hydraulic engineers.[9] Whereas water was controlled locally before, its development becomes state led and highly centralized after the first transition, leading to the growth of hydrocracies bent on "developing" water resources. As remarked by Allan "engineers solve problems and engineers showed themselves to be very competent in solving water problems in early modernity. They came to be essential allies of the state in achieving economic goals such as food self-sufficiency. Politicians, engineers, farmers and food consumers were all certain that the progressively larger withdrawals of water (…) were good" (2005: 188-189).

Figure 1.2. River basin closure



Source: Adapted from Molden *et al.* (2005).

Worster (1985) and Reisner (1993) provide an historical analysis of the development of the hydraulic mission in the USA. Based on Wittfogel's (1957) hydraulic society thesis, Worster (1985) argues that there are three generic modes of water control, namely subsistence, agrarian and capitalist. Characteristic for this last mode are two centers of power, a private sector of agriculturists and a pubic sector made up of bureaucratic planners and elected representatives, that interactively reinforce each other and work together to achieve an unprecedented control over water. This ties in with Reisner's (1993) analysis of the ethic of the US Bureau of Reclamation, namely to dam every river in sight and not to waste a drop of water by letting it run to the sea. Based on the analysis of Worster and Reisner, it can be argued that water resources development by the state is an emergent, and at times intentional, political strategy for controlling space, water and people and recursively constitutive of everyday forms of state formation. It results in the growth of hydrocracies driven by the hydraulic mission to create ideal orders as well as deeply transforming agricultural production and agrarian relations, resulting in the creation of irrigation constituencies keen on increasing their access to water.

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[9] However, Reisner (1993) does not use the term hydraulic mission in his book, while Swyngedouw (1999) speaks of the hydraulic engineering mission, but does not define it.

This thesis defines the hydraulic mission as the strong conviction that every drop of water flowing to the ocean is a waste and that the state should develop hydraulic infrastructure to capture as much water as possible for human uses.[10] The carrier of this mission is the hydrocracy, who based on a high-modernist worldview[11] sets out to control nature and "conquer the desert" by "developing" water resources for the sake of progress and development.[12] The term mission is used intentionally because of its military and religious connotations and to reflect the conviction that it is an important duty of the state to develop water resources. However, the use of the term is not intended as a value judgment, but rather is an attempt to conceptualize an empirically verifiable mindset. Also, the hydraulic mission and the hydrocracy are not monolithic and how strong or contested they are in different time periods and countries is an empirical question. This thesis explores how the hydraulic mission, the growth of the hydrocracy and the centralization of water management mutually reinforced each other in the Lerma-Chapala Basin and how this legacy continues to strongly influence water reforms.

If left unchecked, the hydraulic mission leads to river basin closure. This is when water demand outstrips supply even though all available water sources have been developed or are prohibitively expensive to develop.[13] The process of river basin closure induces increased competition between water use(r)s and water scarcity reaches such a level that the exploitation limits become evident. However, using the term "water scarcity" to describe situations of water overexploitation is dangerous, as it obscures issues concerning unequal access to and control over water (Bakker, 1999; Krishnan, 2007; Mehta, 2000, 2001). For most people water scarcity is caused by competition between water uses and by political, technological and economic barriers that limit their access to water, rather than physical water scarcity (Falkenmark and Lundqvist, 1998). Water scarcity is not only caused by variability in supply (supply-induced scarcity) or increases in population (demand-induced scarcity) but has also been created through the development of water resources, the selective entitlement of water rights and resource capture by the better off,

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10 For the case of Spain, Swyngedouw (1999: 453) quotes a parliamentary document from 1912 that stated that "not a single drop of water should reach the Ocean, without paying its obligatory tribute to the earth". Similar quotes can be found for all the countries where large water works were constructed, such as the USA, Pakistan, India, China, USSR, Mexico, Egypt, Morocco and Iran. For example, Reisner quotes from a 1901 speech by Theodore Roosevelt, who stated that "The western half of the United States would sustain a population greater than that of our whole country if the waters that now run to waste were saved and used for irrigation" (1993: 112).

11 Scott defines high modernism as "a strong (…) version of the beliefs in scientific and technical progress (…) [with] at its center (…) a supreme self-confidence about continued linear progress, the development of scientific and technical knowledge, the expansion of production, the growing satisfaction of human needs, and, not least, an increasing control over nature (…) commensurate with scientific understanding of natural laws. *High* modernism is thus a particularly sweeping vision of how the benefits of technical and scientific progress might be applied—usually through the state—in every field of human activity" (1998: 89-90; emphasis in original).

12 Turton provides a similar, but less detailed, definition of the hydraulic mission of the state as "the official policy that seeks to mobilize water and improve the security of supply as a foundation for social and economic development" (2003: 11).

13 Molle (2003) provides a sophisticated analysis of the stages and responses to river basin closure, stressing the importance of responses by both water users and the state to closure through conservation, allocation and supply augmentation.

which Homer-Dixon (1999) terms structural scarcity. The design and social control over water technologies such as dams, pipelines and irrigation canals leads to what Vincent (2004) terms designed water scarcity, which influences who gets access to water.

Basin closure and water overexploitation results in a complex interplay between water quality decline, inter-sectoral water transfers, inequitable water allocation and reduced access to water (Molle *et al.*, 2007). The inequality in access to water and the conflicts between the different users of water lie at the heart of the need for new approaches to water management (Mehta, 2000). The path-dependency and lock-in created by existing water infrastructure and water use systems exacerbates this predicament (Sexton, 1990). For example, the construction of large dams, irrigation schemes, inter-basin transfer schemes and groundwater pumps guarantee that the water they capture will be used. The socioecologies that become dependent on these technologies and the water resource base are formidable and very difficult to reverse (Shah *et al.*, 2003). Thus, the overbuilding of river basins results in a situation that constrains the scope for reducing water use, but at the same time it radically alters the role that hydrocracies need to play, from centralized water resource developers to regulators and facilitators of polycentric and decentralized water governance. This thesis contributes to understanding how this works empirically and to how the hydraulic mission mindset continues to inform transitions in water governance.

Water reforms and decentralization

The above has outlined the challenges that river basin closure poses for water resources management. In essence, this entails a transition from water resources development based on the hydraulic mission to polycentric water governance based on an environmentally and socially just ethic (Feldman, 1991; Postel, 2003; Wester *et al.*, 2004a). This transition requires substantial institutional transformations and hence far reaching water reforms (Turton and Ohlsson, 1999; Wester *et al.*, 2001a). In this thesis water reforms are defined as public policies and programs that aim to change in a qualitative manner existing water policies, institutions, organizations and governance arrangements. Although the need for a "water transition" is well established, this has only very partially informed the water reforms of the past three decades, which have focused more on the neo-liberal agenda of downsizing the state and formalizing property rights (cf. Boelens and Zwarteveen, 2005). The following briefly discusses water reforms and the research issues they raise.

Uncertainty about the soundness of the hydraulic mission started to develop in the 1970s, primarily in the western United States, with the rise of the environmental movement and opposition to new dams (Allan, 2005). Gottlieb (1988), Reisner (1993) and Espeland (1998) provide an insightful analysis of different aspects of this change in the western USA that resulted in more emphasis being placed on "putting water back into the environment" (Allan, 2005: 190). Internationally, the large post-war investments in irrigation started to decline in the 1980s and there was increasing concern for improving the management of existing irrigation schemes as opposed to constructing new ones (Chambers, 1988). Merrey *et al.* (2007) provide an analysis of the sequence of water reforms attempted in agricultural water management in developing countries, progressing from "blaming and training" the farmers, to the formation of WUAs and then on to IMT, while more recently emphasis has been placed on forming river basin organizations.

However, they conclude that none of these reforms have "substantially improved water management at any scale" (Merrey *et al.*, 2007: 198), due to a social engineering bias,[14] a focus on watersheds instead of "problemsheds" and the neglect of pluralities, such as legal pluralism, polycentricity and multiple uses of water. What is also characteristic for the water sector is that water reforms are conceived and promoted as "neutral and technical interventions aimed at assisting central water agencies in controlling and managing water resources and crises" (Boelens and Zwarteveen, 2005: 753). The deeply political nature of water reforms and the struggles they entail is too frequently glossed over, also in studies on water reforms.

This thesis is based on the insight that water reforms are political processes (Boelens and Zwarteveen, 2005; Merrey *et al.*, 2007; Mollinga and Bolding, 2004). However, as indicated by Mollinga and Bolding (2004), there is a dearth of research on water policy processes and thus little is known on how and in which networks water policies are articulated and the role of the hydrocracy in this.[15] Based on their review of water reforms in the past three decades, Merrey *et al.* (2007) conclude that the state needs to play a leading role in water reforms, but that at the same time the hydrocracy and powerful agendas within the state are most in need of reform. This primarily concerns the role of hydrocracies in water reforms. In spite of the widespread consensus on the desirability of IWRM, this has not translated into efforts to restructure hydrocracies or to temper the hydraulic mission. The resistance of hydrocracies to change and their resourcefulness in maintaining their command-and-control and construction orientation – under the guise of apparently drastic institutional reforms – has been highlighted by Mollinga and Bolding (2004), based on in-depth studies of irrigation reforms in seven countries. Gottlieb (1988) and McCool (1994) make a convincing argument that this is also the case in the Western USA, while for southern California Waller shows that "the nature of the region's water management regime allowed those who benefitted from the status quo to effectively resist needed reforms" (1994: 13).[16] This is not to suggest that no water reforms have been attempted in the past three decades, but shows that the deeper transition needed to deal with basin closure is incipient. Through its study of the Mexican hydrocracy, this thesis aims to contribute to a better understanding of the resistance of hydrocracies to change due to the enduring legacy of the hydraulic mission mindset and their control over infrastructure and resources, while also highlighting their crucial role in water reforms.

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14 For a more detailed analysis of the emphasis on policy models and blueprints in water reforms see Mollinga and Bolding (2004) and Rap (2006).

15 An exception is the rich body of literature on water policy processes in the USA, such as the studies by Ferejohn (1974), Espeland (1998), Gottlieb (1988), Ingram (1990), McCool (1994), Pisani (2002) and Waller (1994).

16 Waller (1994) shows how California's water agencies are well-versed in "nonpolitical politics" and in depoliticizing issues, while establishing alliances with economic elites to keep the water flowing. The water agencies portray themselves as nonpolitical agencies governed by professional judgements based on expertise, working for the "people" and the "common good". This is often the most effective kind of politics as it protects organizational autonomy and shields the deeply political decision-making of the hydrocracy from the public eye. This is generally the case for technocratic bureaucracies and expert systems, but hydrocracies appear particularly good at it.

It is fair to say that we live in an era of "water reforms", in which the role of the state in water resources management is being redefined. This revolves around the redistribution of power and authority over water affairs and is intimately linked to decentralization. A characteristic of the hydraulic mission era was that the state played a very large role in developing hydraulic infrastructure, leading both to the formation and expansion of a technically specialized hydrocracy and the centralization of water resources development in these public agencies. This centralization entailed that the hydrocracy became the leading actor in water resources development at the expense of local water users and lower levels of government. The use of the term centralization here is somewhat unconventional, as it not only refers to the concentration of governmental decision-making at the national or federal level, but also to the concentration of water decision-making within the state. This process was never smooth or automatic and occurred to varying degrees in different countries. However, in the 20th century the weight and importance of centralized hydrocracies in water resources development did increase significantly in many countries. Much of this thesis shows the struggles surrounding first the centralization and then the attempted decentralization of water resources management for the case of Mexico.

Centralization has created legacies that impede the current water transition, of which decentralization is a central component. Again, decentralization is understood wider here, as not only the "delegation of power to lower levels in a territorial hierarchy, whether the hierarchy is one of governments within a state or offices within a large-scale organization" (Smith, 1985: 1),[17] but also to the inclusion and delegation of authority to non-state actors in water resources management. Many water reforms contain elements of decentralization, such as the creation of WUAs to take over the irrigation management tasks, the delegation of political authority over water affairs to states (in a federation) or provinces and local governments, the deconcentration of bureaucracies[18] and the creation of new political and administrative institutions for river basin management. In Mexico the creation of river basin councils and IMT were presented as decentralization measures, although as this thesis will show the federal hydrocracy retained strong control over irrigation systems and river basins. The delegation of more political and administrative authority over water affairs to the state level was strongly resisted by the federal hydrocracy. As decentralization is about the distribution of decision-making power and responsibilities, it is at the heart of many water reforms, as this thesis will show. A special form of decentralization is the rescaling of water resources management that takes place when river basins are turned into territories of governance. The following introduces this research theme.

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[17] Smith further indicates that decentralization concerns "the extent to which power and authority are dispersed through the geographical hierarchy of the state, and the institutions and processes through which such dispersal occurs. Decentralization entails the subdivision of the state's territory into smaller areas and the creation of political and administrative institutions in those areas" (1985: 1).

[18] The term deconcentration is generally used to describe decentralization within bureaucracies, to indicate that administrative responsibilities are transferred to local offices of central government ministries (Robinson, 2000). In Mexico a distinction is made between decentralized and deconcentrated government agencies, with decentralized agencies generally being parastatals and deconcentrated agencies forming part of a federal ministry, but with a large degree of autonomy.

Water allocation and river basin politics

The third research theme dealt with in this thesis is water allocation and river basin politics, defined by Sneddon and Fox as "the contestations and collaborations among different actors seeking to articulate, define and advance – through discourses, policies, coercion and other means – a particular relationship between, on one hand, human social and economic activities and, on the other, river basin ecohydrological networks" (2007: 10). In closed river basins these politics primarily revolve around water allocation (who gets how much water, including the environment) and the process of turning river basins into territories of governance, although the development of new hydraulic infrastructure also remains important. In closing river basins the pressure on irrigated agriculture to relinquish water for environmental and urban/industrial uses is increasing and thus water allocation mechanisms are crucial (Molle *et al.*, 2007). Water reforms are fundamentally about changes in the ways water is owned, allocated and managed, and "over the right to define what a water right entails" (Boelens and Zwarteveen, 2005: 752). The centrality of water allocation has led Allan (2006: 41) to argue that IWRM should be expanded to IWRAM (Integrated Water Resources Allocation and Management), as "water professionals tend to ignore the allocative role of management. With allocation being ignored, management can be projected as a technical matter susceptible to modelling. In practice the political pressures associated with contentious allocation overwhelm the information provided by the technical professionals" (*ibid.*). The analysis in Chapters 5 and 8 brings out the validity of this statement.

To make the "water transition" the currently dominant water policy narrative places a strong emphasis on "integration", evidenced by the hegemonic stature of IWRM. Although loosely defined and interpreted in many different ways in the past (Mitchell, 1990; Downs *et al.*, 1991; White, 1998), a strong international consensus has been created in the past ten years regarding the need for IWRM and what it should entail (cf. GWP, 2000b). Discussions on IWRM frequently single out river basins as the "natural" and therefore "logical" unit for organizing water management (cf. Newson, 1997), with Integrated River Basin Management (IRBM) proclaimed as IWRM at its best (Chenoweth *et al.*, 2001). Pioneering countries in applying this approach are Spain (Bhat and Blomquist, 2004) and France (Betlem, 1999; Buller, 1996), while more recently Australia has joined the select list of countries reputed to have "successful" river basin management (Chenoweth, 1999; Malano *et al.*, 1999; Pigram, 2000). Several middle-income countries, such as Brazil (Lemos and Oliveira, 2004), Mexico (Wester *et al.*, 2003) and South Africa (Waalewijn *et al.*, 2005), are at the forefront of applying variations of IRBM to achieve IWRM. In many other countries efforts are also underway to define the river basin as the territorial unit for water governance,[19] thereby cross-cutting existing administrative boundaries and political constituencies (Molle *et al.*, 2007).

The conviction that the river basin is the natural unit for water management is longstanding and widespread (White, 1957; Teclaff, 1967; Newson, 1997; Molle, 2006)

[19] Governance is used here to refer to the range of state and non-state actors, institutions and procedures involved in the process of steering and regulating an issue-area, entailing how power is exercised and decisions are made (cf. Nuijten *et al.*, 2004; Grindle, 2007). Section 1.5 further discusses the concept of *domains of water governance* developed in this thesis.

and the renewed emphasis on river basin management can be seen as a third wave of interest in the river basin concept.[20] A first wave emerged in the late 19th century with the birth of the hydraulic mission, when the basin-wide planning of water development started, particularly in the Nile Basin (Willcocks, 1901), the Indus Basin (van Halsema, 2002) and the Western USA (Teclaff, 1967, 1996). A second wave was inspired by the creation of the Tennessee Valley Authority (TVA) in 1933, a river basin authority created for the unified planning and full development of water resources on a river basin scale in order to achieve comprehensive regional development (Lilienthal, 1944; White, 1957). The strong appeal of the TVA model to engineers, planners and diplomats (Ekbladh, 2002), and the political constellation after World War 2, led to the spread of river basin authorities across the globe, primarily to developing countries.[21] While the TVA and its "clones" in hindsight underachieved in terms of unified, bottom-up development (Newson, 1997; Scudder, 1989), they enabled the building of dams and irrigation schemes on a massive scale and entrenched authority in the hands of hydrocracies.

Integrated river basin development started to lose momentum in the 1970s (Barrow, 1998), with the growing recognition of the associated social and environmental costs, but also with the decreasing availability of suitable dam sites. Priority shifted towards water quality and environmental sustainability, setting the stage for the third recycling of the river basin concept in the 1990s. This third wave is strongly inspired by the ecosystem approach, in which a river basin is seen as an ecosystems continuum and water as an integral part of ecosystems (Marchand and Toornstra, 1986). In many ways this third wave is a reaction to the construction bias of the second wave of river basin management, but adherents of the ecosystem approach are adamant that "water resources should be managed on the basis of river or drainage basins in an integrated fashion, with a continued and deliberate effort to maintain and restore ecosystem functioning within both catchments and the coastal and marine ecosystems they are connected with" (IUCN, 2000: 16). As pointed out by Teclaff (1996: 381) "this is remarkably like the valley authority approach to creating all-purpose basin units, but without the valley authority and with the addition of environmental and some sociological concerns." In the early 1990s, the third wave was reflected in the Dublin Principles (ACC/ISGWR, 1992) and the formulation of IWRM approaches and later formalized by the European Union in its Water Framework Directive (EU, 2000).

A central element of river basin politics is the process of turning river basins into domains of water governance, a "scale-making project" (Tsing, 2000) frequently pursued by hydrocracies (see Chapter 5). However, this process is hidden from view, as recourse is made to the "naturalizing metaphor" of the river basin (Bakker, 1999). This leads to a neglect or denial of the political dimensions of river basin management, through the

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20 See Molle (2006) for an excellent summary of the emergence and evolution of the idea of using river basins as the unit for water development and management over the past 150 years.

21 In the context of the Cold and Vietnam Wars, the TVA model, presented as hydraulic development as an alternative to social conflict, became what Arthur Schlesinger called "a weapon which, if properly employed, might outbid all the social ruthlessness of the Communists for the support of the people of Asia" as "our engineers can transform arid plains or poverty-stricken river valleys into wonderlands of vegetation and power" (1962: 233).

reification of "natural" boundaries, the emphasis on "neutral" planning and the search for optimal management strategies. Frequently, the situation before the creation of new river basin institutions is treated like a *tabula rasa* while in effect many organizations and institutions and the technologies for controlling water are already in place (Wester and Warner, 2002). Barham points to the risk that new river basin organizations may:

> Sap the effectiveness of existing democratic channels of communication in the interest of finding more efficient *technical* solutions to complex problems. Social organizations (boards, committees, etc.) created for watershed planning are imposed as it were *from the outside*, overlaying natural boundaries in a new way on top of existing social and political boundaries (…). To use a water metaphor, authority, funding, research, and new scientific approaches can all be poured from existing social and political "containers" into the watershed boundary. But we can't be certain that processes of democratic deliberation that were associated with the older containers will be poured along with the rest or separated out and cast aside unless we give this careful and constant attention. (2001: 190; emphasis in original)[22]

The rationale for river basin management most frequently stressed in water policy circles is that nature prescribes, or even mandates river basins as the management units for water. The policy prescription that river basins are the logical scale for organizing water management is depoliticizing in that it rules out debate by drawing "nature" into the equation. Anyone wishing to dispute the need to manage water on the basis of river basins or the need for river basin organizations has lost beforehand, as the boundaries of river basins have been drawn by nature itself and hence water should and must be managed on the basis of river basins. By making recourse to Nature, the debate on river basin management is prematurely closed, as it rules out democratic deliberation on the desirable scales for water management. As pointed out by Blomquist and Schlager, "the definition of a watershed and the selection of boundaries are matters of *choice*. As soon as the matter of choice is present, there is a role for politics – which, among other things, is about who decides and how and with what effects" (2005: 104-105; emphasis in original). This is not to suggest that water should not be managed on the basis of river basins, but rather that this choice is political and that river basins are thus as much political units as they are natural units. This points to the importance of recognizing the political dimensions of river basin management, as explanations grounded in politics show that boundaries and institutional arrangements are not natural but matters of choice and contestation. Thus, river basin politics revolves around the scales for water management, who decides on these scales and how and in which forums these decisions are taken.

[22] Barham's observation closely mirrors the concerns raised by Wengert some 50 years ago, concerning "the absence within the river basin unit or region of effective devices and institutions for raising and settling value, goal, and other policy issues. In short, the political process is stunted with respect to the river basin because there is no effective political forum for discussion and resolution of basin problems. (…) The result is that no matter how suitable a river basin may be as a spatial unit for the solution of water and other resource problems, the absence of political and administrative organizations and institutions competent and responsible for the basin decisions hampers this approach" (1957: 271).

This thesis critically engages with river basin management, based on a concern that the political dimension of river basin management has not received sufficient attention (Wester and Warner, 2002). The closure of river basins from a political perspective is an issue that warrants careful consideration, as it gives rise to blueprint policy prescriptions and is potentially damaging to democratic forms of decision-making. This thesis aims to stimulate debate and critical reflection on the politics of river basin management and engender a shift in policy prescriptions from a normative and technocratic "should" to a democratic "could".

1.4 Problem Statement and Research Question

The subject of this thesis is water overexploitation, river basin politics and water reforms. The need for institutional transformations in water management, especially in closing and closed river basins, is widely established (Merrey *et al.*, 2007; Molle *et al.*, 2007). To determine whether and how transitions are occurring empirical research is needed. However, to date, very few studies have been conducted on institutional transformations in closed river basins from a sociopolitical perspective. Thus, not much is known about how water policies are made to succeed or fail and the role of hydrocracies in this. This constitutes the outer layer of the research problem tackled by this thesis: how are water policies made to succeed (or fail) and what are their effects? This leads to the core of the research problem, namely how to study and analyze water policy processes and their histories. This thesis does so by applying analytical insights from the sociotechnical approach to interdisciplinary water resources management studies (Bolding *et al.*, 1995; Bolding, 2004; Mollinga, 1998; Rap, 2004; Shah, 2003; Vincent, 2001; Zawe, 2006; Zwarteveen, 2006) to the study of water policy processes.

The sociotechnical approach was developed to study water technologies as a form of mediation between society and natural resources, in which the social, the technical and the material are analyzed simultaneously as different but internally related dimensions of the same object (Bolding *et al.*, 2000). Technology is not neutral; it has social requirements of use, is socially constructed and produces social effects (Mollinga, 1998). As technologies are heterogeneous networks of human and non-human elements, also the linkages between these elements are objects of study. While initially focusing on irrigation artefacts as its object of study (Artifakto, 1990) and then more generally irrigation water management practices, the sociotechnical approach has always linked this to forms of organization, the agrarian structure and the state (Mollinga, 1998). Thus, it can also be used to analyze governance and reforms acting on the actors controlling water technologies. This thesis further develops the sociotechnical approach, by applying it to the study of river basin politics and water reforms. To do so, this thesis offers an interpretive analysis of water policy processes in the Lerma-Chapala Basin, by answering the following research question:

> How did the interactions in the 20th century between the hydrocracy, water infrastructure development and water users in the Lerma-Chapala Basin in central Mexico recursively lead to water overexploitation, the articulation of water reforms between 1990 and 2005 and the reordering of modes of water control?

Focus of the study

To answer the research question, the three research themes introduced in section 1.3 are developed in the thesis. The objectives of this thesis are to:

- Increase the understanding of water reforms as sociopolitical processes and the challenges posed by water overexploitation;
- Elucidate the apparent contradiction between context-specific and process based water reforms and continued water overexploitation and environmental degradation;
- Better understand the resistance of hydrocracies to change and their crucial role in water reforms; and
- Stimulate debate on the politics of river basin management, to engender a shift in policy prescriptions from a technocratic and normative "should" to a democratic and pragmatic "could".

Three assumptions inform the analysis in this thesis. First, that situations of water overexploitation are the outcomes of previous modes of ordering and that this recursively feeds into responses by policy actors, primarily the hydrocracy and water users, to arrive at new modes of ordering through water reforms and adjustments to water scarcity at the field level. Second, that to understand the creation of water overexploitation and the articulation of water reforms it is necessary to analyze the histories of the interactions between water users, water technologies and the hydrocracy. Third, that water reforms are produced by particular institutional constellations and have particular effects, specifically in terms of reordering modes of water control and constituting new domains of water governance.

Although this thesis aims to contribute to a better understanding of water bureaucracies and water reforms, it is not an ethnography of bureaucracy or policy. I only very partially deal with the frontline workers of bureaucracies, the very direct makers of policy as they implement them. For irrigation in Mexico an excellent analysis of this is given by Rap (2004) and van der Zaag (1992), who focus on water management practices, and by Kloezen (2002), who focuses on accountability relations in an irrigation district after transfer. However, I do focus on what are more conventionally understood as policy makers and on a whole cast of characters enrolled in the articulation of water policies.

The Lerma-Chapala Basin is presented in detail as a case study, but this thesis does not present an exhaustive history of this Basin. Considering that the Basin is larger than the Netherlands, and its water management much more complex, there are many histories to be told. However, much will be left out because of the focus on water reforms. Thus, there is not much in the thesis on water management practices on the ground, through detailed studies of actualized water control. Again, the excellent work on irrigation management practices and reforms by van der Zaag (1992), Kloezen (2002) and Rap (2004) will not be expanded on here. Also, this thesis does not give much attention to the larger changes in Mexico throughout the 20th century, except where it is relevant to understanding changes in water policy. Also, more attention could have been given to agrarian change and how the water reforms interrelated with larger agrarian changes. However, this only receives passing attention, as I only very partially studied agrarian change. Another boundary set for this thesis is that it does not deal with water quality in the Basin.

Lastly, although I spent quite some time trying to figure out the water balance of the Basin, I have only included a small part of the results of this exercise in the thesis. To do a solid water accounting of the Basin is a complete thesis unto itself and the hydrological complexities in closing basins is such that very serious training in hydrology is needed to be able to do this. While I claim to understand something of hydrology, my skills are insufficient for this task. However, I am consoled in this shortcoming, in that both Mexico's excellent hydrologists with IMTA and the CNA, as well as international hydrologists, are also still struggling to get the water accounts right. There are too many unknowns and the vagaries of water are such that it is exceedingly difficult to measure, resulting in unreliable data even on surface water flows, as this thesis will show.

1.5 Analyzing Hydrocracies and Water Reforms

> There is no thinkable social life without the participation—in all the meanings of the word—of nonhumans, and especially machines and artifacts. Without them we would live like baboons. Technology is not far from the social realm in the hands of the technologist: it is social relations viewed in their durability, in their cohesion. It is utterly impossible to think for even a minute about social relations without mediating them with hundreds of entities. (Callon and Latour, 1992: 359-360)

The following outlines the main concepts that inform the analysis in this thesis, while in various chapters more detailed attention is given to the specific concepts and debates that inform the argument of those chapters. As mentioned above, the sociotechnical approach to water resources management provides the conceptual foundation of this thesis. This approach focuses on the interrelations between water, water technologies and water users and the resulting agro-ecologies and water-networks. It stresses that water is a politically contested resource and that through water allocation and distribution processes, power relations are constituted, negotiated, mediated, reproduced, transformed or otherwise shaped (cf. Boelens and Zwarteveen, 2005; Bolding *et al.*, 2000; Bolding, 2004; Mollinga, 1998). Thus, how water is used in a river basin is determined by the configurations and interactions between water users, water technologies and water availability. Water management organizations and institutions mediate these interactions and in turn are reshaped by water use in practice. Through water reforms these arrangements are altered, while at the same time the existing configurations of water users and technologies constrain and influence how far water reforms travel. To study the creation of water overexploitation and the articulation of water reforms in the Lerma-Chapala Basin, this thesis focuses on water control, modes of ordering, policy articulation and domains of water governance.

Water control

The central concept in the sociotechnical approach is *water control*, initially set out by Bolding *et al.* (1995) and further developed by Mollinga to "analyse the processes within irrigation systems and their connections with the wider context in which they are embedded" (1998: 25). Water control consists of three dimensions, namely "a) technical control, focussing on the regulation of physical processes through technical devices or shaping of the natural environment, b) organisational control, focussing on the regulation of human behavior, and c) socio-political and economic control, which involves the conditions of possibility for particular forms of technical and organisational control (Bolding *et al.*, 2000: 6). The strength of the water control concept is that these three dimensions are seen as being interrelated and mutually constitutive of each other and hence changes in one dimension translate into changes in the other two. As argued by Mollinga, "management institutions and technical artefacts can be understood as the embodiments of particular social relations of power, and, the other way around, socio-economic and political power in irrigation takes shape in particular forms of organisation and technologies" (1998: 29). This insight is crucial for understanding water reforms, but also for how the hydraulic mission works to expand the hydrocracy's control over humans, water and space. However, a danger of using the term control is that it suggests that "full control" is possible, and "that it presupposes the existence of a desirable state to which the process and system can be redirected" (van Halsema, 2002: 10). To circumvent this pitfall I focus on modes of ordering.

Modes of ordering

To further conceptualize the workings of water control I draw from actor-network theory (Latour, 1987, 2005; Law, 1994), which analyzes plural processes of sociotechnical ordering by tracing the associations through which heterogeneous actor-networks are stabilized. Rather than assuming there is a stable and matter-of-fact division between the social and the technical, actor-network theory (ANT) is interested in analyzing how these divisions are stabilized through heterogeneous associations of humans and nonhumans. The emphasis in ANT is on ordering, as;

> Orders are never complete. Instead they are more or less precarious and partial accomplishments that may be overturned. They are, in short, better seen as verbs rather than nouns. Second, the idea that there is a *single* order ('the' social order) goes. This is the dream, or nightmare, of modernity. But there never was a root order, so we have to replace this aspiration by a concern with plural and incomplete processes of social ordering. And finally, the notion that social ordering is, indeed, simply social also disappears. Rather (…) what we call the social is *materially heterogeneous*: talk, bodies, texts, machines, architectures, all of these and many more are implicated in and perform the 'social'. (Law, 1994: 1-2; emphasis in original)

Thus, instead of a single order there are *modes of ordering*, defined by Law as "self-reflexive strategies for patterning the networks of the social" (*ibid.*: 2). Through modes of ordering actors attempt to build messy networks that combine technical, social and economic elements. However, the elements (including the humans) bound together in actor-networks are, at the same time, constituted and shaped by those networks. The central endeavor of actor-network theory is to study the associations that actors create, thus forming actor-networks, and in particular the transformation of weak associations into strong ones and *vice versa*. These associations are established through translations, by which actors strive to associate elements of different durability in such a manner that the resulting networks become stable. Translation is;

> The methods by which an actor enrolls others. These methods involve: (a) the definition of roles, their distribution, and the delineation of a scenario; (b) the strategies in which an actor (...) renders itself indispensable to others by creating a geography of obligatory passage points; and (c) the displacement imposed upon others as they are forced to follow the itinerary that has been imposed." (Callon *et al.*, 1986: xvii)

The construction of hydraulic infrastructure by the hydrocracy to expand its control over an area and people can be seen as a mode of ordering, that is of "patterning the networks of the social" or of attempting to establish some form of "order", however precarious or durable. Modes of ordering point to the type of water control that is aimed for, the self-reflexive strategies that inform the network builders in making associations between the technical, organizational and sociopolitical dimensions of water control.[23] The same goes for water reforms, which can be conceptualized as attempts to create new modes of ordering. From an actor-network perspective, the hydrocracy not only consists of people and their intentions, but also of the infrastructure it constructs, the hydrological data it collects, the budgets it controls and other heterogeneous associations of humans and nonhumans forming the actor-network called the hydrocracy. Thus I view agency as residing in the relations in an actor-network and not as an essentialist characteristic only attributable to humans. This is important as ANT has been criticized for attributing agency to non-humans, but in my reading of ANT this is not the point. In this I agree with Steins (1999), who, based on Callon and Law (1995), writes that agency is something that emerges through and in the interactions and associations of humans and things and that "by themselves, things don't act" (*ibid.*: 485). However, the same can be said of humans, as we are in and of this world. This is not to suggest that humans do not have agency or can not act intentionally, but that this is always a relational effect.

The sociotechnical networks of relations constituting an irrigation scheme or the aggregate sociotechnical hydraulic networks on a river can be termed *hydrosocial-networks*, or water-networks (Bolding, 2004: 17).[24] These networks are intentionally and recursively shaped around water and its use and are always emergent and becoming as they are precarious and reversible outcomes of modes of ordering. Bolding (2004) defines two critical characteristics of hydrosocial-networks, namely span and durability. Span refers to the spatial, social, material and institutional reach or extent of a hydrosocial-network and can run from a single small canal to a whole river basin. This depends on the scale of analysis and the associations that are being traced. Durability refers to the strength of a hydrosocial-network, to how strong and stabilized the associations between the heterogeneous elements forming the actor-network are. It also refers to the time dimension of the network, to how long the network sticks together before it falls apart. The critical

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23 Rap uses the similar concept of *organizing practices*, defined as "the sets of socio-technical practices that organise the access to and control over resources such as water, maintenance machinery, administrative means and other political and economic resources involved in irrigation management" (2004:10).

24 Bolding (2004) indicates that he calls these heterogeneous collectifs *water-networks* for lack of a better word. Although I readily admit the term *hydrosocial-networks* does not deserve a beauty prize, I think it better reflects the phenomenon being discussed.

actor in hydrosocial-networks is water, as without water the network literally falls dry. The concept of hydrosocial-networks has strongly informed the way I have studied the history of water resources development and current water resources management in the Lerma-Chapala Basin and what I write in the chapters that follow.

Policy articulation

An important conceptual challenge of this thesis is to understand why and when water reforms are effectuated and how alliances are negotiated through which reforms gather momentum. Water is not only a politically contested resource (Mehta *et al.*, 1999; Mollinga, 1998, 2001; Mosse, 1997) but water management institutions and water reforms are the outcomes of political and bureaucratic practices, in which policy actors engage in their institutional reproduction. Water reforms entail the reordering of modes of control over water, without suggesting that this only occurs at the bidding of intentional and powerful actors in pursuit of their own "interests". Through the creation of images of success, reforms are re-appropriated by the government agencies that engendered them, which themselves have changed (subtly or dramatically) as part of enacting the reforms. However, reforms are also appropriated and made durable by water users and used to further their claims to water.

This thesis follows the broad definition of politics given by Mollinga (2001) as the process through which relations of power are constituted, negotiated and reproduced. For the "politics of water", Mollinga (2001) distinguishes between four levels, namely the "everyday politics of water resources management", the politics of policy, hydropolitics (or inter-state water politics) and the global politics of water (to refer to the developing global policy discourse on water). This thesis primarily focuses on the "politics of policy" level, with public policy being defined as "a process through which different interest groups (consciously and at least partly publicly) negotiate the modalities of societal governance and consolidate this into institutional and organisational arrangements, projects, programmes and procedures" (Mollinga, 2005: 20).

An instrumentalist view of government conceptualizes public policy as a tool to steer and regulate society, through incentives, programs and sanctions. Shore and Wright summarize the conventional definition of policy as "an intrinsically technical, rational, action-oriented instrument that decision makers use to solve problems and affect change" (1997: 5). Although policies frequently fail to function as intended, there is widespread agreement that a good policy is one that adheres to the standard of rationality contained in the above definition. However, conceiving of policy as an a-political and unproblematic linear process that progresses from formulation to implementation to expected outcomes is dangerous. It obscures how policies are produced through public and private negotiations, political pressure, media manipulation, legal action and other processes involving a range of actors within and outside of government circles. Moreover there is seldom a simple progression from policy formulation, to legislation, to framing regulations, to execution. The actual process is much less tidy, with iterations, false starts and backtracking where the lead role alternates between policy formulation and application.

An alternative approach for analyzing how policies lead to changes in water management practices, developed further in Chapters 3 and 4, conceives of policy formulation and implementation as political processes in which many interests are at stake. Within sociotechnical studies of water resources management, the “politics of policy” perspective has been developed by Bolding *et al.* (2004), Mollinga (2001), Mollinga and Bolding (2004), Nikku (2006), Oorthuizen (2003), Rap (2004) and Zawe (2006), strongly drawing on the work by Grindle (1977), Grindle and Thomas (1991) and Long and van der Ploeg (1989). Premised on the notion that water resources management is a politically contested terrain, the “politics of policy” perspective attempts to understand how water policies are “produced” by the interactions between water users, dominant water discourses and the institutional arrangements that mediate water control. Through these interactions, the content and composition of policies are redefined and transformed, frequently leading to very different outcomes than envisioned. A politically informed analysis of policy processes helps to understand how policies work in practice to change control over water and water management, thereby giving insight into who gains and who loses. Conceiving of water reforms as political processes rather than prescriptive recipes entails taking policy actors such as hydrocrats, water users, politicians and international lending agencies as the unit of analysis and the articulation of reforms as the focus of attention.

The conventional understanding of Mexican politics and bureaucracies, especially the emphasis on political continuity and the authoritarian-bureaucratic state, has hindered a more dynamic perspective on policy processes in Mexico. The common view of policy change in Mexico argues that because Mexico is a strong state with a weak society, the state can push through nearly any policy it wishes. Brachet-Márquez (1995) identifies three common shortcomings in the analyses of policy processes and change in Mexico. First, there is a propensity to view change as directed from above and “to relegate organized groups in society to the role of limited reactors to state initiatives” (*ibid.*: 164). Secondly, in numerous analyses “the State” is presented in personalized terms. Such a view is also present in discussions of organized groups, “which are often considered seamless organizations or simply equated with organization heads” (*ibid.*: 164-165). Thirdly, there has been an inclination “to view actors as power holders solely by virtue of their role in the state machinery or productive process rather than as a result of their ability to deal with unanticipated situational factors and bargain with various constituencies” (*ibid.*: 165). Organized groups, in contrast, “have been alternately seen as powerful or weak according to how well they are connected with the structural machinery of the regime or how big an oppositional block they represent, with too little thought given to potential policy-linked conjunctural alliances with other dispersed discontents” (*ibid.*).

This thesis tries to circumvent these pitfalls by focusing on policy making in action and modes of ordering. However, it can be read as presenting the hydrocracy as a monolithic federal agency that relatively effortlessly imposed its will and directed change from above. This is a result of using the word hydrocracy as a shorthand term for the durable but always precarious and changing actor-networks constituting the hydrocracy. I have not found a satisfactory way to resolve this tension. However, I hope that by emphasizing modes of ordering and policy articulation in the chapters that follow, the hydrocracy is not interpreted as a monolithic and all powerful agency.

To overcome the dichotomy between policy formulation and implementation, this thesis focuses on the production and articulation of water reforms. By focusing on policy making in action, it attempts to bring out how the accomplishment of rule is always precarious and vulnerable (Li, 1999). Policy articulation is the process by which policy actors support, modify, displace and translate a policy idea with as outcome that a policy or reform package becomes less or more "real" (cf. Latour, 1999). Bureaucracies play a crucial role in this process because of the way policies are institutionalized and made routine (cf. Waller, 1994). A "successful" policy follows an unstable trajectory in which it becomes more articulated and dominant, through the enrolment of the necessary actors (cf. Callon, 1986; Latour, 1987). "Trials of strength" transform the characteristics and meaning of the policy and result in the hardening of the reform package and the increasing momentum with which it expands outwards and becomes more "real". Seen in this way commitment to policies is the outcome of struggles and negotiations between different policy actors.

Domains of water governance

A final concept this thesis uses to analyze water reforms is domains of water governance. In the dictionary definition, a domain is an area over which an individual or group has control. Both the spatial connotation and the element of control contained in this definition are important. As used in this thesis a domain of water governance encompasses an issue-area and the range of stakeholders and institutions joined by or linked to that issue-area, who engage in struggles, negotiations and at times collaboration to govern the issue-area (thereby engaging in the work of ordering). The combination of the words "issue" and "area" is used both to connote the spatial dimensions of a domain and to indicate that something is a stake. An example of an issue-area is water allocation at river basin level, explored in detail in Chapter 8. The existence of an issue-area does not mean that the domain also already exists and the existence of a domain does not necessarily mean that all the stakeholders linked to an issue-area are active in the domain. Both the creation of domains and who participates are crucial elements of water reforms and need to be studied empirically to determine how power is brokered and authority exercised.

My definition of domains of water governance draws on the work by Villarreal, who defines "domains of interaction" as "areas of social life wherein practices are routinely organized within specific locales and where certain authorities, values and identities are recognized, reproduced and transformed" (1994: 59). Where I differ with her definition is that domains of water governance are not necessarily precisely located in time and space, but are more encompassing. Within a specific domain, there are many arenas, defined here as the specific localities and places where actors with different perceptions, interests and strategies come together to interact, negotiate, struggle and make decisions concerning an issue (cf. van Bueren *et al.*, 2003). As indicated by Mollinga, an arena is a metaphor that aims to "convey the image of the spectacle of daily life going on in delimited social, spatial and time 'areas'" (1998: 22). This can be meetings, policy events, working groups, water distribution on an irrigation canal or conferences. It is thus more specific than domains, which covers the whole issue-area and is not spatially delimited in a strict sense. As used in this thesis, the arena metaphor resonates with Long's definition of "interfaces" as "some kind of face-to-face encounter between individuals or units representing different interests and backed by different resources. (…) Studies of social interfaces should aim to bring out the dynamic and emergent character of the interactions taking place and to show how the goals, perceptions, interests, and relationships of the various parties may be reshaped as a result of their interaction" (1989: 2). Using slightly different language, namely domains and modes of ordering, this thesis aims to do exactly that.

1.6 Research Methodology

> [Humanity] makes [its] own history, not only under conditions which history hands down to [it], but also through the rewriting of past history. This is because history itself is historical and can only be understood by each epoch, and be of service to it, in the light of its own experience. New experience gives rise to new historical insight, and in the light of new understanding, new problems can be formulated, old and new evidence resifted, and significant facts selected out of a multitude of seemingly meaningless data. (Chi, 1936: ix-x)

To understand water overexploitation and water policies I conceptualize current water use and water policies as the historical outcomes of political, bureaucratic and managerial practices in combination with the appropriation and expansion of hydrosocial-networks by water users. That I focus on histories, river basins, water control, policy articulation and modes of ordering is a manifestation of the epistemic community (Haas, 1992) I form a part of. This community invites me to be explicit in how my knowledge is situated and how I construct my truth claims (cf. Zwarteveen, 2006). The following responds to this invitation, by discussing several points of method and the research methodologies underlying this thesis.

A first point of method concerns my focus on history and the way that I define the historical periods used to write the chapters of this thesis. As argued by Vincent (2004), we can learn from history in ways that enable us to explore not only why but whither. It is a way of thinking about the present and the future, as what I write about the past reflects my own position in time and present ideas and convictions. To understand durability and change, it is instructive to analyze the past, hence my focus on history. There are many ways to cut the historical cake, depending on which processes are being analyzed, but periodization is never neutral or simply a heuristic device. It reflects my own conceptual and substantive interests and concerns, and consists of drawing boundaries in time that could have been drawn otherwise.

To structure my analysis I identify four periods based on the changes in the hydrocracy and I link these to developments in the Lerma-Chapala Basin. These are the rise and consolidation of the hydraulic mission from the 1920s to the 1970s, the years of confusion in the late 1970s and 1980s, the reconstitution of the hydrocracy and the enactment of water reforms in the 1990s and lastly the years of increasing complexities in the early 2000s. This bureaucratic timeline is strongly influenced by the political calendar of the presidential elections, as will become apparent in the chapters that follow. I have chosen to focus on the hydrocracy for my periodization as I think this provides the most insights into water reform and policy processes. In writing this thesis I have become very modest about my interpretations and understandings of Mexico's histories and political processes.

However, this does not discharge me from the responsibility to be rigorous and impartial in developing an analysis and documenting it to the extent possible. I have striven to do this in my analysis of the histories of water management in the Lerma-Chapala Basin, but like any interpretation it needs to be challenged.

A danger of the methodological device of "following the actors" is that too much emphasis is placed on the agency of individuals and on "heroes" or "champions of change" (or "master-actors"), to the exclusion of those who are marginalized and the invisible work contributed by many other actors (Steins, 1999). Focusing on network-builders may suggest that change happens because of their actions and that forceful individuals are needed to make change happen. This tension also runs through this thesis and it is possible to read it as a portrayal of powerful male hydrocrats pushing through reforms with apparently little resistance. However, as outlined in section 1.5, I conceive of agency as a relational effect of actor-networks and thus when I write about these men I view them as representatives or spokesmen of actor-networks and not solely as individuals. They are in effect a shorthand term for the actor-networks being described and should be read as such. This is not to suggest that individuals and their mindsets and modalities of sense making are not important, but that their agency needs to be seen as embedded in actor-networks.

A third point of method concerns the construction of truth claims in this thesis. In this I am drawn towards substantive theories, as opposed to nomothetic theories. A nomothetic theory is utilized to explain as much as possible of the observable, empirical world and assumes a "god-eye view" is possible (cf. Zwarteveen, 2006). The explanations it offers are claimed to be authoritative explanations of that which is observed. They are based on the epistemological belief of monism, i.e. the thought that our separate, individual ways of understanding reality are merging into a coherent whole (Norgaard, 1994). In other words, that there is only one correct, universal way of knowing, namely through the scientific method that produces knowledge which is objective and corresponds to a preexisting reality. Substantive theories, on the other hand, do not offer definitive, totalizing explanations of reality. Rather, it is acknowledged that theories (and science in general) form one of the many possible ways by which reality may be known and understood. They are based on the epistemological premise of conceptual pluralism, i.e. the belief that reality can only be known through alternate and different patterns of thinking that are necessarily simplifications of reality and inherently incongruent (Norgaard, 1994). Thus, standards for what constitutes good knowledge vary and all knowledge is contingent and the product of its time and epistemic culture (Law, 1991). My position is that the production of truth claims is a cultural practice and that the acceptance of knowledge and theories is based on intersubjective agreement between people. This does not mean that anything goes, but that original, valid and credible statements about reality are developed based on verifiable sources. However, making statements about reality always involves an interpretive act, resulting in interpretations that can and need to be challenged.

To understand where water policies come from, and where they end up, this thesis traces the associations through which they are assembled. The thesis also travels through time, by studying the histories of water use in the Lerma-Chapala Basin. Thus, my main method of enquiry was "traveling" (cf. Andersson, 2002), both in the literal sense of flying to

Mexico many times and driving around the Basin to see different people and places and in the figurative sense of traveling through time. Much of the empirical material presented in this thesis was collected from August 1998 to June 2000, while I was working for the International Water Management Institute (IWMI) as a water management researcher. After returning to the Netherlands, I had the opportunity to travel back to the Lerma-Chapala Basin on nine occasions for two to three week periods, the last trip being in July 2007, to continue research on the Basin. In all, the research covered a span of nine years, from August 1998 to August 2007. A characteristic of the research was that I collaborated with many people and that much of the material presented in this thesis was the result of joint research. This led to many joint publications (see Annex A) and immeasurably enriched my understanding of the topics I was studying. In each chapter reference is made to the people I worked with on the research underlying the chapter in question. However, as first author of all the chapters in this thesis I take full responsibility for their content.

When I started my research in August 1998, the Mexican IMT model had already been marketed internationally as highly successful (Rap *et al.*, 2004; Rap, 2006), in part thanks to the speed with which the transfer program was carried out.[25] I was thrilled at the prospect of studying the enactment of water reforms and uncovering Mexico's secret to success. However, at that time I had scant experience with studying water reforms and only a broad understanding of river basin management. This rapidly changed during my two years in Mexico, where I read extensively on river basin management and policy processes and attended a wide range of policy events. I also conducted a range of interviews with senior hydrocrats together with Edwin Rap to understand the emergence and acceleration of the IMT policy, as well as interviews with government officials and water users in the Lerma-Chapala Basin concerning groundwater and river basin management. When I left Mexico in July 2000 I had the feeling that I was just beginning to understand what was happening in the Lerma-Chapala Basin and thus was very fortunate that I obtained three successive grants to continue research in the Basin from July 2000 to July 2007.[26]

To study water reforms, the hydrocracy and the histories of water development, empirically rich research in one locality is not sufficient. Thus, besides spending time in the field as conventionally understood, most of my research took place in offices, hotels, conference venues and documents. Studying water policy elites posed the challenge of "studying up", where participant observation and other research methods "may not be readily portable to elite contexts" (Gusterson, 1997: 116). In my research "studying up"

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[25] Between 1990 and 1994 some 2.5 million ha of state managed irrigation systems were transferred to Water Users' Associations (WUAs) (CNA, 1994a). This pleasantly surprised donors, water professionals, consultants and researchers alike, especially as attempts in other countries to hand over irrigation systems to farmers on such a large scale had generally met with failure.

[26] The Guanajuato Science and Technology Council (CONCYTEG) provided the first grant in 2001 to study the representation of agricultural water users in river basin management. The second grant was provided by the Comprehensive Assessment of Water Management in Agriculture to do a synthesis study of the Lerma-Chapala Basin, from February 2004 to February 2006. The Dutch government provided the third grant through its Partners for Water program to study groundwater management in Guanajuato from July 2006 to July 2007. Although these grants had their own deliverables, parts of their research outcomes could also be used for this thesis.

meant interviewing senior members of the hydrocracy as well as staff of international organizations and Mexican water researchers, as well as attending (and getting invited to) policy events, conferences and closed-door meetings. While I was initially hesitant and uncertain how to approach these "powerful" men, it turned out to be easier than I expected. In this I was strongly aided by Gabriela Monsalvo and Sergio Vargas, without whom many doors would have remained closed. In all, some 30 semi-structured interviews were conducted with (ex)-staff of the federal hydrocracy and state water agencies, while some 60 interviews were held with water managers, water users and researchers. Many of these interviews were conducted together with Edwin Rap as part of our combined research on the IMT policy (cf. Rap, 2004). Sampling for these interviews was purposeful, based on the snowball method. The research further consisted of the analysis of policy documents, newspaper articles and gray literature pertaining to the Basin and participant observation and informal discussions at numerous water meetings. Hunting down hard to find and "confidential" policy documents was an important part of the research methodology and constituted another form of "traveling". When doing history there is an inherent limitation to using archives and written sources to reconstruct the past, as only some histories get recorded. To lessen this constraint many of the interviews I held strongly focused on history, particularly the 1960s and 1970s, while I also interviewed two hydrocrats who had started working in the Basin in the 1940s.

1.7 Structure of the Thesis

This thesis is about water overexploitation and water reforms, in particular where water reforms come from, how they are made to succeed or fail and their effects. The focus on history is integral to the argument of this thesis, namely that to understand water overexploitation and the articulation of water reforms it is necessary to conceptualize current water governance and water use as the historical effects of political and bureaucratic practices. In Chapter 2, a historical analysis of the creation of water overexploitation in the Lerma-Chapala Basin brings out how water resources development is a recursive process in which hydrocracies, water infrastructure, water and water users mutually constitute each other. Between the 1920s and 1970s, the construction of irrigation schemes and river basin development in the Lerma-Chapala Basin, coupled with the bureaucratic-authoritarian character of the Mexican state and the hydraulic mission of its hydrocracy, led to water overexploitation and the strengthening of state control over water, water users and space. This process also deeply transformed agricultural production and agrarian relations, resulting in the creation of irrigation constituencies bent on maintaining and increasing their access to water. Through highlighting these processes, Chapter 2 provides historical depth to the main themes dealt with in this thesis.

A major rupture for the hydrocracy in Mexico was the merger of the ministry of hydraulic resources with the ministry of agriculture in 1976 and the dissolution of the river basin commissions. Chapter 3 analyses how this merger reduced the autonomy of the hydrocracy and resulted in bureaucratic struggles and a politically expressed demand for renewed autonomy on the part of the hydrocrats. The chapter focuses on policy articulation to elucidate how the historical, political and bureaucratic transformations relating to water in Mexico between 1976 and 1988 led to the consolidation of a water reform package and the reconstitution of the hydrocracy in 1989. It argues that the composition of the Mexican water reforms and the commitment to them emerged from a protracted and contingent process of bureaucratic struggles and political accommodations that was strongly driven by the hydrocracy's quest for renewed autonomy and its ambition to be the sole water authority in Mexico.

Chapter 4 analyses the articulation of the IMT policy in Mexico in the early 1990s, focusing on its emergence, standardization and acceleration. It argues that much policy making actually takes place during policy implementation and that policy making is a continuous and on-going process that is potentially self-reinforcing, but often fragile and reversible in practice. This argument is constructed by showing that the articulation of the irrigation transfer policy was not an uncontested process but one that resulted from interactions between policy actors such as hydrocrats, water user leaders, politicians and international lending agencies. This led to the development of a standardized policy package, consisting of specific policy techniques. These techniques were assembled in response to distributed trials of strength: experiments, consultations and clashes in the field and negotiations at the national and international level. Feedback and centering mechanisms coordinated by the hydrocracy led to a convergence of distributed experiences and ideas on how to make transfer work, which contributed to the acceleration of the transfer process. The analysis shows that paradoxically through IMT the hydrocracy regained control over the irrigation districts and strengthened its position as Mexico's sole water authority.

Chapter 5 details the major water reforms of the 1990s as they played out in the Lerma-Chapala Basin. These reforms, such as irrigation management transfer and river basin management, were intimately linked with the overriding concern of the hydrocracy to regain its autonomy. Through these reforms, the hydrocracy regained discursive hegemony in the definition of water problems in the Lerma-Chapala Basin in the early 1990s. However, the dynamics of these reforms, which entailed a shift from authoritarian and centralized government to distributed governance, coupled with larger changes in Mexican society, resulted in institutional gridlock in the late 1990s and increased water use. While the hydrocracy furthered its territorial and governmental ambitions by using the concept of river basins as the natural units for water management, it only very partially succeeded in increasing its control over actual water use. The chapter concludes that to reduce water overexploitation, deeper shifts in governance are needed based on collaboration, combined with an equitable approach to the curtailment of primary water use.

Chapter 6 focuses on stakeholder representation in river basin management. This chapter has been published as an article and is included as published in the thesis, leading to some repetition with earlier chapters. Chapter 6 argues that increasing the capacity of water users to influence decision-making is crucial in river basin management reforms. It assesses emerging forums for river basin management in Mexico and South Africa and concludes that the pace of democratization of water management in both is slow. Mexico is characterized by continued government dominance and attempts to include already organized stakeholders in decision-making, while substantive stakeholder representation is lacking. South Africa is placing emphasis on social mobilization and transformation, leading to a slower implementation process and struggles over the redistribution of resources. While not a panacea, moving from stakeholder participation to substantive stakeholder representation in river basin management holds more promise of achieving equitable water management.

Chapter 7 analyses attempts to reduce groundwater overexploitation in the Lerma-Chapala Basin, particularly in Guanajuato, through state regulation and user self-regulation. It argues that the political economy of groundwater use is a strong impediment to reducing groundwater overexploitation. Thus, individual water users continue to have nearly unfettered control over their pumps, the federal government continues to provide cheap electricity to agriculture and the hydrocracy seeks rents through the legalization of illegal pumps. This chapter suggests that these strategies remain in place and are stronger than attempts to reduce groundwater use as they strengthen two central concerns of the Mexican state, namely accumulation (increasing earnings through export agriculture and industrialization) and legitimacy (providing production subsidies to potentially unruly farmers and domestic water to powerful voting constituencies).

Chapter 8 continues the analysis started in Chapter 5 by focusing on the politics of surface water management in the Basin after 2000, in particular water transfers from irrigation districts to Lake Chapala and the negotiation processes surrounding the revision of the 1991 water allocation agreement. The continuing decline of Lake Chapala from 1999 onwards and the water transfers to the Lake led to increased conflicts between states and water users in the Basin and complicated renegotiating the 1991 agreement. The changing dynamics of water user representation in water governance from the field to the basin are explored through an analysis of a farmer initiative to influence decision making at the river basin level in response to the water transfers. While a new water allocation agreement was signed in 2004, no provisions were made for environmental flows or for compensations to farmers for reductions in water allocations. This brings out how difficult it is to readjust water allocations after basin closure, let alone reduce water use and secure environmental water requirements, even if parties are willing to negotiate.

Chapter 9 presents the main findings and conclusions of the thesis. Two important findings are that the articulation of water reforms was only very partially driven by river basin closure and that the reforms did not lead to a reduction of water overexploitation. Rather, the sociopolitical analysis in this thesis of the water reforms pursued in the Lerma-Chapala Basin brings out that an important driver of the water reforms was the objective of the hydrocracy to strengthen its bureaucratic autonomy and control over domains of water governance. The active role of the Mexican hydrocracy in the articulation of water reforms shows that it supported change processes that it initiated and controlled and that would bring benefits to the hydrocracy. Its marked disinterest in making environmental sustainability and social equity the priorities of water reforms needs to be seen in this light. As long as these concerns do not bring benefits to the hydrocracy, and without strong political and social pressures being brought to bear on the hydrocracy to make these concerns its priorities, water overexploitation and the further concentration of water rights will continue. The thesis concludes that an explicit recognition of the powerful interests linked to water use and finding ways to bring these interests to the negotiating table is a necessary first step for making the "water transition".

2

Capturing the Waters: The Hydraulic Mission in the Lerma-Chapala Basin

This chapter shows how the hydraulic mission of the federal government, embodied in a centralized hydrocracy, led to the creation of water overexploitation in the Lerma-Chapala Basin. It does so by analyzing the centralization of water development in the Lerma-Chapala Basin from around 1875 to 1975. In the late 19th century the federal government began asserting its control over water, both to promote commercial agriculture and to arbitrate in water allocation conflicts between large landowners. The centralization of water development accelerated in 1926 with the creation of the *Comisión Nacional de Irrigación* (CNI; National Irrigation Commission) and continued until the 1970s. These fifty years witnessed a large increase in the irrigated area in the Lerma-Chapala Basin, intertwined with the formation and expansion of a strong hydrocracy with a keen sense of its hydraulic mission. The logo of the CNI and its successor, the *Secretaría de Recursos Hidráulicos* (SRH; Ministry of Hydraulic Resources), formed in 1946, contains the bold mission statement of Mexico's hydrocracy, namely *Por la Grandeza de México* (for the greatness of Mexico). A more apt summary of the hydraulic mission is hard to come by.

2.1 Introduction

This chapter sketches the history of water development and the creation of water overexploitation in the Lerma-Chapala Basin and links this to the development of a strong federal hydrocracy.[27] The hydraulic mission of the hydrocracy – water development for the greatness of Mexico – and the bureaucratic-authoritarian state that developed in Mexico after the Revolution of 1910-1920 strongly influenced water development in the Basin. The hydraulic mission of the hydrocracy was premised on the notion that the federal government should capture as much water as possible for human use through infrastructure development. The hydraulic mission, the centralization of water resources development and the growth of the federal hydrocracy mutually reinforced each other and formed an important component of state formation in post-revolutionary Mexico. This chapter brings out how the centralization process and irrigation and river basin development in the Lerma-Chapala Basin led to water overexploitation and the strengthening of state control over water and water users. Through highlighting these processes this chapter provides historical depth to the main themes dealt with in this thesis, namely the links between the hydraulic mission, hydrocracies and river basin closure, water reforms and decentralization and water allocation and river basin politics.

Three phases in the centralization of water resources development in Mexico can be identified: the birth of the hydraulic mission in the late 19th century, the rise of the hydraulic mission during the CNI era (1926-1946) and the zenith of the hydraulic mission during the SRH era (1946-1976). Section 2.2 sketches the first phase of centralization, which entailed a move away from local water control towards larger intervention by the federal government. The Porfirio Díaz regime (1876-1911), known as the Porfiriato, strongly supported private capital and foreign investment and developed laws that led to extreme forms of land concentration. In 1888 a law was passed that placed lakes and navigable rivers under federal jurisdiction and specified that water concessions and the confirmation of existing water rights could only be issued by the federal government. This marked the birth of the hydraulic mission and the first attempt by the federal government to increase its control over water. In the Lerma-Chapala Basin several land reclamation projects were undertaken by large landowners, with support from the federal government and on several of the tributaries of the Río Lerma the federal government drew up river regulations. Lastly, the development of hydroelectricity plants became important.

The second centralization phase was an outflow of the Revolution of 1910-1920, which led to the redistribution of land and much stronger state intervention in irrigation development. The expansion of irrigation and the centralization of water development were strongly interwoven with the efforts of post-revolutionary governments to politically stabilize the country and to achieve economic development. Article 27 of the Mexican Constitution of 1917 defined surface water as national property and granted sole authority to the federal government to administer it. In 1926 the CNI was created, leading to the

[27] This chapter is largely based on secondary sources, and partly on interviews for the SRH era. In addition, the primary sources from the Archivo Histórico del Agua (AHA) contained on the DVD *Riego y Gestión del Agua en la Cuenca Lerma-Chapala: Documentos para su Historia, 1896-1985*, complied by Isnardo Santos, Sergio Vargas and Eric Mollard, proved invaluable.

construction of irrigation districts by the federal government. In just two decades this hydrocracy succeeded in consolidating its control over water resources and according itself a primary role in Mexico's development. Section 2.3 analyzes how the rise of the hydraulic mission led to increased federal control over water in the Lerma-Chapala Basin and the expansion of the irrigation frontier. This included superimposing new irrigation systems on already existing infrastructure in the Basin and a process of bringing existing water boards under CNI control. However, the centralization process was never smooth or automatic and the hydraulic mission began to be questioned in the third phase.

The third phase began when the SRH was formed in 1946, uniting all federal government responsibilities concerning water in one ministry. River basins as units of development became important and SRH river basin commissions were created to achieve comprehensive river basin development. The SRH became one of the most powerful federal ministries in Mexico and the hydraulic mission reached its zenith in the early 1970s with the passage of a new water law and the formulation of a national hydraulic plan. In the Lerma-Chapala Basin the creation of the SRH coincided with the first Lake Chapala crisis, which lasted from 1945 to 1958. The combination of a drought, abstractions from the Lake for hydroelectricity generation and irrigation upstream nearly resulted in the Lake drying up. However, water development continued unabated and after the crisis had passed the irrigation frontier was expanded further and dam storage capacity more than doubled in the 1960s and 70s. Section 2.4 discusses how the hydraulic mission led to the "overbuilding" of the Basin by reviewing the Lerma-Chapala-Santiago study commission created by the SRH in 1950, the controversies surrounding the first Lake Chapala crises and the continued expansion of the irrigation frontier in the 1960s and 70s.

2.2 Towards Federal Water Control: The Birth of the Hydraulic Mission

Irrigation development in the Lerma-Chapala Basin started on a large scale with the arrival of the Spaniards and the resulting colonization of the Basin. The discovery of silver mines in Guanajuato in the 1550s led to the rapid settlement of the Bajío and the development of irrigated agriculture for wheat cultivation, mostly through private initiative and by monasteries (Murphy, 1986). For example, in 1580 the Augustinian friar Diego de Chávez had a diversion weir built on the Río Lerma called de Lomo del Toro to divert water to a natural depression situated on the left bank of the river. This led to the creation of Lake Yuriria with a capacity of 220 hm^3 (Murphy, 1986). The increasing demands for cereals by Mexico City and Guadalajara led to the expansion of irrigation in the 17th and 18th century based on run-of-the-river irrigation schemes and the ingenious use of flood waters in the Bajío, through the construction of *cajas de agua*.[28] By the end of

[28] Sánchez (2000) provides an analysis of the development of *cajas de agua* (embanked field ponds) on the Río Laja. This system consisted of interlinked and embanked fields of 5 to 200 ha each that were filled in succession with the flood waters of the river as well as direct runoff from hill slopes. These *cajas* (literally boxes) were drained in a staggered pattern after several months, and then sown with wheat. The larger *cajas* were also used to store water for supplementary irrigation. This form of controlled flooding was developed to a high degree of complexity in the Bajío.

the colonial period the Basin's water resources were already intensively used and by 1900 the run-of-the-river irrigation potential of the tributaries of the Río Lerma had been largely developed, covering around 60,000 ha (SRH, 1953).

The hydraulic mission started to gather force in Mexico towards the end of the 19th century, with the first attempts to bring water under the control of the federal government. Before then, irrigation and drinking water had largely been local affairs, although land and water rights were originally based on royal grants during the colonial period. The first 75 years of the 19th century were a period of turmoil and political unrest, with few new irrigation works in the Basin. This changed in the last quarter of the 19th century, with attempts by *hacendados* to turn marshes and lakes into private property for land reclamation purposes. The birth of the hydraulic mission during the Porfiriato led to increased federal involvement in water affairs in the Lerma-Chapala Basin. In the final years of the Porfiriato, several leading *científicos* published reports promoting large federal investments in irrigation development as the solution to Mexico's agricultural problems. It was not until after the Revolution of 1910-1920 that their calls were heeded.

Towards the federalization of water allocation and development

Mexico's independence from Spain in 1821 was followed by fifty years of turmoil, political unrest and economic stagnation. It was ruled by forty-five governments between 1821 and 1875, was invaded several times and lost nearly half its territory to the USA in 1848 (Centeno, 1994). During this period water management remained in the hands of local governments and large landowners, much as during the colonial period. However, the wars and uprisings in the first half of the 19th century caused much damage to hydraulic infrastructure and curtailed new investments. This also affected the Lerma-Chapala Basin, where few new irrigation works were constructed. An exception was the Corona barrage built in 1853 on the Río Santiago, some 40 km downstream of Lake Chapala, to irrigate 4,000 ha on the Atequiza *hacienda*. This barrage is still in use today for irrigation and forms part of the water supply system of Guadalajara (see section 2.4 and Chapter 5). Another development was that initiatives were undertaken to drain marshes and lakes in the Lerma-Chapala Basin.

The first large land reclamation project in the Lerma-Chapala Basin was an attempt to drain the Lerma lakes and wetlands (Lagunas de Lerma), which began in 1857 and continued until 1870. These *lagunas*, consisting of three larger lakes and numerous smaller wetlands, formed the headwaters of the Río Lerma near Toluca City and had historically been intensely used by the indigenous inhabitants of the area. With the support of the governor of the state of Mexico, the *hacendados* of the area set out to enlarge and deepen the Río Lerma to drain the lakes and lay claims on the drained land for enlarging their estates (Boehm and Sandoval, 1999). Although work was started on the project, the lakeside communities fiercely opposed it and the project was not completed. Thus, the wetlands continued to provide benefits to the inhabitants of Toluca Valley until the 1950s, when Mexico City succeeded in sucking them dry. However, land reclamation projects became increasingly popular with the birth of the hydraulic mission during the Porfiriato.

The turmoil of the 19th century subsided under the dictatorship of Porfirio Díaz (1876-1911), although the plight of the majority of the Mexicans worsened. To consolidate his rule Díaz granted state favors to *hacendados*, industrialists and bankers, as well as extensive concessions to the United States (Cockcroft, 1983). During his regime the federal government established control over the country and focused on the development of mining and the building of railroads (Hamilton, 1982). An oligarchy of some 250 families, controlling 80% of the nation's land, handsomely profited from the increased production and trade, while an estimated 90 to 95% of rural households, forming 75% of Mexico's population, were landless according to the 1910 census (Cockcroft, 1983; Hamilton, 1982). The widespread dispossession of *campesinos* and *indígenas* of their communal lands by *hacendados* and foreign companies was encouraged by the federal government through its *baldio* (vacant land) and colonization legislation, under which nearly one fifth of Mexico's territory was granted to surveying companies between 1883 and 1892 (Hamilton, 1982). As argued by Cockcroft (1983: 93), the widespread impoverishment of Mexico's inhabitants was not the result of "feudalism" or a colonial legacy, but the outcome of the liberal capitalism model followed by the Díaz regime. The extreme concentration of land ownership, with eight individuals holding 22.5 million hectares in 1910, was a potent ingredient of the Revolution that was to follow (Hamilton, 1982).

During the Porfiriato the scale and number of hydraulic projects increased considerably and the federal government started to play an active role in water development and the concessioning of water rights. In an excellent historical study, Aboites (1998) traces what he terms the centralization/federalization process in water affairs from 1888 to 1946. He indicates that in the Mexican context the term federalization refers to the process that led to the concentration of political and legal powers and faculties in the federal government, in short centralization (Aboites, 1998: 11). Before 1888, although the colonial crown had granted initial water rights, communities and municipalities administered water rights and water was controlled locally. This changed in 1888, when Congress passed the *Ley General de Vías de Comunicación* (General Law on Communication Routes) that placed lakes and navigable rivers as well as boundary rivers under federal jurisdiction. The law did not establish water as national property, but it did authorize the federal government to regulate the public and private use of navigable and inter-state rivers and specified that water concessions could only be issued by the federal government (Aboites, 1998).

The 1888 law met with criticism from large landowners and industrialists, as it was vaguely worded and existing water rights had to be confirmed by the federal government. The federal government on the other hand wanted to establish federal jurisdiction over all of Mexico's water, but the liberal 1857 Constitution was very restrictive and defined water as private property. This resulted in a new law being passed in 1894 that clearly authorized the federal government to issue water concessions to individuals and companies wishing to use water falling under federal jurisdiction. A decisive step in the federalization of water management was the amendment of Article 72 of the Constitution in 1908, which placed rivers in the public domain. Based on this amendment it was concluded that water as private property no longer existed and that access to water was only possible through concessions issued by the federal government. Thus, in a space of twenty years, in legal terms water in Mexico passed from being a local affair to falling in the public domain administered by the federal government. In 1910, this change was perfected through the promulgation of the first federal water law that superseded all previous laws concerning the dominion and administration of federal waters (Aboites, 1998; Sánchez, 1998). The birth of the hydraulic mission during the Porfiriato entailed that the federal government established control over water and supported private capital (the oligarchy) in developing water resources, as brought out below for the Lerma-Chapala Basin.

Land reclamation projects in the Lerma-Chapala Basin

Water development in the Lerma-Chapala Basin during the Porfiriato consisted of two main thrusts, namely land reclamation combined with irrigation and the development of hydroelectricity. These projects were undertaken by large landowners, sometimes in conjunction with foreign capital, but with an increasingly active involvement of the federal government in the funding and approval of these initiatives. The actual drainage of the Chapala and Zacapu marshes, and the proposals to drain the Lagunas de Lerma and the Cuitzeo and Yuriria Lakes, stand out as examples of the land reclamation efforts. The expansion of run-of-the-river irrigation works on tributaries of the Río Lerma also received attention, but the main incursion of the federal government in this area consisted of the formulation of river regulations. Another development was that a permanent barrage was built for the first time on the main stem of the Río Lerma, based on a concession granted by the federal government. In the late 19th century the *hacendado* Carlos Markazuza ordered the construction of a barrage on the Río Lerma upstream of La Piedad to irrigate some 4,000 ha of his landholdings. This Markazuza barrage currently forms part of the infrastructure of the Alto Río Lerma irrigation district (de P. Sandoval, 1981).

The drainage of the Zacapu marsh (Ciénega de Zacapu), located in Michoacán near the headwaters of the Río Angulo, is exemplary of how land reclamation projects were undertaken during the Porfiriato. As in other land reclamation projects, there was an important link between foreign capital, the federal bureaucracy and large *hacendados*. The Zacapu marsh covered an area of around 150 km^2, was up to 8 meters deep and was surrounded by several haciendas and farming communities (Guzmán-Ávila, 2002). Eduardo Noriega, a large *hacendado* and friend of Porfirio Díaz, obtained a concession from the federal government in 1900 to drain the marsh and construct a hydroelectricity plant near the exit of the marsh. As the Río Angulo was not navigable and did not form a boundary between two states and thus legally did not fall under federal jurisdiction, other *hacendados* challenged this concession, but to no avail. Noriega struck a deal with Antonio Carranza, the other large landowner in Zacapu, and in 1902 work on constructing drainage canals and a pumping station was finished. On the reclaimed land of 12,000 ha Noriega developed an irrigation system that started functioning in 1907, with a large loan from the federal government. In addition, he sold his concession for hydroelectricity generation to the Michoacan Power Company, a US enterprise, in December 1906, who constructed a hydroelectricity plant (Guzmán-Ávila, 2002).

The land reclamation fever rapidly spread throughout the Basin during the Porfiriato and various proposals were submitted to the federal government by *hacendados* to drain the Lagunas de Lerma and the Yuriria and Cuitzeo Lakes. The earlier plans to drain the Lerma wetlands and to reclaim them for agriculture were taken up again in 1906 when

Gumesindo Enríquez, an ex-governor of the state of México, submitted a proposal to the federal government for the complete desiccation of the Lerma wetlands. This was approved by president Díaz on 5 September 1906. In the contract signed between the federal ministry of development and Enríquez he was authorized to construct all the necessary hydraulic works to drain the wetlands and as compensation would receive all the lands that fell dry. An important clause in the contract stipulated that the lakeshore landowners had to approve of the project and if not the contract would be void. In 1907 Enríquez obtained this approval, after a series of negotiations, in which it was agreed that only 40% the new land would become his property and the remainder would be divided among the existing *haciendas*. However, the Revolution of 1910-1920 caused serious delays in construction and in the 1920s the federal government indicated that the drained lands could be expropriated to form *ejidos*. In the end, the contract to drain the Lerma wetlands was cancelled in 1930 by the federal government, as the works had not been executed (Camacho-Pichardo, 1998). Similar proposals were put forward to drain the Cuitzeo and Yuriria Lakes, both to provide flood control and to bring new lands under agriculture, but these works were not executed.

A land reclamation project that was executed before 1910, and that was to have a lasting impact on the Basin and Lake Chapala, was the draining of the Lake Chapala marsh (Ciénega de Chapala). This land reclamation project was linked to the development of hydroelectricity plants fed by Lake Chapala and set the stage for the first Lake Chapala crisis from 1945 to 1958. Until the late 19th century Lake Chapala remained in its natural state, but this changed dramatically during the Porfiriato. In 1885 a hydroelectricity plant, called El Salto (The Fall), was constructed on the Río Santiago near Juanacatlán, some 60 km downstream of Lake Chapala (see Figure 2.1), to provide Guadalajara with electricity. This plant received its water from Lake Chapala that flowed into the Río Santiago near the city of Ocotlán if the Lake level was above cota 95.00,[29] as an outcropping of rock at the mouth of Lake Chapala stopped the flow of water if the Lake dropped below this level. However, even if the Lake was above this level, the form of the outlet to the Río Santiago and the large amount of sediments deposited there by the Río Zula, which joins the Río Santiago at the mouth of Lake Chapala, restricted the amount of water leaving the Lake. According to Robles-Gil, during the rainy season the waters of the Río Zula would flow in two directions at its confluence, both upstream towards the Lake and downstream along the Río Santiago. This effectively blocked the outflow from the Lake during the rainy season and combined with the inflows to the Lake from the Ríos Lerma and Duero could head up the water in the Lake by some two to three meters.[30] In one of the first studies on Lake Chapala, Miguel Quevedo y Zubieta mentions that the highest level reached by the

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[29] The depth of Lake Chapala is measured with a locally defined benchmark, originally called the *acotación* (elevation mark) and later the *cota* (literally benchmark in Spanish). This benchmark was established around 1897, apparently by engineer Luis P. Ballesteros, with cota 100 defined as the bottom of the keystone of the sixth arch of the bridge over the Río Santiago in Ocotlán (unfortunately destroyed in 1965). This elevation of this point was later determined to be 1,526.80 m.a.s.l. (de P. Sandoval, 1981: 16). At present, the Lake's normal maximum operating level is at cota 97.80, while at around cota 90.00 it is nearly empty.

[30] Archivo Histórico del Agua (AHA), Aprovechamientos Superficiales (AS), *Memoria descriptiva del proyecto de las compuertas que el Sr. D. José M. Bermejillo, establecerá en el Puente de Ocotlán*, by Alberto Robles-Gil (1896), Box 4613, File 61389, pp. 94-126.

Lake was between cota 98.50 and 99.20 in 1887, but that this figure was highly uncertain as it had not been measured directly but had been determined ten years later based on oral accounts (Quevedo y Zubieta, 1906: 15). What is clear is that from 1896 to 1904, when Lake levels were measured, the Lake on average reached cota 97.13 in the rainy season and would then fall to an average of cota 95.82 in the dry season (*ibid*.: 18).

The studies by Robles-Gil and Quevedo y Zubieta (1906) describe Lake Chapala before it was altered. Figure 2.1 presents the original condition of the Lake, showing the large extent of the Ciénega de Chapala at the eastern end of the Lake and the Laguna de Pajacuarán, of 2 km wide and 17 km long, in the Ciénega. The Río Lerma flowed through the haciendas of San Agustín and Cumuato, to enter the Lake at the Isla de Maltaraña, while the Río Duero emptied into the Laguna de Pajacuarán. As the average elevation of the Ciénega was cota 96.20, a large part of it would flood each year, depending on river inflows and Lake levels. During the colonial period and in the 19th century an intricate form of transhumance developed, combining flood recession agriculture with livestock, with several large haciendas owning most of the land in the Ciénega. When the Ciénega was flooded, Lake Chapala would reach a length of 100 km, a surface area of 1,600 km^2 and would store around 9,400 hm^3 (de P. Sandoval, 1994: 26). Robles-Gil even suggests that the maximum storage capacity of the Lake was around 10,500 hm^3. The question of the natural storage capacity of the Lake became a contentious issue in both the first and second Lake Chapala crisis and it is generally argued to have been 4,750 hm^3. This misconception arose due to the construction of the Poncitlán barrage, detailed below.

There are reports that in 1897 the Lake nearly completely dried up, dropping to around cota 90.50, and that as a result the El Salto hydroelectricity plant and irrigation from the Corona barrage had to stop (de P. Sandoval, 1981: 15). However, the report by Quevedo y Zubieta (1906) casts strong doubt on this undocumented claim by de P. Sandoval. Drawing on a study conducted by Robles-Gil in 1904,[31] Quevedo y Zubieta (1906: 18) states that between 1896 and 1904, the lowest measured Lake level was cota 95.20 and the average low level during the dry season was cota 95.82. However, during the dry season when the Lake dropped to around cota 95.00, the little water that flowed into the Río Santiago was held up at the Poncitlán rapids. This motivated José Bermejillo, a *hacendado* with lands irrigated from the Corona barrage, to obtain a concession from the *Secretaría de Fomento* in March 1896 to construct a barrage on the Río Santiago.

He hired Alberto Robles-Gil to conduct two studies to determine the best location to install a gated barrage on the Río Santiago, to regulate the volumes stored in Lake Chapala and to ensure a continuous flow in the Río Santiago.[32] Robles-Gil recommended placing gates in the Ocotlán bridge, which crosses the Río Santiago just below its exit from Lake

[31] Robles-Gil was commissioned by the Secretaría de Fomento in 1904 to demarcate the ordinary high shoreline of Lake Chapala, to determine the area of the Lake falling under federal jurisdiction. I have not been able to locate his report, mentioned by Quevedo y Zubieta (1906: 12).

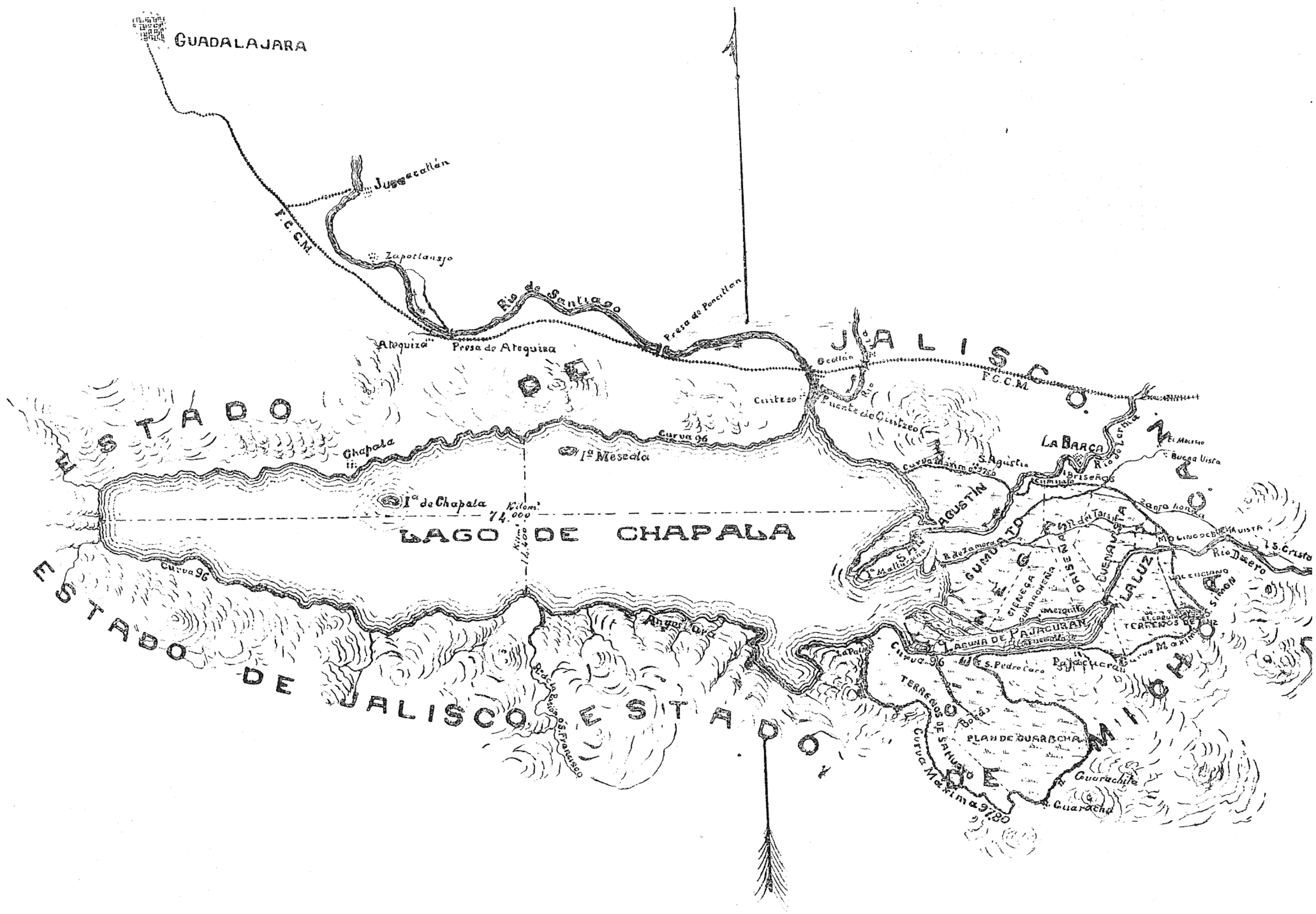
[32] AHA, AS, *Memoria descriptiva del proyecto de las compuertas que el Sr. D. José M. Bermejillo, establecerá en el Puente de Ocotlán* by Robles-Gil (1896), Box 4613, File 61389, pp. 94-126, and AHA, AS, *Memoria descriptiva de las obras hidráulicas de los rapidos de Poncitlán* by Robles-Gil (1897), Box 4619, File 61484, pp. 65-69.

Chapala, and to construct a barrage across the rapids of Poncitlán, located some 23 km downstream of Lake Chapala. Work on canalizing the rapids of Poncitlán had already started in 1893 and in 1897 a more permanent barrage was constructed. In the end, the gates in the Ocotlán bridge were not placed and in 1903 the Poncitlán barrage was finished, consisting of 22 bays with movable wooden gates (de P. Sandoval, 1981). With this barrage, the level of Lake Chapala could be kept at cota 97.80. In February 1905 the *Secretaría de Fomento* published a ministerial declaration in the Diario Oficial stating that cota 97.80 was the Lake's ordinary high water level and that all the lands covered by water at this level where under federal jurisdiction (Quevedo y Zubieta, 1906).

According to de P. Sandoval the Poncitlán barrage increased the storage capacity of the Lake by some 3,223 hm^3, as it increased the maximum level of the Lake from cota 95.00 to 97.80 (de P. Sandoval, 1994). This claim was to be used during the first and second Lake Chapala crisis to argue that the maximum storage capacity of the Lake had been created artificially and that the "original" storage level of 4,750 hm^3 at cota 95.00 that existed before the construction of the Poncitlán barrage should be used as the target level for the Lake. However, as discussed above, before the embankment of the Ciénega de Chapala the Lake could hold up to 9,400 hm^3 in the rainy season, although it would slowly drop to around 5,000 hm^3 in the dry season. The Poncitlán barrage made it possible to prolong this level of storage, to gradually release it throughout the dry season for the El Salto hydroelectricity plant, and in this sense it did "increase" the storage capacity of the Lake. However, the Poncitlán also led to another development, that was to influence Lake Chapala throughout the 20th century, namely the embankment and drainage of the Ciénega de Chapala. An area of 500 km^2 (50,000 ha) was cut off from the Lake between 1905 and 1910, reducing the storage capacity of the Lake by some 1,500 hm^3 and leading to its current maximum storage capacity of 7,900 hm^3 at cota 97.80.

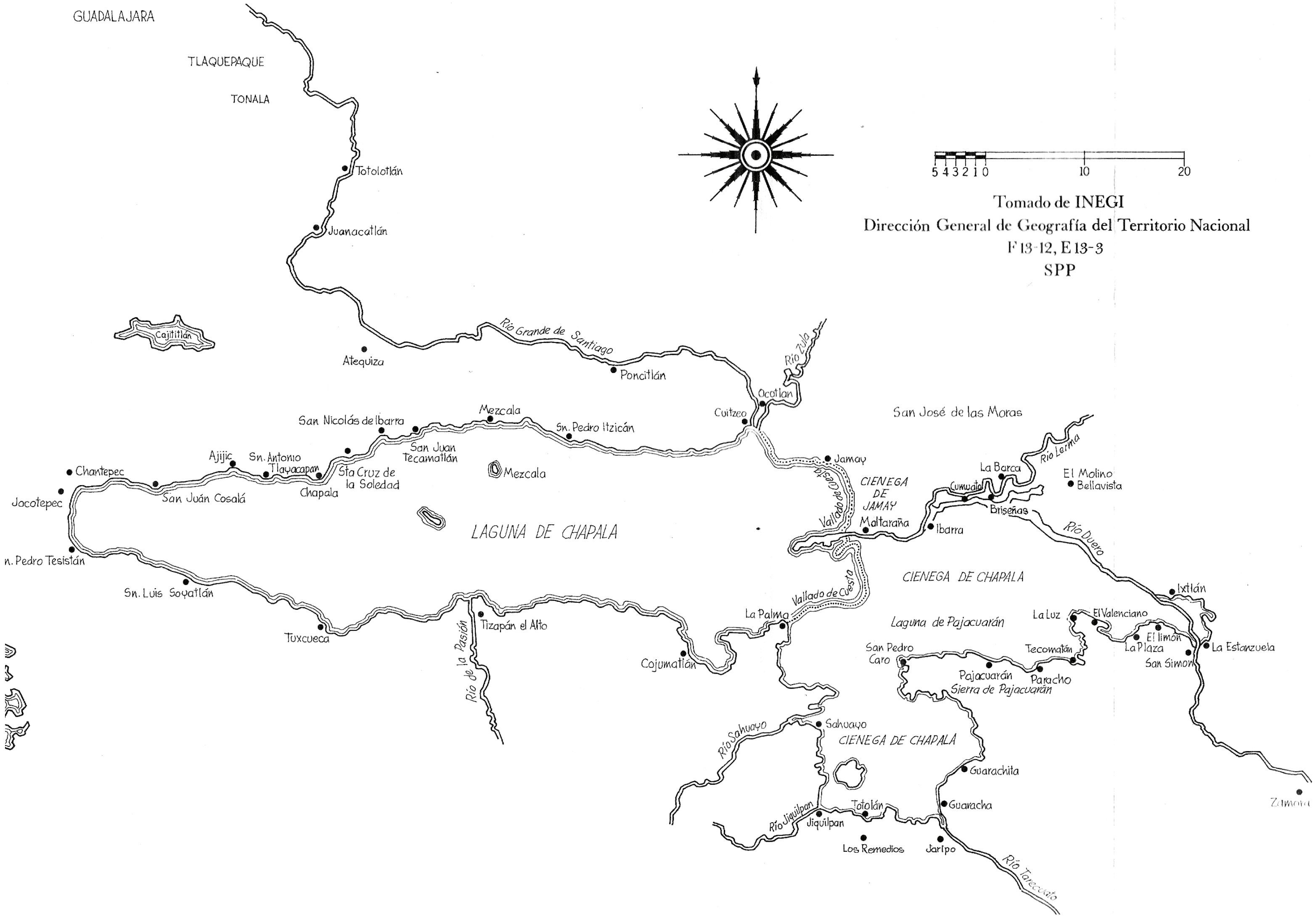
The construction of the Poncitlán barrage entailed that the Ciénega de Chapala remained flooded longer, leading to repeated complaints from *hacendados* with land in the Ciénega (Quevedo y Zubieta, 1906). This motivated Manuel Cuesta-Gallardo, a large *hacendado* in the Ciénega to develop plans to embank and drain the Ciénega de Chapala, both to increase his agricultural lands and the amount of water stored in Lake Chapala for hydroelectricity generation. He was also the owner of the Atequiza *hacienda*, which drew its irrigation water from the Corona barrage on the Río Santiago, as well as partner in the El Salto hydroelectricity company and hence had benefited from the construction of the Poncitlán barrage (Boehm, 1994). He hired engineer Luis P. Ballesteros to develop a plan for the reclamation and subsequent irrigation of the Ciénega and in 1903 obtained a concession from the federal government to do so (Boehm, 1994: 360). In 1905 work started on constructing embankments with a length of 95 km from La Palma in Michoacán in the south to Jamay in Jalisco in the north to separate the Ciénega from Lake Chapala, which was completed in 1910 (see Figure 2.2). In addition, the courses of the Ríos Lerma and Duero were altered, with the Duero entering the Río Lerma at Ibarra, and both rivers were embanked (Boehm, 1994).

Figure 2.1. Original state of Lake Chapala and the courses of the Ríos Lerma and Duero



Source: Quevedo y Zubieta (1906).

Figure 2.2. Map of Lake Chapala and the Ciénega de Chapala after embankment



Source: Boehm (1994).

This led to the reclamation of 50,000 ha that the federal government granted to Cuesta-Gallardo. Precisely this point led to heated debates, as both indigenous communities and *hacendados* already owned land in the Ciénega, and they strongly disagreed with the maximum shoreline of Lake Chapala that the Secretaría de Fomento had set at cota 97.80 (Quevedo y Zubieta, 1906). In response to complaints by *hacendados*, Quevedo y Zubieta studied the levels of the Lake and suggested that cota 96.20 should be set as the maximum shoreline (1906: 21). This was to no avail, however, and with the support of the federal government Cuesta-Gallardo succeeded in obtaining all the property rights to the drained land. In 1909 he formed the *Compañía Hidroeléctrica é Irrigadora del Chapala* (Hydroelectricity and Irrigation Company of Chapala), including several of the *hacendados* in the Ciénega and the son of president Díaz as shareholders. This signed a new contract with the federal government to develop irrigation on the newly drained lands, with a loan of three million pesos from the federal government to do so.[33] However, he did not enjoy these rights for long, as after the Revolution the majority of the lands in the Ciénega were divided and constituted as *ejidos* (land reform communities) and the CNI turned the Ciénega de Chapala into an irrigation district (Vargas-González, 1993). Nonetheless, the damage to the Lake had been done, with the loss of the extra storage buffer in the Ciénega.

Besides the land reclamation projects, the federal government became actively involved in drawing up river regulations. Based on the 1894 law, existing water rights had to be reconfirmed on rivers falling under federal jurisdiction and new water concessions had to be approved by the federal government. Kroeber (1983) and Aboites (1998) provide a detailed account of how the Fifth Section of the *Secretaría de Fomento* rapidly increased the number of river regulations it drew up and how this led to increased federal control over water. In the Lerma-Chapala Basin the Río Laja, a tributary of the Río Lerma largely flowing through Guanajuato, provides an example of this process, analyzed by Sánchez (1999). In 1895 a small group of *hacendados* with colonial water rights to the Río Laja requested the federal government to settle a water allocation dispute. The federal government quickly established a commission to study the dispute and in May 1897 decided that a complete study of the river needed to be undertaken to regulate all the water rights on the river. This was not what the *hacendados* had in mind and they resolved their conflict in 1900 and requested the federal commission to conclude its studies. However, the federal government enlarged the mandate of the study commission in 1901, to confirm and formalize existing water rights, and to conduct a full study of the river to verify if new water concessions could be awarded. This increasing incursion of the federal government was characteristic for all the rivers studied by the Fifth Section, in its attempt to bring rivers under federal control (cf. Kroeber, 1983; Aboites, 1998). Interestingly, the Río Laja was not a river falling under federal jurisdiction, but this did not withhold the Fifth Section to propose a detailed river regulation in 1906, which included the establishment of a permanent federal commission to inspect water withdrawals from the river. Although this was resisted by the haciendas drawing water from the Río Laja, gradually the river was brought under federal control (Sánchez, 1999).

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[33] AHA, AS, *Escritura Constitutiva de la Sociedad Anónima denominada Compañía Hidroeléctrica é Irrigadora del Chapala.—México. 13 de Julio de 1909*, Box 4071, File 55688, pp. 23-34.

The above has reviewed how the federal government increased its control over water during the Porfiriato and how this constituted the birth of the hydraulic mission. Through changes in the legal framework the federal jurisdiction over rivers and lakes was expanded and the federal government became actively involved in confirming existing water rights and the formulation of river regulations. More importantly, large *hacendados* were granted concessions to drain lakes and to construct irrigation and hydroelectricity works, which frequently entailed the dispossession of previous water right holders, primarily *campesinos* and *indiginas* but also other *hacendados*. This oligarchic form of water resources development entailed that the federal government itself did not construct water works, but rather supported a clique of *hacendados* and foreign companies with loans and water concession to do so. This radically changed with the Revolution of 1910-1920, with both the role of the federal government in water resources development and its beneficiaries changing. However, as the following shows, the Revolution also led to a further centralization of water resources development, with water being defined as national property and the federal government appointed its custodian.

2.3 The Rise of the Hydraulic Mission: From Oligarchic to Revolutionary Irrigation

The Mexican Revolution of 1910 to 1920 set the stage for the rise of the hydraulic mission, which accelerated with the creation of the CNI in 1926. This hydrocracy set out to develop "revolutionary" irrigation systems, as opposed to the promotion of "oligarchic" irrigation under the Porfiriato (Aboites, 1988). The revolutionary aspect initially consisted of using the construction of irrigation systems by the federal government to break up *haciendas* and colonize them with a new type of industrious farmer, working and owning a medium sized irrigated farm (20 to 100 ha). This new rural middle class would gradually replace the large *haciendas* and would bring prosperity and stability to the countryside. With the more radical land reforms of the 1930s the attention shifted to supporting land reform communities, the *ejidos*, with irrigation works. However, what both these aspects of the development of "revolutionary" irrigation had in common was that the federal government led this social transformation process, by funding, designing, constructing and managing the irrigation systems and by selecting its beneficiaries (Aboites, 1998). This led to the growth of a powerful federal hydrocracy, with a keen sense of its hydraulic mission. This section reviews the rise of the hydraulic mission and the efforts undertaken by the CNI to develop irrigation districts in the Lerma-Chapala Basin between 1926 and 1946.

Recovering from the Revolution

The widespread concentration of landholdings and the impoverishment of large segments of the population were to lead to the Mexican Revolution of 1910 to 1920. The Revolution started as a middle class movement against the reelection of Porfirio Díaz in 1910, headed by Francisco Madero, a large *hacendado* and industrialist from the north who espoused a liberal program. After escaping from jail in October 1910 and fleeing to the USA, Madero called for a national uprising against Díaz (Cockcroft, 1983). The response was immediate, with Pascual Orozco and Francisco "Pancho" Villa taking up arms in the north and the peasant army led by Emiliano Zapata in the south. Madero returned to Mexico in

February 1911 and in early May Orozco's troops won a decisive battle against Díaz's army. This led to the Ciudad Juárez peace treaty of May 1911, which allowed Díaz to go into exile, and set new presidential elections for October 1911, which Madero won (Cockcroft, 1983). However, this was only the beginning of the Revolution.

One of Madero's first actions as interim president was to call for all the revolutionary armies to hand in their weapons, promising that land reform would take place afterwards. In August 1911 he dispatched General Huerta to Morelos to oversee the disarmament of the Zapatistas, but for unclear reasons Huerta ordered his troops to open fire on the Zapatistas once they had handed in their weapons. This led Zapata to issue his "Plan de Ayala" calling for a continuation of the Revolution until land had been returned to the *campesinos* and also motivated the armies in the north to continue fighting (Cockcroft, 1983). In February 1913 the same Huerta arranged for the assassination of Madero and proclaimed himself president. This perceived "counter-revolution" led to intensified fighting, with large numbers of *campesinos* and workers joining Zapata's army in the south and Pancho Villa's in the north. It also led to the rise of the "Constitutionalists", a group of army generals headed by Venustiano Carranza, Alvaro Obregón and Plutarco Elías Calles from the northern states of Coahuila and Sonora, whose goal was to restore constitutional order. These revolutionary factions maintained an uneasy alliance in their fight against Huerta, but then descended into civil war when he resigned in July 1914. By April 1916 the Constitutionalists had secured control over Mexico City and Carranza declared himself president and called for a convention to draw up a new constitution. This convention met in late 1916 in Querétaro, leading to the signing of a new constitution on 31 January 1917 and the constitutional election of Carranza as president.

The 1917 Constitution was modeled on the liberal Constitution of 1857, but also partly incorporated the economic and social reforms fought for by the revolutionary armies, especially regarding land ownership and worker rights. It also called for a strong interventionist state, centralized power in the federal government and gave the president extensive powers. Article 27 defined natural resources, including oil, land and water, as the inalienable property of the nation and established the *ejido* form of land tenure for the redistribution of the *haciendas* to the landless, with a combination of community (*ejido*) and private (*ejidatorio*) usufruct. Article 27 also established that the only way to gain access to the nation's water was through a concession granted by the federal government. However, Article 27 also included a provision that the federal government could recognize existing private property rights and could transfer the control over land and water to private parties, thereby constituting private property.

The promulgation of the 1917 Constitution is frequently mentioned as the end of the Revolution, although fighting continued until 1920 between Zapata's peasant army in the south and the Constitutionalists in control of Mexico City, while Pancho Villa held out in the north. The assassination of Zapata on 10 April 1919 by a Carranza agent and the truce established with Pancho Villa in 1920 marked the transition to the reestablishment of rule by the Constitutionalists, the "winners" of the Revolution. The Revolution cost over ten percent of Mexico's population, with an estimated 1.5 to 2 million people losing their lives (Hamilton, 1982: 60). By 1920 the Constitutionalists were firmly in power, with Obregón becoming president after Carranza was assassinated. His task was to stabilize the country and to make good on the revolutionary promise of "*tierra y libertad*" (land and liberty).

The trend towards larger federal control over water initiated under Porfirio Diaz's regime was consolidated in Article 27 of the 1917 Constitution. The definition of water as national property has pervaded developments in the Mexican water sector to the present. Based on Article 27 the centralization of water management began in earnest in the 1920s, when President Calles launched a program for the construction of large-scale irrigation systems (termed irrigation districts in Mexico). This program found its legal expression in the Irrigation Law issued in January 1926, which also created the *Comisión Nacional de Irrigación* (CNI; National Irrigation Commission), the first government agency solely devoted to the design and construction of irrigation districts and their subsequent management (Orive-Alba, 1960). This marked the consolidation of the hydraulic mission in Mexico that had started under the Porfiriato but had not accorded the federal government a direct role in water resources development. This changed with the creation of the CNI, whose interventions strongly increased federal control over water. As shown by Aboites (1988, 1998) water resources development by the federal government played an important role in the formation and consolidation of the post-revolutionary state.

The construction of irrigation systems was a crucial component of Calles' agrarian policy, which started a persistent bias in agricultural and water policies towards the northern parts of the country. In Calles' vision the agrarian question was to be solved by breaking up the *latifundios* through the construction of irrigation systems and colonizing them with a prosperous group of middle class farmers. Aboites (1988) has termed this "revolutionary irrigation" as Calles focused on using irrigation to achieve the revolutionary promise of "land and liberty", instead of extensive land reforms. Article 2 of the irrigation law stated that existing irrigation systems fell under federal jurisdiction, while article 5 stated that the federal government was to receive a portion of both old and new lands benefited with federal irrigation works (cf. Greenberg, 1970). Based on these clauses, the CNI could subdivide *haciendas* where it constructed irrigation systems, thus reducing their size, while handing out the thus obtained land to independent farmers. The CNI was thus instrumental in creating this new class of farmers through the selection of the beneficiaries for the settlement of the newly constructed irrigation districts. It was envisioned that these private landowners would be instrumental in achieving social stability in the countryside and would serve as an example to small farmers of how to practice modern irrigated agriculture. In Calles' vision the *ejidos* were a transitional form of land tenure and in the long term agriculture would only prosper if it was based on private property. Thus, despite the stated intention of Article 27 of making the peasantry the target of land distribution, Calles' agricultural and irrigation policies contributed to the creation of a new elite of middle-sized commercial producers in the northern regions (Aboites, 1998).

The CNI was formed as a semi-autonomous agency within the federal *Secretaría de Agricultura y Fomento* (SAyF; Ministry of Agriculture and Development). The Waters Directorate within SAyF also continued to exist and focused on developing river regulations and water concessions as it had during the Porfiriato. The CNI focused on the design and construction of irrigation systems, but as there was hardly any hydraulic expertise in Mexico, several US companies with Mexican subsidiaries were hired to construct dams and other larger works. Only in the early 1940s were the American interests in these subsidiaries bought out and did the CNI decide to let out construction contracts to Mexican companies (Greenberg, 1970: 18). The CNI also contracted four high level engineers from the US Bureau of Reclamation, paying them triple their US salaries. While advisors to the CNI, these men took most of the technical decisions in the CNI and trained a new generation of Mexican hydraulic engineers (Greenberg, 1970: 16). These four included Andrew Weiss and Max King, who played an important role in water development in the Lerma-Chapala Basin.

With the help of the foreign experts, the CNI rapidly established itself as competent hydrocracy and could even claim that it was at the forefront of hydraulic developments at the time. For example, for the first time in the world low heat cement was used for the construction of the Rodríguez dam in Baja California, which later led to the use of low heat cement in the construction of the Hoover dam (Jiménez-Lopez, 1938). The CNI also rapidly set to work developing irrigation districts, with 11 under construction by 1935. Although exact data on the area irrigated before the creation of the CNI are not available, Orive-Alba (1970) estimates it to have been some 800,000 ha. In twenty years time the CNI doubled this figure through the construction of another 816,200 ha of large-scale irrigation systems and 21,343 ha of small-scale systems (SRH, 1975). The zeal and hydraulic mission mindset of the CNI is brought out by a statement by one of its leading engineers:

> The struggle against nature is a question of life in Mexico, and it is precisely for this reason that it is absolutely necessary to be able to count on men capable of dominating nature, in other words, engineers. The development of the country is in the hands of engineers. The country needs engineers in the full meaning of the word (…) engineering-men infused with the idea of social and professional responsibility that do not spare efforts, sacrifices and energies in the gigantic task that has been given them to increase the greatness of Mexico. (Jiménez-Lopez, 1938: 4)[34]

A lasting outcome of the irrigation development efforts under Calles was that subsequent administrations continued to support large irrigation works. The construction of irrigation systems was not only necessary to meet the food requirements of a growing population, which increased from 13.6 million in 1900 to 19.6 million in 1940, but also served political ends. From the 1930s onwards, the content of irrigation policy was subject to the vicissitudes in the relationship between the state and the peasantry. This revolved around the long standing tension between policies targeting private capital as a means of increasing agricultural production and those directed at the *ejido* sector to retain political support in rural areas (cf. Fox, 1992 and Stanford, 1993). In the mid 1930s, President Cárdenas (1934-1940) dealt with this challenge in quite a different manner from his predecessors by proceeding to make true the revolutionary promise of giving the "land to the tiller", especially in regions where large landowners were amongst his political

34 "La lucha contra la naturaleza es cuestión de vida en México, y es precisamente por eso por lo que se hace absolutamente necesario contar con hombres capaces de domeñar a la naturaleza, en otras palabras, de ingenieros. El desarrollo del país está en manos de los ingenieros. El país necesita de ingenieros en toda la extensión de la palabra (…) ingenieros-hombres compenetrados de la idea de responsabilidad profesional y social, que no omitan esfuerzos, sacrificios y energías en la gigantesca tarea que les está reservada para el engrandecimiento de México."

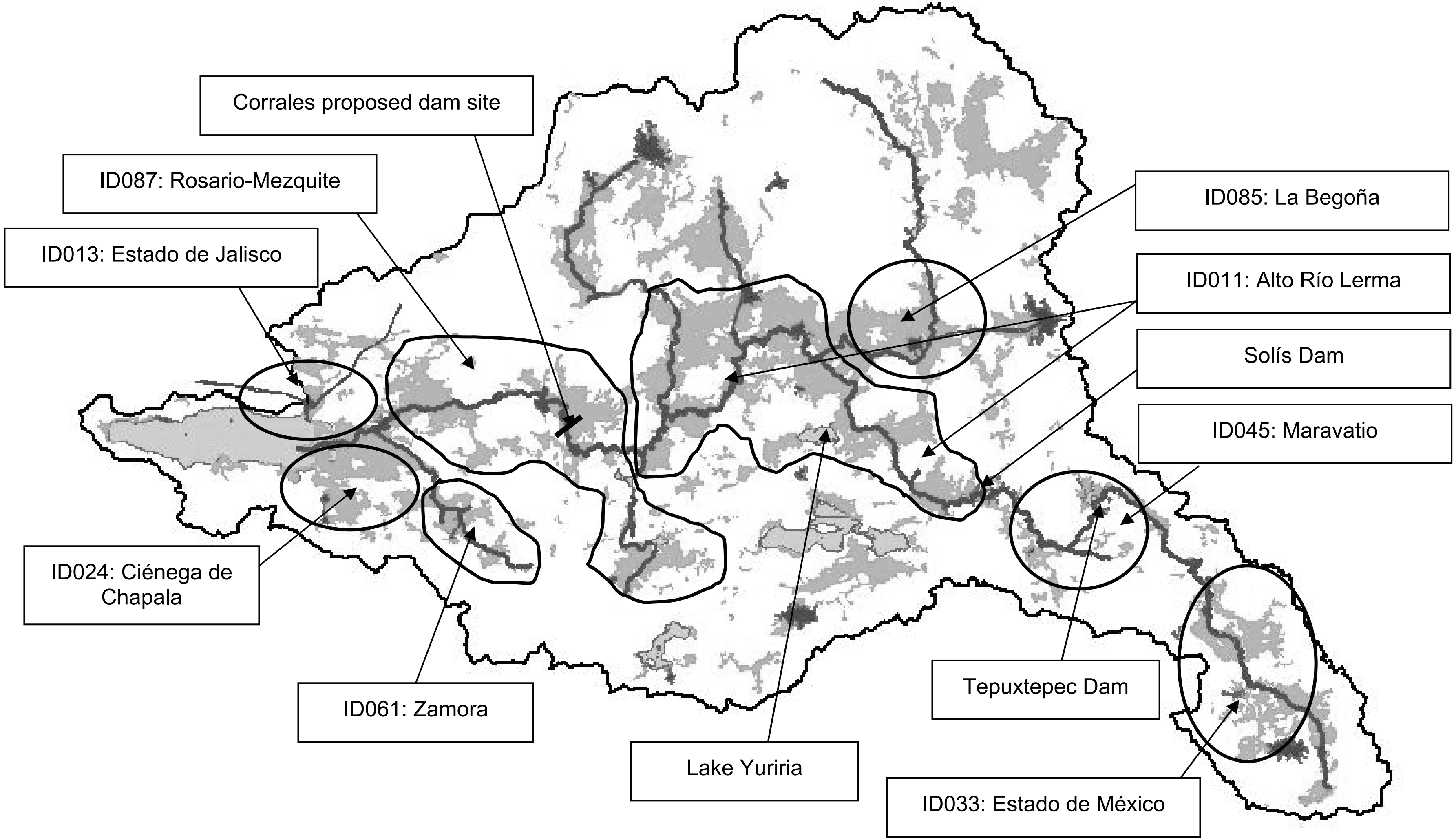
opponents. In 1930, *ejidos* only controlled 15% of the land in irrigation districts, but by 1940 this had increased to 60% (Wionczek, 1982: 370). Although the beneficiaries of the revolutionary irrigation policy were different, what remained the same was that the federal government directed these efforts. The management of the irrigation districts also became increasingly centralized from the 1930s onwards, although the various water laws promulgated between 1926 and 1947 contained provisions for the creation of water boards to manage irrigation districts. However, the CNI frequently took control of the irrigation districts, as detailed below for the Lerma-Chapala Basin.

The *Comisión Nacional de Irrigación* in the Lerma-Chapala Basin

No studies have been published providing an overview of the history of irrigation and water resources development in the Basin during the CNI era. Hence, the following is a preliminary attempt to sketch the overall lines of development, primarily based on archival material, and necessarily passes over many of the details. Also, the relationships between land reform, agrarian change and irrigation development are not dealt with, as this justifies a thesis of its own. Attention is mainly paid to the creation of the Alto Río Lerma irrigation district (ARLID) in the Middle Lerma region, which was to become the largest irrigation district in the Basin, and brief mention is made of developments in the Lower Lerma region. This brings out how the CNI increased its control over water in the Basin and set in motion the creation of water overexploitation in the Basin.

Before the CNI started developing water resources in the Basin, around 60,000 ha were already irrigated in the Basin with numerous run-of-the river irrigation systems and *cajas de aguas* (SRH, 1953). Shortly after the CNI had been formed, heavy rainfall in 1926 led to extensive flooding in the Lerma-Chapala Basin, including all of the Ciénega de Chapala. As a result, the CNI immediately focused its attention on the Lerma-Chapala Basin and formed two internal commissions, the *Comisión de Lerma* led by Pedro Dosal and the *Comisión de Chapala* led by Luis Ballesteros, to develop plans for the development of irrigation districts and hydroelectricity plants in the Basin. In their combined proposal published in 1927 they recommended the construction of the Corrales dam on the Río Lerma, several kilometers upstream of La Piedad near the border between the Middle and Lower Lerma region, to complement the Tepuxtepec dam then under construction (Cuevas-Bulnes, 1941: 21). The Corrales dam, with a planned storage capacity of between 750 and 1,500 hm^3 would serve to irrigate the lands of the Lower Lerma region, including the Ciénega de Chapala, and to generate hydroelectricity using the 150 m drop of the Zoró falls on the Río Lerma. They also recommended the construction of a new dam downstream of Tepuxtepec, to store more water for irrigation. It was estimated that 261,000 ha could be irrigated in the Basin with surface water if these two new dams were built. Figure 2.3 presents the area currently irrigated in the Basin and the main irrigation schemes and dams discussed in this chapter and in Chapter 5.

Figure 2.3. Main dams and irrigation districts in the Lerma-Chapala Basin



A report by a CNI engineer on the possibilities of irrigation development in Guanajuato clearly brings out the hydraulic mission mindset of the CNI in its early days:

> It being the mission of this institution [the CNI] to utilize all the waters in irrigation works or for producing energy, it has focused its attention on the Río Lerma precisely in the stretch that crosses and delimits the state of Guanajuato (…) It can be said of this dam [Tepuxtepec] that it is the first of the works that the [CNI] is studying to achieve the most efficient and complete utilization of the waters of the Río Lerma. (Quiros-Martinez, 1931: 451)[35]

When Ballesteros and Dosal presented the first version of CNI's master plan for the Basin the construction of the Tepuxtepec dam had just started. In 1923 a private company had requested permission from SAyF to construct the Tepuxtepec dam, located near the transition from the Upper to Middle Lerma region near the town of Maravatio in Michoacán, for the generation of hydroelectricity. In October 1926 a contract was signed between SAyF and the *Compañía de Luz y Fuerza del Suroeste de México* (Light and Power Company of Southwest Mexico), granting it an annual water concession of 750 hm^3 for hydroelectricity generation and permission to construct the dam (Santos-Salcedo, 1937: 157). The first phase of the dam was completed in 1930, with a capacity of 162 hm^3. In a second contract, signed in August 1933 with the CNI, it was agreed that the company could increase the dam's storage capacity to 370 hm^3, which it did by July 1936, and finally to 500 hm^3 when deemed necessary (Santos-Salcedo, 1937: 157).[36]

After the construction of the Tepuxtepec dam the amount of water flowing in the Río Lerma increased during the winter season. This led to an increase in the irrigated area from some 36,000 ha in 1927 to some 46,575 ha in 1937 in the area that was to become the Alto Río Lerma irrigation district (Santos-Salcedo, 1937: 160). This increase in irrigated area was partly autonomous, but mainly occurred because the CNI had started rehabilitating the old run-of-the river canals and constructing new ones on the Río Lerma below the dam. In 1933, the CNI formed the National Irrigation System Number 11, Alto Río Lerma, to fully develop the lands that could be irrigated with water from the Tepuxtepec dam. However, this created conflicts with water users on the already existing canals, who resisted the intrusion of the CNI. During the 1920s the Dirección de Aguas of SAyF had drawn up water distribution regulations for the run-of-the river canals along the Río Lerma, including the canals of Acámbaro,[37] Salvatierra,[38] Valle de Santiago and Jaral

[35] "Siendo la misión de ésta [CNI] aprovechar todas las aguas en obras de riego o producir energía, ha fijado su atención en el río Lerma precisamente en el tramo que cruza y limita el Estado de Guanajuato (…) Esta presa [de Tepuxtepec] se puede decir que es la obra inicial de las que está estudiando la [CNI] para el más eficiente y completo aprovechamiento de las aguas del río Lerma."

[36] This third construction phase took place between 1970 and 1973, when SRH elevated the dam's crest and increased its storage capacity to 585 hm^3 (Garcia-Huerta, 2000: 103).

[37] AHA, AS, *Proyecto de Reglamento para la Distribución de las Aguas que se Derivan del río Lerma, Destinados al Riego de Terrenos en la Hacienda de San Cristóbal, Acámbaro, Gto. y para los Canales de Desagüe de los mismos Terrenos de 13 de noviembre de 1925*, Box 1143, File 16004, pp. 159-165.

[38] AHA, AS, *Se Remite Reglamento Provisional y Cuadros para la Distribución de las Aguas del Río Lerma en la Región de Salvatierra, Gto.* Box 383, File 7615, pp. 15-17. This document is not the actual Regulation but refers to the existence of a provisional Regulation that I have not found.

de Progreso.[39] For these canals *Juntas de Aguas* were established based on the 1926 irrigation law and the *Dirección de Aguas* attempted to regulate their water withdrawals by confirming existing water rights. In November 1933 an agreement was signed between the CNI and the *Dirección de Aguas*, in which control over all the irrigated areas from the Tepuxtepec dam to the city of Salamanca were passed to the CNI, to fall under the newly created Alto Río Lerma irrigation district. Through this agreement the CNI increased its control over an irrigated area that until then had been managed locally for nearly 400 years. The wording of the agreement reflects the CNIs intention to bring the area under its control:

> Form this date onwards the control over all of the diversion works established on the Río Lerma from Tepuxtepec to Salamanca and the distribution of the water of this river in the cited stretch will fall under the Comisión Nacional de Irrigación (…). To control the diversion works and water distribution the [CNI] will provisionally apply the existing Regulations and other dispositions currently in force.[40]

In 1934 the chief engineer of the new district executed a thorough study of all the existing irrigation works and water rights in the area between the Tepuxtepec dam and Salamanca, both to bring these under the control of the CNI and to plan new irrigation works.[41] The increasing intrusion of the CNI led to protests from the existing *Juntas de Aguas*. In November 1936 the Acámbaro *Junta de Aguas* wrote a letter to the SAyF minister protesting against the actions of the manager of ID011, José Santos-Salcedo, stating that "said Official, in a dictatorial manner and without following any of the requirements contained in the current water law, and without even having the consent of the Users he intends to expropriate, has given the authorization to construct a gated division structure in our canal called "La Luz" at a point situated 9 kilometers downstream of the diversion headgates on the river."[42] Their protest was to cost them dearly. In February 1938 the CNI reacted by suspending all the *Juntas de Aguas* and taking over their responsibilities, based on a declaration by the SAyF minister, which stated that: "The National Irrigation System # 11 will from now onwards and until a new Agreement is reached be responsible for and

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39 AHA, AS, *Reglamento para la Distribución de las Aguas del Río Lerma y sus Brazos Llamados "El Arroyo" o " Río Lerma" y "El Arroyito" o "Río de la Zanja", en el Tramo Comprendido entre la Presa de "Lomo de Toro" y el Rancho "La Puerta del Valle", en los Distritos de Jaral del Progreso y Valle de Santiago del Estado de Guanajuato. 30 de julio de 1926*, Box 2488, File 34920, pp. 2-16.

40 "A partir de la fecha del presente, pasará a depender de la Comisión Nacional de Irrigación el control de todas las tomas que hay establecidas en el Río Lerma desde Tepuxtepec a Salamanca y la distribución del agua de esta corriente en el tramo citado (…) Para el control de las tomas y distribución del agua, la [CNI] aplicará provisionalmente los Reglamentos y disposiciones actualmente en vigor." in AHA, AS, *Acuerdo a la Comisión Nacional de Irrigación y a la Dirección de Aguas, Tierras y Colonización de 25 de noviembre de 1933*, Box 2279, File 33469, p.70.

41 AHA, AS, *Estudio de Reglamentación de las Aguas del Río Lerma en el Tramo que Abarca el Sistema Nacional de Riego # 11, por José Santos-Salcedo,* Box 3994, File 55052, pp. 12-183.

42 "dicho Funcionario, en forma dictatorial y sin ajustarse a ninguno de los requisitos que previenen en la Ley de Aguas vigente, sin contar siquiera con el consentimiento de los Usuarios a quien pretende expropiar, dió autorización para que se construya un represo con una compuerta sobre nuestro canal denominado "La Luz" en un punto situado a 9 kilómetros de la boca-toma en la derivación del rio." in AHA, AS, Box 2406, File 34110, pp. 54-56.

perform the functions that previously the Juntas performed as well as those that were conferred to them under previous Agreements."[43] It was not until the irrigation management transfer program in the 1990s that these *Juntas de Aguas* were reestablished, this time as water user associations. In the meantime the hydrocracy would control the irrigation district, as made abundantly clear in the Regulations of the Alto Río Lerma irrigation district published in March 1939 in the Diario Oficial, which stated that:

> The Irrigation District will have absolute control over all the existing and to be constructed hydraulic works in its jurisdiction, to utilize in any manner the waters of the Río Lerma, taking charge of the management of the gates [and] the surveillance of the rivers and canals, whether these are federal or private property (…) The control and distribution of the waters of the Río Lerma will be the exclusive charge of the District.[44]

While the CNI was establishing its control over the run-of-the-river canals now forming part of ID011, work had also started on constructing a new dam downstream of the Tepuxtepec dam to store the hydroelectricity releases for irrigation and to improve flood control. After five dam sites were reviewed in 1927 by the *Comisión de Lerma*, the Solís dam site some 10 km upstream of Acámbaro in Guanajuato was chosen as the best site in 1930. After a series of studies, construction of the Solís dam started in 1939 and was completed in 1949 with a capacity of 800 hm^3. The CNI also built several large new canals to expand the area under irrigation in ID011, especially the Bajo de Salamanca canal that brought 17,000 ha under irrigation. By 1946 the irrigated area in ID011 had increased to 75,860 ha, more than double the area irrigated in 1927 of 36,000 ha when the CNI started to bring the area under its control.[45] By 1940 the CNI had also developed plans for the further expansion of irrigation in the state of Guanajuato, including the construction of the Alto de Salamanca canal (later renamed the Coria canal) to bring 25,000 ha under irrigation and the Begoña dam in the Río Laja to irrigate some 18,000 ha.[46] Due to the first Lake Chapala crisis (see next section) these works were delayed, but had been constructed by the end of the 1970s.

A similar process occurred in the Lower Lerma region, where the CNI took over the control of the Ciénega de Chapala through the construction of irrigation and drainage works under the leadership of Ballesteros. Vargas-González (1993) provides a detailed

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[43] "El Sistema Nal. de Riego # 11 tendrá en lo sucesivo y hasta nuevo Acuerdo, las funciones que desempeñaban las Juntas además de las que tiene conferidas según Acuerdos anteriores." in AHA, AS, *Acuerdo del Secretario de Agricultura y Fomento de 25 de febrero de 1938*, Box 2279, File 33469, pp. 264-265.

[44] "El Distrito de Riego tendrá absoluto control sobre todas las obras hidráulicas existentes o que se construyan dentro de su jurisdicción, para aprovechar en qualquier forma las aguas del río Lerma, encargándose del manejo de compuertas, vigilancia en ríos y canales, ya sean estos últimos propiedad federal o particular (…) el control y distribución de las aguas del río Lerma, estará a cargo exclusivo de aquél." in AHA, AS, *Reglamento General para el Distrito de Riego "Alto Río Lerma", Diario Oficial viernes 17 de marzo de 1939*, Box 397, File 7689, pp. 362-363.

[45] Figure given on page 12 of AHA, CT, *Distrito de Riego del Alto Lerma, Mich. Y Gto.*, Box 211, File 1839, pp. 203-214.

[46] AHA, Consultivo Técnico (CT), *Proyectos de Riego en el Estado de Guanajuato mediante Obras de Grande Irrigación*, Box 211, File 1839, pp. 132-133.

account of how these developments interrelated with the redistribution of land in the area and how this led to increased federal control over the area. Ballesteros joined the CNI in 1926 as chief engineer of the Lower Lerma region and vigorously promoted the construction of the Corrales dam to increase the irrigated area in the Lower Lerma.[47] After his death in 1932 he was replaced by Elías González-Chávez, who was to play a crucial role in the development of the Basin until the end of the 1960s.

In the end, the Corrales dam was not built, initially due to financial constraints and later because it became clear the proposed dam site was situated on a geological fault. Nonetheless, the overall water resources development plan presented by Ballesteros in 1927 was to guide developments in the Basin until the late 1970s and most of the other works he and his immediate CNI colleagues proposed in the 1930s were eventually constructed. This has led Pérez-Peña (2004: 57) to speak of the "Ballesteros school" in the development of the Lerma-Chapala Basin, whose primary objective was the full utilization of the Basin's waters. The leader of the third generation of this school, engineer Francisco de P. Sandoval eloquently summarized the mindset of the Ballesteros school in an interview with Pérez-Peña in 1999: "The civil engineer has to see to it that all the rivers do not reach the ocean. [What does this mean? well to utilize and take advantage of all the water] (…) The federal government has to satisfy the demands of the people and to increase production it is necessary to cultivate more [land]" (Pérez-Peña, 2004: 227).[48] However, as discussed in Chapter 1, the hydraulic mission was not unique to the Lerma-Chapala Basin or to Mexico, but was common on all countries where large-scale irrigation development by the state occurred.

The above has outlined how the CNI increased its role in water development in the Lerma-Chapala Basin, by taking over the control of irrigation systems that had previously been managed locally, both through legal means and through the construction of hydraulic infrastructure. This was most apparent in the Middle Lerma region, where through the creation and expansion of the Alto Río Lerma irrigation district the CNI incorporated the existing, dispersed run-of-the-river irrigation systems in the Bajío and replaced them with a centrally controlled grid of irrigation canals fed by the Solís dam. Especially the dissolution of the *Juntas de Aguas* in ID011 was a harbinger of the highly centralized water control that was to develop after the 1940s. The land reform and the break up of the *haciendas* partly helped the CNI in establishing its control, but a stronger drive was its hydraulic mission to make good the promises of the revolution by developing "revolutionary irrigation". This mission was to reach its zenith between 1946 and 1976, with the creation of the SRH and the continued expansion of the irrigation frontier in the Lerma-Chapala Basin.

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47 See AHA, CT, *Observaciones y rectificaciones al estudio que sobre aguas disponibles en el río Lerma en "Los Corrales", se presentó el 21 de agusto de 1930* by Luis P. Ballesteros, Box 238, File 1966, pp. 343-352.

48 "El ing. civil tiene que encargarse de que todos los ríos no lleguen al mar. [¿que quería decir? pues aprovechar toda el agua] (…) El gobierno federal tiene que satisfacer las necesidades de la gente y para aumentar la producción necesita sembrar más."

2.4 River Basin Development and the *Secretaría de Recursos Hidráulicos*

In the 1940s, Mexican agrarian policy shifted away from land reform to emphasize commercial production. Agriculture's task became to support the industrialization of the country by generating foreign exchange, both through the provision of cheap basic grains and the production of export crops. To achieve this objective renewed emphasis was placed on the construction of irrigation systems and dams. Also during the 1940s, the concept of river basins as a unit of development started to gain force in Mexico, based on the Tennessee Valley Authority (TVA) model and the flooding of around half a million hectares in the Papaloapan Basin in 1944. Based on a study of this disaster, the CNI suggested that the problems of this region needed to be tackled in a unified manner, through the construction of dams on the principal tributaries and embankments along the length of the main trunk of the river. In addition, the construction of roads, water supply and sanitation works, schools and local industry were proposed as part of the plan (Poleman, 1964). During the election campaign of Miguel Alemán in 1946, the CNI successfully lobbied the presidential candidate to initiate projects for regional development in various Mexican river basins. During his presidential inauguration, Alemán outlined his plans for comprehensive river basin development.[49]

> Based on the experiences in the United States, where with great success they have executed a program known as the Tennessee Valley System, we have thought about the benefits of choosing two regions in our country, with limitless economic potential, to initiate a comprehensive regional development program. (cited by Hugo Rangel-Couto in the introduction to the Spanish edition of Lilienthal, 1946.)[50]

Until 1946, responsibilities for water resources development had been spread over several federal ministries and agencies: irrigation with the CNI, flood control with the ministry of communications and public works, potable water with the ministry of health and hydroelectricity with the CFE. These ministries and agencies jealously guarded their interests and felt they had guardianship over the rivers and water bodies on which they had constructed works. The then executive director of the CNI, Adolfo Orive-Alba, convinced Alemán of the need to correct this dispersion of administrative efforts. Directly after Alemán became president this happened, with the creation of the *Secretaría de Recursos Hidráulicos* (SRH; Ministry of Hydraulic Resources) in December 1946 to replace the CNI. This was a pioneering move in many respects and was the first time water resources was elevated to the level of a ministry in the Western Hemisphere. The objective of the SRH was the comprehensive development of water resources and the concentration of the government's efforts in this field in a single organization.

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[49] The term used in Spanish is "integral" that best translates into encompassing, comprehensive or unified. It does not mean integrated, for which the Spanish equivalent is "integrado".

[50] "Aprovechando la experiencia en los Estados Unidos, en donde con muy buen éxito se ha realizado el programa conocido con el nombre de Sistema del Valle de Tennessee, hemos pensado en la conveniencia de escoger dos regiones de nuestro país, de ilimitadas posibilidades económicas, para llevar adelante un programa de desarrollo regional integral."

Along with the concentration of water resources development in the SRH, river basin commissions, were created by presidential decrees between 1947 and 1950 for several of Mexico's key basins, such as the Papaloapan, Tepalcatepec, Fuerte and Grijalva, (Barkin and King, 1970). These commissions were to pursue comprehensive river basin development, based on the TVA model, but with the SRH minister as their president. In 1941 the TVA Chairman, David Lilienthal, had traveled to Mexico and met with Orive-Alba, which led to six young CNI engineers being sent to the TVA in May 1942 for six months "to study our methods, etc. the better to equip them for similar work the Mexican Government is projecting" (Lilienthal, 1964: 492). In an interview in 1981 with Steven Neuse, Orive-Alba "stated rather proudly that he knew David Lilienthal and that "he impressed me very, very much. He is a very great, great man"" (Neuse, 1996: xi). In December 1962 Lilienthal again visited Mexico and went to see Orive-Alba. He notes the following in his journal:

> Seventeen years ago [1945] he had taken us through the country to see some of the feeble beginnings of a water conservation and irrigation program. We had found him a warm and passionate man about the needs of poorer people. He had read about TVA, particularly my book, and was greatly stimulated about what "integral" development (the word the Latins use for what we call *unified*) could do for Mexico. A few months later Miguel Alemán was elected President (…). Hardly had Alemán been inaugurated when he made a trip to TVA with Orive Alba, who gave me, today, more detail about the result of that trip. "Mr. Alemán," he said, pointing to his picture on the wall, "became very excited. On his return he said we should pick two regions in Mexico that needed help badly and develop them like TVA. So he established Comisiones—our word for Authority—in the basin of the Papaloapan, in the tropics, on the east, and another in the Tepalcatepec Basin in the west. He gave us the money and told us to go ahead: dams, irrigation, health, schools, roads, everything *put together*, integral. That was the essence of TVA to us. He put the former President Lázaro Cárdenas in charge of the western TVA and he wrought a miracle. Where before people were sick of malaria and exhausted from heat, and starving to death, now they export melons, fruit—the place is a kind of paradise. All of this," he said with Latin gusto and exaggeration, "came from your book and your work, Mr. Lilienthal." (Lilienthal, 1971: 418)

The emphasis on comprehensive river basin development was to characterize the zenith of the hydraulic mission. From 1946 to 1976 the SRH vastly expanded its activities and mandate, with the river basin commissions serving to bypass state governments and other federal agencies. The SRH believed it was responsible for achieving "the greatness of Mexico" not only through water resources development but also through regional development based on river basins. However, these hegemonic tendencies created many conflicts with states and federal agencies (Greenberg, 1970) and the assessment of the benefits of "regional development" as opposed to regular government investments has been quite negative (cf. Barkin and King, 1970). The river basin approach did lead to the construction of dams and irrigation systems on an unprecedented scale and further strengthened the hydrocracy.

In the Lerma-Chapala Basin the hydraulic mission of the SRH led to the creation of water overexploitation, although it was clear that the Basin had already reached its limits of water availability during the first Lake Chapala crisis from 1945 to 1958. The following sketches the developments in the Basin during the SRH era, by first focusing on the Lerma-Chapala-Santiago study commission that was formed in response to the first Lake Chapala crisis. This crisis is then discussed in more detail, focusing on the hydraulic interventions that were undertaken to deal with the crisis, as well as the political dynamics it generated. The section ends with a very brief review of the period that followed after Lake Chapala recovered in 1958, which saw a large expansion of the irrigation frontier and a doubling of the storage capacity in the Basin.

The Lerma-Chapala-Santiago Study Commission

For the Lerma-Chapala-Santiago Basin a study commission was formed in 1950, but with less autonomy and fewer resources than the executive commissions. Its creation was strongly related to the first Lake Chapala crisis. In April 1947 the Lake dropped below cota 95.15, at which point water no longer flows to the Río Santiago, for the first time since 1916 (see Figure 5.1). Hence, the three hydroelectricity plants on the Río Santiago that depended on Lake Chapala frequently had to stop operating. As these plants, owned by the *Nueva Compañía Eléctrica Chapala* (New Electricity Company of Chapala),[51] were the only source of electricity for Guadalajara, this led to strong demands from industrialists and the inhabitants of Guadalajara that the Lake should be kept full by restricting irrigation in the Basin. According to Alba (1988: 164) by 1950 the federal government was under intense pressure from interest groups and the Basin states to solve the Lake Chapala crisis. In Guadalajara a media campaign had started against the SRH, blaming the problems of the Lake on the inter-basin water transfers to Mexico City and the completion of the Solís Dam in 1949 (Estrada, 1994: 11).

This led Orive-Alba, the SRH minister, to form a commission consisting of respected engineers from the Basin both to study the problems of the Basin and to provide a political space where the states could vent their differences and arrive at agreements (Santos, 2006: 32). In its founding charter of 28 November 1950, the commission was defined as a SRH study commission consisting of representatives from the Federal District and the states of Mexico, Guanajuato, Michoacán, Jalisco and Nayarit.[52] The SRH representative and chairman of the commission was Antonio Rodríguez-Langoné, SRH director of water development,[53] while Elías González-Chávez, SRH chief engineer of the Bajo Lerma irrigation district,[54] and Andrés García-Quintero, SRH director of hydrology, were

[51] This private company was formed after the Revolution based on Cuesta-Gallorda's company, with a US citizen holding most of the shares (de P. Sandoval, 1981). In 1941 the *Comisión Federal de Electricidad* (CFE; Federal Electricity Commission) became the major shareholder of the company.

[52] The states of Querétaro, Aguascalientes, Zacatecas and Durango were not included in the commission, although parts of these states fall in the Lerma-Chapala-Santiago Basin. See AHA, AS, *Acta constitutiva de la Comisión Lerma-Chapala-Santiago*, Box 3085, File 42611, pp. 2-4.

[53] This was the only river basin commission in Mexico whose chairman was not the SRH minister. Estrada (1994: 12) suggests that Orive-Alba intentionally distanced himself from the commission so he would no longer be the target of media attacks.

[54] González-Chávez started his career under Luis P. Ballesteros in 1922. With the death of Ballesteros in 1932, he became CNIs chief engineer in the Lower Lerma region, and until his retirement in 1968 was one of the main hydrocrats in the Basin (de P. Sandoval, 1981: 20).

designated as technical advisors to the commission.[55] As the Jalisco representative Francisco de P. Sandoval was appointed, an engineer we will meet several more times throughout this thesis. In addition, two of the state representatives (Gustavo P. Serrano for Guanajuato and Alfredo Becerril-Colín for Mexico) had been executive directors of the CNI. This commission of senior hydrocrats, all linked to the SRH, set themselves the task:

> (…) to achieve a complete regularization of the existing water use systems [in the basin] and a better planning of those that can be realized in the future; arrive at a full understanding of the available water resources and their potential; and effectuate a more equitable water distribution in the basin through an adequate and combined operation [of existing infrastructure]. (Vallejo-Ivens, 1963: 5)[56]

The focus of the study commission was the river basin as a unit for planning the comprehensive development of water resources. Its aim was to fully utilize the Basin's water, working over the heads of the states in the Basin. This is brought out in one of the few documents written by the chairman of the commission, where he states that:

> The most natural and unmistakable territorial boundary is the watershed. The circumscription of a region that this boundary creates is the most appropriate for human collectives to utilize natural resources to their maximum. For an adequate planning of the best utilization of natural resources the advantage of considering the river basin as the basis is unquestionable, as it constitutes the perfect territory. Contrast the advantages of planning based on such a foundation with the enormous disadvantages of attempting to do so based on <u>administrative-political boundaries</u>. (Rodríguez-Langoné, 1958: 1; emphasis in original)[57]

The commission immediately set to work and made its first recommendations in September 1951. In the same month the Mexican president charged González-Chávez with water allocation at the Basin level and the operation of the hydraulic infrastructure. From April 1953 until the end of 1957 the commission also was an executive commission, which meant it could construct hydraulic infrastructure, and González-Chávez was designated as its executive director. However, throughout this time the SRH state delegations were also responsible for construction (Estrada, 1994). In a report published in December 1953 the commission sets forth its recommendations for solving the lack of hydroelectricity due to low levels in Lake Chapala and its plans for fully utilizing the Basin's water (SRH, 1953). The commission proposed the construction of a large

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55 AHA, AS, *Acta constitutiva de la Comisión Lerma-Chapala-Santiago*, Box 3085, File 42611, pp. 2-4.

56 "(…) lograr una completa reglamentación de los aprovechamientos hidráulicas existentes y una mejor planeación de los que en el futuro se pudieran realizar; para llegar a un conocimiento pleno de las posibilidades y recursos disponibles, y para poder realizar mediante una operación de conjunto adecuada una más equitativa distribución de las aguas."

57 "El límite territorial más natural e inconfundible es el parteaguas. La circunscripción que este límite hace de una región es la más apropiada para que las colectividades humanas aprovechen al máximo los recursos naturales. Para una planeación adecuada del mejor aprovechamiento de los recursos naturales es indudable la ventaja de considerar la cuenca hidrográfica como base, pues esta constituye un territorio perfecto. Contratan las ventajes de una planeación así fundada con las enormes desventajas de pretender hacerlo basándose <u>en la división territorial política</u>." In AHA, AS, *Problemas de la Cuenca Lerma-Chapala-Santiago, by Antonio Rodríguez-Langoné, 12 febrero 1958*, Box 3616, File 50181, pp. 2-39.

hydroelectricity dam on the Río Santiago downstream of the confluence of several of its tributaries, to replace the plants that depended on Lake Chapala. It also strongly recommended the construction of the Corrales dam on the Río Lerma, originally proposed by Ballesteros in 1927, with a storage capacity of 500 hm^3, and the construction of the La Begoña dam on the Río Laja with a capacity of 180 hm^3. Its other proposals consisted of plans to drain lakes throughout the Basin to "suppress unnecessary evaporation". Thus, the commission recommended constructing a 20 km long and 6 m high embankment in Lake Chapala to reclaim 25,000 ha for agriculture. It also recommended draining Lake Cuitzeo by constructing a canal connecting it to the Río Lerma, thus reclaiming 45,000 ha for agriculture and draining Lake Yuriria, to reclaim 7,000 ha (SRH, 1953: 41). Besides these dam and land reclamation projects, the commission recommended executing more studies that would make it possible to:

> Propose the best solution for the basic hydrological problems in the Basin, including: (…) The rational utilization of the available surface water (…) to allocate the largest possible volume of water to irrigation, (…) increasing to 300,000 ha those 116,000 ha that currently receive irrigation. (SRH, 1953: 42)[58]

Although the execution of its plans would have a devastating effect on Lake Chapala, there was no disagreement in the commission on the desirability of these plans. The hydraulic mission was clearly in high gear. A contentious issue that the commission did have to deal with was the sinking of deep tubewells near the headwaters of the Río Lerma to supply drinking water to Mexico City. In the 1940s work had started on canalizing the mountain streams feeding the Río Lerma and transferring this water to Mexico City through a tunnel. This transfer went into operation in 1949, but in addition it was proposed to sink deep tubewells near the Lagunas de Lerma to augment the supply to Mexico City. The representative of the state of Mexico in the study commission strongly opposed this project and questioned the legitimacy of the Federal District being a member of the commission as it was located outside the Basin (Santos, 2006: 33). Guanajuato's representative also opposed the inter-basin transfer, arguing it would have negative consequences for agriculture in Guanajuato. However, the government of the Federal District persevered and succeeded in increasing the number of groundwater wells surrounding the Lerma wetlands. In the early 1950s some 4 m^3/s (126 $hm^3/year$) were transferred to Mexico City, increasing to 10 m^3/s (315 $hm^3/year$) by the 1970s (Alba, 1988: 163). These transfers affected the hydrologic cycle of the Basin by sucking dry the Río Lerma at its headwaters. After the inter-basin transfer started the Lagunas and wetlands quickly fell dry, to only partly fill during the rainy season. Another, even more contentious issue the study commission had to deal with was the sharp drop in the water levels in Lake Chapala. It had largely been created in 1950 to deal with this crisis, but as the following shows, in many ways its actions made the crisis worse.

[58] "Proponer la mejor solución de los problemas hidrológicos básicos dentro de la Cuenca General que son: (…) Utilización racional de las aguas superficiales disponibles (…) para destinar al riego el mayor volumen de agua que sea posible, (…) aumentándose a 300,000 hectáreas las 116,000 que ahora lo reciben."

The first Lake Chapala crisis (1945-1958)

From 1945 onwards a period of lower than average rainfall,[59] combined with extractions from Lake Chapala for hydroelectricity generation, resulted in the first Lake Chapala crisis. The response of the federal government to this crisis was strongly influenced by the hydraulic mission mindset of the time and primarily consisted of efforts to secure the water supply of the hydroelectricity plants operated by the Eléctrica Chapala company on the Río Santiago. As during the second Lake Chapala crisis (see Chapter 8), the hydrocracy blamed the desiccation of the Lake on the drought and the high levels of evaporation from the Lake (de P. Sandoval, 1981).[60] However, the extractions from the Lake by the Eléctrica Chapala company of some 520 hm^3 a year, combined with 215 hm^3 for irrigation contributed strongly to the decline of the Lake. Without these abstractions the Lake would not have fallen below cota 96.00 throughout the 1945 to 1958 period (de P. Sandoval, 1994). The efforts of the SRH and the Lerma-Chapala-Santiago study commission focused on ensuring these abstractions, by a succession of hydraulic interventions in the Lake. The majority of these works, summarized in Table 2.1, were planned and executed by the Eléctrica Chapala company with authorizations from the SRH, while some were directly executed by the SRH.

Table 2.1. Main hydraulic interventions in Lake Chapala from 1945 to 1958

Year	Minimum Lake Level	Hydraulic Intervention
1945	96.12	Rainfall of 483 mm in the Basin, the lowest on record.
1946	95.28	Dredging of the Río Santiago from Ocotlán to the Corona barrage to lower the riverbed to cota 93.00.
1947	94.63	Construction of a large pumping station in Ocotlán by Eléctrica Chapala, at the confluence of the Ríos Santiago and Zula, to pump 22.5 m^3/s (710 hm^3/year) from Lake Chapala into the Río Santiago. The pumping station consisted of 15 horizontal centrifugal pumps manufactured by Worthington with a capacity of 1,500 l/s each. These pumps were acquired from the Netherlands, where the Allies had installed them after the war to pump dry the polders flooded in 1944, as in the years directly after World War 2 the required pumps were not available on the market.
1948	94.36	The arrival of the pumps in 1948 coincided with what was then the lowest measured level of the Lake, namely cota 94.36. The pumping plant began operations in 1948 and continued pumping until 1958, with frequent stops between 1952 and 1955 due to low Lake levels. To the present day, the Ocotlán pumping station is used to pump water from Lake Chapala when its levels are too low to provide outflow to the Río Santiago.
		Continuous dredging of the Río Santiago upstream of the Ocotlán pumping station and 8 km into the Lake from May 1948 to July 1952, creating a canal 40 meters wide with its bed at cota 90.00.

[59] Average rainfall from 1935 to 1944 was 683 mm in the Lerma-Chapala Basin, while from 1945 to 1958 it was 626 mm (de P. Sandoval, 1994).

[60] In the first systematic hydrological study of the Basin conducted by García-Quintero in 1952 for the Lerma-Chapala Santiago study commission it was recognized that the inter-basin transfer to Mexico City and the expansion of irrigation in the Basin had reduced the inflows to Lake Chapala by some 468 hm^3 (García-Quintero, 1952: 124). However, the importance of these factors was downplayed in comparison with the evaporation of the Lake of some 1869 hm^3.

1949	94.20	Attempts to produce artificial rain around Lake Chapala.
1950	93.28	Lowering of the Ocotlán pump inlets from cota 91.50 to 89.50.
		Francisco de P. Sandoval became the head of the civil engineering department of the Eléctrica Chapala, transferring from the SRH.
1951	92.69	The Ocotlán pumping station could not continue operating continuously, as the shoreline of Lake Chapala receded beyond the mouth of the canal dredged between Ocotlán and the Lake.
1952	91.73	Construction of the Ballesteros canal, 21 km long and with a capacity of 25 m^3/s, in the dry Lake bed, connecting the Río Lerma to the outlet of the Lake near Ocotlán. Damming of the Río Lerma where it enters the Lake at Maltaraña with an earth dam so that no water would flow into Lake Chapala.
		CFE changes the management of Eléctrica Chapala just before the presidential elections, de P. Sandoval dismissed in July due to difficulties with the new management and returns to SRH.
		A new hydroelectric plant on the Río Santiago, the Colimilla, starts operating. Under construction since 1942, this plant is fed by a 80 meters high dam located 8 km above the confluence with the Río Verde. It completely depends on Lake Chapala for its water.
1953	91.90	Construction of the Maltaraña diversion barrage in concrete, with 20 bays closed with wooden planks, designed by de P. Sandoval.
		The new Mexican president Ruiz Cortines appoints a new CFE director general, who changes the management of Eléctrica Chapala, appointing González-Chávez as general manager, who also continues as the executive director of the Lerma-Chapala-Santiago commission and as SRH employee.
		Work started on connecting Lake Chapala to the water supply system of Guadalajara (see below).
		Presidential decree issued on 18 December authorizing the SRH to construct an embankment in the eastern end of Lake Chapala to reclaim 18,000 ha of land and to reduce the evaporation of the Lake.[61]
1954	91.60	No actions undertaken.
1955	90.80	Lowest Lake level on record, CFE installs many small pumps in the Lake to feed the Ocotlán pumping station. González-Chávez, as general coordinator of water allocation in the Basin, has water sent from the Markazuza barrage to the Lake.
		Exceptionally good rainfall in the second half of the year, leading to a good recovery of the Lake to cota 94.22.
1956	93.42	Lake drops somewhat, no actions undertaken, Guadalajara water supply system inaugurated in November 1956.
1957	93.23	Lake drops somewhat, no actions undertaken
1958	91.99	Increasing concern as Lake drops to below cota 92.00, but very heavy rainfall leads to extensive flooding throughout the Basin and the destruction of the spillway of the Solís dam. The Lake recovers to cota 96.93.
		The embankments of the Ciénega de Chapala raised to cota 100.50.
1959	96.57	End of first Lake Chapala crisis, Lake reaches maximum level of cota 98.02 and averages cota 96.97 between 1959 and 1979. The Eléctrica Chapala continues to withdraw at least 536 hm^3 from the Lake during this period, but its concession is cancelled in 1980 and the hydroelectricity plants drawing water from Lake Chapala cease functioning.

Sources: de P. Sandoval (1981) and Estrada (1994).

[61] AHA, AS, *Decreto Presidencial de 18 de diciembre, 1953*, Box 3189, File 43811, pp. 16-18.

The above table makes it clear that the Lerma-Chapala-Santiago study commission, staffed by SRH hydrocrats, viewed Lake Chapala as an unaffordable luxury. It fully aided the Eléctrica Chapala to withdraw large amounts of water from the Lake, to keep electricity to Guadalajara flowing.[62] What is also striking is that González-Chávez occupied an increasing number of posts and from 1953 onwards was a senior SRH hydrocrat, executive director of the Lerma-Chapala-Santiago commission, general manager of Eléctrica Chapala and general coordinator of water allocation and the operation of hydraulic infrastructure in the Basin. Although he and the commission were serving the interests of Jalisco, already in 1948 he became the target of a media campaign in Guadalajara. Lawyers linked to the Eléctrica Chapala initiated a campaign to "defend" the Lake, by arguing that the expansion of the irrigated areas in the Basin was drying up the Lake. They alleged that ex-president Lázaro Cárdenas was aiming to further develop water resources in the Basin to irrigate large areas for his own benefit and that of his friends, Orive-Alba and González-Chávez (de P. Sandoval, 1981: 25). As mentioned above, this media campaign influenced Orive-Alba to form the Lerma-Chapala-Santiago study commission.

A more serious civil movement also developed in Guadalajara during the first Lake Chapala crisis, just like decades later (see Chapter 8), that went against the hydraulic mission of the SRH. Pérez-Peña (2004) provides a detailed account of the origin and activities of the *Comité de Defensa del Lago Chapala* (Committee for the Defense of Lake Chapala), whose promoter was the writer Ramón Rubín. This committee initially consisted of only four people and was formed to protest the 18 December 1953 presidential decree that authorized the Lerma-Chapala-Santiago commission to reduce the size of the Lake by 18,000 ha. In January 1954 the committee sent an open letter to the president requesting the withdrawal of his decree. Throughout 1954 a range of academics, intellectuals and influential politicians, including José Guadalupe Zuno, an ex-governor of Jalisco, joined the committee and pressured the Jalisco governor to stop the desiccation of the Lake. With the recovery of the Lake in 1955 the activity of the committee lessened and by 1958 it had faded away. However, Pérez-Peña (2004: 150) concludes that the committee did achieve three things, namely the start of an ecological consciousness, the halting of the work on enlarging the Ballesteros canal and most importantly, the halting of the implementation of the presidential decree to reduce the size of the Lake.

Although the Lerma-Chapala-Santiago commission failed to construct a new embankment in Lake Chapala, it did sow the seeds for the second Lake Chapala crisis, by making the decision to use Lake Chapala for Guadalajara's water supply. In 1953, at the height of the first Lake Chapala crisis, the Lerma-Chapala-Santiago commission started work on developing the Atequiza-Las Pintas aqueduct to withdraw water from Lake Chapala for Guadalajara (see Figure 5.2). The starting point of this aqueduct was the Ocotlán pumping station. After flowing some 40 km in the Río Santiago, the water was passed into the Atequiza canal via the Corona barrage in the Río Santiago. This canal was enlarged and extended to a length of 25 km. At the end of the Atequiza canal a pumping plant was built, to raise the water 22 m and pass it into the newly dug Las Pintas canal, also 25 km long, to

[62] Interestingly, the company itself used around 30% of the electricity it generated to operate the Ocotlán pumping station (Durán *et al.*, 1999: 112).

end in the Las Pintas reservoir. Another pumping plant was built to raise the water another 55 m and pass it into a 4 km long canal that brings the water to a water treatment plant, connected to the city's main water supply system. The initial capacity of this work was restricted by the maximum capacity of the water treatment plant, which was only 1 m^3/s, but this was increased to 9 m^3/s in the years to come. It entered into operation in 1956, when the Lake had nearly completely dried up (de P. Sandoval, 1981: 48).

In 1955 the drought peaked and in July 1955 the Lake dropped to its lowest recorded level, namely cota 90.8 (954 hm^3). The pumping station in Ocotlán had to stop operating frequently and electricity supply to Guadalajara became very erratic. However, very good rains in the autumn brought relief and the Lake recovered sufficiently for electricity production to restart. By 1958 the Lake had again dropped dangerously low, but another autumn of very good rainfall caused it to recover by nearly 5 meters and the Lake remained relatively full until 1979. The heavy rains of 1958 caused extensive flooding in the Basin and very nearly led to the failure of the Solís dam. The spillway of the dam was seriously damaged and piping at the downstream base of the dam raised serious concerns. As a result, between 1958 and 1982 Solís dam was not filled to its full storage level but kept around 500 hm^3. The water in excess of this storage was passed on to Lake Chapala until 1982, when the reconstruction of Solís dam was completed (see Chapter 5).

Although the first Lake Chapala crisis had demonstrated that the Basin had already reached its limits concerning water availability, the construction of new dams and the expansion of the irrigation frontier throughout the Basin continued unabated during the 1960s and 70s. Many of the works planned by the commission in 1953 were constructed by the SRH and groundwater irrigation became increasingly important (see Chapter 7). The dam storage capacity in the Basin more than doubled from 1,817 hm^3 in 1959 to 3,840 hm^3 in 1979 (de P. Sandoval, 1994), while the irrigated area grew from 390,000 ha in 1960 to 640,000 ha in 1980 (Estrada, 1994). The Plan Lerma, a project funded under the Alliance for Progress initiative by the Inter-American Development Bank, played a large role in this expansion (cf. Alba, 1988). The details of these developments will not be recounted here, but they clearly bring out that the hydrocracy took little heed of the warning of the first Lake Chapala crisis, but rather took it as an affirmation of its hydraulic mission to fully develop the water resources of the Basin.

Having served its purpose, the Lerma-Chapala-Santiago commission was disbanded in November 1970, after González-Chávez had retired in 1968. It was more than a study commission, as by 1953 it had a mandate to construct infrastructure and to allocate water at basin level. However, it never became a full-fledged river basin authority and functioned more as an internal SRH commission. Through the addition of the Plan Lerma it was transformed into a regional planning agency that moved away from a river basin focus. In part this seems to be related to the wet years that started in 1958, which led to the recovery of Lake Chapala. On the other hand, the difficulties with including the states in river basin development planning and the focus of Plan Lerma on rural development resulted in the states becoming the focus of planning. Initially the Plan Lerma was a program of the commission, but by the end of the 1960s the Plan Lerma had become a large federal development organization with substantial funding and overshadowed the commission (Alba, 1988).

2.5 Conclusions

The hydraulic mission of the hydrocracy was to achieve the fullest utilization of water for the greatness of Mexico. The large investments by the post-revolutionary governments in water resources development led to the emergence and expansion of a highly competent hydrocracy, with extraordinary data processing capabilities and dedicated staff. In the Lerma-Chapala Basin its hydraulic mission led to the creation of water overexploitation through the construction of dams, irrigation systems and modifications to Lake Chapala. This was not an unforeseen side effect, but as this chapter has shown the deliberate intent of the hydrocrats working in the Basin. Every drop of water evaporating from Lake Chapala or flowing to the ocean was seen as a "loss" that needed to be captured for human uses. The processes leading to the "overbuilding" of river basins have been analyzed in detail by Molle (2006) and are confirmed by this chapter. As in many other countries (cf. Ertsen, 2007; Molle, 2006), a highly centralized form of water resources development emerged and grew in Mexico, based on the hydraulic mission and a high-modernist worldview. What was characteristic for Mexico was the importance of "revolutionary" irrigation for post-revolutionary state formation and the very strong position its hydrocracy developed in the federal government. This chapter has analyzed these issues, thus setting the stage for the chapters that follow. The material presented in this chapter is insufficient to argue that the hydraulic mission and centralization necessarily go together, but it does show that centralization occurred and that the increased federal control over water and the hydraulic mission of the hydrocracy led to the creation of water overexploitation in the Lerma-Chapala Basin.

Two points of relevance to the Lerma-Chapala Basin brought out by this chapter are that Lake Chapala did not fall dry in the 1890s and that the first Lake Chapala crisis would not have occurred if no abstractions from the Lake for hydroelectricity generation had taken place. Both these points are important, as throughout the years hydrocrats have suggested that the cyclical declines in Lake Chapala were due to years of drought. While years of less rainfall obviously lead to less inflow to the Lake, the historical record shows that the Lake did not fall dry in the 1890s, while the abstraction of 750 $hm^3 a^{-1}$ from the Lake during the 1940s and 50s clearly caused the first Lake Chapala crisis. Blaming river basin closure on a drought is a convenient strategy to hide the responsibility of the hydrocracy in the creation of water overexploitation and to continue with the hydraulic mission, but as the following chapters will show this created even larger problems in the 1990s and 2000s.

The last six years of the SRH constituted the zenith of the hydraulic mission. During the *sexenio* of Echeverría (1970-1976), the SRH was one of the most powerful federal ministries and the centralization of water resources development reached its peak. This was exemplified by the new *Ley Federal de Aguas* (Federal Water Law) of 1972. Article 46 of this law established that the SRH was fully responsible for the irrigation districts, from construction to management, and forbade user management of the districts, in contrast to the preceding water legislation (Diario Oficial, 1972). The law further granted the SRH extensive powers. However, as detailed in Chapter 3, the golden era of the hydrocracy was to come to an abrupt end in 1976, while the economic crisis of the 1980s severely reduced the construction of hydraulic infrastructure.

Things Fall Apart: Towards Reforms in the Confusion Years[63]

A major rupture for the hydrocracy in Mexico was the merger of the ministry of hydraulic resources with the ministry of agriculture in 1976. This merger strongly reduced the autonomy of the hydrocracy and resulted in severe bureaucratic struggles and a politically expressed demand for renewed autonomy by the hydrocrats. This chapter shows how the political and bureaucratic transformations in the 1970s and 80s in Mexico relating to water resulted in the emergence and consolidation of a water reform package in the run-up to the presidential elections of July 1988. This package included the creation of an autonomous water agency and irrigation management transfer, and aimed to recover bureaucratic autonomy and control that had been lost after the fusion. To analyze the emergence of the water reforms this chapter takes policy actors as the unit of analysis and the articulation of reforms as the focus of attention, to clarify why and when water reforms are effectuated and how alliances are formed through which reforms gather momentum. This chapter

[63] This chapter draws on a published paper written together with Edwin Rap and Luz Nereida Pérez-Prado (Rap *et al.*, 2004). It has been revised and updated to fit the argument of this thesis.

argues that the content of the Mexican water reforms and the commitment to them emerged from a protracted process of bureaucratic struggles and political accommodations that was strongly driven by the hydrocracy's quest for renewed autonomy and its ambition to be the sole water authority in Mexico.

3.1 Introduction

The drive by the federal government to mobilize ever more water through the construction of hydraulic infrastructure started to falter in 1976, when the river basin commissions were disbanded. Mestre (1997) indicates that the commissions were disbanded because they were run by the SRH with little interaction with water users and other government agencies and had evolved into powerful bodies that challenged the authority of states and federal agencies. A more serious challenge to the hydrocracy arose in 1976 when President López-Portillo merged the SRH with the ministry of agriculture to create the *Secretaría de Agricultura y Recursos Hidráulicos* (SARH; Ministry of Agriculture and Hydraulic Resources). Consequently, the SRH, historically a strong and affluent bureaucracy, lost its financial and bureaucratic autonomy. This resulted in severe bureaucratic struggles and a politically expressed demand for renewed autonomy on the part of the hydrocrats, which they regained in January 1989 when the *Comisión Nacional del Agua* (CNA; National Water Commission) was created. At the same time, the transfer of government irrigation districts to water users' associations started.

Policy documents single out the strong commitment of the political leadership and policy managers to the IMT program and the creation of appropriate legal and institutional frameworks as explanations for the origin and success of IMT (Gorriz *et al.*, 1995; Groenfeldt, 1998). However, how and in which arenas this commitment was created and which actors were fundamental to this process are not explained. The literature presents the occurrence of IMT in Mexico as a logical and unavoidable outcome of the economic crisis of the 1980s. The argument goes that this crisis led to a large decrease in government funding for irrigation and a reduction in the payment of water fees by water users, resulting in a poor performance of the publicly managed irrigation districts and a widespread deterioration of the irrigation infrastructure. The irrigation reforms were thus an inevitable response of the Mexican government to this state of affairs (Gorriz *et al.*, 1995; Johnson, 1997a, 1997b; Kloezen *et al.*, 1997; Palacios, 1997, 1998). Groenfeldt gives an eloquent summary of this policy narrative when he states that:

> This process [IMT] was initiated as a result of mounting budgetary pressures during the financial crisis that Mexico experienced during the 1980's. Investments in the irrigation sector fell dramatically, resulting in deterioration of the schemes, poorly maintained irrigation and drainage canals, roads and infrastructure. This period of structural adjustment *forced* drastic changes in Mexico's agricultural and irrigation policies. The program to transfer management of the irrigation districts to water users was adopted *out of necessity*. (Groenfeldt, 1998: 55-56; emphasis added)

This chapter challenges this line of argument, as it obscures the bureaucratic struggles and processes underlying the emergence of the IMT policy and the strong commitment it enjoyed from politicians and hydrocrats. Many of the conditions that are said to have led to IMT often existed throughout the history of irrigation development in Mexico, without this leading to transfer. For example, Mexico suffered various serious economic crises between 1930 and 1980, with drastic consequences for irrigation, without this resulting in IMT. In addition, nearly all the works on IMT in Mexico single out the declining levels of water fee payments during the 1980s as the main reason for transfer. Nevertheless, the concern for cost recovery is not new in Mexican irrigation policy circles and dates back to the Irrigation Law of 1926, which decreed that irrigation districts were to be financially self-sufficient. At several points in time, the Mexican government attempted to raise water fees and their level of payment, without a lasting effect. Likewise, the poor maintenance of irrigation districts has been a recurrent theme in Mexico and the need for extensive rehabilitation was already identified in the 1960s. Lastly, ideas of increased user involvement in irrigation management were present in irrigation policy circles since at least the 1930s and several districts were actually managed by users' associations from this time onwards. Although the legal conditions for such involvement were in place for several decades, this never resulted in a substantial number of irrigation districts being managed by its users.

To understand why IMT became a reality in the 1990s this chapter provides a broader analysis by focusing on the historical, political and bureaucratic processes that engendered and sustained Mexico's water reforms. By focusing on their political and bureaucratic embedding it becomes possible to understand the trajectories and variable content of water reforms and the conflictive dynamic of their articulation. This chapter acknowledges that policy-making in Mexico in the 1970 and 80s "(…) does not result from pressures exerted by mass publics, nor does it derive from party platforms or ideology, nor from legislative consultation and compromise. Rather, it is an end product of elite bureaucratic and political interaction" (Grindle, 1977: 7). Consequently, this chapter focuses on the political and bureaucratic actors, arenas and conditions that played a role in engendering policy ideas and bureaucratic transformations.

This chapter focuses on the role of hydrocracies in water reforms. Irrigation management by bureaucracies was criticized in the late 1970s and 1980s rural development literature (Bottrall, 1981a, 1981b; Chambers, 1988; Moore, 1981; Repetto, 1986; Wade, 1978, 1982; Wade and Seckler, 1990). This literature stressed the need to study irrigation bureaucracies, but primarily focused on the discrepancies between policy objectives and implementation, highlighting the problematic role of field staff. By sustaining the divide between policy formulation and implementation, this literature viewed the bureaucracy as an instrument for attaining policy objectives, thus disregarding the role of senior hydrocrats in policy-making activities both before and after policy legislation (Clay and Schaffer, 1984; Long and van der Ploeg, 1989; Yanow, 1988). To overcome this, this chapter focuses on policy articulation, defined in Chapter 1 as the process by which actors support, modify, displace and translate their various and contradictory interests concerning a policy idea with as outcome that a policy or reform package becomes less or more real. Seen in this way, commitment to policies is the outcome of struggles and negotiations between different policy actors. A "successful" policy follows an unstable trajectory from a policy idea to a policy likelihood, and finally to a policy reality, i.e. it becomes more articulated, through the enrolment of the necessary actors. Along the way, the policy's content and composition is redefined and transformed.

To analyze the role of bureaucracies in policy articulation, this chapter views bureaucracies as "the accumulated product of a social history of past policies [that] become congealed in institutional form and develop a network of interests around them, both inside and outside the bureaucracy" (Beetham, 1987: 51). These networks of interests are rooted in the history and culture of particular bureaucracies, their relationship to larger socio-political constellations as well as in actors' education and professional experiences. Also of importance for studying policy articulation is the insight that the division of functions and domains between governmental agencies have "significant consequences for the alignments of interests and the balance of political forces" (*ibid.*: 51). As part of these struggles, actors in state agencies develop what Fox (1992) calls different "embedded orientations", or overriding concerns, and "historically acquired ways of feeling" about certain policy problems. Focusing on the historical and cultural embedding of a bureaucracy's overriding concerns prevents that they are fully attributed to individuals and that too much emphasis is placed on the intentional behavior and strategic action of individuals.

To understand policy articulation processes in Mexico it is necessary to place the struggles between policy actors in the broader frame of historical, political and bureaucratic transformations. The answer to the question what is distinctive about the link between the Mexican political system, its bureaucracies and the policy process can be found in several key developments in the country's political history. The political authorities that have ruled Mexico since the 1920s managed to establish a relatively stable political regime compared to other parts of Latin America. The Mexican Revolution was appropriated by the triumphant political elites gathered in the *Partido Revolucionario Institucional* (PRI; Revolutionary Institutional Party). Since its foundation in 1929, the PRI ruled the country uninterruptedly until 2000. According to some authors, the PRI owed its "success" to its early establishment of political and economic mechanisms for solving conflicts within the elite and for ensuring mass support and political control. Through clientelism and corporatist representation and control the party successfully incorporated workers, farmers and the middle class (Camp, 1999; Grindle, 1996).

As detailed in the sections below, the political history of the Mexican hydrocracy provides interesting instances of policy choices advanced or rejected by the networks of interests inside and outside the bureaucracy. In Mexico, bureaucratic transitions occur in close interaction with two important phenomena in Mexican political and bureaucratic life, namely presidentialism and the presidential term of six years called the *sexenio*. Presidentialism refers to the dominant role that the Mexican president plays in reordering bureaucratic domains and in the materialization of political and economic reforms during his *sexenio*. The *sexenio* amounts to a calendar of political time, as described by Grindle (1977). A relative rupture with the preceding administration characterizes the beginning of each *sexenio*, through changes in the leadership at all levels of the federal administration involving a process of elite bargaining, coercion and accommodation. At the end of the *sexenio* bureaucratic groups align themselves with and offer their support to the expected presidential candidate and his close allies (Greenberg, 1970). These prospective senior government officials influence the presidential candidate's views on institutional and policy reforms as well as on the division of bureaucratic functions and allocation of resources. Such alliances can be essential in settling a struggle between bureaucratic agencies that are functional rivals. Policy changes and bureaucratic transitions are thus most frequently shaped and defined at the end of a *sexenio*, to be initiated at the beginning of a new *sexenio*. The particular dynamic of the transitions that the hydrocracy underwent, from a commission in 1926 to a ministry in 1947 and to an under ministry in 1976 can be understood in this light.

Section 3.2 explores how the Mexican hydrocracy developed a set of overriding concerns between the 1920s and the 1970s related to the control over irrigation infrastructure and bureaucratic and financial autonomy. These overriding concerns make clear why the fusion between the hydraulic and agricultural bureaucracies in 1976 was so traumatic and led to an energetic struggle for renewed autonomy, reviewed in section 3.3. Against this backdrop, the emergence of new policy ideas and the contours of a water reform package are explored in section 3.4. The consolidation of this reform package during the election campaign of Salinas is analyzed in section 3.5. Lastly, section 3.6 discusses the conclusions and implications of the analysis contained in this chapter.

3.2 The Overriding Concerns of the Hydrocracy

To understand the emergence of the water reforms and the creation of the CNA in the late 1980s, this section delves in the overriding concerns of the hydrocracy, specifically control over the irrigation districts and bureaucratic and financial autonomy. These overriding concerns developed over a period of fifty years, between 1926 and 1976, as an outcome of the centralization of water resources development and the priority given by the federal government to irrigation development. This led to the formation and expansion of a hydrocracy that attained a large degree of bureaucratic and financial autonomy through the good relations that it maintained with the president, the party and a broader set of state institutions and funding agencies. However, the merger of the ministry of agriculture and the SRH in 1976 severely weakened the hydrocracy and thwarted these concerns.

Control over the irrigation districts

An overriding concern of the hydrocracy has always been the control over the irrigation districts. The construction, settlement and management of medium and large-scale irrigation districts entailed control over large sums of money as well as political control over the selection of beneficiaries of government programs and their access to irrigated agriculture (Martínez-Saldaña, 1988). Consequently, control over the irrigation districts and the resources allocated to this function were the subject of much bureaucratic competition between “functional rivals”. Greenberg (1970) argues that the functional rivals of the hydrocracy consisted of those agencies whose activities were similar enough that their staff felt them to be in competition with each other. Concerning the irrigation districts, the ministry of agriculture in particular fit this bill.

Between the 1920s and 1940s, the content of irrigation policy was subject to both inter-bureaucratic struggles as well as the vicissitudes in the relationship between the state and the peasantry. This revolved around the long standing tension between policies targeting private capital as a means of increasing agricultural production and those directed at peasants to retain political support in rural areas (Fox, 1992; Gates, 1988; Stanford, 1993). Under President Calles in the 1920s, the construction of irrigation districts served to replace large landholdings with medium-sized family farms. The CNI was instrumental in the creation of this new class of farmers through the settlement and land distribution efforts it oversaw in the irrigation districts. Although falling under the ministry of agriculture the CNI enjoyed a large degree of budgetary and bureaucratic autonomy.

In the mid-1930s President Cárdenas reversed the agricultural policies fostering private capital, by proceeding to make true the revolutionary promise of giving the "land to the tiller". As the CNI was too closely linked with Calles' policies and Cárdenas doubted whether it would carry out his policies, he transferred the administration and colonization of the irrigation districts to his trustees at the Bank of Agricultural Credit in 1934. The CNI was vehemently opposed to this move and in 1943 won the inter-bureaucratic struggle and regained control over the administration and colonization of most of the irrigation districts (Orive-Alba, 1970). However, the hydrocracy's control over the irrigation districts was to last shortly. In December 1946, while the SRH was being formed, the *Secretaría de Agricultura y Ganadería* (SAG; Ministry of Agriculture and Livestock) persuaded Alemán that it should manage the irrigation districts, thus continuing its struggle with the hydrocracy (Orive-Alba, 1970). Again this met with severe resistance from the hydrocracy and Agriculture's control over the irrigation districts was to last only for a short while, with the SRH regaining control over the irrigation districts in 1951.

The above shows how bureaucratic transitions concerning the control over the irrigation districts were subject to bureaucratic struggles between functional rivals, such as the SRH and SAG. It also shows that policy changes and bureaucratic transitions are most frequently shaped and defined at the end of a *sexenio*, to be initiated at the beginning of a new *sexenio*. Bureaucratic competition between functional rivals, such as the SRH and SAG, over functions and resources was settled by political negotiations, alliances and personal relations of bureaucratic groups with the presidential candidate. When viewed in a longer time frame, it becomes apparent that the radical ruptures in the control over the irrigation districts are structured by the political calendar of the *sexenio* and in that regard turn out to be an element of continuity.

In the following decades, the SRH consolidated its control over the irrigation districts and managed to keep the ministry of agriculture out. In 1953, Directive Committees were created in each irrigation district, consisting of a representative of the ejidos and of the private landowners plus the district chief and representatives of several government agencies related to agriculture (Palacios, 1994; Vargas, 1996). The Directive Committee had formal authority for planning and deciding the level of water charges. Aboites (1998) states that the Directive Committees served to strengthen government influence over the use of water and crop planning, while Greenberg (1970) concludes that the committees functioned as rubber stamps for the SRH, who made all the decisions. SRHs control over the irrigation districts culminated in 1972, with the promulgation of the *Ley Federal de Aguas* (Federal Water Law), in which the SRH was charged with the planning, construction, administration, operation, maintenance and development of the irrigation districts. Article 46 of the Federal Water Law even went so far as to forbid user management of the districts (Diario Oficial, 1972).

Financial autonomy

Another overriding concern of the hydrocracy has been the control over resources and financial autonomy. This concept refers to the degree that a bureaucracy can generate and control its income flows, set its own budgets and decide on expenditure and investment independently from other bureaucratic entities. The more affluent a bureaucracy is and the more budgetary freedom it has the larger its degree of financial autonomy. The monopoly of the CNI and the SRH in the construction of irrigation systems secured it a large and steady income flow between the 1930s and the 1970s. These resources represented an important element of continuity for the hydrocracy and largely accounts for the financially wealthy and autonomous bureaucracy that the SRH became. The SRH's budget was one of the largest among the federal agencies with 61 to 100% of pubic investments in the agriculture sector going to the construction of irrigation works between 1926 and 1976. Further, it managed its own funds and had relative budgetary freedom from other bureaucratic entities, although subject to presidential and party priorities (Durán, 1988; Greenberg, 1970; Grindle, 1977; Wionczek, 1982).

It was only in the 1960s that foreign loans started to become important for the SRH (Durán, 1988; Greenberg, 1970; World Bank, 1983). Because of an international reputation as an efficient and technically competent ministry, the SRH was very successful in acquiring international loans for irrigation construction, thereby generating urgently needed foreign currency for the government. From 1966 to 1975, foreign loans constituted more than 15% of SRHS irrigation investments on average (Durán, 1988; World Bank, 1983). Mexico, and more in particular its hydrocracy, became favored clients of the World Bank. As a major recipient of external funding, the SRH was granted privileges not given to other ministries, such as a large degree of autonomy in making technical decisions and a significant budget to hire a cadre of well-trained professional engineers (Greenberg, 1970).

Another source of income for the hydrocracy was the water charges that it levied on irrigators. However, this source of income was much less stable and controllable. Apart from the fact that the water charges collected in the districts were never sufficient to fully cover Operation and Maintenance (O&M) costs, the fees were not paid directly to the SRH but to the ministry of finance (van der Zaag, 1992). The initial policy intention under Calles was that those who benefited from state-built irrigation works would reimburse the state for its investment as well as fully cover the O&M costs of the irrigation systems (Wionczek, 1982). This objective was reiterated in the 1947 irrigation law. Nonetheless, water charges generally covered only a fraction of irrigation investments and O&M costs (Aboites, 1998). Between 1950 and 1964 cost recovery averaged 60% (Orive-Alba, 1970). From 1965 to 1976 this average slipped slightly to around 56%, but between 1977 and 1982, it dropped drastically to around 20% (Johnson, 1997a).

Although it is unclear how fees were established by the different agencies responsible for the irrigation districts throughout the years, political criteria were often more relevant than technical and financial ones (Wionczek, 1982). The argument often used to justify low water charges was that the poorer farmers in the districts would not be able to pay the fees (Wionczek, 1982). However, this does not explain why the fees were not adjusted in accordance with the increased value of irrigated land. Policies favoring low fee levels and the government's priority to invest in large construction works rather than in optimal use of the available infrastructure led to a sub-optimal use and deterioration of the irrigation infrastructure.[64] However, this deterioration presented itself selectively, especially harming small farmers. Middle and large producers were financially able to solve maintenance problems for themselves. Although supported in the name of social equity, low water service fees were mainly beneficial to larger farmers.

Bureaucratic autonomy and culture

The third overriding concern of the hydrocracy was bureaucratic autonomy. During the SRH era the hydrocracy attained a large degree of autonomy due to the importance of the ministry and the good relations of its elite with the president and the PRI. Until the late 1990s, the president and the PRI stood at the center of the Mexican political system, not only deciding which programs the bureaucracies should undertake but also having the power to appoint and remove officials at all levels of the bureaucracy (Greenberg, 1970). Hence, officials needed to maintain good relations with the party and party activity was an important prerequisite for high level appointments in the bureaucracy (Grindle, 1977). Bureaucratic recruitment in Mexico thus presented a conflict between political appointments and the need for technically trained and competent officials. However, from an early date the government granted the SRH relative immunity from political interference and the SRH had remarkable autonomy in its recruitment, largely because of the importance of the ministry (Greenberg, 1970).

During the SRH era senior hydrocrats stood in direct contact with the president. The minister was the central figure in the SRH, appointed by the president and directly responsible to him for all the actions of the ministry. The president allowed his minister, often a friend or a political confidant, to build a personal empire in the SRH by appointing his own team (*equipo*) of trusted collaborators and left the internal operations and the management of funds to the discretion of the minister. The minister thus enjoyed a considerable degree of operative and budgetary autonomy, within the broad policy lines negotiated with the president. Historically, well-qualified men, all trained as civil engineers and with experience in the ministry, led the SRH. The minister's technical qualifications were considered important to impress donor agencies during loan negotiations and to convince them that their money would be well spent. The SRH minister also played an important role in national politics and in the presidential succession (Castañeda, 1998; Orive-Alba, 1970; Greenberg, 1970).

During its 30 years of existence, the SRH was not constrained by any superior bureaucratic entity and fell directly under the president. An important concern of senior hydrocrats thus became their bureaucratic autonomy, i.e. the degree of operational freedom and internal control that a bureaucracy has and the extent to which it can prevent external influence on decision-making. In the case of the SRH, its autonomy was very large, with near complete

[64] In 1960, the SRH estimated that more than 200,000 ha of the irrigation districts, or 10% of the irrigable area at that time, could not be used due to deteriorated or incomplete infrastructure. That same year, a proposal to increase water charges was opposed by a group of 10,000 large producers with a strong commercial and productive weight at the national level (Wionczek, 1982).

freedom in technical decisions, personnel recruitment based on internally defined selection criteria and budgetary authority (Greenberg, 1970). In part, this autonomy was achieved because of the close relations with Mexico's presidents and the PRI and the important role that the hydrocracy played in their political projects.

To illustrate the distinct "embedded orientations" and "historically acquired ways of feeling" (Fox, 1992) of the hydrocracy that led to its overriding concerns, this section also reviews the composition of its staff and the consequences this had for the internal relationships, bureaucratic culture and networks of interests that developed. The expansion of the hydrocracy and the professional and bureaucratic formation of its cadre occurred in a complex of education and research institutions, professional associations, private construction companies and international organizations, with which the hydrocracy maintained close relations.

A distinct attribute of the hydrocracy was the relatively homogeneous composition of its staff, with similar academic and bureaucratic careers, which contributed to the closed and hierarchical culture of the SRH and the strong sense of identity of hydrocrats. The professional staff of the CNI and the SRH consisted of civil and irrigation engineers that had similar educational backgrounds and bureaucratic careers. The majority of these engineers were trained in the two major Mexican engineering schools: the Faculty of Engineering of the National Autonomous University of Mexico (civil engineers) and the Chapingo National School of Agriculture (irrigation engineers). Apart from professional skills, these schools imparted students with a strong sense of hierarchy and discipline, while many students developed strong friendship bonds (*camaradería*) and clientele networks in these schools, which benefited them in their bureaucratic careers. In addition, the relation between the bureaucracy and these education and research institutions was actively maintained, with SRH officials returning to their universities as lecturers and vice versa. In the 1960s and 1970s, education and training abroad started to become important. Many high level officials of the hydrocracy did a Masters or PhD outside of Mexico, in the US or Europe. These officials benefited from these experiences, apart from broadening their academic perspective, in terms of their international networks, which for some became useful at a later stage in loan negotiations with international funding agencies or as consultants for international organizations.

The similar training and bureaucratic trajectories of most of the engineers had an important impact on the bureaucratic culture and professional climate of the SRH. The SRH was a ministry with a staff of well-paid engineers that worked in a disciplined manner and with a large respect for hierarchy (Greenberg, 1970). In comparison with the ministry of agriculture, the SRH was known for its closed, conservative and authoritarian culture and the strong discipline of its engineering teams. During the first decades of the hydrocracy, its engineering staff developed a strong hydraulic mission – to develop water for the greatness of Mexico – and possessed a strong esprit de corps. In this period upward mobility was primarily based on professional merit and not on political relations, which was quite uncommon in Mexican bureaucracies (Grindle, 1977). Officials of the hydrocracy identified with the grand tradition of Mexican hydraulic engineering and its major accomplishments and defined themselves as a distinct group with its own bureaucratic history and culture. This resulted in a sense of pride towards the profession and the institution, strengthened by closed networks (to the outside world) of friendship and mutual support.

An important relation that the hydrocracy maintained was with construction companies. In the early 1940s, it was decided to tender contracts for the construction of dams and large irrigation works and that the hydrocracy itself would no longer construct works. This resulted in the formation of several large Mexican construction companies, which played a major role in the development of the SRH, since they served both as builders and as consultants to the ministry (Greenberg, 1970). In addition, former members of the hydrocracy frequently staffed them and senior hydrocrats were advisors for these companies or had financial interests in them. The hydrocrat thus fulfilled different roles, namely that of bureaucrat, politician and businessman. Understandably, the close links with contractors resulted in pressures within the SRH to give priority to construction projects and partly explains the strong construction bias of the hydrocracy (Greenberg, 1970).

The relations with international organizations formed another field of institutional interactions. Because of the good reputation of the Mexican hydrocracy, senior SRH engineers became consultants for the FAO, the Inter-American Development Bank and the World Bank. These contacts facilitated the negotiation of international loans in which the SRH became reasonably successful (Greenberg, 1970) and played an important role in obtaining the World Bank's support for the prestigious National Hydraulic Plan at the beginning of the 1970s, as detailed in section 3.4.

Three main points emerge from this section. First, irrigation development and management from the 1920s to the 1970s was characterized by increasing intervention by the federal government. Second, this centralization of water management coupled with the priority given by the government to the development of large-scale irrigation lead to the formation, expansion and specialization of a hydrocracy. Over time, this bureaucracy developed specific overriding concerns, namely control over irrigation districts and bureaucratic and financial autonomy, and cemented its relative autonomy through the relations it maintained with the president, the party and a broader set of state institutions and funding agencies. However, this autonomy was severely challenged between 1976 and 1988, with the fusion between the two functional rivals, the SRH and SAG.

3.3 The Fusion: Political and Bureaucratic Entanglements

In 1976 President López-Portillo merged the smaller but financially affluent SRH with the larger but financially poorer SAG to create the *Secretaría de Agricultura y Recursos Hidráulicos*. The creation of SARH was linked to several political, administrative and economic considerations. Apparently, senior SRH officials backed another presidential candidate in 1975, which persuaded López-Portillo to "punish" the SRH and remove certain bureaucratic groups from the political stage. In addition, as a Minister of Finance during the Echeverría administration (1970-1976), López-Portillo had experienced severe problems with SRHs financial autonomy and found it difficult to enforce budgetary discipline on the SRH. However, larger processes were also at work.

In economic terms, things were not going well for Mexico in 1976. The number of federal government employees had grown from 0.3 to 1.3 million between 1969 and 1976, the public sector deficit had risen from 2.8% of GDP in 1972 to 4.6% in 1976 and inflation and foreign debt were also on the rise. This forced the government to devalue the peso in 1976 and to sign a stabilization agreement with the IMF, in which it pledged to reduce government spending (Grindle, 1996). Nonetheless, during his *sexenio* López-Portillo expanded the state's interventionist role in the economy and society, which was made possible by the discovery of extensive new oil deposits and the substantial increases in oil prices after 1976 (Grindle, 1996). The government's policy to "sow the oil" in the economy and to "administer the abundance" benefited nearly all sectors and economic growth was unprecedented (Grindle, 1996).

To expand the state's interventionist role López-Portillo announced a substantial administrative reform at the start of his *sexenio* to rationalize the wide array of bureaucracies created in previous decades (Martínez-Saldaña, 1988). These reforms took place in several sectors, strengthening certain bureaucratic groups at the expense of others. An important ministry that was created was the *Secretaría de Programación y Presupuesto* (SPP; Ministry of Programming and Budget), which unified financial planning responsibilities that had previously been distributed among various ministries. In the following two *sexenios*, SPP functioned as a stepping stone for its two subsequent ministers Miguel de la Madrid and Carlos Salinas to become president (Castañeda, 1999). The creation of SARH was also part of this administrative reform and served to unify and rationalize the activities related to agriculture in one ministry, to better tackle the problems in the rural areas (Arce, 1993).

With the creation of SARH, the SRH was effectively downgraded to the level of an under ministry. Merino Rabago, an experienced politician, but without an engineering degree or a university title, was appointed as the new SARH minister. SARH was divided in three under ministries, each headed by a deputy minister: Agriculture and Operation, Planning and Hydraulic Infrastructure, to which most of the old SRH officials were assigned. Consequently, senior hydrocrats were no longer in direct contact with the president. The deputy minister now had to submit his policy initiatives to the SARH minister, significantly curtailing his discretionary powers. Senior hydrocrats lost control over crucial bureaucratic domains and resource flows to other bureaucratic groups, which increasingly started to dominate SARH. The hydrocracy thus lost its bureaucratic autonomy and was subjected to the control of the agricultural bureaucracy.

The creation of SARH entailed a serious demotion for the hydraulic engineers and provoked "institutional turmoil" in the water sector (Mestre, 1997). The SRH top opposed the fusion from day one, as they clearly understood that it would entail a significant loss of autonomy, but they could not prevent it. The politically influential SRH minister, Rovirosa Wade, who would have had the political weight to prevent the fusion had stepped down as minister in early 1976 to become governor, and was replaced by a temporary minister with insufficient authority to protest. For many hydrocrats, the fusion was traumatic and they experienced the demise of the SRH as the end of the grand era of hydraulic engineering in

Mexico. To make matters worse they were fused with an old-time functional rival.[65] In 1970, unaware of the fusion to come, Greenberg wrote that "The sharing of power with the Agriculture Ministry is the result of a long history of struggle which saw first one, and then the other agency, in a position of dominance" (1970: 87). The fusion started a new phase in this historical struggle and engendered an energetic and politically expressed demand for renewed autonomy on the part of the hydrocrats.

Although the irrigation districts were left intact, they became the responsibility of the under ministry of agriculture and operation in 1976, implying that the hydrocracy lost control over the irrigation districts as well as the income flows related to the districts (Palacios, 1994). In addition, after an initial phase in which the hydrocrats continued to dominate in the state delegations and the irrigation districts, many of them were replaced by agronomists (Arce, 1993). The subordinate position of the hydrocrats led to intense conflicts between groups of ex-SRH and SAG officials. Not only were the academic and bureaucratic careers of the hydrocrats dissimilar, also the conservative and authoritarian culture of the SRH, the bureaucratic discipline, the professional identity they shared and the strong pride they felt towards the grand tradition of hydraulic engineering made them feel very distinct from the SAG-agronomists. These antagonistic cultures contributed to severe tensions between these two groups over the internal operation and control of SARH. Ex-SRH officials at the time jokingly referred to the merger of the SRH and SAG as the confusion instead of the fusion.

The displeasure of the hydrocrats over the loss of control was not only directed at the agronomists, but also at the growing influence of "politicians" and "administrators" in the ministry, i.e. non-engineers without experience and interest in hydraulic matters. The first SARH minister (1976-1982) was a politician without a professional degree and the second minister (1982-1988) was a lawyer, something which radically broke with the SRH tradition of being led by well-qualified men, trained as civil engineers and with a career in the SRH itself (Greenberg, 1970). In SARH, ex-SRH officials were thus confronted with politically appointed administrators in positions that used to be occupied by engineers. The changed set of decision criteria and especially the ignorance or neglect of specific technical criteria was a recurrent source of frustration for them.

The hydrocrats in SARH were also severely constrained in their financial autonomy. In the SRH, the major source of income had been the funds for the construction of irrigation systems. In SARH, decisions over the construction funds were taken out of the hands of the hydrocrats and their deputy minister. Agronomists interfered with the decisions over construction funds and succeeded in diverting much of these funds to other purposes. Especially the construction companies, the traditional beneficiaries of the contracts tendered by the SRH, were affected by this shift in decision-making power.

Senior ex-SRH officials never accepted the loss of bureaucratic and financial autonomy and their subordinate position in SARH. At the end of López-Portillo's *sexenio*, influential groups of civil engineers started to lobby for renewed bureaucratic autonomy and

[65] A telling joke that recalls the fusion of these long-time rivals narrates that it was like merging *America* and *Chivas*, the two major football clubs of Mexico with a long tradition of rivalry.

explicitly expressed their demand for an autonomous water authority during the election campaign of presidential candidate de la Madrid in 1982. During this campaign a working group of politically influential ex-SRH ministers and senior hydrocrats was formed to define the water sector policies for the upcoming presidential administration and campaign meetings were held on water (IEPES, 1982). This working group was coordinated by Dr. González-Villarreal in close collaboration with de la Madrid's campaign manager, Carlos Salinas, who later became Mexico's president (IEPES, 1982).

This working group promoted policy ideas strikingly similar to the ones adopted six years later with the creation of the CNA. The working group agreed on the need to create a "new water culture" among water users and to increase their active participation. They also suggested the need to manage water at the level of river basins. A politically more potent recommendation was the proposal to organize a "financial system for water" that would give the hydrocracy large discretionary powers over funds destined for the water sector. Lastly, the working group repeatedly stated that the authority to manage water should be located in a single water agency (González-Villarreal, 1982a). Several alternatives were put forward, such as a new under ministry of water, a new ministry, which effectively would mean the re-creation of the SRH, or a new decentralized public agency with broad executive powers and administrative autonomy (González-Villarreal, 1982a; IEPES, 1982).

This attempt to re-establish autonomy did not succeed. After de la Madrid became president in 1982 the under ministry of hydraulic resources was maintained as a separate but dependent part of SARH. It is likely that a more autonomous authority was not feasible at this time because of the economic crisis that held the country in its grip. Thus, the ex-SRH engineers had to accept their subordinate position in SARH for another six years, during which time their financial and bureaucratic autonomy was further curtailed. The working group of ex-SRH officials achieved only partial success through the appointment of their coordinator as the new deputy minister for Hydraulic Resources.

The financial situation of SARH severely worsened between 1982 and 1988, largely because of the unprecedented economic crisis that hit Mexico in 1982. To deal with the crisis, de la Madrid, the first economist after a series of lawyers as president, adopted a neo-liberal approach that strongly departed from the populist and interventionist economic policies followed by previous presidents. In agriculture this resulted in a restructuring of SARH, the lifting of subsidies for agricultural inputs and a liberalization of agricultural prices (Vargas, 1996). This also led to a sharp drop in public investments in irrigation during de la Madrid's term. Only 44.5 billion pesos were invested in the irrigation sector from 1982 to 1988, compared to 89.8 billion pesos during the previous presidential term (in constant 1979 pesos) (Palacios, 1994). To make matters worse, the World Bank stopped making new loans to the irrigation sector, in response to the moratorium on payments of foreign debts that the government had declared. This was a strong departure from the past twenty years during which the Bank loaned more than $800 million to Mexico for the irrigation sector (World Bank, 1983). In the World Bank, the construction bias of the hydrocracy also started to be a matter of debate around this time. Buras (1983) mentions that the World Bank wanted to see the orientation of the hydrocracy change and was no longer willing to support the construction projects that many hydrocrats and construction companies had in mind. Although construction activity in these years did not stop, it was seriously reduced.

As one of the many reorganizations of SARH during de la Madrid's *sexenio*, the irrigation districts were combined with the rainfed districts in 1985 to form rural development districts (Palacios, 1994). Ostensibly, the reason behind this policy was to reduce costs and improve the use of resources. However, it also entailed that the hydrocracy's control over the irrigation districts was further reduced. The new rural development districts, which fell under the under ministry of agriculture and operation, became to an increasing extent the domain of agronomists. Moreover, due to the lack of funds the irrigation districts' infrastructure was deteriorating quickly. This situation was completely unacceptable to senior hydrocrats and the need to "rescue" the irrigation districts was to play an important role in the definition of the IMT policy (Vargas, 1996).

3.4 The Emergence of Policy Ideas during the Confusion Years

The fusion resulted in severe bureaucratic struggles and a politically expressed demand for renewed autonomy on the part of the hydrocrats. A group that played an important role in the campaign for renewed autonomy was the water resource planners formed as part of the *Plan Nacional Hidráulico* (PNH; National Hydraulic Plan) commission, created by the SRH in 1973 with funding from the World Bank. During de la Madrid's election campaign in 1982 the water resource planners rose to ascendancy and in coalition with influential groups of civil engineers lobbied for renewed bureaucratic autonomy. The rise to power of this team of hydrocrats parallels a larger process at work in the Mexican bureaucracy since the 1970s, termed the "technocratic revolution" by Centeno (1994), whereby planning was institutionalized as the central focus of public policy making and technocrats came to dominate the state at the expense of *políticos*, *burocratas políticos* and *técnicos*.[66] The policy ideas developed by these *tecnócratas* during the SARH era is reviewed below.

Enter the water resource planners

In response to the difficult SARH era, new policy ideas concerning irrigation and the restoration of autonomy for the hydrocracy were developed by senior hydrocrats. To understand their origins it is necessary to back up a little. The *Plan Nacional Hidráulico* (PNH; National Hydraulic Plan), a water master planning organization created in 1973 to

[66] Centeno (1994: 104-106) defines *políticos* as the "dinosaurs" of the regime, responsible for managing the corporate structure of the party and ensuring that elections are won. The *burocratas políticos* make their careers inside the national office of the party and traditionally were the most powerful wing of the governing elite concerned with maintaining political stability. The *técnicos* are the specialists in the bureaucracy, committed to their area of expertise and generally reluctant to play the "dirty games" of politics. The *tecnócratas*, finally, combine the educational credentials of the *técnicos* with the political acumen of the *políticos* and were able to transfer their control over technical areas to overall command of the state. Characteristically, they are committed to the imposition of a single, exclusive policy paradigm, based on neo-liberal models of economics, through political negotiation.

provide a frame of reference for future lending programs in the field of water resources, played an important role in this. This planning organization led to the formation of a team of water resource planners that departed from the traditional construction bias of the hydrocracy by developing a broader vision on water resource planning and management. The water resource planners, largely civil engineers, developed policy ideas favoring the participation of water users in irrigation and river basin management and handing over of government tasks in water management. Other groups within the bureaucracy, more related to construction or O&M departments, were much less receptive to these ideas.

In 1973, the Mexican Government, the World Bank and the UNDP signed a tripartite agreement to develop a National Hydraulic Plan by 1975 (Herrera-Toledo, 1997). For this purpose the World Bank created a special office in Mexico to assist in the formulation and evaluation of policy ideas and to advise on policy decisions (Buras, 1983). The SRH created a special Plan commission as a semi-independent body in the SRH to produce the Plan. Dr. González-Villarreal, a civil engineer trained in the Faculty of Engineering of the UNAM, was appointed as the General Coordinator of the Plan. He composed a team of young and dedicated professionals for this purpose, who became his close collaborators. They generated an impressive set of studies on land and water resources and their use at both the river basin and national level. These studies attempted to match estimates of future water demands by the domestic, industrial and agricultural sectors with estimated future supplies and specified alternative courses of actions for meeting the projected shortfalls (Cummings *et al.*, 1989; Herrera-Toledo, 1997).

In an evaluation of the first National Hydraulic Plan, Buras[67] (1983) points out that at the start the PNH study group had a "definite engineering orientation" with relatively little input from economic, agronomic or social disciplines. He states that the first PNH started out as a super-project in hydraulic engineering and that solutions to the discrepancies in water availability were initially sought in the construction of inter-basin transfers and the expansion of irrigation.[68] An important component of the Plan was the *Sistema Hidráulico Interconectado del Noroeste* (SHINO; Interconnected North-western Hydraulic System), an ambitious plan to expand the irrigated area in the arid Northwest by connecting five river basins through inter-basin transfers. It was planned to take water from the Rio Santiago in the south and transfer it north through a network of dams, tunnels and canals, to irrigate an additional one million ha (Cummings, 1974). However, several studies showed the technical and financial unfeasibility of this plan (Buras, 1983) and the World Bank was not willing to finance it.

Although the first PNH had a clear construction bias and this bias did not fully disappear in subsequent revisions of the Plan, the perspectives of the water resource planners working on the Plan was significantly broadened. They developed policy ideas and gained experiences that departed from the traditional construction bias of the hydrocracy, more specifically of groups within the under ministry of construction and their network of

67 Buras was appointed to the Advisory Council of the PNH as a foreign expert on water resource planning and thus intimately involved.

68 It was calculated that it was necessary to double the area under irrigation, to 10 million ha, by 2000 (SRH, 1975; Herrera-Toledo, 1996).

beneficiaries. Ex-staff of the Plan confirm that the influence of World Bank advisors on the development of policy ideas was important. The World Bank was thus intimately involved in putting certain policy issues on the agenda and further developing them.

The first Plan was received well by both president Echeverría and the World Bank in 1975 and two of its recommendations were immediately implemented (Herrera-Toledo, 1997). Firstly, the PNH commission was converted into a permanent planning agency falling under SARH in 1976, thereby institutionalizing the planning process. Dr. González-Villarreal continued to coordinate the PNH commission and kept on the same team. He reoriented the objectives of the PNH to support the implementation of policies and programs contained in the first Plan and to continue studying present and future water needs. During this time the commission gained sufficient technical authority to play an important role in policy formulation and decision-making at the highest levels of government (Herrera-Toledo, 1997).

Secondly, the recognition that traditional large-scale irrigation development would not work in the humid tropical lowlands of the Gulf Coast resulted in the *Programa de Desarrollo Rural Integrado del Trópico Húmedo* (PRODERITH; Program for the Integrated Rural Development of the Humid Tropics). Interestingly, PRODERITH fell under the PNH commission, which was directly charged with executing works. In 1976 several pilot projects were started, centering on drainage, small-scale supplemental irrigation and agricultural development. PRODERITH aimed to stimulate the social and productive development of the marginalized villages of these regions (Herrera-Toledo, 1997). The World Bank played a role in preparing the program and partially financed it. By 1985, when the pilot projects had been successfully implemented, a second phase started, in which the efforts were concentrated on transferring the developmental process and decision-making to organizations of beneficiaries (Herrera-Toledo, 1997).

Some of these regions had a conflictive history of authoritarian government intervention in terms of land development and forced resettlement schemes. The explosive social situation lead to popular protests and military interventions. PRODERITH experimented with an alternative approach, based on “social participation”, in marked contrast to the paternalist manner in which the government had intervened and tried to develop these regions in the past. The approach entailed negotiations with the communities in which people could participate in developing a local development plan based on their problems and priorities. These plans served to involve and organize the communities and to determine the program support activities in the region. The program successfully established relations with the communities and carried out the development plans.

Different SARH officials acknowledged that the experience with this model of social participation in decision-making was important in the development of policy ideas that also applied to the irrigation districts. Some observers state that it served as a pilot for the transfer of the irrigation districts. More generally, the team of water resource planners that Dr. González-Villarreal formed around him during the two *sexenios* that he led the PNH commission developed a more encompassing vision on water resource planning and management, although there was a strong construction orientation at the outset. This group of planners developed policy ideas favoring water user participation, water pricing and institutional reform that can be seen as precursors to the creation of the CNA policies and the IMT policy. In addition, they developed good relations with officials of the World Bank and were consequently well informed about the international trends in loan policies and irrigation management reform.

The emergence of the IMT policy idea

Although user management of irrigation districts was a recurrent theme throughout the history of irrigation development in Mexico, irrigation management transfer as such was not on the policy agenda in the early 1980s. However, discussions on user participation in irrigation increased during the 1970s and early 1980s. This section traces how discussions on increased user participation and cost recovery changed content and how the IMT policy current widened after 1982. It shows that the sharp reduction in government funds allocated to SARH after 1982 coupled with farmers paying significantly less water charges provided the backdrop for the emergence of IMT as a policy idea, but that these factors in themselves do not explain why senior SARH officials defined the outlines of the IMT policy between 1985 and 1987. To understand why senior hydrocrats started to entertain IMT as a policy idea it is necessary to analyze how this was intertwined with their larger concerns of constituting a sole water authority, increasing control over resources and regaining control over the irrigation districts.

Discussions on user participation in irrigation increased during the seventies and early eighties, as part of the PNH, PRODERITH and the election campaign of de la Madrid. To understand how these discussions contributed to the emergence of the IMT policy idea it is necessary to analyze what meaning was imputed to user participation at this time. A key recommendation of the 1975 PNH concerning the irrigation sector was to reduce the subsidies to the irrigation districts and to increase "user participation" in the financing of irrigation development, operation, maintenance and rehabilitation (SRH, 1975: 75). This point was taken up again at the water meetings held during de la Madrid's election campaign in 1982, where it was suggested that:

> The Mexicans that avail over (...) drainage and irrigation services are in a privileged situation. But those who benefit from these services also have a greater responsibility towards the nation; a responsibility which should imply increased participation (...) in the financing of the administration of water and the works to utilize it. (González-Villarreal, 1982b: 21)[69]

This recommendation was mirrored in the conclusions of an important World Bank study on the irrigation sector in Mexico, which singled out an "across-the-board increase in water charges" as the most important policy decision that needed to be taken by the Mexican government concerning the irrigation sector (World Bank, 1983). Thus, in 1982 an important concern of senior hydrocrats and international funding agencies was the low levels of cost recovery in the irrigation districts. This concern materialized in an

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[69] "Los mexicanos que cuentan con servico de (…) drenaje o riego, se encuentran en una situación privilegiada. Pero quienes desfrutan de estos servicios, tienen también una mayor responsabilidad frente a la nación; responsabilidad que debe traducirse en una mayor participación (…) en el financiamiento de la administración del agua y de las obras para aprovecharla."

amendment of the *Ley Federal de Derechos* (Federal Rights Law) for 1983, which was decreed 30 days after de la Madrid became president. It enacted that in 1984 the payment of water charges would have to cover the costs of operation, maintenance and improvement of irrigation districts. In 1985 it would have to be sufficient to create a fund for improvements and expansion of the districts, and in 1986 to recover government investments in implemented works (World Bank, 1983). The emphasis on cost recovery suggests that IMT[70] was not a policy option in the run-up to the de la Madrid *sexenio*. A thorough analysis of the literature and held interviews confirms this finding.

Actual cost recovery seriously lagged behind these ambitious objectives. Although farmers were to pay 100% O&M costs by 1984, cost recovery averaged 23% from 1983 to 1988. Although water charges were raised in many districts inflation was much higher due to the economic crisis, rendering the increases largely superfluous. In addition, many farmers could not or did not pay, further reducing income from water charges. The failure to persuade farmers to pay much higher water charges made it clear to senior hydrocrats that more drastic measures were needed. An increased role of water users in the management of irrigation districts became more important as an option to improve cost recovery:

> It is fundamental to look for new ways of managing the irrigation districts which would permit a more comprehensive participation of users in their administration and financing, with the aim of rationalizing possible subsidies and preventing excessive bureaucratic intervention. (González-Villarreal, 1982a: 123)[71]

This first hint at the need for more radical reforms in the management of the irrigation districts shows that Dr. González-Villarreal already recognized in 1982 that simply increasing water charges would not be sufficient. In 1983 and 1984 several factors combined to precipitate a shift in thinking on the management of irrigation districts. Most important among these were the failure of the cost recovery strategy and the failure to include irrigated agriculture in the *Ley Federal de Derechos* coupled with a shift in the World Bank's agenda for the irrigation sector.

The *Ley Federal de Derechos*, which is updated each year and sets out all the taxes that need to be paid to the government, was promulgated in 1982. Chapter 8 of this law deals with water and sets the level of taxes for the right to use the nation's water. In 1985, a working group was formed between SARH and the finance ministry to review the law and to further define a fiscal policy for the use of water, with the aim of achieving financial self-sufficiency in the water sector. Besides industry and the commercial service sector, it was decided to include irrigated agriculture in the law, implying that farmers would have

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70 International policy debates on irrigation during the seventies and eighties did not include the term "Irrigation Management Transfer". Turn-over, on the other hand, was well established in policy discourses by 1983. It would be interesting to study when the term IMT made its appearance in irrigation policy discourses and how its supremacy was established. My hypothesis is that this happened sometime between 1990 and 1992 because of the "success" of transfer in Mexico.

71 "Es fundamental buscar nuevos caminos en la operación de los distritos que permitan una participación más amplia de los usuarios en su administración y financiamiento, con objeto de racionalizar los posibles subsidios y evitar una excesiva intervención burocrática."

to pay an annual tax for the right to use water on top of water charges. The proposal was sent to Congress at the end of 1985, but due to the serious problems agriculture faced as a result of the economic crisis Congress established a zero tariff for the agricultural water tax (Palacios, 1996). This was a severe blow to SARH, as it had been agreed in negotiations with the finance ministry that the irrigation districts would no longer be subsidized and that the proposed water tax would be used to finance the irrigation sector.

Besides the financial concerns of the hydrocracy and the bureaucratic struggles surrounding the irrigation districts, international debates and financing agencies also influenced the emergence of the IMT policy idea. In 1982, the World Bank temporarily stopped lending to the irrigation sector in Mexico. To assess future investment priorities the World Bank carried out a review of the irrigation sector towards the end of 1982. The following quote succinctly summarizes the Bank's justification for this study:

> For more than a decade now, increases in production from irrigated areas have not been commensurate with the Government's strong financial commitments to develop new systems, and there is increasing evidence that existing systems are not serving at optimum efficiency. The wisdom of continuing Government commitments in this field is therefore increasingly questioned. Since a severe shortage of investment and operational funds is likely in the coming years (…) an in-depth look at this subsector, which has routinely absorbed about three quarters of all public agricultural investment, becomes even more important. (World Bank, 1983: 4)

In line with international debates on irrigation management (Bottrall, 1981b), the 1983 World Bank review of the Mexican irrigation sector concluded that Mexico needed to shift attention away from the construction of new irrigation systems to improving the management and efficiency in existing systems. To do so, the report outlined a three-point action program for the irrigation sector:

> First, the Government has gradually become less able to keep irrigation systems functional in the long-term with public funds, and the present austerity program indicates that this will increasingly be the case in the coming years. As it is not in the interest of farmers to observe a run-down in the irrigation infrastructure, *an across-the-board increase in water charges* would ease the budget constraints which are the biggest obstacle to adequate maintenance. (…) Second, it should be realized that, in order to achieve a fair water pricing system acceptable to farmers (…) *a program of repair and upgrading of existing systems* needs to be undertaken in most Districts. (…) Third, (…) if users are to be increasingly responsible for irrigation financing then *their role in decision making will need to be increased* (…). (World Bank, 1983: 17-18; emphasis added)

The report goes on to recommend the bulk sale of water by the government to users' associations in the districts, who would then sell and distribute the water to its members, citing the successful use of this system in the Río Yaqui irrigation district. Although "turn-over" or "IMT" is not mentioned in the report, its recommendations strongly coincide with the core of the IMT program in the 1990s. The 1983 report signified an important shift in the Bank's agenda for the irrigation sector and its recommendations influenced both the emergence and contents of the IMT policy idea. To obtain external funds the hydrocracy needed to accommodate the Bank's new agenda and to readjust its construction orientation. This is a striking transition, as a central objective of both the 1975 and 1981 versions of the National Hydraulic Plan had been the construction of 5 million ha of new irrigation systems before the year 2000 (SRH, 1975; SARH, 1981).

Around 1985 several senior SARH officials seriously started considering the possibility of transferring the irrigation districts to water users. The ramifications of transfer and how to initiate it were discussed at a breakfast meeting in 1985 between the Minister of Agriculture, Dr. González-Villarreal and other senior SARH officials. This shift in thinking was based on the concern by senior hydrocrats that the irrigation districts would deteriorate completely due to the severe lack of funds. They saw no way to reverse the already serious deterioration of the districts and to resolve the financial problems without drastic changes in the way the districts were managed. They also understood that to obtain desperately needed external funds they had to accommodate the Bank's new agenda. It was clear at this point that such elements had to be incorporated in the policy agenda for the upcoming *sexenio*. To formally initiate the transfer of irrigation districts was politically not feasible at the middle of the *sexenio* and the 1985 earthquake in Mexico City, which disrupted the country and destroyed the central SARH offices, seriously slowed down concrete initiatives.

In 1986, the World Bank resumed talks with SARH and started to suggest possible new irrigation loans for the upcoming *sexenio*. The negotiations were led by Dr. González-Villarreal, who proved to be a skilful negotiator and proposed a number of policy initiatives, including the proposal to transfer a limited number of irrigation districts. At the same time, a number of experiments with user management of irrigation districts started (see Chapter 4 for more details). From 1985 to 1987, transfer remained a policy idea with its modalities and characteristics still largely undefined, although its financial and institutional basis was seriously worked on. It was not until the end of 1987 that the policy became a serious likelihood at the national level, as reviewed below.

The above shows how several distinct strands came together around 1985 and resulted in the emergence of the IMT policy idea. That senior hydrocrats started to entertain IMT as a policy idea is closely intertwined with the three overriding concerns of the hydrocracy, namely autonomy, control over financial resources and control over the irrigation districts. The attainment of these three objectives was severely curtailed in the eighties, as shown in section 3.3. The shift in the World Bank's agenda for the irrigation sector entailed that the hydrocracy had to explore new avenues to secure control over financial resources. The drop in the collection of water charges and the sharp reduction in government funds for the irrigation sector aggravated the loss of control over resources and strengthened the need for finding innovative ways out. Embedding the IMT policy idea in the overriding concerns of the hydrocracy shows that it emerged because senior hydrocrats needed a new translation strategy to attain these objectives, after other strategies and options had failed.

3.5 Towards a Reform Package: The 1988 Election Campaign

The further loss of financial and bureaucratic autonomy and a weakening of the control over the irrigation districts by the hydrocracy during the de la Madrid *sexenio* were unacceptable to most hydrocrats. For them, the major issue in water management was the dispersion of responsibilities and resources over different bureaucratic agencies. Although SARH was legally responsible for the nation's waters, urban and industrial water use, water for hydropower and water quality fell under other ministries (IEPES, 1987). It was argued that the lack of inter-ministerial coordination made it very difficult to manage water adequately. To senior hydrocrats it was clear that radically different policy scenarios had to be explored to extract the hydrocracy from its worst crisis. Ideally, this would entail the reconstitution of an autonomous water authority that would concentrate the responsibilities and financial resource flows related to water. The emergence of IMT as a policy idea was closely intertwined with the aim of the hydrocracy to re-establish financial and bureaucratic autonomy and control over the irrigation districts. To achieve this aim, different groups of ex-SRH engineers started exerting political pressure towards the end of the *sexenio* of de la Madrid, setting the stage for the creation of an autonomous water authority.

The policy actors

In January 1989, Salinas created the CNA, less than six weeks after he became president and in June 1989 the National Development Plan was released, endorsing IMT and a wider water reform package. The Plan mentions that "the formation of organizations with social and private participation, which will be made responsible for the operation and maintenance of the hydraulic infrastructure, is considered expedient. It is expected that the irrigation districts will be financially autonomous and administratively independent" (Poder Ejecutivo Federal, 1989: 77).[72] In the following years, this phrase was used repeatedly in CNA policy documents to formally justify the IMT policy. These rapid developments indicate that in 1987 and 1988 disparate policy ideas, such as the transfer of irrigation districts, the creation of an autonomous water authority and water pricing were articulated further and combined in a single reform package. This occurred during the run-up to the presidential elections in 1988 when an influential segment of water resource planners within the hydrocracy negotiated the water reform package with the presidential candidate. Although international lending agencies were not directly involved in these negotiations, their position on necessary water reforms and the prospect of new loans played a crucial role in defining the reform package. This section outlines the different positions and agendas of these three policy actors and shows how they reached agreement on a reform package that included both a concentration[73] of bureaucratic domains and

[72] "Se estima conveniente la formación de órganos con participación social y privada que se responsabilicen de la operación, conservación y mantenimiento de la obra hidráulica. Se pretende que los distritos de riego sean financieramente autónomos y administrativamente independientes."

[73] Concentration is used here to refer to the integration of existing bureaucratic domains and resource flows regarding water, formerly dispersed over different government agencies, into a "single water authority".

resource flows related to water and a decentralization[74] or irrigation management to water users. In particular, this section highlights the role of the group of water resource planners in the articulation of the reform package.

The team of water resource planners formed by the PNH and led by Dr. González-Villarreal took the lead in proposing IMT to Salinas and convincing him of the need for an autonomous water authority during his election campaign in 1988. In this they were supported by different groups of civil engineers working for the under ministry of hydraulic resources in SARH, construction companies or stationed at the faculty of engineering of UNAM. Especially the construction companies played an important role in supporting the demands of these engineers in line with their interests. When Salinas became a presidential candidate and started galvanizing support from the bureaucracy for his campaign, this coalition of engineers offered its support to him in return for the creation of an autonomous water agency (van der Zaag, 1992).

During the *sexenio* of Salinas (1989-1994) the neo-liberal agenda of de la Madrid was continued with increased intensity. During his election campaign in 1988, Salinas set out an ambitious agenda to modernize rural Mexico, through a set of economical, political and social reforms. He emphasized the need to break with the paternalist practices of the government in the rural areas through a strategy that would allow for more participation of the social and the private sector. Key concepts in Salinas' discourse were shared responsibility (*coresponsabilidad*) and social consensus building or consultation (*concertación social*). These ideas originated from his academic research on popular support for the political regime in rural communities and experiences with organizing farmers (Cornelius *et al.*, 1994; Gordillo, 1988)

In Salinas' vision shared responsibility would be reached through social reconciliation efforts, both in the rural and urban areas. He proposed a mode of governance termed "social liberalism", which sought to avoid the excesses of both unfettered free market capitalism and heavy-handed state intervention, thereby leading to the reduction of absolute poverty and an increase in social well-being (Cornelius *et al.*, 1994). Salinas' ambitious agenda aimed to modernize the relations between state, society and the market and strongly favored decentralization and participation of the social and private sector in water management. During his *sexenio* Salinas followed a policy of liberalizing trade, deregulating the economy, privatizing parastatals, reforming the financial sector and weakening the corporate structure of the PRI (Grindle, 1996).

A group that played an important role in mapping out the course of the hydrocracy and the irrigation districts during the 1980s and 1990s was the team of water resource planners under the direction of Dr. González-Villarreal. They were the intellectual authors of many

[74] Decentralization is used here as the delegation of authority and financial resources concerning water management from the federal government to water user organizations, generally with the aim to reduce government expenditure through the creation of self-sufficient water management organizations. The choice for this definition is pragmatic. The disadvantage of the term is that it suggests a delegation of political power to lower levels of government in a territorial hierarchy (Smith, 1985), and thus excludes non-government actors.

of the policy ideas presented to Salinas during his election campaign. Through his different contacts and positions in the bureaucracy, Dr. González-Villarreal came to represent the broadly shared claim of the hydrocracy for bureaucratic and financial autonomy.[75] The coordinator of the PNH was widely respected for his vision and expertise concerning the planning and management of water resources. In addition, he knew irrigation from a practical perspective as his father was a producer in the irrigation district of Rio Yaqui in the northern state of Sonora, a system that was managed by its users for several decades. His respected position was acknowledged when he coordinated campaign meetings on water for de la Madrid in 1982. During these meetings, he developed a set of ideas that were basically in embryo what was proposed at the end of the 1980s to Salinas.

As a SARH deputy minister during de la Madrid's administration, Dr. González-Villarreal led the hydrocracy in a time of severe crisis. During this period he frequently interacted with Salinas, who as minister of Budget and Planning had an important say in setting SARH budgets. Their discussions and interactions regarding water reforms in view of the serious difficulty of the state to continue financing the irrigation districts and other forms of water use date from this period. Both also showed interest in the shared responsibility of the social and private sector in the financing of water management (González-Villarreal, 1982a; Poder Ejecutivo Federal, 1989). Finally, the IMT policy idea fit well into Salinas' plans to "modernize the countryside", in which strategies of "social reconciliation", deregulation and decentralization played an important role (Poder Ejecutivo Federal, 1989).

In addition, Dr. González-Villarreal and his team of water resource planners knew the world of international funding agencies well. They developed good relations with officials of the World Bank during the PNH and were well informed about international trends in loan policies and irrigation management reform. Thus, in 1988, Dr. González-Villarreal found himself centrally positioned to propose water reforms. He represented different groups of hydrocrats in SARH and maintained good relations with academia and the influential construction sector. His respected vision and expertise on water resources and irrigation and his political participation in the PRI[76] were important for his capacity to convince a wide array of political, bureaucratic and societal actors of the transformations that were needed in the water sector. In him Salinas saw a person with a vision of how to reform the water sector, the skills and authority to deal with potential resistance from the bureaucracy and water users and the necessary relations with influential interest groups and the World Bank. He thus became a central actor for Salinas in bringing about a reduction in public spending, to give a strong push to his policy agenda of modernizing the relations in the countryside through decentralization, to reorganize the bureaucracy and to acquire international funding to support the proposed transformations.

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75 Dr. González-Villarreal had good relationships with leaders of the guild of hydraulic engineers (ex-ministers and deputy ministers) and with important political actors. Through his position as president of the College of Civil Engineers he also maintained good relationships with civil engineers in the government, the academic world and in construction companies.

76 He was PRI-candidate for governor of his home state of Sonora more than once.

The election campaign and the consolidation of the reform package

In December 1987 and January 1988, five national meetings on water were held as part of Salinas' election campaign. That Salinas made this effort indicates that he saw the political and electoral importance of the problems in the water sector. During these meetings, the contours of the water reform package for the next *sexenio* became clear. As detailed in section 3.4, the recognition of the need for IMT gathered force among senior hydrocrats between 1985 and 1987. During the election campaign the IMT policy idea was further articulated. In the first meeting in Acapulco, Salinas asked Rovirosa Wade, the SRH minister in the 1970s, what he thought of the SAG/SRH fusion. Wade responded:

> Concretely, I do not propose that the [SRH] is recreated, but that at least there would be an independent authority located in the Presidency of the Republic that it is given all the power necessary for water management. I was slightly concerned when the fusion of the two ministries came, feeling that (…) the concept of water as a resource could be lost. Giving all the power to an independent entity, I think, would be a solution that this country is demanding for the management of water as a vital resource. (IEPES, 1987: 10)[77]

It is interesting that Wade did not suggest recreating the SRH, but that he did argue strongly for an independent water authority directly linked to the president. During the same meeting, Salinas asked Dr. González-Villarreal his opinion on the risks of transferring irrigation districts to the users. His answer is illuminating:

> The transfer of irrigation districts to users already was an established policy of this administration [of de la Madrid], which has encountered some difficulties. (…) Those of the Northwest and North of the country are prepared to start taking on their own administration. (...) In a program that will be financed in the near future with international credit, called 'modernization of irrigation districts', a subsequent phase after the original construction of the districts is proposed, consisting of the bulk delivery of water to the users and an administration directed by them (...). However, in the districts of the center of the country (...) we believe that the process has to be more gradual. First, some rehabilitation and public investment will be needed, before a first phase of user organization, if the process is to be effective. (IEPES, 1987: 7)[78]

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[77] "En concreto, propongo no que vuelva a crearse la [SRH] sino, que por lo menos hubiese un organismo independiente y radicado en la propia Presidencia de la República; que se la dé toda la fuerza necesaria al manejo del agua. Me preocupé un poco cuando se vino la fusión de ambas secretarías, sintiendo que (…) se pudiera perder el concepto del recurso agua. Darle toda la fuerza a una unidad independiente, creo yo que sería una solución que esta exigiendo este país pare el manejo del agua como recurso vital."

[78] "La transferencia a los usuarios de los distritos de riego ha sido una política ya establecida en esta administración [of de la Madrid], que ha enfrentado algunas dificultades. (…) Los del noroeste y del norte del país están preparados para ir adoptando su propia administración. (…) En un programa próximo a financiarse con crédito internacional, llamado "Modernización de distritos de riego", se plantea una etapa superior a la construcción original de los distritos así como en la entrega de agua por volumen a los usuarios, una administración dirigida por ellos (…) Sin embargo, en distritos de riego del centro del país (…) creemos que el proceso tiene que ser mas gradual. Se requerirá primero de alguna rehabilitación y de inversión publica, de una primera fase de organización de los usuarios, para que el proceso pueda ser eficaz."

This indicates that the discussions with international lending agencies that were initiated in 1986 to negotiate loans for modernizing and transferring a number of irrigation districts had reached such an advanced stage that Dr. González-Villarreal felt confident enough to announce publicly to Salinas that international loans for IMT would be forthcoming. Based on the meeting in Acapulco and four additional meetings held in late January 1988, Salinas officially accepted the IMT policy and publicly reaffirmed that the irrigation districts would be transferred, by stating that:[79]

> We need to make great strides in the modernization of the operation of the irrigation districts. The state should not be the only responsible party. More spaces for participation and, therefore, of shared responsibility, should be opened up for the producers. (…) In the countryside, I offer to decentralize, gradually, but firmly, the operation of the irrigation districts to organized producers. (PRI, 1988: 50/53)[80]

Another element of the reform package proposed during these meetings was a "financial system for water", which was already presented in the PNH (SRH, 1975). This system entailed that government income from water would accrue directly to the hydrocracy. González-Villarreal strongly argued for this option, stating that "[t]he financial system for water, consisting of the investments, the taxes for the use of water and the payment of differentiated tariffs for services, could be more sound if the fees and taxes collected are re-invested in the same sector" (PRI, 1988: 41).[81] This clearly reflected the concern of the hydrocracy for financial autonomy. During the SARH period the income flows related to water were not controlled by the hydrocracy, but were dispersed over different ministries. A concentration of the control over these income flows would significantly strengthen the financial autonomy of the authority.

From the campaign events held at the end of January 1988, it becomes clear that the various policy ideas had been discussed in more detail with Salinas, as he publicly accepted the need for institutional reforms in the water sector and the transfer of the irrigation districts. He called for a careful reflection on how the coordination of different water uses could be strengthened and stated that: "We need to create (…) one sole agency that is responsible for hydraulic services (…) which will make it possible to guarantee that the distribution, use and preservation of water in Mexico is in agreement with standards of efficiency and equity" (PRI, 1988: 52/53).[82] He attributed many capacities to this new agency, including the authority to decide over its own programs and budgets, something that the existing under ministry did not have. Lastly, he stressed that "the recovery of the

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79 At the same time, in January 1988, an instruction was sent from the SARH central office to several districts to initiate transfer (van der Zaag, 1992). This will be analyzed in more detail in Chapter 4.

80 "Debemos dar grandes pasos en la modernización de la operación de los distritos. El estado no debe ser el único responsable. Deben abrirse mayores espacios de participación y, por lo tanto, de corresponsabilidad a los productores. (…) En el campo ofrezco descentralizar gradual, pero firmemente, la operación de los distritos de riego a los productores organizados."

81 "El sistema financiero del agua, integrado por las inversiones, los derechos por el uso del agua y el pago de tarifas diferenciales por los servicios, puede ser más sano si las recaudaciones se reinviertan en el propio sector."

82 "Tenemos que crear (…) un sólo organismo que tenga a su cargo los servicios hidráulicos (…) que permita garantizar que la distribución, el uso y la preservación del agua en México respondan a patrones de eficiencia y equidad."

full authority over water is a necessary condition to expand decentralization schemes and to strengthen mechanisms for reaching consensus" (PRI, 1988: 53).[83] This paradoxical combination of "rescuing" the full authority over water by the federal government through the concentration of water responsibilities in a single federal water agency as a precondition for fuller decentralization is at the heart of Mexico's water reforms. Decentralization is only possible if the federal government is fully in control, as will become apparent if the following chapters. The reform package as a whole containing both IMT and the creation of a new water authority came together at the end of the campaign meetings on water in a PRI document published in June 1988 outlining the party's election platform.

> It is a priority to rehabilitate and modernize the irrigation and rain fed zones with the participation of the users and the state governments, so that when they are in a condition to operate efficiently, they can be transferred gradually to the users. (…) The comprehensive management of water quantity and quality, by an agency that is constituted as the water authority makes it necessary to realize legal adjustments that leave no doubt about the national property of water, on the one hand, and for the administrative reordering on the other. (IEPES, 1988: 33/38)[84]

The same document considered four options for the legal structure of the new water authority, namely 1) the consolidation of the current administrative structure, 2) strengthening the under ministry of hydraulic resources in SARH or creating a deconcentrated authority[85] in the ministry with full responsibility for all water related activities, 3) the creation of a new ministry, and 4) the creation of a public decentralized authority (IEPES, 1988: 39-42). Although the creation of a new ministry was unlikely, the group of water resource planners formulated its charter, regulations and organizational structure in full detail in the latter half of 1988. In November 1988, shortly before he assumed the office of president, Salinas resolutely ruled out this possibility, as the PRI did not have a majority in parliament to approve the creation of a new ministry. Instead, it was decided that the new water agency would become a deconcentrated authority that would fall under SARH. The hydrocracy was thus forced to accept the "second best" option and had to go back to the drawing board to define the legal, financial and organizational structures of the new water authority.[86]

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[83] "El rescate de la plena autoridad sobre el agua es una condición necesaria para ampliar esquemas de descentralización y fortalecer mecanismos de concertación."

[84] "Es prioritario rehabilitar y modernizar las zonas de riego y temporal con la participación de los usuarios y los gobiernos estatales, para que una vez que estén en condiciones de operar con eficiencia, puedan ser entregadas gradualmente a los usuarios. (…) El manejo integral del agua en cantidad y calidad mediante un órgano que se constituya en la autoridad del agua, plantea la necesidad de realizar adecuaciones jurídicas que no dejen duda sobre la propiedad nacional del agua por una parte, y para la reordenación administrativa del sector, por otra."

[85] In Mexico, a deconcentrated authority is a semi-autonomous federal agency with the power to set its own policies, levy taxes and fines, issue permits and carry out acts of authority throughout the country. This contrasts with decentralized public agencies, which are also semi-autonomous, but depend on their mother ministry for overall policy guidelines and direction.

[86] Interview with a senior SARH official at the time.

The above shows how different policy ideas became an integral part of the water reform package and how it became more articulated during the election campaign of Salinas. This transition occurred in a small circle of policy actors, consisting of the president, senior hydrocrats and World Bank officials, as part of the policy agenda setting for the upcoming *sexenio*. Combining these different policy ideas in a reform package increased their feasibility, as it had become clear during de la Madrid's administration that merely recreating a water ministry as an individual reform was politically and financially infeasible. To make the move of creating an autonomous authority feasible, it had to be accompanied by a set of apparently paradoxical reforms: a concentration of bureaucratic domains and resource flows, a decentralization of the irrigation districts and a new water taxing and pricing policy. If successful, this composite strategy would reduce government expenditure in water management, secure higher and more stable income flows from water use and attract international loans. In addition, it would enjoy the political support of the president and international lending agencies. When Salinas stated during his campaign that the new water authority was a precondition for his proposed policies of decentralization and social reconciliation, he acknowledged the link between concentration and decentralization measures. The composite strategy of concentration, decentralization and water pricing made the reform package viable–financially, politically and bureaucratically.

The reform package offered another advantage. Many observers state that González-Villarreal faced groups of middle and senior hydrocrats that were opposed to the transfer of the irrigation districts. The advantage that he could project to them was that the IMT policy opened up the possibility of reconstituting an autonomous water authority and that it would return a certain level of control over the districts, which at that time fell under the agricultural bureaucracy.

Arm twisting and impositions

Most of the people interviewed for this chapter stated that the World Bank imposed IMT on Mexico, against the will of the hydrocracy. The possibility that the hydrocracy defined the IMT policy was deemed highly unlikely. The reasoning behind this is that the hydrocracy had always played a central role in state intervention in the countryside and that its engineers had a very state-centered outlook. As a senior water researcher eloquently deduced for me:

> No serious studies on the irrigation districts were conducted before the transfer program. As there was not a group of researchers criticizing the irrigation districts the transfer could not have emerged as the result of critical research. In addition, irrigators associations did not exist in Mexico. Maybe in various districts the users had complaints and grievances but this never resulted in a movement at the grass roots that said, right, let's change this. Also, it would seem unlikely that the hydraulic engineers were a dissident sector, that they were discontented, as far as I know. Hence, this is where the idea comes from that if it was not the critical intellectuals, if it was not the users, and if it was not the engineers [that were demanding transfer] then it must have been an external source. It must have been the World Bank or the International Monetary Fund.

Although the World Bank did not directly influence the creation of the CNA, its financial and ideological support for the proposed reforms were crucial in making the creation of an autonomous water authority feasible. The role of the World Bank in promoting IMT was more direct, as it was clear that new irrigation loans would become available if IMT was implemented. However, this chapter clearly shows that it is too easy to posit that the World Bank imposed IMT and the water reforms on the Mexican government and its hydrocracy. This is not to suggest that there was no financial and ideological persuasion, as every international loan is accompanied by some "arm-twisting", as one CNA official expressed it. The policy ideas leading to IMT were a product of historical experiences and concerns of a group of water resource planners, developed in interaction with World Bank officials, but clearly defined and supported by the hydrocrats. If IMT was a condition to loans "it did not cost the World Bank much trouble to convince the Mexicans", according to a well-informed interviewee. Considering the history and pride of the Mexican guild of hydraulic engineers it is difficult to see how they could have accept a completely "foreign" imposition of a policy that would affect them in such a drastic manner. The World Bank is limited in its influence when its policy agenda is not supported by and does not create benefits for the hydrocracy.

From a definition of presidentialism, which attributes a dominant role to the president in policy and bureaucratic transformations, it could be argued that Salinas imposed the reforms on the hydrocracy. However, the hydrocracy proposed rather concrete policy ideas to the presidential candidate and actually enrolled him in their effort to re-establish autonomy. As a presidential candidate, Salinas needed the political support of the hydrocrats as well as their support for achieving his ambitious reforms in the rural sector. On the other hand, the authorization of Salinas was crucial for the senior hydrocrats to achieve their objectives. His full support was especially needed for overcoming potential resistance within the bureaucracy. Also, it is clear that Salinas did not concede all of the proposals made by the hydrocracy, exemplified by his refusal to create a new ministry.

A different reading of the IMT policy process suggests that much more was at stake. The idea of increased user participation and the need to reduce subsidies to the irrigation districts grew among senior policy actors of the hydrocracy during the eighties. The emergence of the IMT policy idea in the hydrocracy was also strongly related to bureaucratic experiences with "social participation" in PRODERITH and user management of the Rio Yaqui irrigation district. In addition, the efforts by senior hydrocrats to reconstitute an autonomous hydrocracy played an important role in the transition of IMT from a policy idea to a policy likelihood. Some have suggested that Salinas promised Dr. González-Villarreal an independent hydrocracy on the condition that the irrigation districts would be transferred. On the other hand, it is argued that Dr. González-Villarreal discussed IMT with Salinas in 1986 and 1987 and that Salinas accepted the policy as it fit in his neo-liberal agenda. As one interviewee commented:

> This idea [IMT] could not have come only from González-Villarreal. He did not do this without the go ahead from the president first. González-Villarreal probably proposed to the president that they should do the transfer and the president said yes, go ahead. This is what I believe.

This shows the crucial importance of the relationship between the hydrocracy and the president. If Salinas had been opposed to IMT then it would not have happened. However, it would also be too easy to posit that Dr. González-Villarreal simply convinced Salinas of the need for IMT. This chapter suggests that IMT attained a prominent position on the policy agenda in 1988 as the result of a complex interplay between various (f)actors, including the lack of government funds for the hydrocracy, the crisis in the irrigation districts, the neoliberal agenda of Salinas, the close link between Dr. González-Villarreal and Salinas, persuasion by the World Bank and the need of the hydrocracy for international funding. In this process not one single actor or factor was instrumental, but rather the combination of (f)actors resulted in IMT becoming a policy likelihood.

Without denying the political, financial and ideological coercion that is needed for a reform program of this magnitude, it is clear that for all three policy actors there was a limit to the realization of their agendas. This chapter has highlighted the active role that senior hydrocrats played in the definition of the reform package, driven by a concern for bureaucratic and financial autonomy and control over the irrigation districts. This is something that is often underrated by approaches that analyze policy formulation and implementation by focusing on the required commitment of politicians and international funding agencies to a single, isolated and black-boxed policy. This chapter shows that there was not one policy, well defined and isolated, to which the policy actors could choose to commit themselves to or which was imposed by one of these actors. The individual elements of the reform package meant different things to the policy actors involved. At the end of the 1980s, the interaction between the different policy actors and their agendas had already gone through a trajectory that started with the PNH. During Salinas' election campaign a process of mutual enrolment occurred in which the shape of the individual reforms was further articulated and the reform package as a whole became more irreversible. The commitment of the political leadership and influential segments of the bureaucracy to the IMT policy was the outcome of this protracted process of interplay.

Although IMT became a policy likelihood in 1988, it was only very broadly defined at this time. Importantly, the idea was to slowly transfer the districts to the users and not to privatize them. In addition, the need for rehabilitation was singled out. During the nineties these characteristics of the IMT policy changed and it was only during implementation that the policy was fully defined. How the IMT policy fared after its endorsement in the election campaign of Salinas is described in Chapter 4, which analyzes how the IMT policy was transformed between 1989 and 1995, as it traveled outward from the small circle of policy elite into the reality of the Mexican countryside.

3.6 Conclusions

In a sense, user management of irrigation districts has come full circle in Mexico if a longer historical view is taken. By the early 1990s user management of irrigation districts was once again enshrined in policy and law, as it had been in the 1930s and 1940s. However, there was nothing logical or unavoidable about this happening. This chapter has shown that to unravel the articulation of water policies it is necessary to focus on the interactions between policy actors and the short and long term circumstances that shape the ways in which they try to advance particular policy ideas. As stated in the introduction, the aim of this chapter was to focus on the role of hydrocracies in water reforms, thereby complementing the manner in which IMT and bureaucratic reform in Mexico have been discussed in the literature to date. This chapter has shown how the creation of the CNA and the endorsement of IMT were strongly linked with the engagement of the Mexican hydrocracy in policy articulation. To understand water reforms, or the lack thereof, it is necessary to bring the hydrocracy back in to the analysis.

The composition of and the commitment to the water reforms emerged from a complex and protracted process of interaction and enrolment between policy actors such as senior hydrocrats, the Mexican presidential candidate and World Bank officials. By focusing on these policy actors and their agendas this chapter has shown how the reform package emerged as an outcome of mutual persuasion, compromise and coercion between these policy actors. Segments of the hydrocracy played a crucial role in this process, as part of an ongoing struggle within the Mexican bureaucracy. The reforms gained momentum when the concentration of bureaucratic domains and resources in a single water authority, the decentralization of the irrigation districts and active water pricing policies became part of the reform package. Thus, IMT and the creation of the CNA cannot be considered as individual reforms, but have to be seen as part of the larger reform package that aimed at both bureaucratic and financial autonomy for the hydraulic bureaucracy. This packaging strategy made the water reforms viable as it would attract international funding, reduce government subsidies, secure a steady income flow for the hydrocracy, receive authorization from the president and find sufficient support among the upper reaches of the hydrocracy. This leads to the conclusion that the IMT policy became feasible because it was embedded in a broader reform package that would result in greater autonomy for the hydraulic bureaucracy, thus generating important benefits for segments of the hydrocracy.

The overall conclusion of this chapter is that the commitment to reforms and the political will to implement them are the outcomes of policy articulation rather than prerequisites for reform. This has several implications for researching and promoting water reforms. First, it suggests that it is necessary to conceive of water reforms as effects of specific political and bureaucratic policy practices and experiences. Second, it entails analyzing how officials of international funding agencies, researchers, consultants, politicians and hydrocrats engage in their institutional reproduction through articulating reforms that reorder the control over contested bureaucratic domains, redirect resource flows and redefine themselves and their clientele.

4

The Practices and Politics of Making Policy: The Case of Irrigation Management Transfer in Mexico[87]

Philippus Wester and Edwin Rap

Abstract

This article analyzes the making of the Irrigation Management Transfer (IMT) policy in Mexico in the early 1990s, focusing on its emergence, standardization and acceleration. It argues that policy making is a continuous and on-going process that is potentially self-reinforcing, but often fragile and reversible in practice. We construct this argument by focusing on how a standardized policy package was developed, consisting of a set of

[87] This chapter is an article that will be submitted to a policy journal for review. As it was written as an article it has some overlap with the other chapters in this thesis.

specific policy techniques. These techniques were assembled in response to distributed trials of strength: experiments, consultations and clashes in the field and negotiations at the national and international level. Feedback and centering mechanisms coordinated by the hydraulic bureaucracy led to a convergence of distributed experiences and ideas on how to make transfer work, which contributed to the acceleration of the transfer process. Our analysis shows how a package of policy techniques emerged and worked to include support and exclude opposition, by which the policy gathered momentum and was made to succeed.

4.1 Introduction

To understand the practices and politics of policy processes it is revealing if the word policy making is taken literally. This entails focusing on how policies are assembled and made to work, that is how practices produce policies. In this perspective, policy making is seen as an ongoing process that traverses the boundaries between politics, bureaucracy and everyday practices and the neat stages of policy formulation, policy decision, implementation and evaluation. Thus, there is not one central decision maker and not one key policy decision, but many dispersed decisions and practices throughout the policy process that influence how a policy turns out. This article develops such a perspective on policy processes, by analyzing the making of the IMT policy in Mexico in the early 1990s, focusing on its emergence, standardization and acceleration.

As part of the neoliberal reforms enacted in Mexico during the Salinas administration (1989-1994), some 2.5 million ha of government irrigation districts were transferred to Water Users' Associations (WUAS) (CNA, 1994a). The main objective of the transfer policy was to reduce public expenditure on irrigation through creating financially self-sufficient WUAS that would pay the full operating costs of the irrigation districts (Gorriz *et al.*, 1995; Johnson, 1997a). Before the transfer program, federal agencies were fully responsible for the irrigation districts and the 1972 water law prohibited user management of the districts. The speed with which the transfer program was carried out surprised donors, consultants, water professionals and researchers alike, especially as handing over irrigation systems to farmers on such a scale had not been attempted before. Consequently, Mexico's IMT program was declared a success in water policy circles and the "Mexican model" became an international showcase for promoting neoliberal irrigation reforms (Gorriz *et al.*, 1995; Groenfeldt, 1998; Rap, 2006).

Mexico's IMT program has received much attention, but very few studies have focused on how the transfer policy was assembled and made to succeed, with the exception of Rap *et al.* (2004) and Rap (2004, 2006, 2007). Rap *et al.* (2004) analyze the historical, political and bureaucratic transformations in Mexico that resulted in the consolidation of a water reform package in the run-up to the Mexican presidential elections of July 1988. The composition of these reforms and the commitment to them emerged from a protracted process of interaction and enrolment between policy actors such as senior hydrocrats, the Mexican presidential candidate and international lending agencies. This reading stands in marked contrast to the conventional narrative on IMT in Mexico, which argues that the transfer policy was a logical and inevitable outcome of the economic crisis of the 1980s

(Gorriz *et al.*, 1995; Groenfeldt, 1998; Johnson, 1997b). Schematically, the policy narrative consists of four arguments:

1. The economic crisis led to a decrease in government funding for irrigation and a reduction in the payment of water fees by water users, resulting in low cost recovery and a widespread deterioration of the irrigation districts.
2. Hence, at the end of the 1980s, the Mexican government became committed to the policy of transferring the irrigation districts to WUAs in order to reduce subsidies and improve the productivity and viability of the irrigation districts.
3. The *Comisión Nacional del Agua* (National Water Commission; CNA) was established as Mexico's sole water authority to implement IMT and other water policies. The CNA designed WUAs as entities with clear responsibilities and boundaries, thus enabling them to function as financially and administratively autonomous irrigation organizations.
4. The WUAs became efficient entrepreneurial entities and performed irrigation tasks better than government agencies, as the WUA leadership was financially and electorally accountable to the water users. WUAs therefore contained the cost of water management while improving operational performance and enhancing the productivity of irrigated agriculture. The IMT policy is consequently considered a success (Rap, 2006).

The stabilization of a particular interpretation of policy-related events is what Mosse (2004: 646) terms a policy model. In most studies the Mexican IMT policy model is presented as a black box that links prescribed inputs with predictable outcomes. The characteristic inputs are believed to be a strong institutional capacity, a solid legal framework and the necessary political will to implement the reforms. Since the inputs are known and success is the outcome, there is no reason to open this black box and study the process of policy making. However, Rap *et al.* (2004) show that the three main inputs that purportedly turned the IMT policy into a "success", were actually the outcomes of a contingent policy process rather than the prerequisites for its emergence and success. Thus, the conventional narrative on IMT in Mexico obscures how the policy was assembled and made to succeed.

This article opens up the blackboxed IMT policy process by focusing on policy making practices as contingent and inherently political processes involving many actors. It does so based on a concern for the reifying and depoliticizing effects of discourses that state that policies are enacted because they are "necessary", "inevitable" and "logical". This renders the hard work and political choices that make policies a reality and their effects invisible. Grounded in the notion that irrigation management is a politically contested terrain (Mollinga, 2001; Mosse, 1997) and that policies embody the governing ambitions of bureaucratic elites, this article shows that there is nothing "logical" or "inevitable" about irrigation policies but that they are produced by particular institutional constellations and are made to succeed or fail through the interactions between policy actors (cf. Mosse, 2004). We explore how the strength of a policy depends on its constituting policy network and stress the negotiated character of policy making. We also focus on the widely held view that politics only enters into the decision making stage and that politicians make policy decisions, while implementation is an administrative activity. We will show that politicians and senior bureaucrats are very actively involved in policy implementation, as an ongoing and interactive process of policy making.

Methodologically, our research posed the challenge of "studying up" (Gusterson, 1997), as participant observation is a research technique that "may not be readily portable to elite contexts" (*ibid*.: 116). This is partially so because informants are often too busy to engage in frequent interaction, or reluctant to disclose sensitive information. In our research "studying up" started with acquiring a detailed ethnographic knowledge of organizational practices of devolved irrigation management and various regional histories of the transfer to WUAs (Rap, 2004, 2007). Building on this, we interviewed some twenty members of the upper reaches of the hydrocracy and other key political figures in the Salinas government as well as staff of international organizations. We also interviewed Mexican water scholars and extensively analyzed policy documents and newspaper articles.

In the following we first engage with different perspectives on policy making to develop our perspective on policy processes. To make our argument we subsequently analyze three episodes of the policy process, namely 1) the emergence of the transfer policy, 2) its assemblage and standardization and 3) its promotion and acceleration. The conclusions draw out the implications of our findings for the debate on the politics of policy processes.

4.2 Perspectives on Policy Processes

Studying how policy processes work challenges deeply held believes about what constitutes the policy process. Although much criticized, the linear model of public policy remains very enduring (Long and van der Ploeg, 1989), partly because it portrays the world as policy makers would like to see it: controllable and amenable to rational analysis (Fischer, 2003). According to the linear model a policy neatly progresses through the sequential stages of policy formulation, political decision, policy implementation and impact evaluation. Central to the linear model is that politics only enters into the decision making stage and that politicians make policy decisions, while implementation is an administrative activity. Grindle and Thomas (1989) and Thomas and Grindle (1990) develop a critique of the linear model by focusing on policy implementation. In their view, the linear model ignores the implementation process, as it takes the policy decision as the critical choice, which then automatically results in implementation. Consequently, policy makers are not much involved or interested in policy implementation or consider it the responsibility of lower-level managers. This has the beneficial side-effect for policy makers that they can always blame failing policies on the implementation process and the responsible officials.

To study the politics of policy implementation, Thomas and Grindle (1990) propose to focus on the conflicts and reactions that a policy generates in implementation and the political and bureaucratic resources that policy makers need to mobilize to deal with such responses in order to sustain the policy (Thomas and Grindle, 1990: 1163). They argue that "implementation is an interactive and ongoing process of decision making by policy elites (political and bureaucratic officials who have decision-making responsibilities and whose decisions become authoritative for society) and managers (implementors) in response to actual or anticipated reactions to reformist initiatives" (*ibid*.: 1165). Central to their analysis is the assumption that the specific characteristics of the policy being implemented will largely determine the reactions of individuals in strategic locations in the public or bureaucratic arena. This can favor, alter or reverse a policy at every stage of the policy process with multiple potential outcomes (*ibid*.: 1163). Examples of such policy characteristics are the duration of the implementation and the dispersion of benefits and costs. This interactive model successfully problematizes policy implementation as a political process involving a variety of policy actors in which an accommodation of interests occurs. We aim to show that this applies throughout the policy making process, with policy actors such as politicians, senior bureaucrats, implementors and "policy subjects" all actively involved in negotiating, aligning, accommodating and anticipating the policy.

While making a strong case for taking policy implementation seriously, in our reading of the interactive model it shares the basic assumption of the linear model, namely that policy formulation and implementation are discrete and sequential activities that are separated by a political and centrally enforced decision. Two other key assumptions of the interactive model are that the characteristics of a policy are determined before the implementation phase and that these characteristics remain relatively constant during implementation. Lastly, underlying the interactive model is a concern that decision makers and policy managers do not sufficiently anticipate the responses and reactions to their policies and that they do not sufficiently develop strategies to overcome opposition. In our analysis of the Mexican IMT policy we will engage with these four assumptions of the interactive model, by highlighting that an ongoing process of policy making involves the adaptation of policy characteristics to mobilize support and exclude opposition. To analyze how policies are made we draw from other perspectives.

Literature based on Foucault's notion of governmentality suggests that policy discourses work to obscure the "instrument-effects" of policies. In his 'The Anti-Politics Machine' Ferguson (1990) shows that the framing of development interventions in a technical policy discourse explains why "[m]any projects fail in terms of their stated objectives while being more successful in terms of unstated agendas" (Gasper, 1996: 166). It works as part of a two-sided process: the ideological effect of such a discourse – depoliticization – disguises its institutional effect, that is the expansion of bureaucratic power (Ferguson, 1990). This can be nicely illustrated with the Mexican IMT policy model. On the one hand, the technical and a-political narrative goes that a new set of policy and institutional arrangements for irrigation management were chosen to solve public budgetary and performance problems. On the other hand, for a policy elite of hydrocrats this 'unexpectedly' led to an expansion of the power and autonomy of the hydraulic bureaucracy. Through its discursive working the IMT policy model obscures these 'instrument-effects' (Ferguson, 1990).

This type of argument has been criticized for its instrumental and functionalist view of the policy process, "which merely replaces the instrumental rationality of policy with the anonymous automaticity of the machine" (Mosse, 2004: 644). However, it does provide a basis for the insight that intervention practices and effects are concealed rather than revealed by policy. In many cases "instead of policy producing practice, practices produce policy, in the sense that actors in development devote their energies to maintaining coherent representations regardless of events" (Mosse, 2004: 640). This proposition turns the understanding of policy processes on its head and points towards conceiving of policy making as a continuous and precarious process. It also points to the importance of practices, to where and how policies are actually made. Policy actors actively seek to legitimize their actions and positions in terms of a coherent policy framework, both in terms of process and content. This works to obscure policy objectives and institutional projects that are not officially part of the policy package, but nevertheless form desired outcomes, while at the same time reducing potential criticism and opposition by de-politicizing the process.

Our analysis of the transfer policy tries to move such policy analysis further. Latour (1987) argued perceptively that the success of a policy is not simply based on an empirically verifiable fact, an argument or a narrative, whose diffusion and standardization result from its own impetus. Success "depends upon the stabilization of a particular interpretation of events, a policy model" (Mosse, 2004: 646). The success of a policy 'is not inherent' or 'given at the outset', but 'arises from the ability to continue recruiting support and so impose' a 'growing coherence on those who argue about or oppose' such an interpretation (Latour, 1996 in Mosse, 2004: 646). The more policy actors are tied up with a particular interpretation, 'the more stable and dominant' the policy becomes (Mosse, 2004: 646). When this happens, "policy closure" occurs, meaning that a strong consensus has been created among different policy actors about the dominant interpretation of a policy and what it entails.[88]

Thus, policy making consists of a continuing process of production and promotion aiming to mobilize and maintain the support of the policy network to which they are directed and which they shape. The more successful the actors involved in the policy process are in achieving policy closure, the less opposition the policy is likely to meet. There are several key, non-linear, elements in the process of policy closure:

- Assembling the policy package through the active alignment and accommodation of different actors and their interests.
- The standardization of a set of policy techniques that make the policy work.
- The active depoliticization of the policy by stressing that there is no alternative, so that opposition can be averted or ascribed to implementation failure.
- The development of a convincing and coherent policy model that ascribes policy content and process to a logical sequence and natural reasoning.
- All this works best if the policy is shown to be a success (cf. Rap, 2006).

How this worked in the case of the IMT policy in Mexico is detailed below.

4.3 Policy Episode One: Emergence of the IMT Policy Idea

On 16 January 1989, shortly after his inauguration as president of Mexico, Salinas created the CNA and instructed it to give priority to the transfer of the irrigation districts (Palacios, 1994). The IMT policy was formally endorsed through its inclusion in the National

[88] The concept of closure was first developed for the analysis of technology development. "Closure (…) means that the interpretative flexibility of an artifact diminishes. Consensus among the different relevant social groups about the dominant meaning of an artifact emerges and the "pluralism of artifacts" decreases." (Bijker, 1990: 95)

Development Plan 1989-1994, released in June 1989. However, much before transfer became an official policy, experiments with handing over irrigation districts to farmers were initiated in El Grullo, Río Mayo, Río Yaqui and Delicias between 1985 and 1988 (Palacios, 1993; van der Zaag, 1992). These experiments formed part of a bureaucratic struggle over the control of the irrigation districts and were important in assembling the transfer policy package and in the definition of several of its characteristics. Río Mayo was one of the first irrigation districts in which this occurred (Palacios, 1993). As part of an irrigation modernization program, engineers from the *Secretaría de Agricultura y Recursos Hidráulicos* (Ministry of Agriculture and Hydraulic Resources; SARH) told water users that the district would be handed over to the users. It appeared that SARH was testing how to organize the hand over and that the district would serve as a model for other districts to follow. In August 1986 the then Minister of Agriculture announced at a meeting in Sinaloa that "steps are being taken to hand over to organized farmers the operational management of the irrigation districts, so that every peso that is paid in water fees will be invested in the same district" (El Financiero, 19 August 1986). This suggests that initiatives on the ground were well underway in 1986. Based on instructions received from SARH headquarters at the start of 1988, the Río Mayo district office began to organize WUAs that would become responsible for the operation and maintenance of the infrastructure.

Another important policy experiment occurred in the El Grullo irrigation district in the south of Jalisco, which strongly contributed to the assemblage of the transfer policy. Farmer involvement was not new in El Grullo, as a team of SARH engineers had experimented with a water user commission from 1980 to 1983, to counter the interests of a local sugarcane lobby (van der Zaag, 1992). The same team of engineers transferred the La Barca irrigation district, in east Jalisco, to a WUA in November 1985, apparently the first in Mexico (Lomeli, 1991). This informal group of hierarchically linked and regionally based engineers (*equipo*) had studied at the University of Guadalajara in the early 1970s and was led by Engineer Velazco,[89] their professor, who was head of the SARH delegation in the state of Jalisco in the late 1980s. This bureaucratic faction within SARH had experimented with organizing farmers in the 1970s and 80s, primarily in Jalisco, and was linked with particular SARH officials at the federal level.

In May 1987, Velazco instructed the El Grullo District Head, who was under him in the hierarchical line but not a member of his informal *equipo*, to put water users in charge of the maintenance tasks of the district (van der Zaag, 1992). Initially the District Head opposed this initiative, but in February 1988 he informed farmer representatives that SARH had a new policy of decentralizing its functions to farmer organizations. He proposed the creation of a WUA and stated that he was authorized to hand over machinery for maintenance tasks. During the first months of 1988 district officials went to the *ejidos*[90] to explain that SARH could no longer maintain the irrigation district and that a WUA could do it better. Delegates were chosen in each *ejido* and by the private farmers. In May 1988 the

[89] Throughout the text fictitious names are used to refer to senior hydrocrats.

[90] Land reform communities created after the Mexican Revolution of 1910. *Ejido* land belongs to the state, with a combination of community (*ejido*) and private (*ejidatorio*) usufruct. Since the amendment of Article 27 of the Constitution in 1992 *ejidatarios* can sell their land.

founding assembly of the WUA was held in the presence of Velazco and a working group was formed to draft internal regulations. In November 1988 the regulations were accepted and the Association's board was chosen (van der Zaag, 1992). Interestingly, all of this occurred in anticipation of the presidential elections of July 1988, while transfer was not yet an official policy.

In early 1989, a new district head was appointed to El Grullo by SARH, which at that time still controlled the irrigation districts. This engineer was an important member of Velazco's equipo and had earlier experience in El Grullo with farmer organization and handing over management tasks in the La Barca irrigation district. He was fully in favor of transfer and gave a strong impetus to it by handing over maintenance machinery to the newly formed WUA. The Association started to train new personnel and carried out large-scale maintenance in the district and received visits from national SARH officials and the governor of Jalisco.

The CNA gained control over the irrigation districts from SARH in September 1989, when the separation between the Irrigation Districts and the Rural Development Districts that had existed before 1985 was re-established. Immediately, in September 1989, the CNA appointed a new District Head to the El Grullo irrigation district now under its control. The CNA incorporated the WUA as its own initiative and changed its regulations to curtail the board's influence and bring it under CNA's control. It also slowed down the transfer process by delaying the transfer of the operation of the irrigation district. The SARH engineers of the "Guadalajara group" remained with SARH and were removed from the irrigation district. They were denied any credits for their work on transfer to the outside world. In CNA documents on transfer, El Grullo is presented as a CNA transfer pilot project, deleting all references to the pre-CNA phase and the SARH involvement.

Important characteristics of what was to become the transfer policy were developed during these experiments. However, these experiments did not take place outside the purview of national level decision makers. Behind this process an element of competition existed between competing bureaucratic groups in SARH with different institutional projects to initiate and hence control the transfer, the irrigation districts and the potential political and institutional benefits that might accrue. This needs to be seen as attempts by bureaucratic groups to further their institutional projects in anticipation of formal decision making, political transitions and upward bureaucratic mobility, in this case the presidential elections of 1988. How the transfer policy idea emerged at the national level in the run up to the 1988 elections is detailed below.

In 1976, the *Secretaría de Agricultura y Recursos Hidráulicos* (SARH) arose from a controversial fusion of the *Secretaría de Recursos Hidráulicos* (SRH; Ministry of Hydraulic Resources) and the ministry of agriculture. As a result, the SRH, a traditionally strong and affluent hydrocracy, lost its financial and bureaucratic autonomy. A group that played an important role in the emergence of the transfer policy was the water resource planners formed as part of the *Plan Nacional Hidráulico* (PNH; National Hydraulic Plan) commission, created by the SRH in 1973 with funding from the World Bank (cf. Rap *et al.*, 2004). During De la Madrid's election campaign in 1982 the water resource planners in coalition with influential civil engineers lobbied for recreating the SRH. The working group that was formed to define water policies for the incoming administration was coordinated by Dr. González-Villarreal in close collaboration with de la Madrid's campaign manager, Carlos Salinas (IEPES, 1982). This attempt by senior hydrocrats to re-establish bureaucratic autonomy did not succeed and they had to accept their subordinate position in SARH for another six years.

During De la Madrid's administration (1982-1988) the team of water resource planners further developed policy ideas favoring water user participation, water pricing and institutional reforms. Several factors combined to precipitate a shift in thinking on the management of irrigation districts. In 1982, the World Bank stopped lending to Mexico, in response to the moratorium on foreign debt payments that the government had declared in August 1982 (World Bank, 1983). The hydrocracy further lost income as cost recovery from 1983 to 1988 in the irrigation districts was very low. Lastly, the irrigation districts were combined with the rainfed districts in 1985 to form rural development districts, which fell under the under ministry of agriculture and operation, entailing that the hydrocracy further lost control over the irrigation districts (Palacios, 1994). This situation was unacceptable to senior hydrocrats and the need to "rescue" the irrigation districts played an important role in the emergence of the transfer policy (Vargas, 1996).

Rap *et al.* (2004) show that the emergence of the policy idea in the 1980s was closely intertwined with three concerns that have historically characterized the hydrocracy, namely bureaucratic autonomy, control over financial resources and control over the irrigation districts. To senior hydrocrats it was clear that new strategies had to be explored to regain bureaucratic autonomy and strengthen the hydrocracy. In 1988, González-Villarreal took the lead in proposing transfer to Salinas and convincing him of the need for an autonomous water authority (the later CNA). Through his good relationships with senior hydrocrats, important political actors and civil engineers in the bureaucracy, academia and construction companies, González-Villarreal represented the broadly shared claim of the hydrocracy for bureaucratic and financial autonomy. When Salinas started galvanizing support from the bureaucracy for his election campaign, this coalition of engineers offered its support to him in return for the creation of an autonomous water agency (van der Zaag, 1992).

In December 1987 and January 1988 the policy idea of transfer was taken up at national meetings on water as part of the election campaign of Salinas. At one of these meetings Salinas asked González-Villarreal his opinion on the risks of transferring irrigation districts to the users. His answer is illuminating:

> The transfer of irrigation districts to users already was an established policy of this administration [of De la Madrid], which has encountered some difficulties. (…) Those of the Northwest and North of the country are prepared to start taking on their own administration. (...). In a program that will be financed in the near future with international credit, called 'modernization of irrigation districts', a subsequent phase after the original construction of the districts is proposed, consisting of the bulk delivery of water to the users and an administration directed by them (...). However, in the districts of the center of the country (...) we believe that the process has to be more gradual. First, some rehabilitation and public investment will be needed, before a first phase of user organization, if the process is to be effective. (IEPES, 1987: 7)

This indicates that González-Villarreal and Salinas had reached a basic agreement on the need for transfer. Interestingly, González-Villarreal proposes a gradual scenario that differentiates the pace of transfer according to a categorization of irrigation districts. Based on the election campaign meetings Salinas endorsed the transfer policy and publicly reaffirmed that the irrigation districts would be transferred, by stating that:

> [W]e need to make great strides in the modernization of the operation of the irrigation districts. The state should not be the only responsible party. More spaces for participation and, therefore, of shared responsibility, should be opened up for the producers. (…) In the countryside, I offer to decentralize, gradually, but firmly, the operation of the irrigation districts to organized producers. (PRI, 1988: 50/53)

Thus, during the election campaign of Salinas, the decision was made to gradually transfer the operation of the irrigation districts to farmers, which later became the slow track transfer program. However, this decision only consisted of a broad statement of intent. The efforts by senior hydrocrats to regain autonomy played an important role in the emergence of the transfer policy. The transfer attained a prominent position on the policy agenda in 1988 as the result of a complex interplay between various (f)actors, including the lack of government funds for the hydrocracy, the crisis in the irrigation districts, the neoliberal agenda of Salinas, persuasion by the World Bank and the need of the hydrocracy for international funding. This first episode shows that the emergence of a policy emanates from political and bureaucratic practices and is driven by the exigencies of bureaucracies and the competing "institutional projects" of bureaucratic factions.

4.4 Policy Episode Two: Assemblage and Standardization of the Policy Package

Our second episode shows that policy characteristics are defined during and by implementation, with policy making taking place "in the field". In 1989 and 1990 the transfer package was assembled in response to a set of experiments, experiences and clashes in the field, through a method of 'trial and error'. These experiences were fed back to the national level, where they were discussed, evaluated and adapted and then brought back to the field. These feedback mechanisms, centrally controlled by the CNA, led to a convergence of dispersed experiences and ideas on how to implement the transfer. The policy techniques forming the transfer package emerged out of this process of centering: a step-by-step procedure for organizing and promoting transfer, as well as organizational and legal devices and documents. Since international advisors from multilateral banks and UN organizations were enrolled from the start, this resulted in substantial funds for rehabilitating the irrigation districts and promoting transfer. The empirical basis for reconstructing this policy episode was gained through interviews with senior hydrocrats directly involved in articulating IMT, the Ph.D. thesis by Pieter van der Zaag (1992) and interviews with several key farmers from Guanajuato and Jalisco involved with IMT in its early stages.

Assembling the policy package

Although transfer had the full backing of the president, in early 1989 the policy was still largely undefined and how the hydrocracy was going to effectuate the transfer was unclear. Several obstacles stood in the way. First, the transfer of irrigation districts to WUAs was illegal under the 1972 water law. Second, the irrigation districts were still part of the rural development districts, over which the CNA had no control. Third, the large majority of the irrigation districts were not financially self-sufficient and efforts to convince farmers to pay modestly higher water fees had consistently failed in the past (Rap *et al.*, 2004). Lastly, many of the irrigation districts were severely run down in the perception of the farmers, making it unlikely that they would willingly accept the infrastructure.

The uncertainties surrounding the transfer in 1989 meant that the hard work of assembling the policy package would determine if it would become a reality or not. At the end of 1988, Dr. Iglesias, a respected irrigation engineer with a long career in the SRH and SARH, was appointed by the CNA and charged with transferring the irrigation districts. When Iglesias and his team started assembling the transfer policy package in 1989 they turned to the initiatives with transfer on the ground as discussed in episode one. Through a careful process of co-optation and appropriation in 1989, the CNA brought these initiatives under its control and used them to assemble the policy package. However, attempts to initiate transfer in other irrigation districts in 1990 and early 1991 encountered opposition from farmers, unions, regional bureaucratic staff and the administrative section of the hydrocracy. This resistance further shaped the development and composition of the policy package, such as a step-by-step procedure to organize and promote transfer as well as particular legal and organizational devices. How the policy package was assembled and how the policy techniques developed and changed along the way is detailed below. The experiences in the El Grullo irrigation district continued to play an important role in this process.

In 1989 and 1990, senior CNA engineers visited El Grullo several times to draw up the new regulations and charter of the Association as well as the Concession Title (*Titulo de Concesión*). At this time the already existing WUA was converted into an '*Asociación Civil*' (civil association). This was necessary as the 1972 water law prohibited transfer. To resolve this issue, a group of CNA lawyers and senior hydrocrats devised an ingenious legal arrangement, which consisted of dividing the districts into irrigation units. Under Article 77 of the 1972 water law, irrigation units are defined as farmer-managed irrigation systems with users' associations fully responsible for operation and maintenance and collecting water fees. Article 78 of the law states that two or more irrigation units could be joined to form an irrigation district (Diario Oficial, 1972). Based on these clauses, the lawyers argued that an irrigation district could be considered to exist of various irrigation units, which were called *módulos* (modules) to prevent confusion (Palacios, 1994). The constitution of WUAs as civil associations was necessary to ensure that the WUAs would fall under the control of the CNA, as "normal" WUAs for irrigation units as provided for by the 1972 water law would fall under SARH (Espinosa de León, 1994). This policy technique was subsequently used in other districts and was legally sanctioned in 1992 when a new water law was enacted.

Another important policy technique developed by senior CNA officials was the alternation of WUA board members. CNA officials were concerned that the elections for board positions would create conflicts between *ejidatarios* (members of *ejidos*) and private landowners, the two landholder categories that were now subsumed under the new organizational label of 'water users'. This issue was resolved by deciding to alternate the posts of president and treasurer of the WUA every three years between representatives of the *ejidatarios* and representatives of the private farmers. This policy technique combined traditionally separate spheres of influence on the WUAs board to represent a newly organized constituency of water users and was crucial for reaching agreements between groups of farmers that had historically been opposed to each other. The *alternancia* (alternation) was established in the charter of the El Grullo association, which served as the basis for the charters drawn up in other associations later on. At the beginning of 1990 the operation of El Grullo was turned over to the WUA and the Concession Title was presented to the WUA in May 1990. On 21 January 1991 president Salinas visited the region and officially handed over the irrigation district to the WUA. This event received much press attention and during subsequent years water users from other districts and national and international visitors frequently came to El Grullo, which the CNA used to demonstrate the benefits and success of its transfer policy.

In El Grullo the transfer process had developed a momentum that was difficult for the CNA to control. However, the CNA succeeded in incorporating this transfer initiative and used it to assemble and promote the transfer policy package. This resulted in the development of crucial policy techniques, such as constituting WUAs as civil associations, alternating the presidency of the WUA and the Concession Titles that detailed the tasks and responsibilities of the WUA and the CNA. These techniques became the core of the policy package and ensured that the CNA regained control over the irrigation districts and the transfer process.

The slow track

Based on the transfer policy package assembled in 1989, the National Program for the Decentralization of the Irrigation Districts was drawn up towards the end of 1989, listing 21 districts to be transferred between 1990 and 1994. These districts were carefully selected based on an assessment by the CNA of the willingness of the users to accept the transfer (CNA, 1991c; World Bank, 1991). Most of them were large, commercially-oriented districts located in the north of Mexico with few infrastructure problems. This could be called the "slow track" transfer program, consisting of three policy objectives: substantially raise irrigation service fees, rehabilitate and modernize the 21 irrigation districts slated for transfer and finalize the transfer of these 21 districts by mid 1994 (CNA, 1991a).

A crucial shove to transfer was given by international lending agencies. In 1988 and 1989 the World Bank sent eight missions to Mexico as part of the loan identification phase of what was to become the Irrigation and Drainage Sector Project. Extensive discussions were held with the CNA concerning the transfer policy, with emphasis placed on the need to reduce government subsidies to the irrigation districts to zero. In December 1991 the loan was approved by the World Bank, to become effective in June 1992. The US$400 million loan was to finance part of CNA's irrigation and drainage investment program for the fiscal years 1991 through 1994, totaling US$1.2 billion (World Bank, 1991). It was the first time that the World Bank financed a government's irrigation program for a specified number of years – termed a time-slice operation in Bank jargon – anywhere in the world. For the Bank this was an important innovation, as it provided much more scope for policy dialogue and flexibility during loan execution. Instead of funding the construction of a specific irrigation system, the time-slice loan made it possible to reassess investment priorities and redirect resource flows. The loan supported the slow track transfer model, targeting 21 irrigation districts for rehabilitation and transfer.

In July 1991 the CNA published an important document, the 'Instruction for the Transfer of the Irrigation Districts to Water Users' (CNA, 1991b). This document detailed how to transfer irrigation districts and formally presented the transfer policy package, some three years after the decision to go ahead with transfer had been made. The publication of these transfer instructions entailed the operational closure of the transfer package. The policy no longer only consisted of statements of intent, but had become a policy with objectives, deadlines and procedures to be followed. The document sets out in detail a step-by-step procedure to transfer irrigation districts, consisting of policy techniques that formed the heart of the transfer policy package. The sequential steps were as follows (CNA, 1991b):

- **Diagnosis**: To initiate transfer a thorough study is made of the district to assess the feasibility of transfer and the willingness of users to participate in the transfer process. This step identifies farmer leaders with the capacity to lead the new user associations and groups that are opposing the transfer.
- **Promotion**: After the diagnosis, a large number of meetings are held with *ejidatarios* and private farmers to promote the transfer program, determine the boundaries of the *módulos* and to appoint the water delegates (*delegados de agua*) to represent "the users" in the assembly of delegates.
- **Constitution of the WUA**: The promotion team helps the water delegates with drawing up the charter of the WUA, constituting it as a civil association and drafting the Concession Title according to CNA formats.
- **Acceptance of commitments**: The WUA signs an agreement in which it accepts the conditions of transfer, the willingness to take over the management of the *módulo* and the commitment to increase fee levels and maintain them to achieve self-sufficiency.
- **Concession Title**: A comprehensive legal contract between the CNA and the WUA is drawn up, which details the rights and obligations of both concerning transfer.
- **Actual transfer of the *módulo***: During an official ceremony the Concession Title is signed and the *módulo* is handed over to the WUA.
- **Parallel operation**: During a period of six to twelve months after the transfer, the CNA manages the *módulo* together with the WUA. After this stage the WUA becomes fully responsible for the management of its *módulo*.

Although the CNA assembled and standardized the policy package in 1989 and 1990, it proved very difficult to convince farmers to accept transfer. Aside from the three irrigation districts where transfer initiatives had already developed their own momentum, the slow track ground to a halt in 1991 in the other 18 irrigation districts listed for transfer. Attempts by the CNA to convince farmers of the benefits for 'water users' to accept the poorly maintained irrigation infrastructure while at the same time agreeing to pay significantly higher water fees and taking on greater responsibilities in the management of the irrigation districts were met with staunch opposition (Espinosa de León, 1998). In addition, many of the CNA field staff, heads of irrigation districts and the administrative section of the CNA strongly resisted transfer as it was clear that they would lose either their jobs or control over financial resource flows. Towards mid 1991 it became apparent that the slow track transfer program was not making much headway as only 17 per cent of the area planned for transfer in 1991 had been transferred. This led to the dismissal of Iglesias, as his approach to transfer, with its emphasis on rehabilitation and the gradual transfer of a limited number of districts, was not working. People close to him mentioned that he had a bureaucratic approach to implementing the transfer package and that the political dimensions of transfer surpassed him. How the transfer policy fared after his dismissal is the subject of our third policy episode.

4.5 Policy Episode Three: Promotion and Acceleration

This third policy episode shows that policies are made to succeed by emergent policy strategies and techniques developed by policy makers to diagnose potential conflict, overcome and exclude opposition and mobilize and expand the networks supporting the policy. Policy implementation is thus a contingent process of ongoing policy making, in which policy characteristics such as the dispersion of costs and duration can change quite drastically after a policy decision has been taken and a concrete policy package assembled. The celebration of the transfer policy, through public events and publicity played a key role in the policy making process, by showing that it was working and a success.

Accelerating into the fast track

In the summer of 1991, Dr. Sánchez, a respected irrigation engineer with a long career in the SRH and SARH, was appointed to manage the transfer program. CNA insiders mentioned that he was very skilful in striking deals with government officials, *ejido* leaders, associations of private farmers, politicians and private sector interest groups. When Sánchez joined the CNA, there were strong pressures to make rapid progress with transfer. The conditions he encountered were more favorable than those his predecessor had faced, as the transfer policy package had already been assembled and an organizational structure was in place for promoting transfer and convincing water users to accept the transfer policy. This paved the way for a more routine-like implementation of the policy package in different parts of the country and facilitated the acceleration of the transfer.

The shifting political tide in Mexico in mid 1991 also strongly influenced the transition of transfer from the slow to the fast track. In August 1991, the PRI regained an outright majority in Congress in mid-term elections. This political victory for President Salinas, who started out as one of the weakest presidents of Mexico (Grindle, 1996), was the major turning point of his presidency. The widely disputed nature of his election in 1988 had motivated Salinas to take a cautious approach. However, the electoral victory of 1991 significantly strengthened Salinas' position and prepared the way for the neoliberal, more authoritarian style of government that characterized the later half of his administration

(Grindle, 1996). In 1992 Salinas succeeded in putting a revision of Article 27 of the Mexican Constitution through the PRI dominated Congress without much opposition or public dissent, although it was widely debated in the press and academic circles (Grindle, 1996). This changed the legal basis of land ownership and the *ejido* system. Later that year the National Water Law, which formed the legal basis of the transfer program, was accepted with even less opposition. Although part of the opposition in Congress walked out during the vote, a public and academic debate on the water law did not ensue. The shifting political tide greatly enhanced the acceleration of the transfer program. A government official speculated that Salinas increased the political pressure on the CNA to increase the rate of transfer and to transfer as many districts as possible before the end of his administration.

As a consequence of these political developments, in the second half of 1991 a strong effort was made to make up for the first part of the year in which actual transfer was negligible and the process had seemed to stall. The efforts of Sánchez and his team concentrated on the Northwest. In the Culiacan district, successful negotiations with important regional leaders led to the transfer of two-thirds of the district. In the Río Yaqui district more than half the district was transferred in the last months of 1991. These two large districts in the Northwest alone sufficed to nearly comply with the area planned for transfer in 1991. Thus, in the last months of 1991, the CNA succeeded in catching up with the original planning agreed with the World Bank, giving a much needed boost to the transfer program.

In early 1992 it became clear that the original idea of transferring only 21 districts over a period of four years was outdated. The transfer in those districts was taking less time than originally planned. This resulted from increasing political pressure from the presidency and state governors, but also from an increased interest of producer groups to take over the *módulos*, as they came to realize that the WUAs would become important actors in irrigation management. The CNA came to believe that the transfer could be accelerated and that the transfer of all the irrigation districts in Mexico was possible. In 1992, transfer activities around the country multiplied, with nearly a million ha being transferred, some 300,000 ha more than originally planned under the slow track. In 1993, the transfer policy was consolidated and some 725,000 ha were transferred, 300,000 ha more than planned under the slow track program. In 1994, the transfer slowed down, because the end of the Salinas' term was approaching – a period in Mexican politics in which the bureaucracy concentrates on the presidential succession – and only around 230,000 ha were transferred.

The acceleration of transfer was strongly linked to the strategic use of the policy package by the CNA to overcome opposition to transfer. The policy package was adapted to local circumstances and demands, with variations in the number of water delegates, the size of a *módulo* or the sequence of the transfer procedure. The CNA increasingly prescribed the parameters within which the policy had to be accepted. After 1991, the enrolment and inclusion of leaders and producer groups granted access to in the transfer negotiations became more selective and directed by the CNA. In the districts, the ground was prepared by using diagnostic studies, followed by a targeted promotion of the transfer. Although the strategies to convince water users to accept transfer varied per district, depending on the level of opposition, the relationships between different power bases and leaders and the condition of the infrastructure, in most cases the CNA exerted political and financial pressure to push through the transfer. The CNA argued that the transfer had to occur, because otherwise the irrigation districts would stop functioning as the government would not renew subsidies. Farmers opposed to transfer were faced with a situation in which they had to agree to the transfer. This led to very complicated situations, both socially and politically, that were often related to existing social, ethnic or political problems. In extreme cases violent protests erupted, such as in the Tula District where the CNA offices were torched. The widespread opposition to transfer among farmers was also dealt with by more subtle means that limited public conflict and open opposition. The CNA used an array of techniques and strategies, partly ingrained in the policy package, to overcome opposition and advance with the transfer. Below, we will review how the *diagnosticos* and selective inclusion in transfer negotiations, the calculated distribution of resources and the promotion of the policy worked in practice, and how this led to the acceleration of the transfer process. The empirical basis for identifying the policy techniques developed and used by the CNA was provided by interviews with senior hydrocrats, Dr. Sánchez and IMTA staff who conducted the *diagnosticos*.

The *diagnosticos*

The *diagnosticos* (diagnostic studies) were applied strategically to evaluate the willingness of different groups of farmers and their leaders to accept the transfer policy. Around twenty-four of these studies were carried out by the *Instituto Mexicano de Tecnología del Agua* (IMTA; Mexican Institute of Water Technology). Influential people in an irrigation district were identified and interviewed, to ascertain their opinion about the transfer: included were leaders of *ejidatarios*, private landholders, political leaders and representatives of producer organizations. Initially, in many districts the mood was against transfer, because of the poor state of the infrastructure and the substantial increase of irrigation service fees that preceded the transfer. Well-informed government officials estimate that, when the CNA started their efforts, around 60 per cent of the farmers in the irrigation districts opposed transfer, 30 per cent were not aware of the changes and only around 10 per cent supported the transfer. In many districts, farmers argued that the infrastructure had to be improved to an acceptable level before they would agree to take over the district.

Through the *diagnosticos* CNA officials also assessed the resistance of two important groups in the irrigation districts, namely field staff and peasant leaders. According to Sánchez, two explicit aims of the transfer program were to "eliminate" the:

- SARH workers' union, which formed a serious obstacle in the water distribution process.
- corrupt *campesino* (peasant) leaders who, through their political influence, systematically hindered attempts to raise the water fees and improve O&M conditions.

These 'corrupt unionized people' were especially found among the *canaleros* (ditch riders), who would lose their jobs, influence and income sources because of the transfer. The SARH unions lost influence because the WUA staff received temporary contracts and could no longer be organized in government unions. As a consequence of the transfer, the number of CNA district staff was reduced in phases. Most of the CNA field staff (around 40,000) were retired and received a pension, others were shifted to other CNA departments and a limited group was contracted by the WUAs on temporary contracts. After the transfer, this number was reduced to around 4,000. The *campesino* leaders were effectively neutralized as a result of the organizational forms that were designed and applied, as very few made it onto the boards of the WUAs. According to a senior CNA engineer the 'corrupt campesino leaders' used to enjoy considerable influence in irrigation management and traditionally opposed substantial fee increases in the districts to defend their constituency. However, their influence was curtailed through the transfer. He pointed out that decisions on the increase of irrigation service fees after transfer are taken in the Hydraulic Committee, where *campesinos* or *ejidatarios* are democratically represented in this body as 'water users' by the presidents of the WUAs. As a consequence of this changed mode of representation, the *campesino* leaders that used to influence such matters no longer had direct influence and were excluded. This specific policy technique and organizational setup thus did the work of politically excluding these opposing forces to the transfer and reducing their influence.

Another policy technique to exclude opposition to the transfer policy was the phased strategy of rotating and removing District Chiefs and State Delegation Heads. This was crucial in neutralizing potential opposition from CNA higher level staff in the Districts and State delegations. The diagnostics served to assess the position of the District Head and his confidence staff,[91] who could potentially slow down the transfer process because it would lead to a serious reduction of their influence. A senior CNA engineer recounts that a generally applied rule was that District Chiefs plus their confidence staff were removed from their posts while a district was being transferred and shifted to other districts in the country, in most cases to be fired at a later stage. This was to prevent the District Chief from resisting the transfer or mobilizing protests against the staff cuts and the reduction of their influence. The official mentioned that this was sort of a 'kamikaze exercise', because the District Chiefs who played an important part in organizing the transfer, in the end also lost their jobs.

An exogenous policy technique originated from international sources of experience. Because the organization of farmers was blocked by irrigation district field staff, the idea to form temporary teams of promoters 'to bypass the blockade of the *canaleros*' was taken up from loan negotiation meetings with the World Bank. The concept of community organizers had been used by the World Bank and USAID in earlier irrigation loan projects in the Philippines and in Sri Lanka during the 1970s and 1980s (Uphoff, 1992; Oorthuizen, 2003). The transfer promoter teams were briefed by the CNA on the transfer strategy and the steps that had to be taken to form a WUA. Subsequently, they went to the assemblies of *ejidos* and associations of private landholders to explain the objectives of transfer, the rights and obligations involved and the need for a substantial fee increase. These promoters encountered the practical problem of having to deal with large numbers of 'water users' organized according to different types of landownership. In response, they developed the idea to appoint water delegates from the *ejidos* and the associations of private landholders in a designated area to form an assembly of water delegates. After the approval of this idea by the CNA, the promoters were given the responsibility to organize the assembly of delegates with a fixed number of delegates from the assemblies of *ejidos*

[91] These higher level bureaucrats cannot unionize and can be dismissed, and thus depend more directly on their superiors for continued employment.

and the associations of private landholders. The assembly of delegates was then given the responsibility of constituting the WUA. For the CNA, the enrolment of an assembly of delegates was much easier and facilitated the political problem of implementing the transfer in a context where a majority of water users opposed it.

Selective inclusion in transfer negotiations

The information produced by the *diagnosticos* served as the starting point for granting selective access to the transfer negotiations. The CNA used them to identify and convince potentially willing leaders and to enroll them to lead the organization of the water users. The *diagnosticos* were also used to evaluate the possibility of reaching agreements between different influential local leaders and groups in order to form an alliance that would support the transfer. The information from the *diagnosticos* was also used to identify the groups and leaders opposing transfer, to then exclude them from the transfer process. The teams sent to the districts to do the *diagnosticos* received detailed instructions from Sánchez, who wanted to know whom to talk to and whom not to, in order for the CNA to negotiate the transfer.

Based on the *diagnosticos* and other sources of information the CNA targeted the politically influential, economically powerful and organized groups in the district. These farmers were generally more favorable to the transfer than the large majority of farmers. They had their power bases in local PRI-affiliated organizations for peasants and for private producers, or in other producer organizations. As such, they maintained close relations with the District, to local PRI politicians and elite interest groups. Their experience with leading producer organizations and their political support for PRI influenced their favorable position towards the transfer. These types of leaders were in many cases enrolled to mediate for 'the water users' and negotiated the transfer with senior CNA officials.

The agreements that were negotiated with these groups often materialized in positions on the boards of the newly established WUAs for their leaders. In socially and politically more complicated districts the CNA negotiated the transfer between different groups by assigning posts to them, or brokered alliances between the different leaders. A policy technique that facilitated such negotiations was to alternate the posts in the WUA board between delegates from the *ejido* sector and delegates from the private landholders. In most cases the majority group was given the presidency for the first period and the minority group the treasury. In this way, an alternation between spheres of influence was secured on the board. This proved to be essential for reaching agreements with and associating different groups of ejidatarios and private landholders, or influential leaders and opposing interest groups. It served to establish alliances between leaders and to unite different groups in one organization.

The selective inclusion in transfer negotiations by the CNA significantly simplified the process of increasing the irrigation service fees and the acceptance of transfer. It also contributed to an acceleration in the formation of WUAs. Initially, the position of the large agricultural entrepreneurs was largely neutral. These producers, who own agro-industrial companies and control large areas in irrigation districts for export agriculture, often maintained close relations with the district staff and already enjoyed a privileged access to water and maintenance services. They were not interested in transfer because they would have to pay higher fees. However, they became convinced of the need to support the transfer, in part because they saw evidence in the first districts transferred that they could acquire direct control over crucial resources, such as water and machinery, and that the WUAs were becoming politically and financially powerful organizations. A senior ex-CNA official explained that at the start of transfer these farmers thought that the machines, offices and irrigation infrastructure were the most important, but that now they think water is the most valuable resource they control. He concluded that nowadays it is more important to become president of a WUA than a member of congress or a mayor (Rap, 2006: 1318). An example is the Alto Río Lerma irrigation district where a group of influential agro-industrial entrepreneurs at first opposed the transfer. After secret negotiations they reached an agreement with the CNA in early 1992, after which they supported the creation of the WUAs in which several of them received the post of president.

As an effect of the selective approach to negotiations, the CNA mainly engaged with popular leaders, local politicians and entrepreneurs allied to the PRI regime. In most *módulos* the board therefore consisted of PRI supporters. Only a limited number of modules were controlled by popular leaders who had links with the opposition. In particular, the left wing party *Partido de la Revolución Democrática* (PRD), the main opponent of the PRI in the 1988 and 1991 elections, had a substantial rural following. However, they hardly gained influence in the districts through the *módulos*. The El Carrizo (076) irrigation district in Sinaloa was an exception. To prevent conflicts in the district the CNA had to negotiate with leaders linked to the PRD and the district was divided in two *módulos* with PRD supporters and two with government allied leaders.

Distribution of resources

Another strategy used by the CNA to manage opposition in the irrigation districts was through 'the calculated distribution of public resources' (Grindle, 1996). This approach made producers focus on the allocation process instead of opposing the transfer itself. By regulating the access to resources and by promising to invest more or less in a district, the CNA selectively enticed and sanctioned user groups according to their willingness to accept transfer. User groups obstructing the transfer process faced the danger of missing out on the resources and projects that the CNA could distribute among the irrigation districts. The promise of rehabilitating the districts and undertaking deferred maintenance in exchange for transfer was frequently made by the CNA. This improved the acceptance of the transfer, although in reality it was difficult to earmark financial resources for this purpose, as the CNA had already committed its financial resources to the 21 irrigation districts included in the original transfer program financed by the time-slice loan. The rehabilitation in those districts that were not part of the loan agreement was done by patching up on a very selective basis. The scarce resources for this purpose were allocated based on the negotiations between the CNA and local producer groups, something that helped to improve the acceptance and the advance of the transfer in those districts. The lack of actual rehabilitation in those districts was partly compensated by giving the modules new maintenance machinery. The allocation of these machines was used to stimulate the producers to accept the transfer.

Promotion of the transfer policy

The acceleration of the transfer process also occurred because of a concerted effort by the CNA to promote and disseminate the transfer policy. Information on the transfer process, largely documents and videos produced by the CNA, was communicated to water users and CNA district staff, indicating how the CNA wanted the transfer process to take place. Besides the centrally coordinated circulation of information, documents and videos, a vast movement of people around the country was organized by the CNA. Teams of engineers and lawyers were sent from CNA headquarters to CNA state and district offices to promote the transfer and assist the promotion teams. In addition, prospective board members and managers of WUAs were taken on trips to already transferred irrigation districts to convince them of the possibilities and benefits of transfer. Irrigation districts such as El Grullo served as exemplars of successful WUAs and were visited by many groups of water users from all over the country. After 1991, the number of available showcases increased, as more districts were transferred. The showcases were carefully selected by the CNA from the more commercial and well-maintained irrigation districts, which added to the positive image of transfer. Also the international interest to visit these exemplary districts increased, as “IMT in Mexico” became a model in itself (Rap, 2006).

A review of the newspapers of the period shows that the press only paid attention to government information on the transfer. In contrast to the ample press attention for the revision of Article 27 of the constitution, irrigation transfer received very little attention. The papers mainly reported on the official transfer ceremonies throughout the country, which were attended by political leaders, party representatives, senior bureaucrats and large crowds. During these large public ceremonies the Concession Title was handed over to WUAs. These public events were often presided over by President Salinas himself, the Minister of Agriculture or the CNA Director. They held speeches on the agricultural and irrigation policy of the Salinas administration, emphasizing the need to eradicate government paternalism and to stimulate the shared responsibility of the water users and the private sector (CNA, 1992a). Local politicians and WUAs presidents thanked the president and his bureaucracy for their beneficial policies. These ceremonies and how they were reported on in the media were crucial for the CNA information campaigns on transfer. Virtually no attention was given to the widespread opposition to transfer in the irrigation districts. As a result, the opposition in different irrigation districts remained isolated, deprived of information from other districts and took place mostly behind the scenes.

Our third policy episode substantiates the finding by Latour (1996) and Mosse (2004) that policies do not succeed under their own impetus, but because they are made to succeed. However, this is not to suggest that strategizing and the targeted enrolment of leaders by the CNA is the full story. Such an overly instrumentalist perspective on policy making suggests that the hydrocracy, and in extension the state, is all powerful, and if it just gets its strategies right can proceed with any policy it desires. While the strategies and techniques developed by the CNA to diagnose and overcome opposition and the increased political pressure to make progress with transfer strongly contributed to the acceleration of the transfer process, the reaction of farmers to the transfer policy was equally important. Thus, the compromises, contingencies and political contests involved in accomplishing the policy (cf. Li, 1999 and Mosse, 2004) highlight the importance of policy making practices in the field. To paraphrase Mosse, policies have to made and sustained socially, in which the networks supporting the policy are expanded through enrolling the necessary actors. Along the way, policy characteristics such as the dispersion of costs and duration can change quite drastically after a policy decision has been taken, as brought out by the acceleration of the transfer policy.

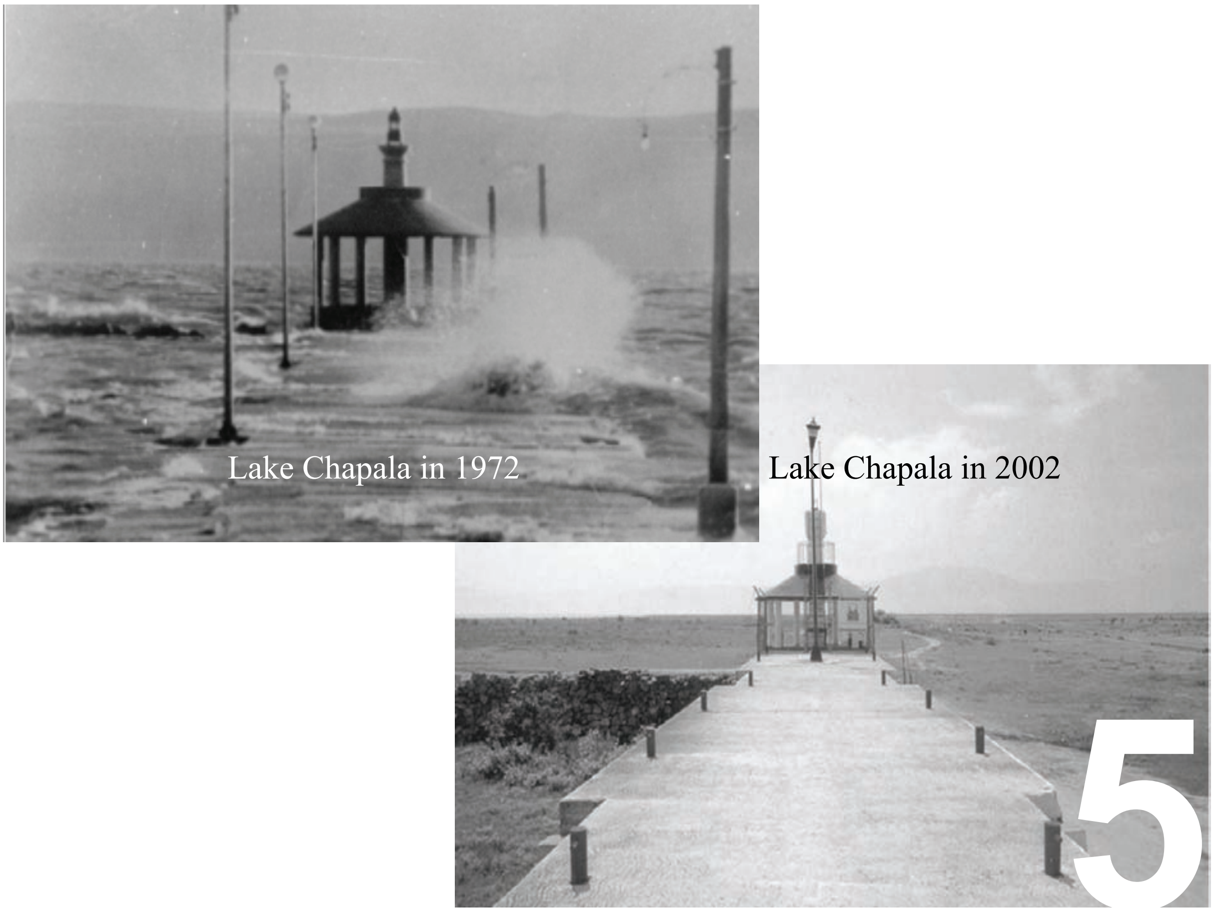
4.6 Discussion and Conclusions

The material presented in this article supports a constructivist perspective on policy processes. Such a perspective widens the definition of policy makers to all the policy actors involved in making a policy. Thus, not only senior government officials, national level politicians or staff of international financing agencies are policy makers, but also the farmers, governors, regional leaders and bureaucracy staff that make or break a policy are policy makers. The strategies CNA officials developed to overcome resistance to transfer reflect the finding by Lipsky (1980) that street-level bureaucrats formulate policies in their daily interactions with clients at the same time as they implement them. However, this insight is applicable to policy making throughout the policy process, and at all “levels”, not just the street or field level. The emergence, production and acceleration of the transfer policy shows that policy making is a continuous and on-going process that is fragile and reversible in practice.

The acceleration of transfer after the summer of 1991 provides interesting insights into how policy processes work. At the time the acceleration was unintended and it was not part of the slow policy track as then defined. Rather, the transfer policy appeared to be quite dead and there was little reason to believe it would shift into the fast track mode. The standardization of the policy package and increased political pressure in 1991 contributed to the acceleration of the transfer. More importantly, the policy techniques developed by the CNA to diagnose and overcome opposition and the more positive reception of the transfer policy by carefully targeted leaders of farmer groups made the acceleration possible. Because of the manner in which the CNA promoted the policy package, it became standardized and blackboxed. Such an objectification of the transfer policy, the process through which it acquired a seemingly tangible existence and legitimacy (Shore and Wright, 1997), contributed to its more rapid dissemination. This affected the terms and means of inclusion of an increasing number of ‘water users’, *módulos* and irrigation districts and the exclusion of resisting groups of policy actors.

This article challenges the distinction between policy formulation and policy implementation and argues in favor of focusing on policy making in a literal sense, to understand how policies are produced. The choice for the term policy making is pragmatic, as it directs attention to how policies are made. However, it may also be problematic, as policy making is frequently used as a synonym for policy formulation. Hence, we propose the concept of policy articulation, understood here as policy making in the literal sense and as a continuous activity, as a more fruitful avenue for understanding policy processes. Policy articulation is defined as the process by which policy actors support, modify, displace and coalesce around a policy idea with as outcome that a policy becomes less or more stabilized and real (cf. Latour, 1999). Bureaucracies play a crucial role in this because of the way policies are institutionalized and made routine. The existence of bureaucratic factions, rivalry and competing institutional projects, results in a continuous stream of new policy ideas. A policy that makes it beyond the ideas stage follows an unstable and unpredictable trajectory through which it becomes either more articulated and dominant, through the enrolment of the necessary actors and the alignment of interests around a policy idea, or not. In the course of assembling the policy package "trials of strength" create and transform the characteristics and meaning of the policy, and lead to the development of policy techniques and a supporting policy network. If this holds together, then policy closure occurs, resulting in the standardization of the policy package and the increasing momentum with which it expands outwards and becomes more "real".

In the case of transfer in Mexico, the policy became more articulated through a process of emergence, standardization and acceleration. This resulted in the hardening and closure of the IMT policy package, the mobilization and enrolment of ever larger groups of policy actors, the exclusion of opposition and an increasing momentum with which it extended outwards and affected an increasing number of groups, institutions and localities. This is not to suggest that all policies follow the same trajectory, but rather that a focus on policy making as a continuous activity brings out that there are different rounds of policy making in the life cycle of a policy. While the presentation of our material could be read to retain the formulation – decision – implementation sequence, it is precisely this linearity that has been questioned. However, our critique of the linear model does not imply that policy processes are unstructured in time, but rather that the phases of a policy are established in the process itself. The value of this approach for studying policy processes is that it clarifies why and when policies are effectuated and how alliances are negotiated through which policies gather momentum.



Bending the Curve Down? Towards Decentralized Water Management in the Lerma-Chapala Basin

This chapter brings together the lines set out in the previous three chapters by analyzing water overexploitation and water reforms in the Lerma-Chapala Basin in the 1990s. It does so by delving into the story behind a powerful image: the fluctuations in Lake Chapala's volumes (see Figure 5.1). Throughout the 1960s and 70s the Lake was full, with volumes fluctuating between 6,000 and 9,000 hm^3. Starting in 1979, the volumes in the Lake started to decline, reaching a low point of 1,860 hm^3 in June 1991. By November 1991 storage had increased to 4,378 hm^3 thanks to good rains and remained above or near 4,000 hm^3 until November 1996. From then onwards storage declined again, hitting a low of 1,844 hm^3 in June 2000. Lake Chapala can be seen as a mirror that reflects the water management decisions taken throughout the Lerma-Chapala Basin (Pérez-Peña, 2004). This chapter looks into this mirror, to find that the fluctuations in Lake Chapala's volumes are as much the outcomes of political and bureaucratic processes as they are correlated to variations in rainfall.

5.1 Introduction

The main issue in closing basins is how to allocate water to competing users, including the environment, while in fully closed basins bending the water depletion curve down is necessary for long-term sustainability. As detailed in section 1.3, the development of hydraulic infrastructure to abstract ever larger volumes of water leads to an S-shaped curve of water depletion. In fully closed basins the level of water depletion exceeds the renewably available water, hence the need to bend the curve down. In the Lerma-Chapala Basin the hydrocracy made an attempt to bend the curve down in the 1990s by defining surface water allocation mechanisms at river basin level and by increasing the participation of state governments and later on of water users in river basin management. This coincided with the reconstitution of the hydrocracy at the national level through the creation and consolidation of the CNA and irrigation management transfer in the irrigation districts. This chapter analyzes these three reforms and asks if they led to a reduction in water overexploitation.

Concern about water quantity and quality issues in the Lerma-Chapala Basin increased in the 1980s with the decline in Lake Chapala's storage. In April 1989, the Mexican president and the governors of the five states in the Basin signed a coordination agreement to improve river basin management and to "rescue" Lake Chapala. In September 1989, a Consultative Council (CC) was formed to translate the agreement into action. The achievements of the CC led to the inclusion of an article in the 1992 national water law on River Basin Councils (RBCS), defined as coordinating and consensus-building bodies between the CNA, federal, state and municipal governments and water users. While responsibility for water management was retained by the CNA, the RBCS were conceived as important mechanisms for negotiation and conflict resolution. The Lerma-Chapala CC became the Lerma-Chapala RBC in January 1993.

On first reading, it appears that the 1989 coordination agreement emerged as a response to the declining levels of Lake Chapala. However, it was also deeply informed by the notion that river basins are the "natural territorial unit for water management" (Moss, 2006: 65). The efforts by the CNA to turn the river basin into a domain of water governance under its control can be read as a "scale-making project", which consists of "rhetorics of scale as well as contests over what will count as relevant scales" (Tsing, 2000: 347). While CNA officials were strongly convinced that the river basin was the most relevant scale for water management, it was only through intensive organizing processes that they could turn it into a scale that mattered. This entailed increasing the role of states and water users in river basin management, but at the same time through its scale-making project the CNA strengthened its position as the main decision-maker at the river basin scale. This chapter explores how the hydrocracy turned the Lerma-Chapala Basin into a domain of water governance and made it into a relevant scale for water management. It suggests that this turns on credibility, legitimacy and salience. The credible argument that the river basin is the natural unit for water management lends legitimacy to the efforts by hydrocracies to manage water at this scale. In addition, the salience of the problems to be addressed at the river basin scale and the appropriateness of the river basin scale for addressing these problems, influences whether the river basin becomes a domain of governance.

The structure of this chapter is complex, as it covers a range of issues and pulls together the lines of argument of the previous three chapters. Section 5.2 summarizes the development of water overexploitation in the Basin by discussing the fluctuations in Lake Chapala and relating these to rainfall levels and the development of hydraulic infrastructure. Section 5.3 analyzes the efforts by the CNA in the early 1990s to turn the Basin into a domain of water governance. It shows that this resulted in stronger CNA control over water use and strengthened the position of the hydrocracy in the Basin. Section 5.4 focuses on the reordering of irrigation management through IMT in the Basin, showing both the diversity of transfer experiences in the Basin and the changing relationship between WUAs and the hydrocracy. Section 5.5 analyzes how shifts in political and bureaucratic relationships between 1995 and 2000, in which the PRI-regime was losing its hold on power and states and water users started to play a more active role in river basin management, complicated CNA's scale-making project. A decline in CNA's control over water use, combined with lower levels of rainfall, resulted in a marked decline in the volumes stored in Lake Chapala. Thus, while the river basin had become a legitimate scale for water governance for the hydrocracy, state governments and water users, this did not lead to a reduction in water overexploitation. The chapter concludes that the centralizing tendencies in the hydrocracy were stronger than the policy current aiming at decentralized water management and that this frustrated attempts to bend the curve down based on mutual collaboration and an equitable approach to the curtailment of primary water use.

The chapter ends in August 2000, when a revised surface water allocation agreement was signed by the RBC. Chapter 6 further analyzes user representation in river basin management, while Chapter 8 continues the story of surface water allocation in the Basin from 2000 to 2006. The material presented in this chapter was collected from 1998 to 2006 through interviews, attending RBC and other water meetings and an extensive analysis of policy documents and literature.[92] During this period, I wrote several papers together with others that served as a basis for this chapter (see Wester *et al.*, 2001a, 2001b, 2004b, 2005, 2007, 2008). The material presented here draws on these publications, but has been reworked to extend the analysis.

5.2 The Second Lake Chapala Crisis

The articulation of new water policies and the bureaucratic struggles analyzed in Chapter 3 coincided with the start of the second Lake Chapala crisis in the early 1980s. After two decades of higher than average rainfall, Lake levels started to decline in 1979, dropping from around 7,000 hm^3 to 2,000 hm^3 by 1990. Since the early 1980s, water in the Basin had been over-committed, with demand exceeding supply in all but the wettest years.

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92 Much of this research was done in collaboration with Gabriela Monsalvo, Sergio Vargas, Paula Silva, Gabriel Torres and Eric Mollard. From 2003 to 2005, I also supervised three MSc students (Hans Paters, Jaime Hoogesteger and Ruben Borge) whose research provided important insights for this chapter. Lastly, I am indebted to Chris Scott, Martin Burton and Sergio Ramos, with whom I conducted research in 1999 and 2000. I gratefully acknowledge their permission to use our collaborative research findings in this chapter, but take full responsibility for its content.

Figure 5.1. Lake Chapala storage volumes and inflows from 1934 to 2001

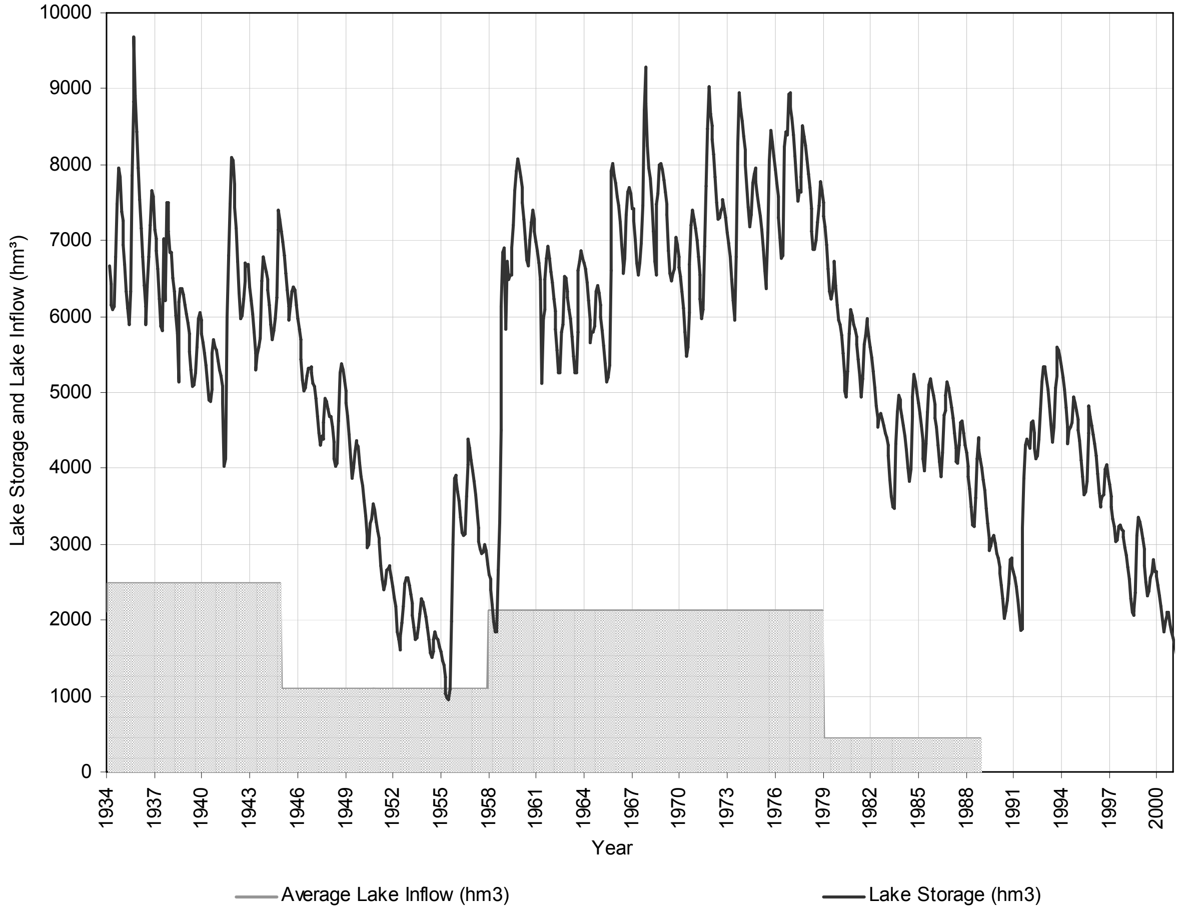


Table 5.1. Overview of key water indicators in the Lerma-Chapala Basin

Period	Original (1934-1944)	Dry (1945-1957)	Wet (1958-1978)	Normal (1979-1988)	Latest (1989-2001)
Rainfall (mm a^{-1})[a]	683	626	764	705	679
Inflow to Lake Chapala ($hm^3 a^{-1}$)[b]	2,485	1,085	2,127	429	n.a.
Inhabitants (thousand of people)[c]	2,500 (1940)	3,000 (1950)	4,500 (1970)	8,700 (1990)	11,000 (2000)
Irrigated area (ha)[d]	155,000	214,000	508,000	675,000	689,000

Sources:
[a] de P. Sandoval (1994) for the periods original, dry, wet and normal and IMTA (2002a) for precipitation from 1989 to 2001.
[b] de P. Sandoval (1994) up to 1988.
[c] de P. Sandoval (1994) for 1940, 1950, 1970. Census figures for 1990, 2000 from CNA/MW (1999).
[d] Estimates of actual irrigated area, averaged for the period, from CNA/MW (1999).

Although average rainfall from 1990 to 2001, at 679 mm a^{-1}, was only 6% below the historical average of 722 mm a^{-1} (IMTA, 2002a), the amount of water used in the Basin exceeded annual renewable water during this period, with no allocations for environmental flows. Groundwater was also being mined (see Chapter 7), with an estimated annual groundwater deficit of 1,336 hm^3 (IMTA, 2002b: 26), while the consumptive use of surface water exceeded river runoff in all but the wettest years. This section portrays river basin closure and reviews the continued development of hydraulic infrastructure in the Lerma-Chapala Basin from 1976 to 1988.

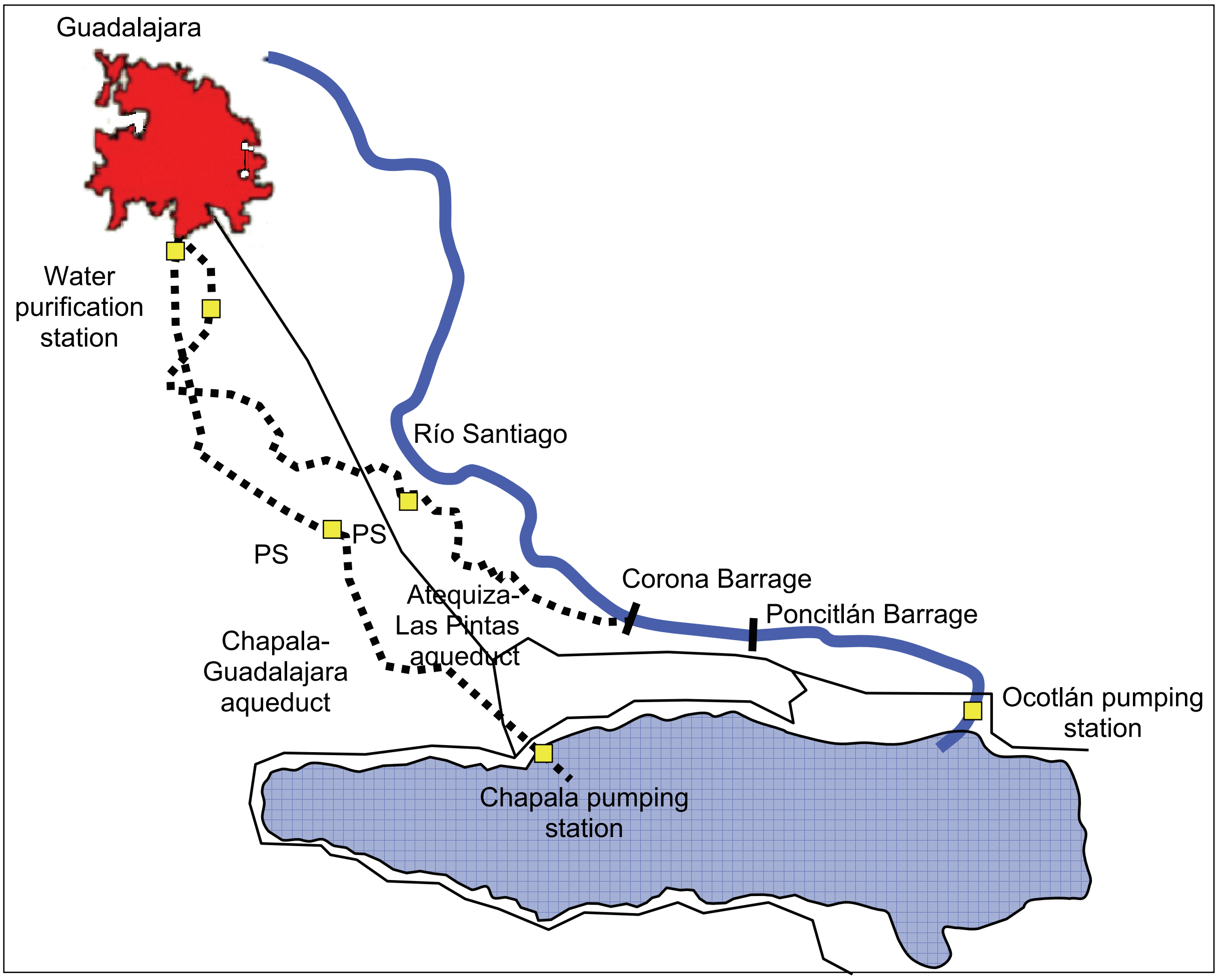
The fluctuations in Lake Chapala portray basin closure in the Lerma-Chapala Basin. Figure 5.1 presents these fluctuations from 1934 to 2001 and relates them to developments in the Basin (presented in Table 5.1). The Lake volumes were drawn from unpublished CNA data and cross-checked with de Anda *et al.* (1998). Starting in 1945, water storage in the Lake declined sharply, from an average of 6,429 hm^3 between 1935 and 1945 to 954 hm^3 in July 1955, as analyzed in Chapter 2. During this period around 214,000 ha were irrigated in the Basin, mainly with surface water, and the constructed storage capacity in the Basin was 1,628 hm^3. However, because of good rains towards the end of the 1950s the Lake recuperated and storage averaged 7,094 hm^3 from 1959 to 1979.

In 1979, a second period of decline set in. By this time, constructed storage capacity in the Basin had increased to 3,840 hm^3 and the average irrigated area had grown to around 680,000 ha, with a significant increase in groundwater irrigation (see Chapter 7). Although abstractions from the Lake for hydropower generation had ceased, Guadalajara City started drawing large amounts of its urban water supply directly from the Lake. The combination of these factors, plus around 8% less rainfall (705 mm from 1979 to 1988) than in the preceding wet period (764 mm from 1958 to 1978), resulted in declines in the Lake level, from 7,771 hm^3 in November 1978 to 2,029 hm^3 in June 1990. After a modest recuperation in the early 1990s, Lake levels started declining again. Between October 1993 and January 2001 the volume of water stored in Lake Chapala dropped from 5,586 hm^3 to 1,764 hm^3 (68% to 21% of maximum storage), the lowest level measured since 1955.

Table 5.1 provides details of the water situation in the Basin, showing the sharp drop in river inflows to Lake Chapala since 1979. While average rainfall from 1979 to 1988 was higher (705 mm) than from 1934 to 1944 (683 mm), the inflow to Lake Chapala was markedly lower. Unfortunately, the river inflow data from 1989 to 2001 are not available, but the continued decline in Lake Chapala and the lower rainfall suggests they would be even lower. Thus, the second period of Lake decline was due to a combination of less rainfall and the over-extraction of water for urban and agricultural use. Between 1930 and 2000, the irrigated area in the Basin increased fivefold according to official statistics, and possibly by a factor of 7.5, while population also increased fivefold during this period. The resulting levels of blue water depletion have made the Basin very sensitive to variations in rainfall, with lower than average rainfall directly translating into reduced inflows to the Lake. Between 1980 and 2001, the Lake experienced a negative annual storage change of 191 hm^3 on average, but in years with above average rainfall, such as 1991, the volume of the Lake increased markedly. The increased storage capacity in the Basin, through the construction of dams, is the primary reason for the reduced inflows to Lake Chapala.

Although the 1960s and 1970s were the heyday of dam construction in the Basin, with storage capacity more than doubling from 1,817 hm^3 in 1959 to 3,840 hm^3 in 1979 (de P. Sandoval, 1994), the 1980s also saw some continued dam construction. Important was the raising of the Solís dam, with the largest reservoir in the Basin, which was completed in 1982. Constructed between 1939 and 1949 in Guanajuato to store water for the Alto Río Lerma irrigation district, the Solís dam had been designed with a maximum capacity of 800 hm^3, of which 50 hm^3 was dead storage, 250 hm^3 was to be reserved for flood control and the remaining 500 hm^3 was for irrigation. However, the reservoir was filled to maximum capacity whenever possible after the dam was completed, for all the storage to be used for irrigation. This resulted in a catastrophic failure of the dam's spillway in 1958, a year of heavy rainfall, and severe flooding in the Bajío. Emergency measures were taken to restore the spillway, but throughout the 1960s and 1970s the reservoir could not be filled to maximum capacity. In 1976 work started on raising the dam height and strengthening its curtain. Completed in 1982, this work raised the storage capacity to 1,200 hm^3, of which 250 hm^3 was to be reserved for flood control and 50 hm^3 for dead storage, leaving 900 hm^3 for irrigation. Together with some minor dams, this increased storage capacity in the Basin to 4,499 hm^3 by the end of the 1980s, nearly equivalent to the annual average surface water runoff in the Basin of 4,908 hm^3. The strengthening and elevation of Solís dam coincided with the start of the second Lake Chapala crisis and was one of the main causes of the crisis.

Figure 5.2. Lake Chapala – Guadalajara Aqueducts



Source: adapted from Guzmán (2003: 265).

Another important development that affected Lake Chapala's storage volumes was that Guadalajara increased its withdrawals from the Lake in the 1980s for its urban water supply. Already in 1953, at the height of the first Lake Chapala crisis, work started on developing the Atequiza-Las Pintas aqueduct to withdraw water from Lake Chapala for Guadalajara (see Chapter 2). The starting point of this first work was the Ocotlán pumping station, which could pump water from Lake Chapala into the Río Santiago if Lake levels were too low for water to flow naturally into Río Santiago (see Figure 5.2). Due to the high Lake levels in the 1960s and 1970s the Ocotlán pumping station was not used and water flowed from the Lake via the Río Santiago to the Atequiza canal by gravity, from where it was pumped to Guadalajara. In 1982, under the brief leadership of Francisco de P. Sandoval, the Guadalajara municipal water supply agency obtained the Ocotlán pumping station from CFE and refurbished it. This proved a propitious move for Guadalajara, as in 1982 the Lake levels dropped to such an extent that water no longer flowed by gravity into the Río Santiago (Guzmán, 2003).

In the 1980s a 42 km long pipe aqueduct was built to directly connect Lake Chapala with Guadalajara and a pumping station was built on the shores of Lake Chapala with a capacity of 7.5 m^3/s. This aqueduct starting functioning in 1992 and was intended to replace the Atequiza-Las Pintas aqueduct that flowed for 90 km in open canals and thus suffered from pollution, infiltration and clandestine withdrawals. However, Guadalajara has continued to use both aqueducts and withdraws more than its concessioned volume of 240 $hm^3\ a^{-1}$ from Lake Chapala. Guzmán (2003: 301) estimates that Guadalajara withdraws around 450 $hm^3\ a^{-1}$ from Lake Chapala, while an additional 130 $hm^3\ a^{-1}$ are withdrawn from the Lake for irrigation. These withdrawals are significant, as the average annual storage change in Lake Chapala from 1980 to 2000 was -191 $hm^3\ a^{-1}$. However, the Jalisco state government has consistently blamed the desiccation of Lake Chapala on excessive irrigation withdrawals upstream in Guanajuato and claims that it has reduced its Lake withdrawals. How the conflict between Guanajuato and Jalisco worsened is detailed in Chapter 8, but first this chapter discusses how the fluctuations in Lake Chapala intertwined with the efforts by the hydrocracy to turn the Lerma-Chapala Basin into a domain of water governance.

5.3 The Rise of the Lerma-Chapala River Basin Council

This section explores how the Lerma-Chapala Basin was turned into a domain of water governance in the early 1990s through the network building efforts and policy articulation strategies of CNA officials. The dissolution of the river basin commissions in Mexico in 1976 and the creation of SARH entailed the demise of the golden era of the hydrocracy and its efforts to harness water resources through a river basin development approach. However, the focus on river basins was kept alive in the PNH commission, where a group of water resource planners developed policy ideas on decentralized river basin management. In the second half of the 1980s several factors came together that improved the policy likelihood of establishing a bimodal form of river basin management in the Lerma-Chapala Basin, consisting of technical river basin agency and a river basin council. These included the decline of Lake Chapala, the larger policy current to reconstitute the hydrocracy and the election of Salinas in 1988.

Building momentum for reform: the reconstitution of the hydrocracy

The water reforms in the Lerma-Chapala Basin in the 1990s were strongly linked to the creation and consolidation of the CNA at the federal level. Through the unification of all water responsibilities in one federal agency, the hydrocracy was set to regain a large degree of autonomy. Shortly after Salinas became president he created the CNA as a deconcentrated agency of SARH and designated Dr. González-Villarreal as its Director General (DG).[93] Although the hydrocracy remained a part of SARH, there is a distinct difference between an under ministry and a deconcentrated agency, which entailed that the CNA could function with relative autonomy. In Mexico, a deconcentrated agency is a semi-autonomous federal agency with the power to set its own policies, levy taxes and fines, issue permits and sign contracts. This contrasts with decentralized public agencies and under ministries, which depend on their mother ministry for approval of policies and decisions. Thus, the CNA had the authority to develop its own policies and was largely independent of SARH. Also, González-Villarreal directly interacted with the president, with little interference by the SARH minister. He appointed many of the water resource planners that had worked under him in the PNH commission and later in SARH to key positions in the CNA, thus creating a group of subordinates that he could trust and with whom he had unambiguous working relations.

In its charter, the CNA was charged with defining the nation's water policies, granting water concessions, establishing norms for water use and water quality and integrating regional and national water plans. To carry out its mandate, the CNA was divided into four levels: federal headquarters, regional offices, state offices and irrigation district offices (see Annex B for the detailed responsibilities of these four levels). At the national level the CNA consisted of a General Directorate and four Sub-directorates: Hydro-agricultural Infrastructure, Urban and Industrial Hydraulic Infrastructure, Water Administration and Planning and Finances. At the regional level, the CNA was initially organized in six administrative-hydrological regions based on river basin boundaries: Northwest (*Noroeste*), North Center (*Centro Norte*), Northeast (*Noreste*), *Lerma-Balsas*, *Valle de Mexico* and Southeast (*Sureste*). This was expanded to 13 regions in 1996. These regional offices were delegated responsibilities from the national level and it was foreseen that they would develop into decentralized river basin agencies. Responsibilities for water management at the state level were more diffuse, where the CNA state and irrigation district offices functioned under the supervision of the regional offices as well as federal headquarters. The role of state governments in water management remained limited in the 1990s to regulating and supporting municipal water utilities and it was only in the late 1990s that State Water Commissions started to take on a larger role (as detailed in Chapter 7 for the Guanajuato State Water Commission).

The officially stated aim of unifying all government responsibilities related to water in the CNA was to create the necessary conditions for moving towards sustainable water management (CNA, 1990a). The position and autonomy of the CNA as the sole federal water authority was consolidated with the promulgation of the *Ley de Aguas Nacionales*

[93] The CNA was the first new federal agency created by Salinas, but it took most of 1989 to establish the CNA as the hydrocrats had put their effort into developing a charter and regulations for a ministry instead of a deconcentrated agency (see Chapter 3).

(Law of National Waters) in December 1992 (CNA, 1992b). This law calls for an integrated approach to the management of surface and groundwater in the context of river basins, which it considers as the ideal unit for the planning, development and management of water resources. It also promotes decentralization, stakeholder participation, better control over water withdrawals and wastewater discharges and full-cost pricing. Under the new water law, the CNA was made the country's sole water authority, charged with managing water resources both qualitatively and quantitatively.

This 1992 water law also describes water allocation procedures based on the proportional appropriation doctrine contained in Mexico's constitution, where surface water is defined as national property placed in the trust of the federal government. Under this doctrine, water use concessions to use a certain quantity of water are issued to users by the state, although the quantity of water that may be used in any year can be adjusted to reflect water availability. As the custodian of the nation's water, the federal government through the CNA has the right to concession surface water-use rights to users for periods ranging from 5 to 50 years. In the irrigation districts and units the concessions are granted to WUAs and not to individual water users. Although the concession titles set out the volume of water a concession holder is entitled to, the CNA may adjust the actual quantity a concession holder receives annually to reflect water availability, with priority accorded to domestic water use. Once issued, water concessions need to be registered in the *Registro Público de Derechos de Agua* (REPDA; Public Register of Water Rights), maintained by the CNA. After registration the concessions become fully tradable within river basins, although the CNA needs to be notified of the trade and needs to approve it (Kloezen, 1998).

With the creation of the CNA as a deconcentrated authority and the powers it was granted by the 1992 water law, the hydrocracy achieved its objective of reestablishing a large degree of bureaucratic autonomy. The financial autonomy of the hydrocracy was also strengthened through the creation of a "financial system for water". Under this system, the CNA gained direct control over a range of income sources as it became responsible for "the collection and administration of the resources originating from the payment of rights for the use of the nation's waters. According to the law all revenues generated by these rights are specifically allocated to the CNA" (CNA, 1994b: 50).[94] Through this legal provision the CNA succeeded in concentrating the income flows related to water use, such as water tariffs for the use of the nation's waters (industry and service sector), bulk water delivery to the urban sector (drinking water levies) and irrigation service fees paid by the WUAs. The income from the collection of water tariffs and fees during CNA's first six years increased rapidly—from 498.6 million pesos in 1989 to 2,341.3 million pesos in 1994—thereby increasing CNA's degree of financial self-sufficiency from 51% in 1989 to 92% in 1994 and strongly reducing its dependency on the federal treasury (CNA, 1994b). The CNA had direct control over these funds and thus a large degree of financial autonomy. In addition, new international loans for the irrigation and drinking water sector were obtained by the CNA, further strengthening its financial position. Thus, in just four years, from January 1989 to December 1992, the hydrocracy succeeded in strengthening its

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94 "la recaudación y administración de los recursos originados por el pago de los derechos generados por el uso o aprovechamiento de las aguas nacionales. Por disposición de ley, se da destino específico a la CNA respecto de todos los ingresos por estos derechos."

bureaucratic and financial autonomy at the national level and regaining control over the irrigation districts through IMT, as outlined in Chapters 3 and 4. In this period it also focused on turning river basins into a domain of water governance, starting with the Lerma-Chapala Basin.

From Commissions to Councils: river basin management revisited

As detailed in Chapter 2, Mexico has a long tradition in using the river basin as the territorial unit for water development. The integrated river basin development focus was largely lost during the SARH era, with the dissolution of the river basin commissions in 1976, but reemerged in a new form in the late 1980s in the Lerma-Chapala Basin. The drying up of Lake Chapala in the 1980s and the contamination of the Río Lerma influenced this reemergence. According to Mestre, CNA's regional manager for the Lerma-Chapala Basin from 1989 to 1997:

> A wide-ranging water diagnosis existing by mid-1989 clearly presented four capital problems in the Lerma River Basin: *scarcity, as well as unsuitable water allocation, pollution, inefficiency of water use, and environmental depredation*. To turn the tide, it became clear that it would be insufficient *and imprudent* to maintain that the federal government was solely responsible for this chaos and for its solution or mitigation. Many groups and individuals, both from public and private sectors, water users, and society itself, should become involved. (1997: 144; emphasis in original)

Shortly after Salinas became president, the federal government and the governments of the five states falling in the Basin signed a coordination agreement in Chapala on 13 April 1989.[95] This agreement set out four objectives to improve water management in the Basin, namely (1) control and regulate surface and groundwater use and allocate water fairly among users; (2) improve water quality by treating municipal and industrial effluents; (3) increase water-use efficiency; and (4) conserve the river basin ecosystem and protect watersheds (SARH, 1989a). The signing of the Chapala coordination agreement was an important step in turning the Lerma-Chapala Basin into a domain of water governance. However, it did not just drop from thin air, but was the outcome of intensive organizing processes by a segment of water resource planners in the hydrocracy.

The concept of river basins as the ideal unit for water management, and not only for water resources development, started to gain ground in the hydrocracy in the 1970s, especially in the PNH commission. The first *Plan Nacional Hidráulico*, published in 1975, contained proposals, drawing on experiences with regional water management in France and England, to reorganize the SRH by decentralizing water management and development functions to thirteen *Organizaciones Regionales del Agua* (ORA: Regional Water Organizations) based on river basin boundaries (Herrera-Toledo, 1997: 27). It was foreseen that the ORAs would become responsible for regional water resources planning

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[95] The full title of the agreement is *Acuerdo de Coordinación que Celebran el Ejecutivo Federal y los Ejecutivos de los Estados de Guanajuato, Jalisco, México, Michoacán y Querétaro para Llevar a Cabo un Programa de Ordenamiento de los Aprovechamientos Hidráulicos y el Saneamiento de la Cuenca Lerma-Chapala*. In the remainder of the text it is referred to as the Chapala coordination agreement.

and development, project implementation and the setting and collection of water use tariffs and effluent charges (SARH, 1977: 82). The creation of SARH in 1976 laid waste to these plans, but the PNH commission further developed ideas on river basin management.

Created in 1976 as a separate planning commission falling under the SARH under ministry of planning, under the leadership of González-Villarreal the PNH commission focused on developing a second National Hydraulic Plan. For planning purposes the commission divided the country into thirteen hydrologic regions based on river basin boundaries and grouped theses into four zones, including the Zona Centro, covering the Balsas, Lerma and Mexico Valley regions, for which Eduardo Mestre was appointed as director. The second PNH, published in 1981, recommended that "in the Mexico Valley and Lerma river basins, [it is necessary to] regularize the existing water use systems by carrying out a strict control of the concessions, assignations, permits and bans, as well as [to] study alternative and more efficient ways to achieve comprehensive water management" (SARH, 1981: 105).[96] The emphasis on achieving comprehensive water management as opposed to comprehensive water development is important and was to form an important basis of the Chapala coordination agreement. The other regional strategies listed in the second PNH for the Zona Centro are also strikingly similar to the objectives of the 1989 coordination agreement. The reason for this becomes apparent by tracing the institutional trajectories of the policy ideas concerning river basin management and the water resource planners working on the Lerma-Chapala Basin.

In 1982, González-Villarreal became the SARH Deputy Minister of Hydraulic Resources (see Chapter 3) and initiated activities to strengthen the position of the hydrocracy in SARH. Although the hydrocracy largely lost its control over the irrigation districts in 1985 when they were merged with the rainfed districts to form rural development districts,[97] González-Villarreal did succeed in pushing through a major reorganization of SARH in 1985. This consisted of creating six regional offices, based on hydrological boundaries, that fell under the under ministry of hydraulic infrastructure and concentrated all water related activities at the regional level. At the national level SARH was also reorganized, with all water-related responsibilities, except for the irrigation districts, placed under the under ministry of hydraulic infrastructure. For the Lerma-Balsas region the regional office was opened in Querétaro, with Eduardo Mestre appointed as regional manager. In 1986 the PNH commission was transformed into the *Instituto Mexicano de Tecnología del Agua* (IMTA) and many of the PNH commission staff were transferred to the new regional offices, or directly to the under ministry of hydraulic infrastructure. This regrouping of the hydrocracy in SARH laid the groundwork for what was to become the CNA.

By 1988, the water resource planners based in the Lerma-Balsas regional office had developed advanced plans for reinitiating river basin management in the Lerma-Chapala Basin. This was based on their work in the PNH that included a review of river basin management in France, Spain and England and the lessons learnt from the dissolution of

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96 "en las cuencas del valle de México y del río Lerma, regularizar los aprovechamientos hidráulicos existentes llevando para ello un estricto control de las concesiones, asignaciones, permisos y vedas, así como estudiar formas alternativas y más eficientes para el manejo integral de las aguas."

97 As detailed in Chapter 3, the rural development districts were largely run by agronomists.

the river basin commissions in 1976. One of these lessons was that the commissions had become too powerful and isolated from other government agencies and hence that the participation of a wider range of government agencies and water users in river basin management was necessary. Based on the French bimodal model of river basin management,[98] these water resource planners set out to form a similar structure in the Lerma-Chapala Basin. The opportunity to do so arose with the election campaign of Salinas and with the mounting social and political pressures to rescue Lake Chapala.

At the start of his campaign Salinas stood very low in the opinion polls and it was not at all certain that he would win the elections as the hegemony and legitimacy of the PRI regime were seriously threatened in 1988. This was related to the widespread resistance to the neoliberal policies of the de la Madrid administration and the reorganization of the political left that had succeeded in establishing alliances with breakaway sections of the PRI who disagreed with PRIs neoliberal and technocratic turn in the 1980s. Under the leadership of Cuauhtémoc Cárdenas, a former PRI member and son of Lázaro Cárdenas, the left stood a good chance of winning the elections, despite the strong support of the state apparatus for Salinas's campaign. During the campaign, water became an important issue and this motivated Salinas to make bold proposals. A CNA official remembers:

> In 1988, Salinas de Gortari was named as the PRI presidential candidate. At that time his campaign started very slowly. (…) Someone said to Salinas de Gortari: Listen, do you want to lift up your campaign, at least here in the center [of the country]? If so, go stand on the shores of Lake Chapala and promise them that you'll save the Lake. (…) Salinas arrives, an impressive event is organized for him on the pier of Lake Chapala and the man promises that, if he becomes the president of the Republic, he will recuperate Lake Chapala for the Jalicienses, the Michoacanos and for the country. (…) It was a campaign promise, in 1988. In 1989 the man had already won the presidency and he was mounting his horse. He returned the same day but a year later to the Lake. By that time, we, the regional office of hydraulic infrastructure for the center [of the country], already had a proposal (…), we already had a program, we had had a year to prepare it; this is the famous agreement of the 13th of April 1989. (…) This agreement set out four objectives (…) for each one of these objectives we had a set of actions and a coordination agreement but we said: we can't eat the cake in one bite, can we? What is the most important now? Water treatment and regulation. Why? Because this is what Salinas had committed to. The 13th of April he arrives, signs the coordination agreement and says: gentlemen, from this moment onwards that which I promised you has started; in one year I will come here and every year I will return here to evaluate progress. The agreement was signed with the five states as a coordination agreement and it was signed fast track. We need to remember who the governors were at that time. They were five PRI governors. One telephone call from the ministry of internal affairs was sufficient:

98 For the six large river basins in France, Basin Committees, consisting of representatives of water users, municipalities and central government, and Water Agencies, the executive arm of the Basin Committees, have been functioning since the 1960s to formulate and implement long-term water management plans. The Water Agencies are funded through water taxes voted on by the Basin Committees and are accountable to the Committees, but fall under the Ministry of the Environment (Huppert and Hagen, 1999; Tardieu, 2001).

> gentleman, we'll see each other there to sign an agreement. The agreement was signed very quickly, without problems. [99]

This quote shows how the group of water resource planners in the Lerma-Balsas regional office created a policy platform for realizing their ideas on river basin management. Based on political speculation, they aligned themselves with Salinas and then prepared the coordination agreement when it became clear they had his support. This group was strongly linked to González-Villarreal and was hopeful in 1988 that a new water ministry would be created after the elections and that the bimodal model of river basin management would be implemented. However, they were also aware that they needed to take things one step at a time and that a limited coordination agreement with the backing of the president was a good first step. That the governors of the states in the Basin were all from the PRI made it relatively easy for the president and the CNA to get the coordination agreement signed. At the signing ceremony, Salinas instructed the CNA to create a mechanism to execute the coordination agreement, to ensure that there would be progress when he returned a year later. This led to the signing of a second coordination agreement on 1 September 1989 to create a *Consejo Consultivo de Evaluación y Seguimiento* (CC; Consultative Council for Monitoring and Evaluation), consisting of the minister of SARH as its president, the DG of CNA as its secretary and the governors of the five states and several federal ministers as its members (SARH, 1989b). The CC instructed CNA's regional office to define a workplan and agreed to meet in one year's time to evaluate progress. Through these two agreements CNA's mandate to manage water in the Basin was strengthened, as well as its control over hydrological data.

Interestingly, the state of Jalisco created a separate Council to represent the Jalisco governor on the CC and to ensure that the commitments contained in the Chapala coordination agreement would be honored. This *Consejo Estatal de Seguimiento y Evaluación del Acuerdo de Chapala* (CESEACH; State Council for the Monitoring and Evaluation of the Chapala Agreement) was created on 19 April 1989 and Francisco Medina Ascensio, a former Jalisco governor, was named its president. Among the ten council members were Elías González-Chávez and Francisco de P. Sandoval, who in 1995 became the president of CESEACH (Pérez-Peña, 2004).

With the creation of the CNA in early 1989 and the signing of the Chapala coordination agreement, the CNA Lerma-Balsas regional office appeared to have got a flying start. However, low rainfall levels in 1989 (570 mm) resulted in a further decline of Lake Chapala, dropping from 3,730 hm^3 in April 1988 to 2,925 hm^3 in July 1989, and the reservoirs throughout the Basin held less than 30% of their maximum storage capacity (CNA, 1990c: 5). The Lerma-Balsas regional office decided to suspend irrigation in the autumn/winter season of 1989/1990, to ensure enough water would be available for irrigation during the spring/summer season of 1990 (CNA, 1990b: 25). The CNA regional office organized extensive patrols along the Río Lerma and the shores of Lake Chapala in 1989 to ensure that no unauthorized water was being withdrawn, resulting in the identification of 643 pumps withdrawing water from Lake Chapala and 560 pumps directly drawing water from the Río Lerma (CNA, 1990b: 27). Of these, some 830 were

[99] Interview with a senior CNA official, June 2004, Mexico City.

illegal, of which 650 were shut down and 180 were fined (CNA, 1990c: 8). All this resulted in strong protests from farmers, but to no avail.

In 1990 rainfall was substantially higher than average, at 852 mm (CNA, 1991d), leading to an increase in the volumes stored in the reservoirs throughout the Basin and hence irrigation was possible during the autumn/winter season of 1990/1991 (CNA, 1990c: 6). However, this did not lead to a recovery of the Lake, which dropped to 2,029 hm^3 in June 1990 and continued to decline in 1991, hitting the second lowest level recorded since 1934 in June 1991 (1,860 hm^3), due to a near lack of rainfall from November 1990 to May 1991. In June 1991 it started to rain throughout the Basin and by the end of July already 400 mm had fallen, leading to a rapid filling of the Basin's reservoirs. Ostensibly to ensure enough capacity for flood storage, CNA's regional office ordered the opening of the Solís dam in July 1991, allowing water to flow to Lake Chapala. This led to strong protests in the Alto Río Lerma irrigation district (ARLID), with farmers occupying the CNA office in Celaya to demand the closure of the dam (IMTA, 1991a). This coincided with attempts by the CNA federal office to initiate irrigation management transfer in ARLID, which understandably floundered.[100] In September the dam was closed although the good rains continued. Unusually heavy rainfall in January and February of 1992 resulted in a recovery of Lake Chapala to 4,623 hm^3, the highest level stored since October 1987.

When the Lerma-Balsas regional office started developing a workplan for the CC to realize the four objectives of the Chapala agreement, it became apparent that an operational coordination mechanism was needed to bring all the government agencies together. The CNA regional office proposed to form a working group that would include technical staff from the various federal agencies and the state governments, in which decisions could be arrived at. In the second formal session of the CC, held on 23 August 1990, it was decided to create a Technical Working Group (TWG), "with a straightforward agenda, to be held responsible for making things happen" (Mestre, 1997: 145). This included negotiating resources, coordinating efforts, forging consensus and defining programs and projects to achieve the four objectives of the Chapala coordination agreement (Mestre, 1997). The TWG was formally installed on 29 October 1990 and originally consisted of some 20 representatives, with CNA's regional manager for the Lerma-Balsas region elected as chair of the TWG. Due to the perceived importance of the TWG by the involved government agencies, the TWG rapidly increased to some 60 representatives and it became an influential decision-making body (Mestre, 2001). During the first half of the 1990s the TWG met three to four times a year and prepared the annual CC meetings that were attended by federal ministers, state governors, high level government officials and several times by the president himself. During this period the CC and TWG only consisted of government representatives and had the full support of the president and CNA's DG, but intensive organizing processes by Lerma-Balsas regional office were needed to arrive at decisions. The chair of the TWG remembers:

> (…) the experience in terms of multiple coordination, political will, financial instruments, and team spirit were very rich. Of course, many apparently insurmountable problems arose. Consensus was adopted as the sole manner to solve

[100] However, the resistance to transfer in ARLID was not only due to the opening of Solís dam, as discussed in more detail in section 5.4.

> disputes. Fortunately, differences in opinion, technical expertise, and political views were always settled, either in group work sessions or by means of lobbying. In many occasions when discussions headed nowhere, sessions were suspended and bilateral and multilateral negotiations started. Such [an] approach was of paramount importance to [the] many successes attained. For extreme cases where consensus was very difficult to attain, TWG created the Permanent Work Group integrated by selected high level members of TWG that whenever difficult issues had to be solved or decisions had to be defined, met on a daily basis until matters were solved. (Mestre, 2001: 8)

At the second session of the CC the TWG was charged with elaborating a surface water allocation agreement. In August 1991, during the third formal session of the CC, the governors of the five states in the Basin and the federal government signed this agreement,[101] which set out surface water allocation mechanisms for all surface water users in the Basin (CNA, 1991e). The overall objective of the treaty was to "assure a rational, equitable and just allocation of water, adaptable to periods of shortage as well as abundance, that would sustain and reinforce the economic development of the region" (Mestre, 1993: 3). The specific objective of the agreement was to maintain adequate water levels in Lake Chapala, thereby ensuring Guadalajara's domestic water supply. Preserving Lake Chapala meant that it would be attempted to keep water levels in the Lake at or above 6,000 hm^3, while levels below 3,300 hm^3 would be considered critical.

To arrive at the allocation agreement, the TWG analyzed rainfall, runoff and dam storage data over the 1950 to 1979 period for the 19 sub-basins of the Basin. To protect existing water rights, water demands for irrigation systems with registered irrigation users were determined and the inventory of unregistered water users was updated. Based on this assessment, average surface water availability in the Basin, excluding the Pátzcuaro and Cuitzeo sub-basins, was determined to be 4,740 $hm^3\ a^{-1}$, while the historical average for water withdrawals was placed at 3,240 $hm^3\ a^{-1}$for irrigation, 240 $hm^3\ a^{-1}$ for Guadalajara from Lake Chapala and an additional 90 $hm^3\ a^{-1}$ from Lake Chapala for irrigation (CNA, 1991e). By mid 1991 the TWG had finalized the draft version of the surface water allocation agreement, although "bitter discussion took place within [the] TWG [on the] reliability of hydrologic data and its interpretations; the legitimacy of water users information; reservoirs' operational schemes; (…) Chapala Lake hydrodynamics, [and] natural and anthropogenic water losses throughout the basin" (Mestre, 2001: 14). Nevertheless, the TWG managed to arrive at an allocation model in which, importantly, Lake Chapala was considered as a water user and an annual volume was assigned to it. However, shortly before the signing of the agreement senior SARH officials modified it, because they considered it incorrect to specifically allocate water to the Lake.

[101] The full title of the agreement is *Acuerdo de Coordinación que Celebran el Ejecutivo Federal y los Ejecutivos de los Estados de Guanajuato, Jalisco, México, Michoacán y Querétaro, para Llevar a Cabo un Programa de Coordinación Especial sobre la Disponibilidad, Distribución y Usos de las Aguas Superficiales de Propiedad Nacional Comprendidas en la Cuenca Lerma-Chapala*. In the remainder of the text it is referred to as the surface water allocation agreement.

To preserve Lake Chapala the allocation agreement set out three allocation policies, namely *critical*, *average* and *abundant*, based on whether the volume of water in the Lake is less than 3,300 hm^3, between 3,300 to 6,000 hm^3 and more than 6,000 hm^3 respectively. Each year the Council verified the volume stored in Lake Chapala to determine the allocation policy to be followed for the next year. For each allocation policy, formulas were used to calculate water allocations for the irrigation schemes (both districts and units) in the Basin, based on the surface runoff generated in each of the five states in the previous year. Table 5.2 indicates how this works for ARLID. Based on extensive modeling runs of these formulas, the TWG concluded that the resulting water allocation would not impinge on the 1,440 hm^3 a^{-1} needed by Lake Chapala for evaporation. Thus, as shown in Table 5.2, if the surface runoff generated is below a certain threshold, a fixed volume is deducted from the irrigation district's allocation, even if this volume is available in the district's reservoir. The logic behind the allocation agreement was that the reductions in the volumes allocated in drier years would ensure sufficient carry-over storage in the Basin's reservoirs. If adhered to, the modeling runs showed that this would generate sufficient spillage from reservoirs during the rainy season and thus provide river inflows to Lake Chapala. The reduction of volumes allocated to irrigation systems under the 1991 agreement was legally possible because surface water rights in Mexico are based on the proportional appropriation doctrine.

Table 5.2. Water allocation principles for the Alto Río Lerma Irrigation District

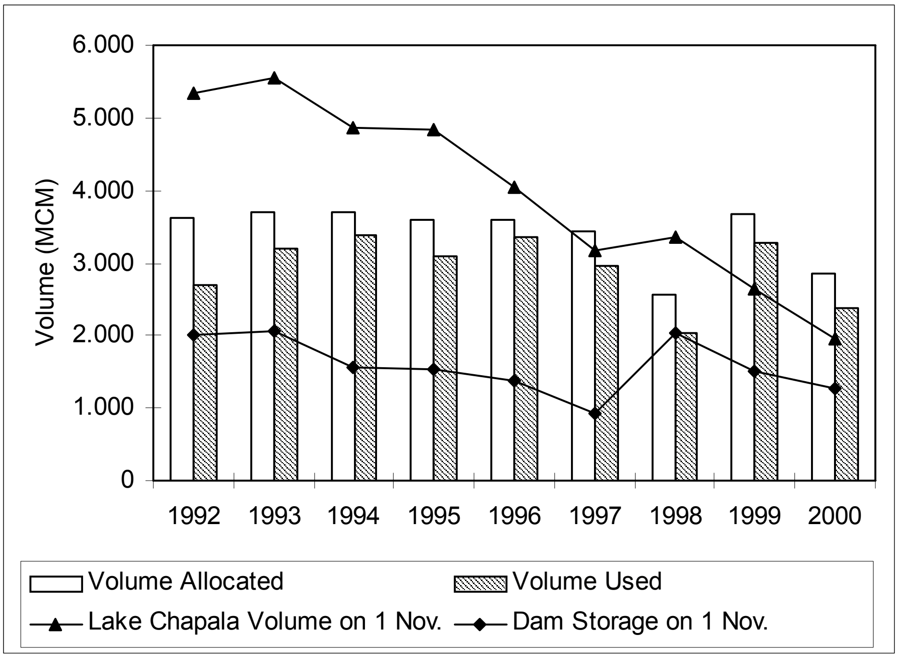
Lake Chapala Volume	Surface Runoff Generated (SRG) in the State of Guanajuato (hm^3 a^{-1})	Volume Allocated (VA) to Irrigation District (hm^3 a^{-1})
Critical	if SRG between 280 and 1,260	then VA = 94.2% of SRG –262.8
	if SRG > 1,260	then VA = 924
Average	if SRG between 144 and 1,125	then VA = 94.2% of SRG –135.6
	if SRG between 1,125 and 1,400	then VA = 924
	if SRG > 1,400	then VA = 955
Abundant	if SRG between 19 and 1,000	then VA = 94.2% of SRG –17.9
	if SRG between 1,000 and 1,200	then VA = 924
	if SRG > 1,200	then VA = 955

Source: CNA (1991e).

Since 1991, the TWG has met each year and has applied the water allocation rules set out in the treaty. Figure 5.3 sets out the volumes of water allocated and used from 1992 to 2000 as well as the volume of water stored in Lake Chapala. This shows that according to CNA data the 1991 treaty has been enforced, as actual use has never been higher than the allocated values. A caveat here is that only the extractions by irrigation districts are accurately measured, thus actual withdrawals may have been higher as the amount of water going to the irrigation units is unknown. Another observation is that since 1995 Lake Chapala's volumes steadily declined, discussed in detail in section 5.5.

Besides the surface water allocation agreement of 1991, the CC worked hard on a wastewater treatment program, initiated in 1989 and entailing the construction of 48 treatment plants and the formulation of a river basin master plan, published in 1993 (Mestre, 1997). Based on the achievements of the CC in the Lerma-Chapala Basin, an article was included in the 1992 national water law on River Basin Councils (RBCS), defined as coordinating and consensus-building bodies between the CNA, federal, state and municipal governments and water users (CNA, 1994c). The Lerma-Balsas regional office and the TWG were actively involved in the drafting of this section of the water law. Initially it included a much more ambitious program to decentralize water management "particularly in terms of basin councils, their attributes, organization and operation (the TWG wanted stronger RBCs); regional hydraulic planning; water management (especially, water allocation schemes under extreme scarcity) and sanction. Great ideas surged, although most of them were finally rejected" (Mestre, 2001: 9) by the CNA, SARH and Congress. The result was one article on RBCs in the 1992 water law, a reflection of the struggle between the centralizing tendencies in the CNA at the federal level and the young water resource planners in the Lerma-Balsas regional office firmly committed to decentralized and integrated water management. Based on this article the CC became the Lerma-Chapala River Basin Council on 28 January 1993, the first RBC formed in Mexico.

Figure 5.3. Surface water allocated and used in the Lerma-Chapala Basin



Source: CNA (1991-2000).

The river basin councils are quite different from the earlier river basin commissions created in Mexico during the late 1940s. While the latter served to develop the "unlimited" potential of water resources and to channel government resources into river basin development, and only consisted of SRH officials, the river basin councils were set up as coordinating and consensus-building bodies between the three levels of government and water users. Their stated goal in the water law is to foster integrated water management in their respective river basins through proposing and promoting programs to improve water management, developing hydraulic infrastructure and the corresponding services and preserving the resources of the river basin. Formally, the river basin councils have very little decision-making power, as the CNA remains responsible for water concessions, the collection of water taxes and water investment programs. The formal role of the councils is to assist the CNA in the execution of its vested powers and to ensure that stakeholders' opinions are taken into account in water policy decisions (CNA, 2000a).

During the first session of the Lerma-Chapala RBC, held on 28 January 1993, a third coordination agreement was signed on regulating groundwater use (see Chapter 7) and the second phase of the water treatment program was agreed on, entailing the construction of 52 new plants and the enlargement of 5 existing ones (Mestre, 1997). The second session of the RBC was held on 27 July 1994, where it was agreed to complete the construction of the water treatment plants agreed on, to continue with the process of regulating groundwater and to support the creation of an assembly of water users in the Basin (CNA, 1994d). In spite of this intention, until the end of 1997 the Governing Board of the Council was top heavy and did not formally include water user representatives. Its president was the federal minister of agriculture until 1995 and the federal minister of the environment from 1995 to 1997, while its members were the governors of the five states making up the Basin, five federal ministers and the DGs of the CNA and the federal oil and electricity companies. How water user representatives were included in the RBC in the late 1990s is detailed in section 5.5.

Concluding remarks

The Lerma-Chapala Basin was rapidly turned into a water governance domain in the early 1990s. Important drivers of this process were the concerted efforts and alignment strategies of the water resource planners in the Lerma-Balsas regional office and their conviction that river basins are the ideal unit for water management. The water pollution in the Basin and the declining levels of Lake Chapala were salient problems that the regional office successfully used to make the credible claim that they needed to be solved at the river basin level. However, this alone does not explain why the Lerma-Chapala Basin became a domain of water governance. The political constellation at the time, with the PRI still the state party and corporatist mechanisms for managing conflicts still functional, were also important factors. The campaign promise of Salinas to "rescue" Lake Chapala and his support for the policy agenda of the CNA regional office, made it possible to create new institutional arrangements at the river basin level, such as the CC and the RBC, that were considered legitimate by state governments and water users. Lastly, these changes came about due to the creation of the CNA, which rapidly established itself as the sole federal water authority. The combination of these factors turned the Lerma-Chapala Basin into a domain of water governance under the control of the hydrocracy, which succeeded in legitimizing its claim to manage water at the river basin scale.

However, in the early 1990s the efforts to move to river basin management in Mexico were confined to the Lerma-Chapala Basin, where a cautious approach was followed. Although there were salient problems in other river basins, these did not lead to similar efforts by the CNA to establish river basin councils. It was only in August 1995 that another council was formed, for the Mexico Valley, and only in 1999 and 2000 that RBCs were formed in Mexico's other river basins. This brings out that the process of turning river basins into a governance domain critically depends on the network building activities of the involved actors and their alignment strategies. The persistence of the Lerma-Balsas regional office in attempting to create a bimodal form of river basin management in the Lerma-Chapala Basin led to results, but did not create sufficient momentum to export this policy idea to other basins. This also suggests that there was insufficient support at the CNA national level in the early 1990s to create RBCs throughout the country and that the initiatives of the Lerma-Balsas office were contested. This was related to the decentralization thrust contained in the bimodal form of river basin management, in which an autonomous regional river basin office would become responsible for regional water management and would be funded through regional water tariffs. This was unacceptable to many senior CNA officials, who were attempting to centralize decision-making at the federal level and were concerned that the RBCs would led to a loss of authority in water matters.

The Lerma-Chapala Basin was turned into a domain of water governance by the hydrocracy in a top-down manner including only government actors. At the time, the transition from a one-party regime to democracy was incipient and the opening up of water management to a wider range of stakeholders was just starting. Thus the CNA, through Salinas, was able to summon the governors of the five states in the Basin, all from the PRI, to sign the Chapala coordination agreement and to create a Consultative Council. As promised by Salinas, this council met every year to review progress and to sign new coordination agreements to achieve the objectives of the Chapala agreement. Especially the 1991 surface water allocation agreement was important and resulted in stronger CNA control over actual water use in the Basin. In combination with above average rainfall from 1990 to 1995, this led to a modest recovery of Lake Chapala and the pressures on the Lerma-Chapala RBC were modest. Thus, through its scale-making project, the CNA strengthened its position as the main decision-maker at the river basin scale. However, the new arrangements at basin level entailed an increasing role of states in river basin management. While CNA's regional office was turning the Lerma-Chapala Basin into a governance domain, a parallel process was underway to transfer the management of irrigation districts to water users' associations. Initially these two processes were not linked, but in the late 1990s the WUAs started to become more involved in river basin management. Their provenance is the subject of the next section.

5.4 Reordering Irrigation Management

Congruently with the establishment of new institutional arrangements for water management at the national and river basin level, the CNA initiated a program to transfer irrigation districts to newly formed WUAs in 1989. Chapters 3 and 4 analyzed the emergence, standardization and acceleration of the IMT policy, but did not touch on how this decentralization policy changed the relationship between the hydrocracy and irrigation water users in the Lerma-Chapala Basin. This section describes the diversity of transfer experiences in the Lerma-Chapala Basin, to argue that the WUAs can be seen as intermediary organizations between water users and government agencies through which new forms of political power are constituted. The diversity and effects of IMT strongly influenced the representation of irrigation water users in river basin management, analyzed in more detail in section 5.5 and Chapter 8. This section does not analyze the impacts of transfer or the actual changes in irrigation water management practices, which Kloezen

(2002) did very well for the largest irrigation district in the Basin, but rather focuses on the effects of the IMT policy on the relationship between the hydrocracy and irrigation water users.

Irrigation management transfer and domains of water governance

The IMT program in Mexico consisted of two phases; the transfer of the management of secondary canal units to WUAs and the transfer of the management of the main system to a federation of WUAs. During the first phase the CNA divided the irrigation districts into irrigation units varying from 1,500 to 50,000 ha in size, termed *módulos*, on the basis on hydraulic boundaries and established a WUA in every *módulo*. The WUAs were formed as civil associations to whom the CNA granted renewable concessions for the use of water and the irrigation infrastructure. An important element of the concession titles was the instructions for the operation, administration and maintenance of the *módulo*, drawn up by the CNA in conjunction with the WUA. These instructions set out how water charges should be determined and how the WUA should maintain their *módulo*. After the first phase, the CNA continued to manage the dams, headworks and main canals of the irrigation districts and delivered water in bulk to the WUAs in exchange for payment. The second phase of the transfer program consisted of the formation of federations of WUAs at the main system level, called *Sociedades de Responsibilidad Limitada* (SRL; Limited Responsibility Societies), who were to take over the management of the main system from the CNA. After the second phase, the CNA remained responsible for managing the headworks and dams.

The formal responsibilities of the five main actors in irrigation district management after IMT, namely the CNA, the SRL, the WUAs, the Hydraulic Committee and the water users, are outlined in the 1992 national water law (see Annex B for details). What is noticeable is that the CNA remained the highest authority in the irrigation districts after transfer, as it retained control over water allocation and the management of dams and headworks, as well as overall responsibility for the management and performance of the irrigation districts. Thus, the CNA Irrigation District Office continued to have important responsibilities and powers, such as approving irrigation service fee levels determined by the WUAs and approving the WUAs annual maintenance plan and ensuring that it is carried out. Lastly, the CNA can cancel or refuse to renew concession titles if WUAs perform unsatisfactorily.

An important new actor in irrigation district management after IMT is the *Comité Hidráulico* (CH; Hydraulic Committee), comprised of the presidents of the WUAs plus representatives from the CNA and the state in which the irrigation district is located. Formally, the CNA chief engineer of the district chairs the hydraulic committee meetings, which in many irrigation districts has become a serious decision making body pertaining to district wide water allocation and setting of water fee levels. The most important obligation of this committee is to formulate the regulations of the district and monitor their application (CNA, 1999b).

Based on the concession granted to them by the CNA, WUAs legally assume the responsibility to operate, maintain and administer their secondary canal unit (*módulos*). Their responsibilities to the CNA are to collect irrigation service fees that fully cover the costs of the WUA and to pay a percentage of the revenues from fee collection to the CNA for its O&M of the dams, headworks and main canal system. In addition, the WUAs need to prepare and submit annual operation and maintenance plans and budgets to the CNA for approval. A WUA consists of a general assembly and an executive board. All farmers that own land within the command area of the irrigation district and are registered as water users with the WUAs and the CNA, are WUA members. However, the generally assembly of the WUA does not consists of all the members of the WUA, but only of the water delegates elected by the *ejidatarios* and private landowners as their representatives on the general assembly. Water users do not directly participate in the operation and maintenance of their *módulo*, but rather pay the WUA for this service and formally control the executive board through their representatives on the general assembly, which functions as the governing body of the WUA. It elects an executive board for a period of three years. In addition, the general assembly needs to approve the seasonal operation and maintenance programs, the WUAs annual budget and the proposed level of the irrigation service fee.

The WUA executive board consists of a president, a secretary, a treasurer and their deputies. In most districts, every three years the board has to be replaced and re-election of board members in the same position is not allowed. Also, every three years the office of the president of the board has to alternate between *ejidatarios* and private landowners. The executive board is responsible for managing the affairs of the WUA. The board hires a manager who is responsible for implementing and supervising the operation, maintenance and administration of the *módulo*. With approval of the board, he contracts the necessary staff to manage the *módulo*. The *canaleros* distribute the water to the fields according to a seasonal irrigation plan, based on farmers' request for an irrigation turn. The positions in the general assembly and executive board are honorary and unremunerated while the WUAs' staff are paid out of the fees which the associations collect from its members.

The fifth actor in irrigation district management is the SRL, in those districts where they have been established. The responsibilities of the SRL are to distribute water from the headworks to the WUAs and to maintain the main system infrastructure concessioned to the SRL by the CNA. The institutional structure of the SRL is very similar to that of the WUAs, with the distinction that its general assembly is made up of the presidents of the WUAs falling in the irrigation district in question. The SRLs expenses are covered by the WUAs, who pay a percentage of their income from water fees to the SRL. The SRLs concession title outlines its responsibilities and those of the CNA. Both the SRL's and CNA's responsibilities are worded exactly the same as in the WUA concession titles, with the exception that it deals with the main system level only (cf. CNA, 1992c, 1997a).

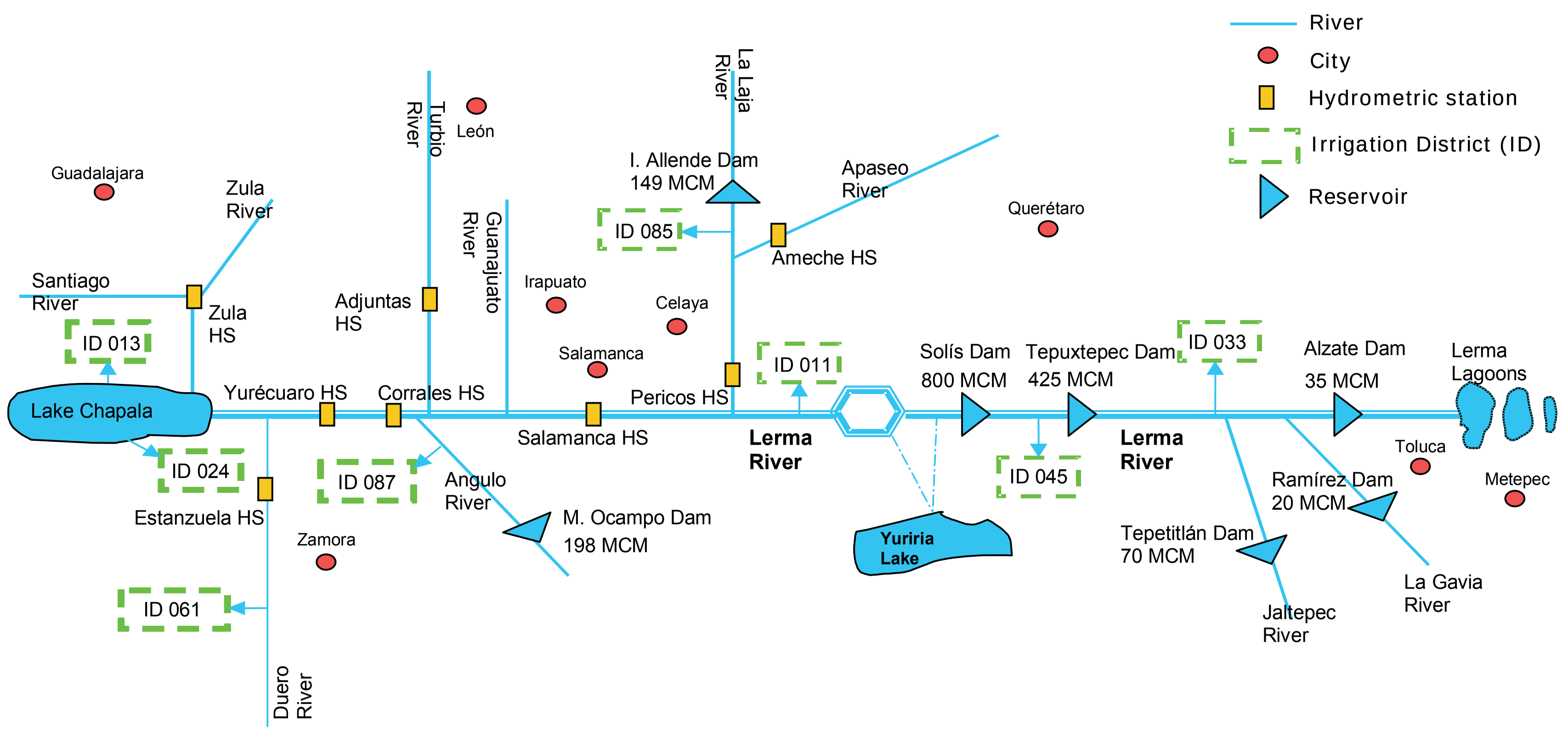
The creation of WUAs to manage sizeable irrigated areas, and the word transfer itself, suggests a far-reaching decentralization of irrigation water management with the hydrocracy no longer playing a role in irrigation district management. However, as the above shows, even on paper the CNA remains the highest authority in the irrigation districts. Although the involvement of selected water users in irrigation district management sharply increased with IMT, Rap *et al.* (2004) argue that at the same time the hydrocracy's control over the irrigation districts was strengthened through IMT through the creation of WUAs designed and controlled by the CNA. Instead of building on existing farmer organizations in the irrigation districts, the creation of new WUAs consisting of "water users" rather than categories of farmers, entailed the creation of a new domain of water governance under the circumscribed control of the CNA (cf. Rap, 2004). In addition, the fact that the WUAs general assembly does not consist of all water users but is restricted to water delegates means that many water users do not actively participate in the WUAs or in irrigation district management. The WUAs operate more as service providers in return for payment from water users rather than as full-fledged user associations. This leads Rap (2004: 304) to conclude that IMT entailed a decentralization of the costs and problems related to irrigation management to water users, coupled with a more effective centralization and concentration of revenues for the hydrocracy. However, in the Lerma-Chapala Basin the creation of WUAs did lead to an increasing autonomy of water users from the CNA in several of the irrigation districts and with time the WUAs came to constitute political capital for their board members (Kloezen, 2002). The large diversity in the process and effects of IMT in the Lerma-Chapala Basin is reviewed below.

The diversity of IMT in the Lerma-Chapala Basin

In the 1990s, the eight irrigation districts in the Lerma-Chapala Basin were transferred to 45 WUAs that now manage secondary canal units varying in size from 1,500 to 30,000 ha (see Table 5.3). In all the districts, the CNA continues to manage the dams and main canals and delivers water in bulk to WUAs, except in ARLID where a federation of WUAs has been formed to manage the main system (Kloezen, 2002). However, how and when irrigation management transfer occurred in the eight irrigation districts and the further development of WUAs was highly diverse. While several *módulos* resisted transfer, other WUAs developed into multipurpose organizations providing credit, fertilizers, land leveling and extension services to water users. This was related to the large differences in the physical, social and economic situations prevailing in the irrigation districts, as described by Mollard *et al.* (2005).

Chapter 2 provided information on the history of the construction of several of the irrigation districts in the Lerma-Chapala Basin but did not provide an overview of all of them. To portray the diversity of the irrigation districts in the Basin a brief overview of the districts is given here. Most of the irrigation districts are not contiguously irrigated areas, but an agglomeration of hydraulically independent units, spread out along the Río Lerma and its tributaries as melons on the vine (see Figure 2.3 and Figure 5.4). This is because the irrigation districts are an administrative creation, where over time what were previously irrigation units were joined to districts for political or economic reasons, such as access to government subsidies that were only available for irrigation districts, or *módulos* were moved between districts. Thus, nearly half the *módulos* have their own water supply source, or various supply sources, while the rest are hydraulically dependent on each other, sharing dams and canal infrastructure. There is also a large diversity in farming systems within and between the irrigation districts, ranging from subsistence farming to highly commercial farming. This discussion does not present the farmer-managed irrigation units that cover around 510,000 ha in the Basin, of which some 330,000 ha are irrigated with groundwater. Although the remaining 177,000 ha in irrigation units irrigated with surface water have an important impact on water depletion in the Basin they largely fall outside the control of the hydrocracy. Detailed studies on the irrigation units are provided in Silva-Ochoa (2000) and in Vargas and Mollard (2005).

Figure 5.4. Irrigation districts in the Lerma-Chapala Basin



Source: adapted from CNA/MW (1999: 99).

The following overview of the eight irrigation districts in the Basin starts at the headwaters of the Río Lerma and then travels downstream.[102] The first irrigation district taking water from the Río Lerma is ID033 (Estado de México), located in the Toluca valley with an irrigable area of 17,738 ha. This district consists of four *módulos*, two of which have their own dam on tributaries of the Río Lerma and two that draw directly from the river. Located at an altitude of some 2,500 m, this irrigation district is characterized by a cold climate with several months of frost. Most of the farmers practice subsistence farming of maize on an average landholding of one ha per family. The second irrigation district, ID045 (Tuxpan), is largely located outside the Basin. Only one of its *módulos*, namely Maravatio, draws its water from the Tepuxtepec dam on the Río Lerma, primarily used for hydroelectricity generation. After the completion of the Solís dam in 1949, Maravatio was added to ID011 but later it was attached to the Tuxpan irrigation district. Both Maravatio and Tuxpan are located in Michoacán, while ID011 is located in Guanajuato, hence the move.

Table 5.3. Irrigation districts in the Lerma-Chapala Basin

Irrigation Districts (ID)		Years of Transfer (a)	Number of Módulos (a)	Irrigable Area (ha) (b)	Surface Water Concession ($hm^3 a^{-1}$) (c)
ID011	Alto Rio Lerma	1992	11	112,772	955(1)
ID013	Estado de Jalisco (2)	1992	11	28,661	150
ID024	Ciénega de Chapala	1995	3	15,851	170
ID033	Estado de México (3)	1996, 2000	4	17,738	90
ID045	Tuxpan (Maravatio)	1997	1	9,669	90
ID061	Zamora	1993	4	18,009	200
ID085	La Begoña	1992, 1993	4	10,822	124
ID087	Rosario-Mezquite (4)	1992, 1993, 1995, 1997	7	63,643	240
	Total		45	277,165	2,019

Sources: (a) CNA (1999c), (b) CNA/MW (1999), (c) Poder Ejecutivo Federal (2004).

(1) Includes the water allocation for the Pastor Ortiz *módulo*, which administratively falls under ID087, but receives water from the Solís Dam (75 hm^3).
(2) This irrigation district consists of 31 *módulos* spread throughout Jalisco, of which 11 receive their water from the Lerma-Chapala Basin. Three *módulos* draw their water from the Río Lerma or Lake Chapala (Jamay, Río Lerma, El Fuerte) and eight from the Río Santiago fed from Lake Chapala (Zula, Canal Atequiza, Zapotlanejo, Canal Aurora, Canal Las Pintas, Cuitzeo, Ejido Emiliano Zapata, Río Santiago).
(3) Includes the Tepetitlán Irrigation Unit, formally not transferred.
(4) Includes ID22 (Zacapu) and the Pastor Ortiz *módulo* in number of *módulos* and irrigable area.

In the Middle Lerma region there are three irrigation districts: ID011 (Alto Río Lerma), ID085 (La Begoña) and ID087 (Rosario-Mezquite). ARLID consists of 11 *módulos*, of which nine receive water from the Solís dam and Lake Yuriria, while one is supplied by the La Purísima dam located on the Río Guanajuato and another draws its water from the Río Turbio. With an irrigable area of 112,772 ha, ARLID is the largest district in the Basin, consisting of five diversion weirs, 477 km of main canals, 1,658 km of secondary and

[102] This section does not discuss ID020 (Morelia-Quarendaro) located in the endoreic Cuitzeo sub-basin as it does not draw water from the Río Lerma or one of its tributaries.

tertiary canals and over 1,900 km of drainage canals. In addition to surface irrigation, serving some 77,697 ha, there are 1,714 groundwater wells serving 35,075 ha (Kloezen, 2002). ARLID is the powerhouse of agroindustrial production in El Bajío, with a diversity of crops grown. There are roughly 24,000 water users in the irrigation district, with 72% classified as *ejidatarios* and 28% as private farmers. The average land holding is 4.8 ha, although land concentration has increased, with several commercial farmers in the district controlling more than 1,000 ha each.

Primarily drawing its water from the Ignacio Allende dam located on the Río Laja, a tributary of the Río Lerma, ID085 (La Begoña) has an irrigable area of 10,822 ha, divided over four *módulos*. One of these (Neutla) is supplied by the Orozco dam, while Comonfort directly pumps its water from the Río Laja based on releases from the Allende dam. The other two *módulos* have a canal network fed by a barrage in the river.

The most complicated district in the Basin is ID087 (Rosario-Mezquite), spread out along the Río Lerma downstream of ID011. Its main dam, called either Melchor Ocampo or El Rosario, is located on the Río Angulo, a tributary of the Río Lerma. Upstream of the dam, the Zacapu *módulo* is located, which at times is listed as a separate irrigation district (ID022), but currently falls under ID087. The Melchor Ocampo dam provides the Angamacutiro *módulo* with water and additional releases are provided for the four *módulos* located downstream of the confluence of the Río Angulo with the Río Lerma (La Piedad, Yurécuaro, Vista Hermosa and La Barca). The La Piedad *módulo* pumps its water directly from the Río Lerma, while the remaining three *módulos* are provided with water through a main canal taking off from the Río Lerma below La Piedad. The seventh *módulo* of ID087 is Pastor Ortiz, which pumps its water from the Río Lerma downstream from ID011, but upstream of the confluence between the Ríos Angulo and Lerma. Thus it depends on return flows from ID011 and releases from Solís dam. Negotiations have been underway for years to incorporate it into ID011, but to no avail. The gross command area of the district is 63,643 ha, but due to its downstream location and complicated infrastructure it rarely receives enough water to irrigate more than a third of this area.

In the Lower Lerma region near Lake Chapala there are two irrigation districts, ID024 (Ciénega de Chapala) and ID013 (Estado de Jalisco). ID024 consists of three contiguous *módulos* of which two have their own dams on tributaries of the Río Duero, while the third withdraws water directly from the Río Duero and from Lake Chapala. Until the 1970s ID013 was the only irrigation district in the state of Jalisco, administratively grouping numerous irrigation units throughout the state. Currently it consists of 31 *módulos*, of which three are located in the Lerma-Chapala Basin, and eight withdraw water from the Río Santiago supplied from Lake Chapala.

The above sketches the diversity of irrigation districts in the Basin. The following briefly describes transfer in three of these irrigation districts, this time travelling up the Río Lerma, starting with the La Barca *módulo* of ID087, passing through ID011 and ending near the headwaters of the Río Lerma in ID033. Formally, IMT began in the Lerma-Chapala Basin in 1991, but already in the 1980s transfer experiments were underway in Jalisco. In 1991 and 1992 a large number of discussions and meetings were held with farmers in the larger irrigation districts in the Basin (ID011, ID013, ID061, ID085 and

ID087), in which transfer was promoted by the CNA. Although the acceptance of transfer was contested, these districts were transferred relatively quickly (by 1993), with the exception of ID087, where several *módulos* continued to resist transfer. In the remaining irrigation districts transfer was much slower, due to the large social and economic diversity in these districts, and the reluctance of farmers to form associations due to conflicts. Especially the higher irrigation service fees and the need to elect representatives created problems, with many farmers arguing that the federal government should continue managing the districts.

First transfer in La Barca

The La Barca secondary irrigation unit, forming part of ID087 (Rosario-Mezquite), was the first *módulo* to be transferred in the Lerma-Chapala Basin, in November 1985. This was well before IMT had become an official policy and formed part of the same policy experiments as described in Chapter 4. The same group of engineers that promoted transfer in the Autlán-El Grullo (ID094) in the late 1980s had previously worked in the La Barca area. Van der Zaag (1992) describes this group, starting with Engineer Chavez, who became the head engineer of ID094 in 1977, and was linked to Engineer Velazco, his former teacher and *padrino*.[103] Both these men were committed to the food self-sufficiency policy developed in the late 1970s by SARH, which brought Chavez into conflict with the sugar cane growers in ID094. In 1980, Chavez managed to get Engineer Ochoa, a trusted university friend, transferred to ID094 and appointed department head. Ochoa suggested forming a *Comisión de Usuarios*, consisting of two delegates from each *ejido*, that would decide on the irrigation plan and the crops to be grown in the district. The commission worked well for several years and laid the foundation for the transfer initiatives that were to follow (van der Zaag, 1992).

Toward the end of 1983, Chavez became involved in formulating the policy that would lead to the fusion of the irrigation districts and the rainfed districts into integrated rural development districts and in 1984 Velasco called him to Mexico City to work on the same reorganization of SARH. In September 1985 he choose to transfer to the La Barca rural development district and took Ochoa with him (van der Zaag, 1992). The La Barca irrigation unit, while depending for its water on the Rosario-Mezquite irrigation district, administratively fell under ID013 (Estado de Jalisco), which with the formation of the rural development districts in 1985 fell under the La Barca RDD, under the charge of Chavez. Upon arriving in La Barca, Chavez and Ochoa encountered an irrigation system badly in need of maintenance and with a low water fee. Thus, they decided to create an *Asociación de Usuarios* (users association) that would decide on the level of the water fees and would become responsible for maintaining the infrastructure of the La Barca secondary irrigation unit. Rather quickly they succeeded in convincing the farmers to set up an association, consisting of two delegates from each *ejido* and two from the private producers, and on 12 November 1985 the association was constituted (Lomeli, 1991: 38). Maintenance machinery was transferred to the association and the association hired a civil engineer to manage the maintenance work. An important decision of the association was to raise the irrigation service fees, from around 2,500 pesos/ha/season in 1985 to 10,000 pesos for 1986 and then to 15,000 pesos in January 1987, to finally jump to 85,000

[103] Both these names are pseudonyms given by van der Zaag (1992) to these men.

pesos/ha in 1988 due to inflation (Lomeli, 1991: 40). Users agreed to this as the association managed the funds and used them to maintain the canals and roads in their irrigation unit.

The La Barca users association rapidly aroused the interest of SARH engineers from the federal level, who came to visit La Barca, and it quite pleased Velasco to see that his former pupils had succeeded in forming a full-fledged water users' association. He appreciated that putting farmers in charge of maintenance would reduce the federal subsidies going to the irrigation districts and that this initiative could help him gain political prestige towards the end of the *sexenio* (van der Zaag, 1992). The initiatives in La Barca also influenced events in Autlán-El Grullo, where an informal group of discontented farmers started considering the idea of setting up a water users' association in early 1987. They traveled to La Barca to discuss with Chavez and Ochoa and as described in Chapter 4 Velasco ordered the district head of ID094 to initiate the formation of a user association, which happened in November 1988 (for details see van der Zaag, 1992). Interestingly, in early 1989 Ochoa was appointed head of ID094 and he quickly proceeded to hand over maintenance machinery to the newly created users association. After the CNA succeeded in separating the irrigation districts from the rural development districts in September 1989 (see Chapter 4), Ochao moved back to the La Barca RDD, where he remained until 2004. We will meet him again in Chapter 8, which describes the role he played in the Lerma-Chapala Basin after 2000.

The complicated situation of ID087, spread out along the Río Lerma with its secondary canal units falling in three states, restricted the transfer initiative in the 1980s to La Barca, located in Jalisco. Four of the other *módulos* are located in Michoacán and the remaining two in Guanajuato. In the early 1990s the La Barca irrigation area formed part of ID013 administratively, was dependent for its operation and water supply on ID087 (with resources managed by ID013), while maintenance and the setting of water fees was realized by the *Asociación de Usuarios Valle de Lerma* (IMTA, 1991b: 2). When the CNA arrived in 1991 to transfer ID087, it ignored the transfer that had already occurred in La Barca and set out to create new WUAs under its control. However, the precarious water availability in this district and the conflicts within and between its *módulos* severely complicated transfer initiatives. In early 1991 farmers occupied the Melchor Ocampo dam to demand the release of water, leading to actions by the "hydraulic police" of the CNA to close down "irregular" pumps along the Río Lerma (IMTA, 1991b: 8). To ease tensions a tripartite commission consisting of representatives of the three states and the CNA was created to allocate and distribute water, somewhat facilitating the transfer process. In 1994 five *módulos* were transferred, including La Barca, and the remaining two *módulos* were transferred in 1995 and 1997. To this day the district remains one of conflicts and irregularities (Borge, 2005). Especially the Pastor Ortiz and the La Piedad *módulos* are problematic, as they consist of numerous pumps along the Río Lerma that are difficult to control. During the winter season they frequently pump the river dry during the daytime, only leaving water for the downstream *módulos* of La Barca, Yurécuaro and Vista Hermosa during the nighttime.

Transfer in the Bajío: ARLID as the epitome of success

The Alto Río Lerma irrigation district (ARLID) is the largest and wealthiest district in the Basin and the only one with a SRL. Transfer occurred relatively quickly in ID011 and by the end of 1992 all its 11 *módulos* had been transferred (Kloezen, 2002). However, this only happened after a deal was struck between a group of commercial farmers, known locally as the group of seven dwarfs, and the CNA in early 1992, after which several of them or their frontmen received positions on WUA boards. However, this group felt the IMT process was incomplete concerning the control over infrastructure. In 1991, triggered by the "safety releases" from the Solís dam as described in section 5.3, this group argued that it was also necessary to transfer the main canals and Solís dam to the WUAs (IMTA, 1991a). Other medium and large farmers agreed to the transfer, but only if the infrastructure was rehabilitated and was given to them in a good state. The *ejido* sector, like in most regions of the country, was skeptical and passively resisted the transfer. They not only objected against the higher irrigation service fees, but also feared that "the intense conflicts that exist over water would intensify and would become insolvable without the arbitration of the government" (IMTA, 1991a: 31).[104] Lastly, ejidatarios interviewed in 1991 as part of the diagnostic study carried out in ARLID indicated that "if the transfer has already been decided on by the government if we like it or not we'll have to accept it" (IMTA, 1991a: 31).[105] Later, to decrease payments to the CNA and to improve water delivery to the WUAs, the group of seven dwarfs placed pressure on the CNA to create a SRL in ARLID to manage the main system. The SRL was formed in 1997 and has become an important actor in the irrigation sector in Guanajuato (Kloezen, 2002). The importance of the SRL in the representation of farmer interests at the river basin level will be further analyzed in Chapter 8.

Formally, the workings of the WUAs in ARLID resemble the business administration model promoted under IMT. WUA leaders often convey the idea that the workings and operation of the *módulo* coincide with the widely shared image of a "good" organization. According to this image, the leadership represents the interests of the WUAs members in negotiations with public and private institutions, participation of all members in decision-making is widespread, conflicts are resolved in a timely and effective manner and the leadership is accountable for the management of the WUAs assets and finances. In practice, the workings and operation of the WUAs can be best understood in terms of the complex relationships and tensions between the economic performance demanded by the organizational model and the need for economically sound administration on one hand and the sociopolitical mapping of the WUAs on the other. Seen thus, politics cannot be kept out of the analysis since the building process of the organization is in itself highly political, characterized by conflicting claims and clashing interests.

Monsalvo (1999) shows an important relationship between the size of a farming operation and its owner's (in all cases a he) participation in decision-making at the WUA level. Private and *ejidatario* farmers who own or have access to less than 10 ha hardly participate in the water user assemblies, as they are rarely elected as water delegates. This

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[104] "los intensos conflictos que existen por el agua se intensifiquen y lleguen ha ser insalvables sin el arbitraje del gobierno."

[105] "si la transferencia ya fue decidida por el gobierno la quieran o no tendrán que aceptarla."

impression is confirmed by Romero (2003: 99), who based on a study of four *módulos* in ARLID and 360 interviews with farmers, indicates that of those farming less than 10 ha between 8 to 22% participated in electing the WUAs board and that only between 36% and 56% knew their representatives (water delegates). Private farmers and *ejidatarios* who control up to 50 ha of irrigated land are those who exercise the voice option the most. Research by Vargas *et al.* (2000) in ARLID brings out that farmers controlling more than 50 ha prefer to exercise influence over the WUAs through frontmen, by making sure that "*mi gente*" (my people) occupy board positions. The men who occupy leadership positions in the WUAs are around 50 years of age and generally come from the strata of farmers controlling between 10 to 50 ha.

In ARLID the politics of water management is deeply imbued with power relations at the local level. There are, however, important variations in terms of the relationship of WUA leaders to political authorities at the local, regional and state level. The position of WUA president and participation in the SRL at irrigation system level provides opportunities for expanding political relations and social standing at the regional and state levels—and even well beyond. Since the transfer in 1992, the importance of the WUAs and the SRL as political platforms for their leaders has become apparent. Several WUA presidents have gone on to run for municipal president, while highly influential farmers have gone on to become ministers of agriculture at the state and federal level. The group of seven dwarfs, consisting of seven wealthy agro-industrial families, has played an important role behind the scenes and it is sometimes suggested that little happens in the agro-industrial-irrigation complex in Guanajuato without their approval. They have intertwined their farming strategies with politics and established strong bonds with government officials in the water sector. The seven dwarfs represent the economic and political elite of the agricultural sector in Guanajuato and their rise to political power was strongly linked with the IMT process. Although the relationships between WUA board members and the large agro-industrialists of the Bajío are not explicit, it is a public secret that many of the board members are their frontmen. Although there is a need for further in-depth research on this issue, it is clear that the WUAs have become important political spaces.

Stalled transfers: The case of ID033

While IMT progressed rapidly in ARLID, and led to the formation of WUAs that increasingly acted as intermediaries between farmers and government agencies, in other irrigation districts transfer was slower and more contested. In ID033 (Estado de México) farmers initially rejected transfer, leading to a drawn out conflict with the CNA, as described by Vargas and Guzmán (2003). Transfer initiatives began in ID033 in August 1993, when a company contracted by the CNA to organize transfer summoned municipal and *ejido* representatives of the four *módulos* in the irrigation district (Temascalcingo, Tepetitlán, Toxi and Atlacomulco) to promote the transfer program. At the meeting, the company asked that representatives for each community be named so that a start could be made with forming WUAs. The representatives of the four *módulos* responded differently, with users from Toxi and Atlacomulco agreeing to organize a WUA and accepting the increase in irrigation service fees. Although this took time, it led to the transfer of these two *módulos* to WUAs in 1996. The users from Temascalcingo and Tepetitlán resisted the transfer, especially the increase in irrigation service fees (Vargas and Guzmán, 2003).

Although a WUA board was created in 1994 by a group of water users in Tepetitlán who agreed to the transfer, other water users in the *módulo* contested this and negotiations to increase the irrigation fees and formalize the WUA stagnated. By the end of 1997 the negotiations were in an impasse, with increasing frustration and disagreement among ejido commissioners. In October 1997, the CNA organized another meeting to discuss transfer, where 600 people showed up. The CNA officials were detained for several hours and they were forced to sign an agreement to dissolve the WUA and stop transfer initiatives before they were released. Another point in the agreement was that the irrigation service fee would be reduced from 12 to 10 pesos and that the CNA would continue managing the *módulo*. After the association had been dissolved, a different group of farmers headed by a local leader started organizing to politically control all the communities in the *módulo*. In early 1999 this leader proposed to the CNA to change the *módulo* into an irrigation unit under his leadership, but by December 1999 the groups that had supported him split and openly opposed his plans. After the 1997 "kidnapping" of its officials the CNA had abandoned the *módulo* and had stopped dedicating funds to it. In 2001, the CNA unilaterally decided to change the *módulo* into an irrigation unit, leaving it up to the users to manage their affairs. This made it possible to report on paper that the *módulo* had been transferred, as it was becoming an embarrassment to the CNA as one of the last *módulos* that had not yet been transferred in the country (Vargas and Guzmán, 2003).

Concluding remarks

The above has shown that IMT entailed the creation of new domains of water governance, but in highly diverse ways. As argued by Rap (2004: 313) for an irrigation district in Nayarit, these heterogeneous outcomes are not the simple reflection of culture, power or politics, seen as unchangeable quantities, but rather the dynamic effects of the culturally and historically specific ways in which the opportunities opened up by IMT have been appropriated. In the Lerma-Chapala Basin the creation of the WUAs triggered a rearrangement of the interest groups around irrigation at the regional and local level, and an adjustment of the relationships between state agencies and water users. Many of the WUAs throughout the Basin have become privileged negotiation spaces where certain groups of farmers can negotiate resources and programs with government agencies and have become new arenas for the mediation of political power. They can be seen as organizational and political spaces for controlling water users, resources (such as water, finances and maintenance machinery) and irrigation infrastructure, that have filled the space vacated by the neo-liberal policies of the Mexican government and the weakening of corporatist mechanisms (cf. Rap, 2004; Romero, 2003; Vargas and Romero, 2001). As research by Kloezen (2000), Monsalvo (1999) and Romero (2003) in ARLID shows, the WUAs have become important political platforms for their leaders. However, it was only towards the end of the 1990s that WUAs started to play a role in river basin management, but by that time the political context in the Basin and the performance of the River Basin Council was very different from the first half of the 1990s. How the contradictions and contested nature of the decentralization of water governance in the Basin, combined with lower than average rainfall and changing political contexts, led to increasing conflicts in the Basin in the second half of the 1990s is analyzed below.

5.5 Running Aground: The Lerma-Chapala Basin from 1995 to 2000

This section describes how political and bureaucratic changes between 1995 and 2000 led to a decline in the quality of river basin management and a weakening of CNA's control over actual water use in the Basin. Combined with lower levels of rainfall, this resulted in a marked decline in the volumes stored in Lake Chapala. While the CNA had succeeded in turning the Lerma-Chapala Basin into a domain of governance, this occurred in a changing political context, in which the PRI-regime was losing its hold on power and state governments were demanding a larger role in water governance. The combination of basin closure, the changing political context and the institutional transitions in the Lerma-Chapala Basin led to an increase in tensions between farmers and the CNA, state governments and the CNA and between state governments. Thus, while the river basin remained a legitimate and credible scale for water governance, this did not lead to a resolution of the many water problems in the Basin.

Changing contexts

In August 1994, the PRI presidential candidate, Ernesto Zedillo, was elected president of Mexico. However, the political violence preceding his election[106] and the collapse of the peso in November 1994 was to overshadow his term in office and would lead to growing demands for change. In this context, the Zedillo administration negotiated a series of political reforms with the country's main opposition parties, including measures to guarantee the autonomy of the Federal Electoral Institute and the promise of a *nuevo federalismo* (new federalism) in which states would receive more autonomy.[107] This paved the way for increasing election victories by the opposition parties, starting at the municipal and state level, and culminating in the presidential election victory of Vicente Fox in July 2000, the first non-PRI president elected in Mexico since the revolution of 1910. In the Lerma-Chapala Basin, the *Partido Acción Nacional* (PAN; National Action Party) won the governor's post in Jalisco in early 1995 and in Guanajuato in May 1995. Both governors challenged the federal government on many fronts, including water management, and demanded greater autonomy. However, the renewed decline of Lake Chapala was to lead to increasing tensions between the two governors, who also represented different factions in the PAN. Together with changes in CNA staff and its halfhearted commitment to decentralization, this led to increasing conflicts in the Basin.

The national crisis of 1994 also had consequences for the water sector. An important group of hydrocrats resigned from the CNA, including González-Villarreal, who had been close to Colosio and had convinced him to turn the CNA into a full ministry if he won the

[106] This included the assassination of the then PRI presidential candidate Luis Donaldo Colosio in March 1994 and the *Ejército Zapatista de Liberación Nacional* (Zapatista Army for National Liberation) uprising in Chiapas that started on 1 January 1994, the day NAFTA entered into effect.

[107] Initiated under Salinas, new federalism entailed the decentralization of decision-making to states and municipalities and an increased recognition of their autonomy. Under Zedillo the *Programa de Modernización de la Administración Publica* (Program for the Modernization of the Public Administration) was initiated to change laws, procedures and attitudes to achieve this.

elections. Instead, Zedillo appointed Guillermo Guerrero-Villalobos, a civil engineer and former DG of the CFE as the new DG of the CNA, and transferred the CNA from SARH to the *Secretaría de Medio Ambiente, Recursos Naturales y Pesca* (SEMARNAP; Ministry of the Environment, Natural Resources and Fisheries).[108] A new group of hydrocrats, with a stronger construction background, were brought in by Villalobos, who also changed the organizational structure of the CNA from a sectoral focus (irrigation, domestic water, etc.) to a functional focus (administration, planning, operations, etc.). Although this new group favored centralized water management, under Zedillo's "*nuevo federalismo*" program the CNA also had to develop plans to decentralize water management programs and functions to water users and state governments and to deconcentrate the CNA. To do so, it was decided to form River Basin Councils covering all of Mexico's river basins and to set up 13 regional offices in hydrological-administrative regions based on river basin boundaries (SEMARNAP, 1996). It was foreseen that these regional offices would become "*organismos de cuenca*" (river basin organisms), thus reflecting the bimodal model of river basin management.[109] The tensions between the centralizing tendencies in the CNA and the demands of the *nuevo federalismo* program rings through in the following two quotes from the *Programa Hidráulico 1995-2000* (Hydraulic Program 1995-2000), the main policy document for the water sector during Zedillo's administration:

> Decentralization entails the separation of normative functions from operational ones; the transfer of some operational functions to users; realizing the planning and administration of water use in a comprehensive manner at the river basin level, retaining at the federal level both those functions that subordinate regional interests to the interest of the Nation, as well as decisions that affect more than one federal entity and the undefended, identified as the environment and future generations. (SEMARNAP, 1996: 3)[110]
>
> To reconcile the requirements associated with the conceptualization of the new federalism with the necessity to administer the resource [water] on a hydrological basis, it is necessary to simultaneously attend to two aspects related to the nature of the functions and activities, be it normative or operational, currently realized by the CNA. The aspects requiring attention are the following: a) An effective decentralization of functions by transferring them to state and municipal governments and to organized users. b) A new regionalization of the CNA (along strictly hydrological lines) to rationally deconcentrate the functions reserved for the Federation and be able to introduce new financing mechanisms. (…) The deconcentration process will be accompanied by two simultaneous actions: on the

[108] This move entailed a much larger degree of autonomy for the CNA as the ministry of the environment was formed in late 1994, and had only one third of CNA's budget.

[109] In 1996 it was decided to create 13 RBCs, one for each regional office, but by 1999 the CNA had decided to form 25 RBCs as the hydrologic-administrative regions were too large for one RBC and frequently covered more than one river basin.

[110] "La descentralización contempla la separación de las funciones normativas de las operativas; la transferencia de algunas funciones operativas a los usuarios; realizar la planeación y administración del aprovechamiento del agua de forma integral a nivel de cuenca, manteniendo a nivel federal tanto las funciones que sujetan los intereses regionales al interés de la Nación, como las decisiones que afectan a más de una entidad federativa y a los indefensos, identificados como el medio ambiente y las futuras generaciones."

> one hand, the reduction of the presence of the CNA in the federal entities [states], and on the other hand the creation of State Water Commissions under the charge of the corresponding governments. (SEMARNAP, 1996: 50-51)[111]

By making recourse to the need to manage water based on river basins, the CNA safeguarded a large role for itself in water management. While it agreed to the creation of State Water Commissions, through its regional offices all major water decisions would continue to be made by the CNA. The 13 regional offices were created in 1996 and 1997, based on a regionalization that largely followed the 13 regions defined by the PNH in 1975. For the Lerma-Chapala Basin this entailed a major change, as the Lerma-Balsas region was split into a Balsas regional office and a Lerma-Santiago-Pacífico regional office. Also, the offices were moved from Querétaro to Guadalajara and it was planned to enlarge the Lerma-Chapala RBC by including the Río Santiago Basin in the Council. This occurred in 1998, but soon after it was decided to split the RBC in two, as the issues in the two Basins were too distinctive.

Developments in the Lerma-Chapala Basin from 1995 to 2000

In 1995 Lake Chapala started to decline again, to reach its lowest level since the 1950s by June 2000. However, the energetic efforts by the CNA regional office and the RBC in the early 1990s to restore the Basin and rescue the Lake ebbed away in the second half of the decade. It was not until April 1999 that the RBC was to hold a formal meeting again, nearly five years after its second session in July 1994. The TWG did continue to meet and allocate surface water each year, but the rhythm of yearly RBC meetings attended by federal ministers, state governors and at times the president was broken. Another change was that Eduardo Mestre was forced to leave the CNA when the Lerma-Santiago-Pacífico regional office was being formed, while many of his team were dispersed throughout the CNA or also left. Around this time the efforts by Vicente Fox to increase the role of Guanajuato in water governance began to have an effect.

When Fox took office as governor of Guanajuato in June 1995, he made it clear that water was a central component of his political project. He openly accused the CNA of corruption and demanded a larger role for the state government in water management. To achieve this, he focused on strengthening the *Comisión Estatal del Agua y Saneamiento de Guanajuato* (CEASG; Guanajuato State Water and Sanitation Commission) that until then had concentrated on supervising the municipal water companies and constructing rural

[111] "Para conciliar los requerimientos asociados a la conceptualización del nuevo federalismo con la necesidad de administrar el recurso sobre bases hidrológicas, es necesario atender simultáneamente dos aspectos vinculados con la naturaleza, ya sea normativa u operativa, de las funciones y actividades que actualmente realice la CNA. Los aspectos por atender son los siguientes: a) Una efectiva descentralización de funciones a través de su transferencia a los gobiernos estatales y municipales y a los usuarios organizados. b) Una nueva regionalización de la CNA (con bases estrictamente hidrológicas) para desconcentrar racionalmente las funciones reservadas a la Federación y poder introducir nuevos esquemas de financiamiento. (…) El proceso de desconcentración estará acompañado necesariamente por dos acciones simultáneas: por una parte, la disminución de la presencia de la CNA en las entidades federativas, y por otra, la formación de Comisiones Estatales de Agua a cargo de los gobiernos correspondientes."

drinking water projects. Based on the new federalism program, Fox attributed a wide range of functions to CEASG, so that it could become a full-fledged state water bureaucracy. From 1996 onwards the DG of CEASG represented Guanajuato in the TWG and in 1998 CEASG began developing a State Water Plan and started forming technical water councils in all of Guanajuato's aquifers. This was an open challenge to CNA's authority, described in more detail in Chapter 7. Although the CNA had formally committed itself to decentralizing functions and programs to State Water Commissions, in practice it was very reluctant to collaborate with CEASG, arguing that it was the sole water authority and that water was a federal prerogative. CEASG responded by developing a state water law, in which it defined water originating in Guanajuato as falling under state jurisdiction. Predictably, the CNA reacted by stating that all water is federal property, although García-León (2004) makes a convincing case that Article 27 of the Mexican Constitution provides states with the faculty to declare water as state property. Although the CNA could not completely ignore Fox and CEASG, until 2000 it went ahead and managed the Basin as it saw fit. This becomes apparent from the way user representatives were elected to the River Basin Council and from the way the 1991 surface water allocation treaty was updated.

As described in section 5.3, the Lerma-Chapala RBC only consisted of government officials in the early 1990s. At the second session of the RBC, held in July 1994, it was agreed to create an assembly of water users in the Basin (CNA, 1994d). This initiative was based on the regulations of the national water law published in January 1994, which stated in article 15.V that up to six user representatives elected by an assembly of water users should represent water users on the RBC. The TWG set to work and on 28 February 1996 the CNA created an Assembly of Users of the Lerma-Chapala Basin. It consisted of water users from the five states in the Basin, representing the industrial, irrigation, domestic water supply, livestock and services sectors. It is unclear how the water users forming the assembly were selected, but it appears that the CNA invited them from existing user organizations. The Assembly did elect five representatives to sit on the RBC and these representatives attended TWG meetings. However, it is noteworthy that in 1999 the presidents of WUAs in ARLID did not know who the agricultural representative was, although he came from Salamanca and was a friend of the president of the Cortazar WUA.

In 1998 a process was started to reinvigorate the users' assembly and to elect new user representatives from six sectors (agriculture, fisheries, services, industry, livestock and urban) on the RBC. This was based on the modifications of the regulations of the national water law enacted in December 1997, which included a revised Article 15 specifying the structure of the RBCs and the participation of water users. This article also stipulated that the number of user representatives on the RBC should at least be equal to the number of other RBC members. However, the regulations did not set out the structure of the new users' assembly, or how its members should be selected. Mestre mentions that:

> An important users' group (as well as government officials) were unwilling to have regional representatives surging from regional water users' organizations (controlled by [the CNA]), as was [CNA's] position. Behind curtains, such struggle had a lot to do with Federal leadership, centralization and political positions within the RBC and beyond, vis a vis increasing autonomy by State Governments. Finally, a compromise was attained where users' representatives would surge from State water users'

> organizations within Lerma-Chapala Basin, and from there, the General Assembly would select its representatives to LCRBC. (Mestre, 2001: 11)

Thus, the CNA created 26 *Comités Estatales de Usuarios por tipo de Uso* (State User Committees per Type of Use) in 1998, of which each sent one representative to the users' assembly at Basin level (CNA, 2000a). On 15 January 1999 the CNA called a meeting in La Piedad where an agreement formalizing the users' assembly was signed and six user representatives were elected by the assembly, with Raul Medina de Wit, president of the La Barca WUA elected as the representative of the agricultural water users. However, only CNA officials were present and 24 carefully selected water user representatives from the five states, excluding the Guanajuato committee of agricultural water users (CNA, 1999d). The selection procedure of the user representatives on the Council was strongly questioned by water users and state governments and it is clear they do not necessarily reflect the interests of the water use sector they represent.

The 1997 regulations of the water law also stated that the DG of the CNA would become the president of the Council, while state governors would remain members. Thus, the RBC became less top-heavy and by 1999 formally included user representatives. In June 2000 detailed rules for the organization of RBCs were enacted by the CNA, indicating that a River Basin Council consists of a Governing Council, a Monitoring and Evaluation Group (MEG), previously the TWG, a Basin Level User Assembly and Special Working Groups, while CNA's regional office forms the Council's secretariat (CNA, 2000a). The decision-making body of the River Basin Council is the MEG, which is a carbon copy of the Governing Council except that state governors send representatives in their stead, while the CNA is represented by the head of its regional office. The MEG meets on a regular basis and is charged with preparing Council meetings and drafting agreements to be signed at formal Council meetings, as well as applying the 1991 surface water allocation agreement.

From 1992 to 2000, the TWG of the Lerma-Chapala RBC met each year to apply the water allocation rules of the 1991 agreement. In two years the critical allocation policy was applied (1997/1998 and 1999/2000) and the average allocation policy was followed in the rest. Nonetheless, Lake Chapala's volume more than halved between 1994 and 2000, although according to CNA data the WUAs in the irrigation districts never used more water than allocated to them during this period. This led to intense debates in the RBC, with environmentalists and the Jalisco state government blaming the upstream irrigation districts in Guanajuato for using too much water. However, CNA's weak control over surface water use in irrigation units, direct pumping from the river and Lake Chapala for irrigation, lower than average rainfall and reduced river baseflows due to groundwater overexploitation are equally plausible reasons for the reductions in the Lake. In addition, the 1991 allocation agreement itself is partly at fault, as it overestimated annual water availability,[112] underestimated water use in irrigation units and did not indicate the status of carry-over storage in reservoirs. Especially this last point was to become contested, as discussed in Chapter 8, with the transfer of unallocated and "unused" water from reservoirs to Lake Chapala.

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[112] The agreement was based on hydrological data from 1950 to 1979, a relatively wet period.

A further weakness of the 1991 allocation agreement was that it used the surface runoff generated in the previous year to determine water allocations. This is clearly brought out by the allocations for 1998 and 1999 (see Figure 5.3). In 1997 rainfall was only 645 mm and dam storage on 1 November (used here as a proxy of surface runoff) was consequently low. Combined with a Lake volume below 3,300 hm^3 the critical allocation policy was followed for 1998, leading to the lowest allocations since the agreement was signed. However, rainfall in 1998 was exceptionally good (810 mm), leading to a recuperation of the volume of water stored behind dams in the Basin and a slight increase in the volume of Lake Chapala to 3,361 hm^3. As a result, the average allocation policy was followed for 1999 and 3,664 hm^3 were allocated to water users, the highest level since the signing of the agreement. Unfortunately, rainfall in 1999 was a historic low of 494 mm. These two factors resulted in Lake Chapala dropping to its lowest level since the signing of the allocation agreement and point to inadequate provisions in the agreement for inter-annual planning of water availability and dealing with contingencies.

Although the signing of the 1991 surface water allocation agreement was historic, the members of the RBC came to recognize its shortcomings. At the third formal session of the RBC held in April 1999, the representatives of Jalisco and Michoacán requested a revision and updating of the 1991 agreement as it was clear that it was not rescuing Lake Chapala. The CNA contracted the same company that had done the studies for the 1991 agreement to carry out the updating of the agreement. This company conducted detailed hydrological studies in 1999 and 2000 using data from 1945 to 1997 to develop a new model for calculating surface runoff (CNA, 1999e). The Council signed the updated version of the 1991 agreement on 24 August 2000, during the fourth formal session of the RBC (CNA, 2000c). However, various states in the Basin, especially Guanajuato, felt that they did not have sufficient input in the design of the surface runoff model and that the CNA imposed the updated agreement on them, thereby negating the coordinating role of the Council. In addition, consultation with water users concerning the amended agreement was minimal, although user representatives on the Council voted in favor. For these reasons the updated agreement did not contain any changes in the algorithms used to calculate water allocations, except for Querétaro, whose allocation under the average allocation policy increased from 65 hm^3 to 90 hm^3 and under the abundant allocation policy from 65 hm^3 to 94 hm^3 (CNA, 2000c). However, the updated agreement did contain a clause that the algorithms would be adjusted within 180 days to "optimize the equitable distribution of surface water in the basin" (CNA, 2000c: 80).[113] As detailed in Chapter 8, this was to take four and a half years, instead of half a year. The transfers of water from reservoirs in the Middle Lerma region to Lake Chapala were one of the main reasons for this delay.

In October and November 1999, because of low Lake levels and to secure Guadalajara's water supply, the CNA transferred 200 hm^3 from Solís dam, the main water source of ARLID, to Lake Chapala. This was the first time that surface water was transferred from the agricultural sector to the urban and environmental sectors under the 1991 agreement. These water transfers met with staunch resistance from farmers from Guanajuato and undermined the legitimacy of the Council. Farmers felt that "their" water was being stolen, as they received no compensation, and because the 1991 agreement does not

[113] "optimizar la distribución equitativa del agua superficial en la cuenca."

outline procedures for water transfers. Scott *et al.* (2001) calculate that the benefits forgone for farmers in ARLID as a result of a reduced water allocation to the district for 1999/2000 amounted to US$ 14 million. Although sufficient water was stored in the district's reservoirs to cover its full allocation (955 hm^3) the district was allocated only 648.2 hm^3 under the treaty, due to the low volume of water in Lake Chapala and the minimal surface runoff generated in Guanajuato in 1999. Although the volume allocated was in accordance with the 1991 agreement, it was unacceptable to farmers that the unallocated water stored in the Solís reservoir was transferred to Lake Chapala. On the other hand, environmentalists and the Jalisco state government argued that much more water had to be transferred to save the Lake, as around 10 hm^3 are needed to raise the Lake level by 1 cm. This led many in Jalisco to refer to the water transfers as "aspirins" for the Lake's headaches, with the media calling for much stronger medicine to cure the Lake.

Before 1999, none of the WUA leaders in ARLID were actively involved in the RBC. However, the water transfers galvanized WUA leaders to act. In May 2000, the presidents of WUAs from Jalisco, Guanajuato and Michoacán met each other for the first time to discuss ways to strengthen their representation in the RBC. Until then, WUAs had only dealt with the CNA and there were no horizontal linkages between WUAs from different irrigation districts. In 2001, the WUAs established a new working group in the RBC, under the leadership of the representative for agricultural water use on the RBC, to safeguard their access to water. How well they succeeded in this is analyzed in Chapter 8.

5.6 Conclusions

This chapter has shown that turning river basins into the territorial unit for water management is intensely political. The efforts to turn the Lerma-Chapala Basin into a domain of water governance strengthened the position of the hydrocracy in the Basin in the early 1990s. This was intentional and strongly embedded in the hydrocracy's conviction that river basins are the natural and ideal unit for water management and that the hydrocracy should be in charge of water governance at this scale. The creation of CNA's regional offices, irrigation management transfer and the creation of state water commissions potentially entailed a shift from a centralized to a more distributed governance, in which states and water users would have a larger say. However, the dynamics of these reforms, coupled with larger changes in Mexican society, resulted in increasing conflicts in the late 1990s in the Lerma-Chapala Basin. While the hydrocracy furthered its territorial and governmental ambitions through a scale-making project based on the concept of river basins as the natural units for water management, it only partially succeeded in increasing its control over actual water use.

This chapter has engaged with one of the central aims of this thesis, namely to elucidate the apparent contradiction between sustained attempts at context-specific, process based and strategic water reforms and their lack of impact on water overexploitation and environmental degradation. Despite the attempts made in the Lerma-Chapala Basin in the 1990s to bend the curve down, the Basin was still faced with water overexploitation and serious environmental degradation by the year 2000, with Lake Chapala dropping to its lowest levels since the 1950s. A cursory analysis suggests that this was because not enough effort was made to reduce primary water use and that the increased control over water use achieved by the CNA in the early 1990s weakened in the second half of the decade. Embattled CNA officials blamed the decline in Lake Chapala on lower than average rainfall and argued that Lake fluctuations are a natural phenomenon linked to the hydrologic cycle (Pérez-Peña, 2004). This is a credible claim, but also suggests that the CNA stopped trying to bend the curve down. A deeper analysis, as set out in this chapter, brings out that the politics of decentralization and changing modes of water control thwarted efforts to reduce primary water use. When the CNA did intervene, such as when it transferred water from Solís dam to Lake Chapala in 1999, this was strongly linked to the upcoming presidential elections and not part of a concerted effort to reduce water use.

The emergence of the river basin council, the transfer of the irrigation districts and the growing role of state governments in water governance were attempts to decentralize water management. However, the centralizing tendencies in the hydrocracy were very strong and proved stronger than the policy current in the CNA aiming for decentralized water management. This was especially the case after 1994, with the ascendance of civil engineers in the CNA with a stronger water development and construction focus. Thus, while 13 regional offices based on hydrologic-administrative boundaries were created, laying the foundation for a bimodal form of river basin management, these offices were not granted autonomy and remained firmly under the control of CNA's central office. Also, the state water commissions were curtailed in their influence and important programs remained under the financial control and decision-making power of CNA's central office. Nonetheless, from 1995 to 2000 the CNA came under increasing scrutiny and was criticized by state governments and water users because of its reluctance to decentralize authority and funds to the regional level and to states. The CNA has also been widely criticized because it functions as both "judge and participant" in water governance, as it is responsible for granting water concessions and establishing water allocation policies, but at the same time has to solve the conflicts that emerge from this. This is especially apparent in the Lerma-Chapala Basin, where the centralizing tendencies in the hydrocracy and the tensions this created with state governments, WUAs and municipal water companies precluded attempts to bend the curve down based on mutual collaboration and an equitable approach to the curtailment of primary water use.

This chapter fully concurs with Allan's statement that "knowing about, wanting, having, operating and effectively operating (KWHOE) water reforming policy and practice can be conceptualised in a sentence but the actual process can take decades" (Allan, 2006: 58). The tensions between centralized and unicentric water management, with power and authority vested in the federal or national government, and decentralized or regional water management is a recurrent theme in water management throughout the world. The examples of India and the USA come to mind, where water is a state affair but strongly influenced by federal government, and France, which has strong decentralized water agencies that are under increasing scrutiny by the central government. However, the strong resilience of the centralizing tendency in Mexico's hydrocracy, even under drastic changes in government as Chapter 8 will show, is remarkable, and a large part of the answer why the context-specific, process based and strategic water reforms attempted in the Lerma-Chapala Basin in the 1990s have been less effective than hoped.

6

Boundaries of Consent: Stakeholder Representation in River Basin Management in Mexico and South Africa[114]

Philippus Wester, Douglas J. Merrey and Marna de Lange

Abstract

Increasing the capacity of water users to influence decision-making is crucial in river basin management reforms. This article assesses emerging forums for river basin management in Mexico and South Africa and concludes that the pace of democratization

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of water management in both is slow. Mexico is characterized by continued government dominance and attempts to include already organized stakeholders in decision-making, while substantive stakeholder representation is lacking. South Africa is placing emphasis on social mobilization and transformation, leading to a slower implementation process and struggles over the redistribution of resources. While not a panacea, moving from stakeholder participation to substantive stakeholder representation in river basin management holds more promise of achieving equitable water management.

6.1 Introduction[115]

The 2nd World Water Forum (WWF) held in March 2000 highlighted the growing global concern about freshwater, and the complexity of the challenges facing developing countries striving to attain effective water governance (Cosgrove and Rijsberman, 2000). In the 20th century, freshwater withdrawals grew dramatically, resulting in water stress in many countries of the world (Seckler *et al.*, 1998). While it has become conventional to cite water scarcity as a significant threat to human well-being, a danger of the water scarcity narrative is that it obscures issues concerning unequal access to and control over water (Mehta, 2000). While freshwater supplies are clearly limited, for most people water scarcity is caused by competition between water uses and by political, technological and economic barriers that limit their access to water (Falkenmark and Lundqvist, 1998).

As a result of water over-exploitation many river basins have become "closed" from a water perspective, meaning they no longer have utilizable outflows as consumptive water use equals or exceeds the amount of annual renewable water (Keller *et al.*, 1996; Seckler, 1996). The closure of river basins results in a complex interplay among declines in water quality, inter-sectoral water transfers, inequitable water allocation and reduced access to water, especially by poor people. The serious inequality in access to and control over water and the conflicts between the different uses and users of water lie at the heart of the need for new approaches to water management (Mehta, 2000; Vermillion and Merrey, 1998). This need is widely recognized as is the belief that existing institutional arrangements for water management are inappropriate and a major constraint for achieving sustainable water management (Cosgrove and Rijsberman, 2000; Gleick, 2000; Merrey, 1997).

To make the transition to more sustainable water management, most analysts recommend managing water based on river basins and increasing stakeholder participation in water management. These prescriptions build on the experiences gained with decentralizing

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water management for agriculture in the past 25 years, which saw much attention directed at creating or strengthening Water Users' Associations (WUAs) and transferring financial and management responsibility for irrigation services to these associations. In the irrigation sector the record is mixed, and even where Irrigation Management Transfer (IMT) policies are judged as "successful", it is rare to find dramatic changes in agricultural productivity (Kloezen *et al.*, 1997; Samad and Vermillion, 1999; Vermillion *et al.*, 1999).

Many policy makers, researchers, and water managers advocate that water must be managed at the level of river basins, based on the argument that river basins are a "natural" unit and thus the "logical" unit for water management. (see Newson, 1997 for a summary of the literature). This new territoriality in water management has become the basis for a new breed of policy instruments (Buller, 1996) and has led many countries to embark on a new round of water reforms, focused on national policies, and on creating new institutions for managing river basins. These reforms pose profound institutional and political challenges and are even more complex and problematic than reforms at the local level (Vermillion and Merrey, 1998). The few examples of functioning coordinating bodies at the river basin level are in rich countries such as France, Australia and England (Betlem, 1999; Buller, 1996; Chenoweth, 1999; Malano *et al.*, 1999; Pigram, 2000). For countries where implementing even local level reforms strains the financial and implementation capacities, trying to reform river basin management is difficult indeed. The political economy of such reforms is daunting, with strong vested interests and weak institutions affecting the capacity of the rural and urban poor and small-scale farmers to gain a voice in water management.

Although stakeholder participation in water management is frequently advocated, actually including the poor and achieving substantive stakeholder representation has proven elusive in practice (Cleaver, 1999). More often than not, participation is little more than token consultation, with no decision-making power in the hands of the people concerned (Wester and Bron, 1998). Too often, the participation discourse draws attention away from the very real social and economic differences between people and the need for the redistribution of resources, entitlements, and opportunities. This is typified by the definition of stakeholders as water users with recognized water rights, thereby excluding those without water rights. The participation discourse also obscures that water is a politically contested resource (Mehta, 2000; Mollinga, 2001), although there is growing recognition that there is a need to move beyond mere participation. As the Chairman and Rapporteur of the 2nd WWF stated,

> Support for "participation" has become an accepted principle for many countries and organizations. The user representatives in the Forum [pointed out] that this should not be limited to asking users to participate in government programs. Participation implies sharing power: democratic participation of citizens in elaborating or implementing water policies and projects and in managing water resources (HRH The Prince of Orange and Rijsberman, 2000, pp. 391-392).

This concern for democracy in water management is both timely and important. As decision-making moves to the river basin level, serious thought needs to be given to how hard-won democratic rights in conventional social and political domains are assured in the river basin domain (Barham, 2001). This raises the question which type of democracy is implied. Liberal democratic theory is premised on a notion of abstract individualism and assumes that all people are equal in the public sphere, which is characterized by modern values of rationality and impartiality (Held, 1995; Luckham *et al*., 2000). In water reforms informed by liberal democracy, it is assumed that it is possible for water management stakeholders to bracket status differentials and power inequalities and to deliberate "as if" they were equals in water management forums such as WUAs or river basin councils. Social democracy, on the other hand, departs from social inequalities and attempts to increase citizen involvement in the affairs of government and expand the concept of citizenship to cover economic and social rights as well as political rights. Thus, it aims at a redistribution of power and resources to enable citizens to participate in the decisions that affect their lives (Luckham *et al*., 2000). In water reforms informed by social democracy, water is seen as a basic human right and a politically contested resource (Gleick, 1998; Mehta, 2000).

Choice and consent are central to both liberal and social democracy, with the legitimacy of government premised on the notion that a majority has consented to be represented by it (Held, 1995; Luckham *et al.*, 2000). In water management, the boundaries of consent are shifting, through increased stakeholder participation in decision-making at both the water use and water resource (river basin) levels. To understand if and how current water reforms are deepening democracy, empirical research is needed to assess emerging forums for river basin management and their democratic content. This entails studying where the line is drawn between token stakeholder participation and actual control over water management decision-making by water users and citizens. It also entails questioning whether liberal or social notions of democracy inform current water reforms, that is, whether emphasis is placed on protecting proven productive capacity and assuming that growth will lead to redistribution or whether real attempts are made to redistribute productive resources.

This article reviews how Mexico and South Africa are putting democratic stakeholder representation in river basin management into practice. Both are committed to the ideals of equitable, productive and sustainable water management and stakeholder participation. Based on the recognition of the unitary nature of water in river basins and the need to deal with the interrelations between surface and groundwater, water quantity and quality and land-water-ecosystem interactions, both governments are sponsoring attempts to create new institutional arrangements for river basin management. This article is based on extensive research in the Lerma-Chapala River Basin in Mexico and the Olifants River Basin in South Africa, which consisted of in-depth interviews with policy-makers, water managers and water users, analysis of policy documents pertaining to these basins and participant observation at numerous water meetings.

This article does not analyze the goals, efficiency, and effectiveness of river basin management in the two basins studied. Rather, we focus on the process of stakeholder representation, paying attention to variables such as stakeholder composition, involvement of stakeholders in decision-making, and the types of participation allowed (cf. Griffin, 1999). Our analysis is informed by the notion that water is a politically contested resource and that water management institutions and policies are effects of political practices (Mehta *et al.*, 1999; Mollinga, 1998; 2001; Mosse, 1997). Thus, institutions are not seen simply as “the rules of the game” (cf. North, 1990) but as embedded in practice where they are reproduced, transformed and subverted through interactions and negotiations between actors (Cleaver, 2000). Such a notion of institutions opens avenues to analyze how power pervades institutional arrangements and gives rise to differentiated access to and control over water, and, more importantly, how to design processes to redress inequities.

6.2 River Basin Management in Mexico and South Africa

Internationally, Mexico and South Africa are at the forefront of applying innovative approaches to water and river basin management. By comparing their attempt to arrive at substantive stakeholder representation in water management important lessons can be learned for other countries. Although cross-country comparisons pertaining to water management are notoriously difficult to make, the similarities between Mexico and South Africa are striking. Both are middle-income countries with comparable levels of income (US$ 7,719/capita in Mexico and US$ 8,318/capita in South Africa in 1999 measured at Purchasing Power Parity (PPP)), poverty (17.9% in Mexico and 11.5% in South Africa of the population below US$1 PPP/day), and marked inequalities in income distribution (10% of the population enjoys 42.8% of income in Mexico and 45.9% in South Africa) (World Bank, 2000). Both countries are also undergoing significant political and social transformations, with free and fair national elections held for the first time in 1994 in both South Africa and Mexico. Agriculture accounts for 5% of GDP and withdraws 78% of freshwater in Mexico (World Bank, 2000), while in South Africa this is 4.5 % and close to 60% respectively (DWAF, 2002). Both countries have embarked on extensive and comparable water reforms, with water defined as national property held in trust by the national government, in line with modern water resources legislation (Burchi, 1991).

Even more complicated than comparing countries is the comparison of river basins. However, the Olifants Basin in South Africa and the Lerma-Chapala Basin in Mexico share a sufficient number of physical and social characteristics to validate drawing conclusions from a comparison between them (see Table 6.1). Both basins exhibit a similar pattern of development, with their upper catchment areas located close to the capitals of their respective countries and containing significant industrial development. Their middle reaches contain extensive irrigated areas while in the lower reaches both basins contain important environmental areas (Lake Chapala in the Lerma-Chapala Basin and Kruger National Park in the Olifants Basin). Additionally, both basins form part of a larger basin (the Limpopo for the Olifants and the Lerma-Chapala-Santiago for the Lerma-Chapala), and cross administrative boundaries. Although both basins cover nearly the same area, water availability in the Lerma-Chapala is nearly three times that of the Olifants, while consumptive water use is nearly 10 times higher. The two basins are increasingly water-stressed, characterized by mounting competition among domestic, industrial and agricultural uses of water, serious environmental issues, and significant water deprivation among large segments of the population. Lastly, both basins are in the early stages of serious and far-reaching institutional reform at the water use and river basin levels.

Table 6.1. Salient features of the Lerma-Chapala and the Olifants Basins

	Lerma-Chapala Basin Mexico	Olifants Basin South Africa
Area (km^2)	54,300	54,388
Population (in 1999)	11,000,000	3,400,000
Irrigated area (ha)	700,000	107,000
Mean annual runoff (million m^3)	5,757	1,992
Groundwater safe yield (million m^3)	3,980	1,800
Annual renewable water (million m^3)	9,737	3,792
Consumptive water use (million m^3)	10,637	1,135

Sources: BKS (2000) and CNA (1999a).

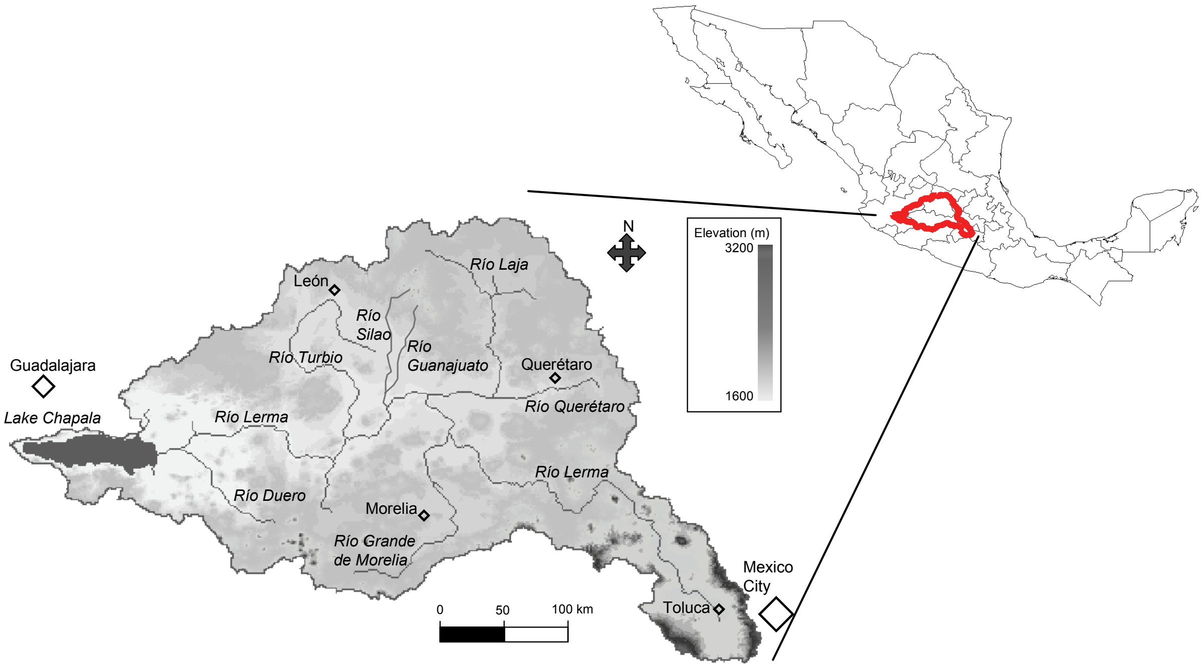
(a) Mexico: the Lerma-Chapala Basin

The Lerma-Chapala Basin in central Mexico lies between Mexico City and Guadalajara and crosses five states: Querétaro, Guanajuato, Michoacán, Mexico and Jalisco (see Figure 6.1). The basin accounts for 9% of Mexico's GNP and is the source of water for around 15 million people (11 million in the basin and 2 million each in Guadalajara and Mexico City) (CNA, 1999a). Irrigated agriculture, covering some 700,000 ha, accounts for 68% of current water use in the basin, while evaporation from water bodies (Lake Chapala and storage reservoirs) accounts for 23% of water consumed (Wester *et al.*, 2001b). Eleven large-scale canal irrigation districts (formerly state-managed) cover around 285,000 ha, while some 16,000 farmer-managed or private irrigation systems (termed "irrigation units" in Mexico) cover 510,000 ha. Twenty-seven reservoirs provide 235,000 ha in the irrigation districts with surface water while around 1,500 smaller reservoirs serve 180,000 ha in the units. An estimated 17,500 tubewells provide around 380,000 ha in the basin with groundwater, of which 47,000 ha is located in irrigation districts (CNA 1993a; CNA/MW 1999). In the irrigation districts there are an estimated 88,000 water users compared to 100,000 water users in the irrigation units (CNA/MW 1999).

The average annual runoff in the basin from 1940 to 1995 was 5,757 million cubic meters (MCM), while annual groundwater recharge is estimated to be 3,980 MCM giving a total of 9,737 MCM annual renewable water (CNA, 1999a). The best available estimates place total process and non-process water depletion at 10,637 MCM, yielding an annual deficit of 900 MCM (CNA, 1999a). As a consequence of the over-exploitation of water in the basin groundwater is being mined, with sustained declines in aquifer levels of 1.00 to 2.58 m year^{-1} (Scott and Garcés-Restrepo, 2001), and the flows in the Lerma River have been reduced to a trickle as a result of which Lake Chapala, into which the river flows, is rapidly drying up. This Lake is the largest in Mexico, giving it a high symbolic value, and it generates significant tourism revenues.

In response to the deterioration in the basin's water resources, several institutional innovations have occurred in the basin since 1989, including the signing of a river basin co-ordination agreement (1989), the creation of a river basin council (1993) and the establishment of aquifer management councils (1995-onwards). Water reforms at the national level, such as the creation of a national water agency in 1989, the decentralization of domestic water supply and sanitation to states and municipalities (starting in 1983), the transfer of government irrigation districts to users (1991-present), the creation of state water commissions from 1991 onwards, and the promulgation of a new water law in 1992, have also significantly altered institutional arrangements for water management in the basin. Driving the water reforms in Mexico are increasing water over-exploitation, the institutional resources of Mexican society to deal with this over-exploitation, the vested interests of the hydraulic bureaucracy, and the neo-liberal policies pursued by the Mexican government.

Figure 6.1. Map of the Lerma-Chapala Basin



Although states, municipalities and water users currently have a larger say in water management decision-making, the role of the federal government is still paramount as surface water is defined in the Constitution as national property placed in the trust of the federal government. As the trustee, the federal government has the right to concession surface water-use rights to users for periods ranging from 5 to 50 years (Kloezen, 1998). The concession titles set out the volume of water a user is entitled to, although the CNA may adjust the actual quantity a user receives annually to reflect water availability, with priority accorded to domestic water use (CNA, 1999b). For allocating surface water, Mexico follows the proportional appropriation doctrine and in theory all concession holders share proportionally in any shortages or surpluses of water. Once issued, water concessions need to be registered in the Public Registry of Water Rights, maintained by the CNA. After registration the concessions become fully tradable within river basins, although the CNA needs to be notified of the trade and needs to approve it (Kloezen, 1998).

The situation surrounding groundwater is more complex, as the Constitution does not define it as national property, but rather states that overlying landowners may bring groundwater to the surface as long as this does not affect other users. In 1946 the Constitution was amended to the effect that the federal government can intervene in aquifers in overdraft, by issuing pump permits or declaring that new pumps may not be installed. Based on a ruling of the Supreme Court in 1983 groundwater is now considered national property, although this is not reflected in the Constitution or the 1992 water law. Groundwater concessions in the Mexico are granted by the CNA on a volumetric basis with a maximum extraction or pumping rate specified.

Mexico has proceeded quickly in establishing new institutions for irrigation management and has followed what is sometimes called a "big bang" approach. As part of the Mexican IMT program in the 1990s ten irrigation districts in the Lerma-Chapala Basin were transferred to WUAs, that now manage secondary canal units varying in size from 1,500 to 30,000 ha. The WUAs were formed as legally recognized non-profit associations to whom the CNA granted concessions for the use of water and irrigation infrastructure. In all the districts the CNA continues to manage the dams and main canals and delivers water in bulk to the WUAs, except in the Alto Río Lerma irrigation district where a federation of WUAs has been formed to manage the main system (Kloezen, 2000). Research carried out by Kloezen *et al.* (1997) and Johnson (1997a, 1997b) shows that the new WUAs have been effective in improving the provision of services and recovering costs from water users, though the impact on agricultural productivity is minimal. More recent work in one district in the Lerma-Chapala Basin raises questions about the WUAs' long-term sustainability and shows how they are an important form of political capital for their leaders (Kloezen, 2000; Monsalvo, 1999).

The management structures in the irrigation units are much more diverse, and may consist of informal WUAs, government-recognized WUAs, water judges, pump groups or commercial management. As state intervention in the units has been piecemeal in comparison to the districts and has usually only consisted of assistance in construction and the concessioning of water rights, their representation in formal decision-making forums is weak (Silva-Ochoa, 2000).

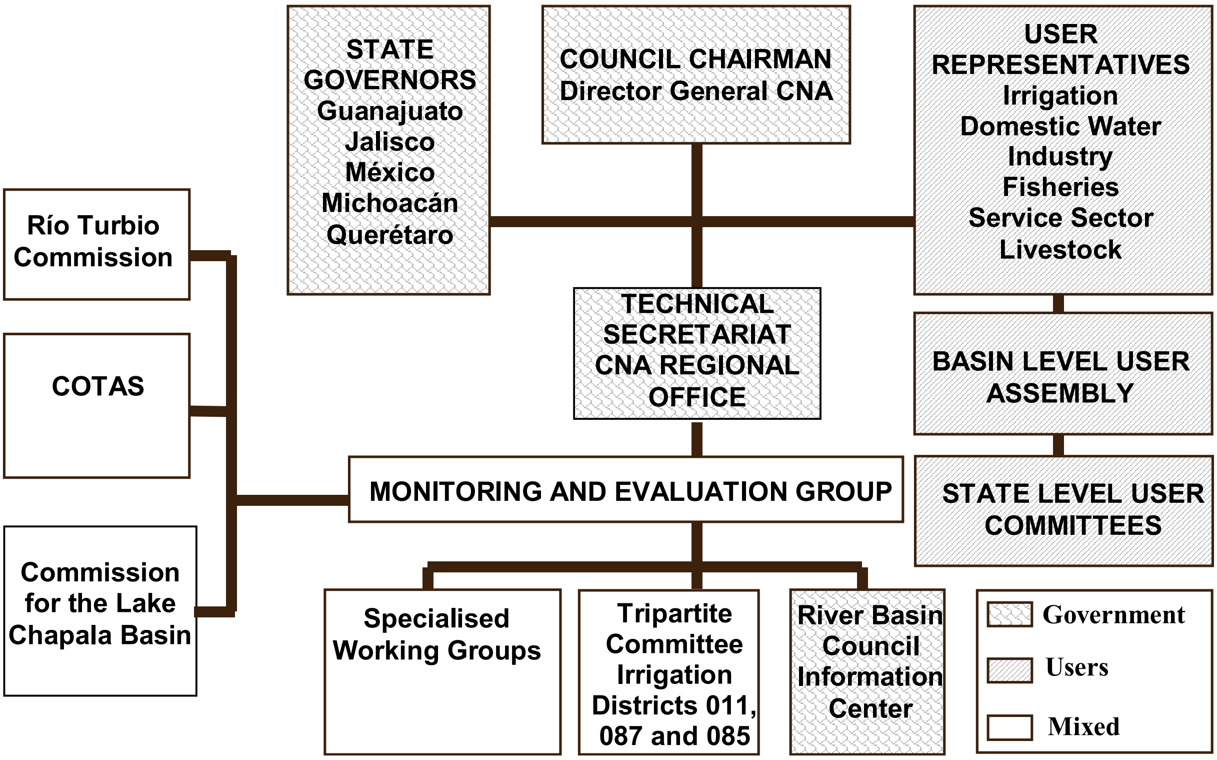
The federal government agency responsible for water management in the Lerma-Chapala Basin is the CNA, which is charged with defining water policy, granting water concessions and wastewater discharge permits, establishing norms for water use and water quality, and formulating regional and national water management plans (Herrera-Toledo, 1997). The official aim of vesting all government responsibilities and powers related to water in the CNA was to create the necessary conditions for moving towards sustainable water management. To complement this move a modern and comprehensive water law was promulgated in 1992 (CNA, 1999b). Unlike in South Africa, this law was not preceded by an extensive consultation process, but rather was written by CNA's legal experts with input from engineering staff and an extensive review of international experiences. This law defines an integral approach for managing surface and groundwater in the context of river basins, which it considers as the ideal geographical unit for the planning, development and management of water. It also promotes decentralization, stakeholder participation, control over wastewater discharges and full-cost pricing (Herrera-Toledo, 1997).

Although Mexico has a long tradition in river basin development and in using river basins as the basic unit for water management (Barkin and King, 1970), including the Lerma-Chapala Basin (Wester *et al.*, 2001b), an important provision of the 1992 water law is the stipulation that stakeholder participation is mandatory in water management at the river basin level. To this end river basin councils, defined in the water law as coordinating and consensus-building bodies between the CNA, federal, state and municipal governments and water user representatives (CNA, 1999b), have been established by the CNA in 25 river basins (CNA, 2000a). To facilitate river basin planning and interaction with stakeholders the CNA has divided the country into 13 hydrologic regions and established an office in each region. The stated goal of the councils it to foster the integral management of water in their respective river basins through proposing and promoting programs to improve water management, develop hydraulic infrastructure and the corresponding services and preserve the resources of the river basin. Formally, the river basin councils have very little decision-making powers, as the CNA remains responsible for water licensing, the collection of water taxes and water investment programs. The formal role of the councils is to assist the CNA in the execution of its vested powers and to ensure that stakeholders' opinions are taken into account (CNA, 2000a). The original intent behind the creation of river basin councils was that they would function as water parliaments that would approve water programs and proposals by the federal water management agency as well as control the budgets to fund these programs. It was hoped that Mexico would choose a dual structure for river basin management as used in France and vest more substantive powers in the river basin councils. Due to resistance by the water bureaucracy this did not come to pass.

Mexico's first river basin council was established in the Lerma-Chapala Basin, in response to the drying up of Lake Chapala in the 1980s, combined with the severe contamination of the Lerma River. According to Mestre, "A wide-ranging water diagnosis existing by mid 1989 clearly presented four capital problems in the Lerma River Basin: scarcity, as well as unsuitable water allocation, pollution, inefficiency of water use, and environmental depredation" (1997, p. 144). He adds that "To turn the tide, it became clear that it would be insufficient and imprudent to maintain that the federal government was solely responsible for this chaos and for its solution or mitigation" (Mestre, 1997, p. 144). In April 1989, the federal government and the five state governments signed a co-ordination agreement to improve water management in the basin, by (a) allocating surface and groundwater fairly among users and regulating water use; (b) improving water quality by treating municipal and industrial effluents; (c) increasing water-use efficiency; and (d) conserving the river basin ecosystem and watersheds.

On September 1, 1989 a formal Consultative Council was formed to follow up on these objectives. Based on the 1992 water law the Consultative Council became the Lerma-Chapala River Basin Council on January 28, 1993. Until the end of 1997, the Governing Board of the Council was very top heavy: its president was the federal minister of agriculture until 1995 and the federal minister of the environment during 1995-97, while its members were the governors of the five states making up the basin, five federal ministers and the Directors General (DG) of the CNA and the federal oil and electricity companies. In 1998 this changed, based on a modification in 1997 of the water law and its regulations to allow for greater user representation, with user representatives from six sectors (agriculture, fisheries, services, industry, livestock and urban) being appointed to the Governing Board by the CNA. Also, the DG of the CNA became the president of the Council and the five state governors continued as members, yielding a total of 12 members on the Governing Board.

Figure 6.2. Structure of the Lerma-Chapala River Basin Council



The Lerma-Chapala River Basin Council has been in flux in the past ten years, and only in August 2000 was its structure formalized by the CNA (CNA, 2000a). It now consists of the Governing Council, a Monitoring and Evaluation Group (MEG), an Assembly of User Representatives and Special Working Groups, while CNA's regional office forms the Council's secretariat (see Figure 6.2). The actual decision-making body of the River Basin Council is the MEG, which is a carbon-copy of the Governing Board except that state governors send representatives in their stead, while the CNA is represented by the head of its regional office. The MEG meets on a regular basis and is charged with preparing and convening Council meetings and more importantly drafting agreements to be signed at formal Council meetings. The structure of the River Basin Council is complemented by a stepped form of user representation consisting of water user committees for the six water use sectors represented on the Council. These sectoral committees can be formed at the regional, state or local level, where possible building on already existing WUAs or other legally recognized water management groups. The water user committees form the Assembly of User Representatives which elects the six user representatives on the Council. In addition, forums at the sub-basin level, such as watershed commissions and aquifer management councils (user organizations formed to reverse groundwater depletion, see CNA, 2000a and Marañón and Wester, 2000), form part of the structure of the River Basin Council.

A challenge for the River Basin Council has been ensuring effective user representation -- critical in the consensus building and co-ordination role envisioned in the law. The six user representatives on the Council have been nominated by the CNA, and are not known to, nor do they necessarily reflect the interests of the water use sector they represent. At present the water user committees are still being formed, but it is unclear at which levels they will be formed (regional, state or local), how many members these committees will have, and how they will be elected. What is clear is that only water users with a water license will be eligible to elect committee members, thus excluding the vast majority of the basin's population. Mestre (1997) emphasizes the Council is intended to be "an open and plural forum." The role of 'Society' is seen as paramount and "comprises non-governmental organizations, private sector organisms and individuals, academic and scientific actors, as well as a myriad of other social groups who participate in a regional water scenario" (1997:142). He notes society is "commonly organized through diverse groups." The assumption that society is already organized and ready to participate in the new Councils is an important one, and understandable in light of the corporatist structure of Mexican society (Camp, 1999). It also explains why Mexico has not felt it necessary to consider the significant numbers of rural poor who are voiceless, and facing "water deprivation" and to invest in social mobilization for the establishment of river basin councils. This is especially relevant for the irrigation units that depend on surface water, which cover some 180,000 ha and currently have no voice in the Council (Silva-Ochoa, 2000).

A recent development has been that agricultural water users have started to organize themselves to gain a larger voice in the Council. At the fourth ordinary session of the Council, held on 24 August 2000, agricultural water users were present in large numbers for the first time and demanded a larger say in the Council's deliberations. The River Basin Council is becoming an important forum for the agricultural sector, as the annual surface water allocations to the irrigation districts and units are discussed in the MEG of the Council. Due to poor rainfall the allocations for the 1999/2000 and the 2000/2001 growing seasons have been very low; as a result the WUAs in the irrigation districts decided to forego the 2000/2001 growing season altogether, letting 200,000 ha of irrigated land lie fallow. Scott *et al.* (2001) calculate that the benefits foregone in the 1999/2000 growing season for one irrigation district where 27,000 ha were not irrigated amounted to US$ 14 million, giving some indication of the devastating impact on both large and small farmers of the current situation.

Before 1999 none of the WUA leaders in the largest irrigation district of the basin were aware of the existence of the River Basin Council, but the lack of irrigation water in the past two years have galvanized them to take action. Together with the agricultural user representative on the Council, the WUA presidents of the irrigation districts in Guanajuato, Michoacán and Jalisco have formed a Specialized Working Group in the Council. This working group consists of representatives from the five State Agricultural Water User Committees, made up of the governing boards of all the WUAs in the state, both from irrigation districts and units. An interesting aspect of this development is that it has been fully carried out by the water users themselves without external support. Essentially, they are filling the void of ineffectual user representation on the Council.

The lack of substantive stakeholder representation in the River Basin Council to date is indicative of the difficulties of decentralizing water management. After nearly 70 years of strongly centralized control over water, the past ten years have seen the five states in the Lerma-Chapala Basin gain much more control over water management decision-making through negotiations in the River Basin Council. In itself this is no small feat and from a liberal democratic standpoint it could be argued that all is well as water users are represented on the Council through their elected governments. However, the institutional arrangements for water management in the Lerma-Chapala Basin revolve around who controls water. With basin closure, the competition for access to water is becoming more severe and poor people are losing their access to water, due to reductions in surface irrigation and increased costs for groundwater irrigation. Meeting the water needs of poor people and substantive stakeholder representation at all levels of water management decision-making is not a priority of the Council, nor of the larger set of institutional arrangements for water management in Mexico. The Mexico case can be characterized as a combination of continued government dominance and attempts to include already organized stakeholders in the river basin decision-making process. South Africa is placing greater emphasis on social mobilization and on transformation from a social democratic perspective, leading to a slower implementation process and protracted struggles over the redistribution of resources.

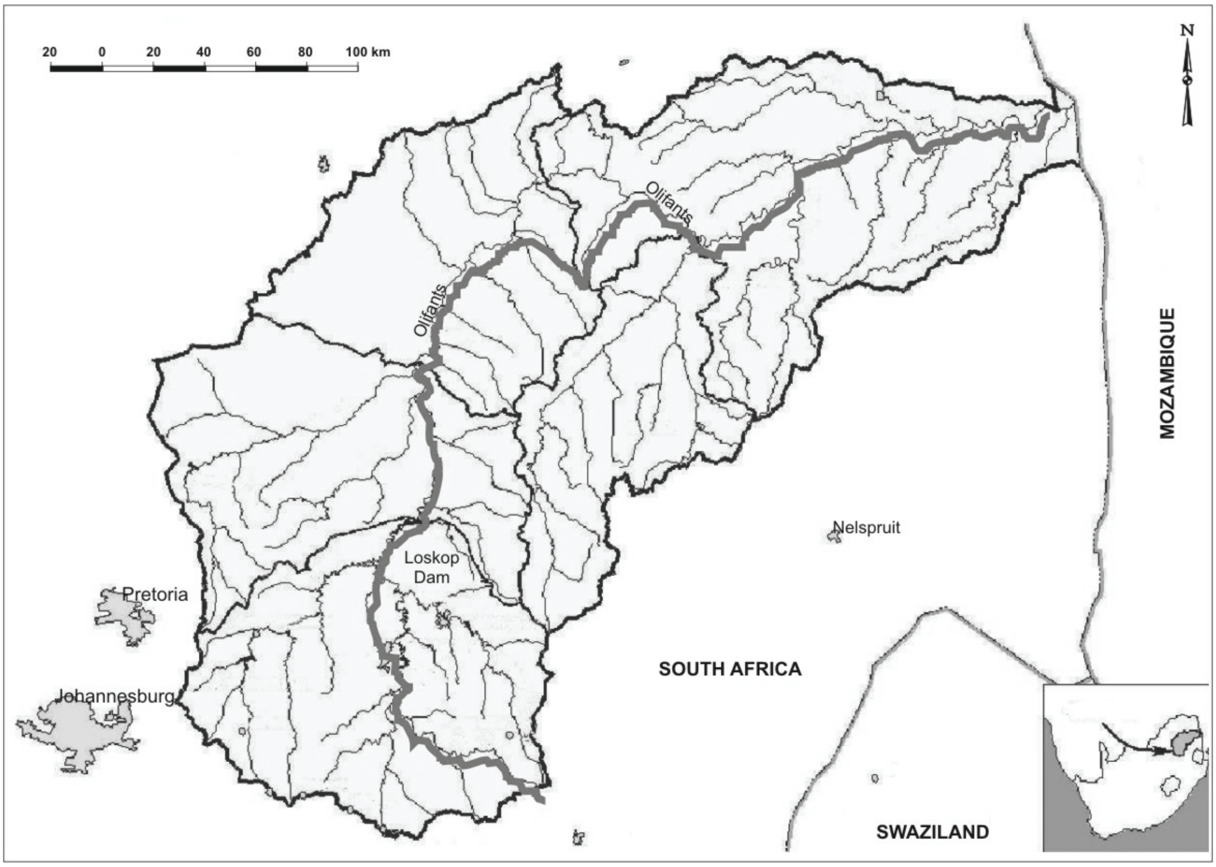
(b) South Africa: the Olifants Basin

The Olifants River in the north-east of South Africa has it source in Gauteng province and traverses Mpumalanga and Limpopo provinces into the Kruger National Park before crossing the border into Mozambique, where it joins the Limpopo River (see Figure 6.3). Irrigation is the largest single user of water (48%) in the basin, covering some 107,000 ha. In the upper catchment of the basin, thermal power plants generate almost 55% of the country's power, using coal from over 50 mines. Some water is imported into the basin to satisfy the power plants' requirement but this is not a significant percentage of the total available water; very small amounts are also exported from the basin for cities. Pollution, largely from the mines, is a serious problem. In all there are over 200 active mines in the basin for gold, platinum, tin, etc.; these are expected to expand significantly over the next decade (BKS, 2000; Stimie *et al.*, 2001).

Over half of the Olifants flow enters the river below its mid-section, making the middle area, where much of the irrigation is located, particularly water-short. About 65% of the total available water in the basin is already used, and much of the remaining water is in the lower tributaries and is difficult to develop for use in South Africa, though this may be seen as an opportunity for Mozambique in future. In some years there is no flow at all into the national park at the downstream end of the basin; and continued development of the upper catchment is likely to prolong these low- or no-flow periods in future. Although the basin is not as stressed as is the Lerma-Chapala, it is also a 'closing' basin under increasing pressure.

An important feature of this river basin is that large areas, particularly in the middle portion, pass through former "homelands" or *bantustans* set up under the previous regime. These marginal areas probably account for more than half of the basin's population, who are desperately poor with inadequate access to basic services and infrastructure. Of the irrigated area in the basin, white commercial farming controls 95%.

Figure 6.3. Map of the Olifants Basin



Source: Ligthelm (2001).

Since 1994 the new democratic government has devoted enormous effort to restructuring the constitution, legal system, policies and institutions to overcome the legacy of the apartheid system. Its water reforms must be seen in this context. The new water management policies were developed through a detailed process of public consultations and commissioned studies, and culminated in the National Water Act (No. 36 of 1998) and its companion Water Services Act (No. 108 of 1997) (see Thompson *et al.*, 2001). The new legal framework adopts integrated water resources management at the 'catchment,' i.e. river basin level. Local water services are to be provided through Water Service Providers (for municipal supplies) and WUAs (for agricultural supplies) while river basin management will be through Catchment Management Agencies (CMAs). The law embodies the following principles (see Karodia and Weston, 2001; Muller, 2001; and Schreiner and van Koppen, 2001 for discussions of the new National Water Act and water policies):

— equity in access to water resources, benefits and services;
— sustainability;
— optimal beneficial use;

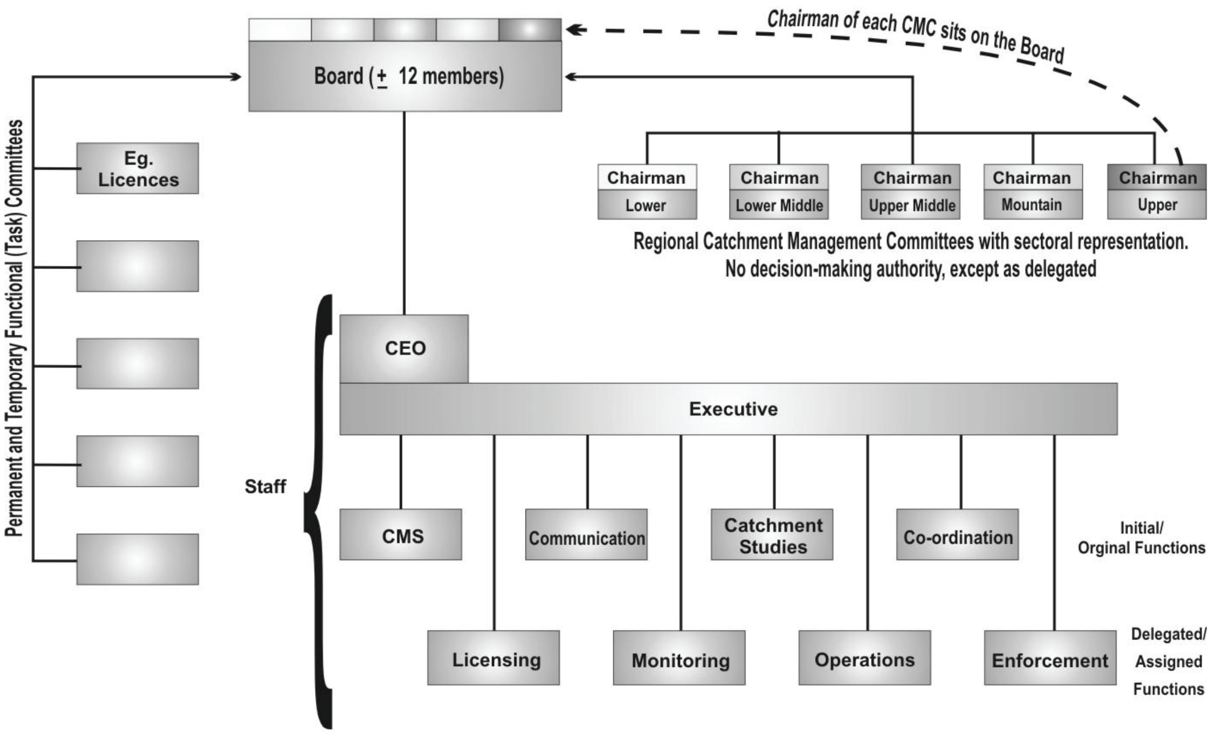
— redress of past racial and gender discrimination and inequities;
— participation by stakeholders in decision-making about water resources;
— "representivity" to ensure consideration of all stakeholder needs, interests and values;
— subsidiarity, i.e., devolution of responsibility to the lowest appropriate level;
— integration of water management functions;
— alignment of water management with other related departments' functions, and
— transparency to foster co-operation and encourage stakeholder support for decisions.

The Department of Water Affairs and Forestry (DWAF) is the lead agency in implementing the new policy. The National Water Act makes the Government responsible for overall water resources management as public trustee, and provides for licensing of water uses as in Mexico. But it also provides for reservation of minimum flows for environmental purposes and basic human needs, and allows any person to use water for "reasonable" domestic use, gardening, stock watering and recreation. The Act also includes a specific "good neighbor" provision applicable to its internationally shared rivers.

An important thrust of the new water act is to replace the previous system of centralized water management by DWAF with decentralized water management at the river basin level. For this purpose DWAF has divided South Africa into 19 Water Management Areas; defined as a large river basin, or several adjacent smaller basins to be managed by CMAs. The CMAs are intended to be statutory bodies established under Chapter 7 of the National Water Act, with five initial functions assigned to them under the law (Section 80): 1) investigate and advise on the protection, use, development and control over water in the catchment, 2) develop a catchment management strategy, 3) co-ordinate related activities of water users and institutions, 4) promote co-ordination of the implementation of the catchment management strategy with development plans resulting from the Water Services Act, and 5) promote community participation. Additional functions, powers and duties may be delegated or assigned to the CMAs by the Minister, including the review, authorization, extension and registration of water licenses. It is foreseen that CMAs will be primarily funded from water use charges in their respective Water Management Areas and that they may choose to carry out their functions in-house or delegate functions to other parties such as Catchment Management Committees, other water-related institutions, DWAF, contractors or even neighboring CMAs.

The establishment of CMAs consists of four stages: 1) initiating participation; 2) formalizing participation; 3) interim management arrangements; and 4) the formation of the CMA and the appointment of its Governing Board (DWAF, 1999). The exact structure of a CMA depends on the consultation process but will probably be a variation of the structure shown in Figure 6.4. The Governing Board is accountable to the Minister of Water Affairs and Forestry for the performance of the CMA and must set the vision, mission, and strategic direction of the CMA. It will consist of 9 to 15 members, to be appointed by the Minister, based on recommendations of an Advisory Committee, in turn also established by the Minister. As detailed in Section 81 of the National Water Act, in making the appointments the Minister must strive to achieve a balance among the interests of water users, potential water users, local and provincial government and environmental interest groups as well as ensure that there is sufficient gender representation, demographic representation and representation of disadvantaged persons or communities. Although stakeholders will not directly elect user representatives on the CMA and formal provisions for the election of representatives as in place in Mexico do not exist in South Africa, the Advisory Committee must consult with the relevant organs of state and interest groups before making recommendations to the Minister. This approach to selecting stakeholder representatives for river basin management would appear to conflict with the general thrust of democratization in the new South Africa, but was eventually chosen to ensure that well-organized interests would not capture the CMA. Through the provisions of the National Water Act the Minister is bound to ensure representivity and the inclusion of the poor.

Figure 6.4. Proposed Structure of the Olifants Catchment Management Agency



Source: Ligthelm (2001).

Currently, the development of proposals for the establishment of CMAs is at different stages for about a third of the 19 designated Water Management Areas, including the Olifants River. DWAF uses consulting firms to lead the process of developing catchment management proposals. The proposal is intended to be developed through consultation with stakeholders, and in its final form should lay out the broad scope and shape of the proposed CMA. After a period of public comment on the draft proposal, the final version goes to the Minister for approval. To date, there are no approved CMA proposals as the process only began in 1998. The first proposal, for the Inkomati Basin, is currently under review within DWAF. The Olifants proposal was scheduled to be sent to the Minister by early 2001, but has been delayed pending the decision on the Inkomati proposal. Proposals are to be accompanied by an independent review of the process of developing the proposal and its provisions, assessing whether it meets the requirements of the policy and Act.

An enormous effort is being devoted to developing the CMA proposal (see Ligthelm, 2001). It will include the proposed name and defined water management area of the CMA, a description of the existing water resources and their management, proposed functions and institutional structure of the CMA, the feasibility of the CMA in terms of technical, financial and administrative matters, and a description of the consultation process followed.

Our research on the consultation process in the Olifants Basin brings out that the mining and industrial sectors, the suppliers of water to larger towns, and the commercial farmers are well-organized to represent and articulate their interests. The commercial farms are large modern farms, using the latest irrigation technologies, some producing citrus and other high-value products for export. The government is seeking to balance the need for established users to have a reasonable and secure water supply with its policy to redress previous inequities. All of these interests are not only well organized but speak the language of, and come from the same culture as, the consultants and DWAF officials.

On the other hand, the millions of rural poor in the former homelands are not well organized to participate effectively in a consultation process on water. There are a number of small-scale irrigation schemes in the basin, many of which were originally built and managed by the previous government. These are in the process of being transferred to the users, but the smallholder sector is still struggling to get organized. Currently, one finds both "traditional" tribal chiefs, many of whom emerged in the apartheid era as a means of social control, and newly elected local councils which as yet have little financial or managerial capacity. Neither of these entities are effective representatives of local communities. The government has a major investment program to supply domestic water to these areas, but its approach has emphasized rapid construction of infrastructure to make up a huge backlog of some 12 million people with no access to safe drinking water. Therefore, insufficient attention has been paid to strengthening local domestic water entities. Similarly, the small-scale irrigation sector is still unorganized, and in most cases not profitable. DWAF has not yet approved the establishment of WUAs for smallholders under the new legislation. Currently there is an inter-ministerial process underway to agree on a consistent policy for "revitalizing" South Africa's smallholder irrigation sector.

A study carried out in the Steelpoort Basin, a major tributary basin to the Olifants, found that rural communities are unaware of the provisions of the new water law and of the CMA process, despite efforts to inform people and offer them opportunities for expressing their views. Small-scale farmers had not heard about the CMA, and municipalities and mining companies were mixed –some knew, some did not. Some of the Irrigation Boards providing water to commercial farmers were however participating actively in the process (Stimie *et al.*, 2001).

Our initial observations of the public consultation process have surfaced many important issues. In short, the effectiveness of the process in the poor rural areas is doubtful. Two reasons for this seem most important. First, the consultants do not speak the prevalent languages of the rural areas, and indeed do not understand the cultures of the rural poor. They have sought to overcome this by using facilitators who do speak the common languages, with only partial success. The minutes of the meetings demonstrate that poor people raise issues of immediate concern to them such as the lack of drinking water, while the consultants are focused on higher level issues, with little attempt to relate the solutions to immediate problems to this higher level process. One fear is that the well-organized sectors may yet monopolize access to most of the water, depriving the poor rural communities, in spite of the strong political commitment to redress these inequities.

Second, the consultants and some DWAF officials appear to see developing the CMA as a largely technical process, and do not recognize that it is a quintessentially political process. Similar concerns are raised by Rogers *et al.*, who state that,

> There is a tendency to superimpose the adaptive management process on old, usually bureaucratic, institutional structures and processes. (…) ignor[ing] the fundamental management axiom of "form must follow function" when planning or changing institutions. Recent conferences and workshops on CMAs revealed that many regional DWAF offices are falling foul of this axiom. There is a rush to set up structures to form the precursors of CMAs, without due regard for the processes needed to perform their intended functions. (2000, pp. 506-507).

Water is a political issue, especially when it is a scarce and valuable good, and when access is so skewed. There are many conflicting views – and real conflicts – among stakeholders over water issues, which need to be articulated clearly as part of the CMA establishment process. Experience from developing the first CMA proposal on the Inkomati Basin, where disagreements of some stakeholders with the proposal delayed its finalization, suggests that not addressing or at least identifying these conflicts may yet lead to similar problems in the Olifants. Again, the economic power of well-organized sectors may lead to continuing inequity in access to water.

6.3 Discussion

On the face of it, stakeholder platforms for river basin management such as river basin councils or catchment management agencies democratize water management by giving voice to a multiplicity of stakeholders. Much depends, however, on how new institutions for river basin management are established and from which social/material practices they emerge, as many roles and rights (sanctioned or informal, established or highly flexible), and certainly the technologies and physical infrastructure for controlling water are already in place. In river basins, it is the norm that water management stakeholders have different levels and kinds of education, speak different languages, differ in access to politics, and hold different beliefs about how nature and society function (see Edmunds and Wollenberg, 2001). If this is not taken into account when creating new rules, roles and rights, participatory processes may further institutionalize power differentials, a real danger in both Mexico and South Africa. Much depends then on the measures taken to ensure inclusive stakeholder representation.

It is clear that the size of the population in most river basins is such that it precludes the direct participation of all stakeholders in basin-level decision-making. The question who will represent groups of stakeholders in river basin management is a highly political one.

The relationship of the people participating in any multistakeholder process to their constituents is problematic, especially when third parties are involved. It is a nostrum of development work that third-party facilitators (researchers, consultants, NGOs) are needed to identify, mobilize, organize and inform stakeholder groups. However, as pointed out by Edmunds and Wollenberg:

> the relationship of a representative to his/her constituency is perhaps most politically charged when representatives of a group are designated by outsiders or are accountable to them, as is often the case in multistakeholder negotiations. From the start, outside convenors and facilitators influence representation by the selection of stakeholder groups, the people to represent each group and how the expression of interests is facilitated in the meeting (2001, pp. 240).

In both Mexico and South Africa the relationship of stakeholder representatives with their constituencies is problematic, not least because the government had a decisive say in their selection. As poverty is not a condition, but an outcome of how societies are structured, it is to be expected that marginal groups are excluded from decision-making. This points to the need for the redistribution of resources, entitlements, and opportunities, as marginal groups will only gain a voice in river basin management when they are no longer marginal.

6.4 Conclusions

This paper does not provide a complete analysis of the complex issues that arise when countries seek to implement new policies and create new institutional arrangements for river basin management. Indeed the processes are on-going, as is research on this subject. But several general observations emerge from this overview.

First, there are important contrasts among developing countries in how they go about crafting new policies and implementation arrangements. On one extreme, one finds a top-down almost entirely bureaucratic approach, driven by government agencies as the major stakeholders. In these cases, the process is essentially driven by a combination of technical and economic concerns and inter-agency politics. There is no room in such approaches for less organized, “informal” interests, especially poor people, to participate and gain access to water. In countries characterized by large groups of voiceless poor people, such an approach is unlikely to lead to overcoming water deprivation as a central element of poverty and will see the continued dependence of the poor on the random goodwill of the state.

Second, the Mexico case exhibits a combination of a top-down, government-driven process with inclusion of representatives of the organized users. An important result in Mexico is that the Council has been able to begin addressing serious water issues; and including representatives of organized users lends the Council legitimacy. This approach is appropriate in conditions where the major stakeholders are organized, as is partly the case in Mexico, or where economic growth is providing opportunities for poor people to improve their lives through other means. However, it is questionable whether many developing countries are characterized by these conditions. Therefore, following such an approach, while ensuring key organized sectors are represented, and enabling rapid attention to problem-solving, also presents the danger of excluding large numbers of poor water users, as is happening in Mexico. As water becomes scarcer, this will amplify the degree of water deprivation among poor people.

The South African approach should be of special interest to developing countries considering how to design new policies and institutional arrangements for river basin management. A clear disadvantage is the time it takes before the basin institution is able to address water management problems. In South Africa, there are parallel processes underway to respond to demands for water from new mines, for example, and decisions will either be postponed at potentially considerable cost in terms of economic development and job creation, or will be made by DWAF, with little involvement of stakeholders. On the other hand, successful empowerment of poor rural stakeholders could enable them to gain access to significant water rights. These could be valuable assets which they could use for productive uses (provided the necessary water infrastructure is put in place), or for bargaining with mines and other commercial users needing additional water.

Mexico and South Africa are two middle-income countries that are at the forefront of applying innovative approaches to water and river basin management. However, their experiences show that the "democratization" of water management is fraught with difficulties and largely informed by liberal notions of democracy and a concern not to disrupt the productive capacity of advanced sectors of the economy through the redistribution of resources. From a social democratic perspective, including the poor and achieving substantive stakeholder representation in river basin management is premised on the redistribution of power and resources to enable citizens to participate in decisions that affect their lives. Although few would disagree that the institutions for managing river basins should be broadly democratic, where the boundaries of consent for river basin management are drawn is a political choice, and should be treated as such in current water reforms.

When the Pumps Run Dry: Arresting Groundwater Depletion in Guanajuato

Based on an analysis of the groundwater situation in Guanajuato, this chapter argues that the political economy of groundwater use is a strong impediment to reducing groundwater overexploitation, either through user self-regulation or state regulation. This finding is of wider relevance, as globally groundwater provides an estimated 100 million ha with irrigation water (Shah *et al.*, 2007), while it is also an important source of urban and industrial water. Groundwater is popular because it is easily accessible with tubewell technology in many areas and is a reliable source of water, especially in dry periods. However, this rapidly leads to groundwater overexploitation, with extraction significantly exceeding recharge. Due to the ten-fold increase in groundwater irrigation world-wide since the 1950s, aquifer depletion is becoming increasingly serious in areas of intensive groundwater use, such as India, the Western USA, the North China Plain, Spain, Iran, the Middle East and Northern Africa and Mexico (Shah *et al.*, 2007). However, the regulation of groundwater pumping in these areas, which account for some 80% of the world's groundwater irrigated area (FAO, 2005), is proving very difficult, even though groundwater is of critical importance to their economies.

It is well established that groundwater regulation is very difficult and that very few examples of sustainable groundwater management regimes exist in areas of intensive groundwater use (Knegt and Vincent, 2001; Shah *et al.*, 2007). Hence, the collective management of groundwater by water users – self-regulation – is increasingly advocated as an alternative or a complement to state regulation (Blomquist, 1992; van Steenbergen and Shah, 2003; Lopez-Gunn and Cortina, 2006). This chapter analyzes one of the few examples from around the world where user self-regulation has been seriously attempted. In the Lerma-Chapala Basin, the state of Guanajuato has supported the self-regulation of groundwater by water users through the establishment of *Consejos Técnicos de Aguas* (COTAS; Technical Water Councils), as a complement to other measures to reduce groundwater extraction. This initiative aimed to contribute to reducing the level of groundwater over-extraction by 30% through user self-regulation and at a latter stage to stabilize aquifer levels. At the same time this initiative entailed that the state government would play a larger role in groundwater regulation.

Besides user self-regulation, other attempts have been made to regulate and reduce groundwater use in Guanajuato. Since the 1950s, areas of intensive groundwater use in the state were placed under a drilling ban (termed a *veda* in Mexico). With this regulatory instrument the government prohibited the drilling of new wells in specified zones, unless a pump permit was granted. More recently, compulsory pump registration, subsidies for irrigation modernization and the reform of electricity subsidies have been used by the government to reduce groundwater use. This chapter questions why these attempts and the COTAS yielded meager results, at best slowing the rate of increase in groundwater use.

7.1 Introduction

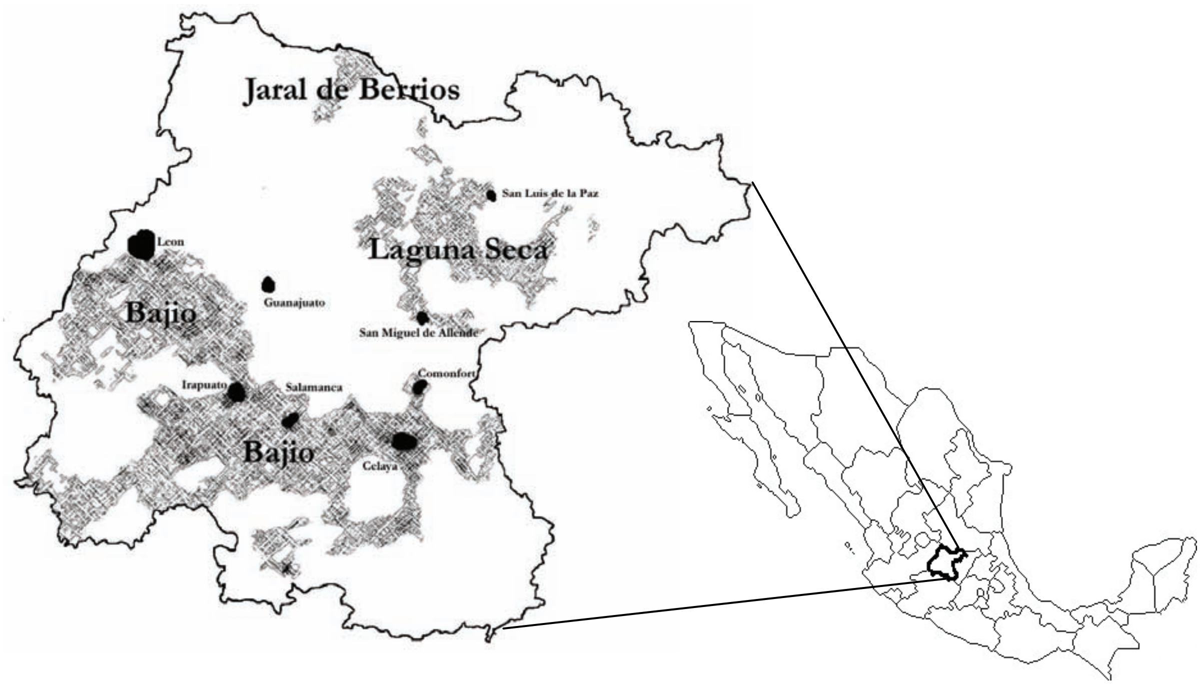
Aquifer depletion is an increasingly serious problem in the arid and semi-arid regions of Mexico, where groundwater is a major source of potable, industrial and irrigation water.[116] Of the 647 aquifers identified by the CNA, 99 aquifers were over-exploited in 1999, up from 32 in 1975 (CNA/World Bank, 1999). A critical region of groundwater overexploitation in Mexico is the Lerma-Chapala Basin. Forty aquifers have been identified in the Basin (CNA/MW, 1999). The upper layer of these aquifers is generally 50 to 150 m thick and composed of alluvial and lacustrine materials, while the lower layers, several hundred meters in depth, are composed primarily of basaltic rocks and rhyolite tuff. The aquifers are recharged through rainfall infiltration, surface run-off and, importantly, deep percolation from surface irrigation. Data from the CNA for the 1990s indicate that average annual groundwater recharge in the Basin, including deep percolation from surface irrigation, was 3,980 $hm^3 a^{-1}$, while average annual extractions were placed at 4,621 $hm^3 a^{-1}$, giving a deficit of 641 $hm^3 a^{-1}$ (CNA, 1999a). More recent studies estimate that the annual groundwater deficit is 1,336 $hm^3 a^{-1}$ in the Basin (IMTA, 2002b). The situation in the Middle Lerma region is particularly acute, with extractions exceeding

[116] Aquifer depletion is the result of the prolonged withdrawal of groundwater from an aquifer in quantities exceeding its average recharge, resulting in a fall in groundwater levels and a reduction in aquifer storage. This differs from groundwater mining, which refers to the extraction of groundwater from an aquifer that largely consists of non-renewable groundwater resources.

recharge by 40%. The Middle Lerma region, which covers the state of Guanajuato and parts of Michoacán and Querétaro, accounts for over half the area and more than 60% of groundwater extractions in the Basin.

This chapter focuses on Guanajuato, as this state faces the most serious aquifer overexploitation in the Basin. Due to intensive groundwater irrigation the state uses the largest amount of both groundwater and agricultural electricity in the country (Scott and Shah, 2004). All its aquifers are overexploited, with studies by the *Comisión Estatal del Agua de Guanajuato* (CEAG; Guanajuato State Water Commission) indicating that annual extractions are around 1,200 hm^3 more than recharge (CEAG, 2006). Total groundwater extractions fluctuate around 4,100 hm^3 while recharge is around 2,900 hm^3 for the whole state (CEAG, 2001) and thus the level of overexploitation is around 40% of recharge. The areas where most of the groundwater is extracted are the central Bajío region and the Laguna Seca region in the northeast of the state (see Figure 7.1). The Bajío contains most of the large cities and industries of the state and is characterized by intensive irrigated agriculture, while in Laguna Seca groundwater is used primarily for the production of export vegetables and fodder crops. Although irrigation accounts for some 83% of groundwater extractions in Guanajuato, groundwater is also critically important for industrial and urban water use.

Figure 7.1 Areas of intensive groundwater use in Guanajuato



Source: adapted from Hoogesteger (2004).

The main consequence of groundwater overexploitation in Guanajuato has been a sustained drop in groundwater levels and a cessation of seepage flow from the aquifers to the rivers. Although there is a shortage of historic data on Guanajuato's aquifers, pilot well observations were carried out during the 1970s and 1980s (INEGI, 1998). Based on measured static water levels for different periods between 1976 and 1994 for eight aquifers, Scott and Garcés-Restrepo (2001) calculated an average decline in static water levels of 1.22 m/year to 3.30 m/year, depending on the aquifer, and an average decline of 2.06 m/year. More recent studies by CEAG indicate that the drop in aquifer levels has continued, with an average of 2.03 m/year between 1995 to 2000 for all the aquifers in the state, and up to 3.5 m/year near cities (CEAG, 2001). Based on extensive studies and mathematical modeling of the aquifers in Guanajuato from 1998 to 2004 and the monitoring of static groundwater levels in 920 agricultural wells since 1998 by CEAG, a decline of 0.5 to 3.0 m/year is reported for the state's 18 aquifers from 1998 to 2004. Static groundwater levels in 2004 varied from 28 to 175 m in the north of the state, from 27 to 185 m in the center, from 30 to 140 m in the southwest and from 10 to 225 m in the southeast of the state (Acevedo-Torres, 2004: 4).

The consequences of declining groundwater levels are felt throughout the state. The decline in static water levels has led to the need to sink deeper wells with dug wells (*norias*) being displaced by wells more than 100 m deep. At present, well depths between 200 and 400 m are common, while depths of 500 to 1,000 m have been reported (Chávez, 1998). In nearly all aquifers, wells have dried out as water tables declined, making it necessary to deepen or reposition wells. This has led to increased pumping costs and capital investments. Another consequence of groundwater declines is the compaction of alluvial deposits, resulting in land subsidence of 2 to 3 cm per year in many parts of the Bajío. Celaya is the city that is most affected by land subsidence, which has damaged buildings, roads and drainage infrastructure.

Many attempts have been made in Guanajuato to regulate and reduce groundwater use. To date, these efforts have been ineffectual as evidenced by the continuing increase in groundwater extractions. Although the rate of growth has slowed since the 1990s, new wells continue to be drilled and the water table continues to be chased unabated. However, this situation is not unique to Guanajuato and is a story that could be told of nearly all areas of intensive groundwater use. This raises the question why the non-regulation of groundwater use is so widespread and if there is something unique about groundwater that invariably leads to its overexploitation. Research has shown that it is difficult to regulate groundwater for various reasons (cf. Blomquist, 1992). First, it is a fugitive and invisible resource, making it very difficult to monitor who is pumping how much and to arrive at collective agreements on reductions in groundwater extractions. Second, groundwater is extracted by widely dispersed and numerous pumps controlled by many individuals, who have a strong incentive to maximize groundwater withdrawals to recover high capital investments (Shah *et al.*, 2007). Worldwide experience shows that permit systems to regulate groundwater use are very prone to corruption and that establishing groundwater rights is even more difficult than for surface water (van Steenbergen and Shah, 2003). Lastly, reducing groundwater extractions is difficult as it entails curtailing the economic benefits of existing groundwater use (Shah *et al.*, 2003; Young, 1992). Thus, the individualized hydraulic mission mindset characteristic of groundwater use, namely pump every drop you can now and worry about the consequences later, combined with the strong economic clout of high volume pumpers such as industries, cities and commercial farmers, militate against sustainable groundwater management.

A complicating factor in groundwater management is that it is difficult to organize aquifer users and develop social control over groundwater pumping. The "invisible" character of groundwater makes it difficult to determine who is pumping how much and to monitor reductions in extractions. In contrast to surface irrigation systems, where water users must collaborate to ensure water deliveries, pumpers operate relatively independently from each other. It is only after prolonged periods of pumping that their combined actions result in groundwater overexploitation and the need for aquifer governance becomes germane. But even if a strong aquifer governance structure is constituted and reductions in groundwater extractions are agreed on, it takes a long time before an aquifer stabilizes and the pumpers see any reward for their restraint. Hence, the incentive for aquifer users to collaborate is limited, which complicates the self-regulation of aquifers by groundwater users.

These characteristics of groundwater have led many to argue that effective groundwater management requires centralized control through a government agency. The alternative, it is assumed, would be chaos. Interestingly, this chapter shows that in Guanajuato it was precisely the strong control of the federal hydrocracy that has led to the current crisis. Cities, industries and commercial agriculture strongly depended on increases in groundwater use for their continued growth and were strongly supported by government policies to achieve this. Thus, if government agencies want to reduce groundwater extractions, they need to tackle the political economy of groundwater use. This chapter contributes to the debate on the regulation of groundwater by analyzing institutional change processes in groundwater management in Guanajuato. Its aim is to provide insights that will contribute to the articulation of future groundwater policies that will be informed by the political economy of groundwater use.

The material presented in this chapter is based on field work conducted in 1999 and 2000, supplemented with a follow up study conducted in 2006 and 2007. In 1999 the COTAS were being formed and there was much uncertainty about their mandate and survival chances. During this period, I researched the COTAS together with Boris Marañón, consisting of interviews with CEAG and CNA officials, COTAS board members and COTAS managers. We attended many of the events organized by CEAG to establish the COTAS and organized a workshop with COTAS managers in May 2000 to discuss our research findings, published in Marañón and Wester (2000). A second period of research followed in 2006 and 2007, allowing for an appraisal of the development of the COTAS and their current position in the hydro-institutional landscape. In between the research periods I supervised Jaime Hoogesteger's MSc thesis research on groundwater in Guanajuato, which provided valuable insights (Hoogesteger, 2004). The following sections outline how groundwater has been managed in Guanajuato in the past and what initiatives have been undertaken in Guanajuato to stabilize its aquifers. Section 7.2 analyzes the development of groundwater use in Guanajuato from the 1950s onwards and the efforts undertaken by the Mexican state to control groundwater use through regulatory and demand approaches. Section 7.3 analyzes the attempts in Guanajuato to regulate groundwater use through user self-regulation, by reviewing the emergence and development of the COTAS up to 2000. Section 7.4 delves deeper into the political economy of groundwater, to show that powerful pumpers continue to increase groundwater extractions without much regard for regulatory, demand oriented or user self-regulation approaches. Lastly, conclusions are drawn in section 7.5.

7.2 Groundwater Development and Regulation in Guanajuato

From the 1950s onwards, the federal government has pursued contradictory groundwater policies, on the one hand subsidizing the drilling of wells, while on the other hand forbidding the extraction of more groundwater. Until the 1990s, efforts to control groundwater extractions by the Mexican state ran aground because preference was given to economic growth and maintaining political stability through investments in the countryside. At the same time, commercial farmers invested heavily in groundwater technology, which formed a crucial input in the development of a highly commercialized agriculture. The result was sustained declines in groundwater levels, subsidized by the state through low prices for agricultural electricity. The response to aquifer depletion by the federal and state governments since the early 1990s has consisted of a mix of regulatory measures, user participation and measures to reduce groundwater demand. Reducing groundwater demand by increasing irrigation efficiencies through "technification" programs has received the most attention, while a less traveled path has been attempts to reduce electricity subsidies. Both these responses are indirect attempts to reduce groundwater extractions by influencing the demand for groundwater, which largely failed. This section reviews the regulatory and demand approaches to groundwater management, to set the stage for the analysis of user self-regulation in section 7.3.

The development of groundwater irrigation in Guanajuato

The driving force behind groundwater depletion in Guanajuato has been the large increase in groundwater irrigation, from around 24,000 ha in 1960 to around 250,000 ha in the 1990s (CEASG, 1999a).[117] During this period, the area irrigated with surface water also increased, but much less, from 135,000 ha to 180,000 ha. The ten-fold increase in groundwater irrigation in less than four decades was strongly linked to the expansion of commercial agriculture and a significant shift in cropping patterns, from basic grains to export vegetables and sorghum and alfalfa for animal fodder. The large investments by the Mexican government and by individual farmers in wells and pumps drove the increase in groundwater irrigation, combined with the spread of the rural electricity grid and highly subsidized prices for agricultural electricity.

Groundwater use on a large scale for agriculture in Guanajuato started in the 1940s, with the advent of tubewell technology and investments by the federal government in groundwater development, both for agricultural and urban use. This led to a modest increase in the number of groundwater wells from less than a hundred in 1940 to some 2,000 in 1960. This formed part of the transition to commercial farming in Guanajuato, which started in the 1950s with the green revolution. In the 1940s, Mexican agrarian

[117] These figures are estimates, as there are no reliable data on the extent of groundwater irrigation in Guanajuato. Based on remotely sensed data, Scott *et al.* (1999) found that around 218,000 ha were irrigated with groundwater in Guanajuato during the 1997-98 winter season, suggesting that the total area irrigated with groundwater per year is likely to be higher than 250,000 ha. Other studies indicate that 295,000 ha (CEASG, 1994) and 270,000 ha (Chávez, 1998) were irrigated with groundwater during the 1990s.

policy shifted away from land reform to emphasize commercial production. Agriculture's task became to support the industrialization of the country by generating foreign exchange, both through the provision of cheap basic grains and the production of export crops (Hewitt de Alcántara, 1978). However, maize and wheat yields had been essentially stagnant in the twenty years before 1950. To tackle this issue, the Mexican government initiated research on the hybridization of wheat. Improved rust-resistant varieties were developed and by 1951 were sown on 70% of the national wheat acreage (Roberts, 1995). This first green revolution vastly improved wheat yields in Guanajuato, from around 1,000 kg/ha in 1950 to 2,500 kg/ha in 1960 on irrigated lands (Young, 1987). Wheat was primarily irrigated with surface water, as were most other crops in Guanajuato until the 1950s, and hence the first green revolution had a minor effect on groundwater levels.

Agriculture in Guanajuato was deeply transformed starting in the 1960s, with the substitution of maize by sorghum and widespread mechanization. From 1960 to the present, agrarian change in Guanajuato broadly consisted of two phases. The first *"internally oriented"* phase, from 1960 to 1982, consisted of a sharp increase in the production of feed grains, sorghum in particular, for the pork and chicken industry in Mexico. The second "*externally oriented*" phase, from 1982 to the present, was characterized by the rapid growth of export crops, mainly of canned and fresh vegetables. Both these phases strongly depended on groundwater.

Between 1960 and 1982, Guanajuato's agrarian structure changed drastically. The main crops of the past, such as wheat, maize and beans decreased in importance relative to sorghum and alfalfa (Gómez-Cruz and Perales, 1981). The area sown to sorghum increased from around 1,000 ha of irrigated land in the early 1960s to around 150,000 ha in the early 1980s, with a corresponding decrease in the area sown to maize. The popularity of the crop reflected its growing demand as animal feed, its resistance to drought and the ease with which harvesting could be mechanized (Roberts, 1995). The increase in sorghum production was closely linked to the growth in the Mexican poultry industry: the number of chickens raised in Mexico increased from 77 million a year in 1960 to 240 million in 1977. By the mid-1970s, chickens consumed 70% of all feed grains in Mexico, of which sorghum made up 60-80%. In response to this high demand, sorghum production increased rapidly in Guanajuato, especially after the construction of two large mills by Anderson Clayton in 1975 and Purina in 1977 in Guanajuato (Young, 1987). The production of alfalfa also increased during this period, from around 10,000 ha in 1960 to 45,000 ha in 1982 (Young, 1987). Because alfalfa is a perennial crop it needs around ten irrigation turns a year, which is mainly met by groundwater since the surface irrigation systems in Guanajuato usually deliver water only five to six months a year.

As part of this agricultural boom, thousands of wells were sunk in Guanajuato. Many of these wells were funded by farmers themselves, mainly middle-sized and large farmers, without direct access to state subsidies for well drilling. However, these commercial farmers did have preferential access to subsidized state credit. The federal government also directly funded well drilling for poor farmers, primarily *ejidatarios*, as part of the *Plan Nacional de Obras de Pequeña Irrigación* (National Plan of Small Irrigation Works) launched by the SRH in 1968. This plan formed part of a larger effort by the federal government to diffuse the agrarian protests and radical *campesino* movements that emerged in the 1960s and formed a credible threat to the legitimacy of the PRI regime. By providing hydraulic infrastructure to small farmers, the Plan aimed to increase food production, contain rural-urban migration, improve rural incomes and forestall rural discontent (Wionczek, 1982). Retired SRH officials that worked in Guanajuato in the 1960s and 1970s mentioned in interviews that they recalled a strong pressure on the federal government and the SRH to develop groundwater resources, especially for *ejidatarios*. Thus, the SRH promoted and covered the costs of well drilling, equipment installation and the running of electricity lines to the pumps. In Guanajuato the implementation of the Plan between 1970 and 1976 led to the construction of small irrigation works and the drilling of new wells to supply some 14,000 ha with irrigation water (Solís, 1976). However, the SRH also switched to promoting groundwater irrigation in Guanajuato in the 1970s as the scope for large irrigation works had been largely exhausted. Plans were made to bring an additional 90,000 ha under groundwater irrigation, although the SRH knew the aquifers in Guanajuato were already overexploited (Herrera, 1976: 14). By 1982, Guanajuato had around 10,000 agricultural wells, up from some 2,000 in 1960.

The second *"externally oriented"* phase of agricultural transformation in Guanajuato, from 1982 to the present, has had an even more marked impact on groundwater levels due to the rapid growth of a highly commercialized agriculture based on fresh and processed fruit and vegetables for export, primarily irrigated with groundwater. This phase began in 1982, with the adoption of the neo-liberal model by the Mexican government, which favored the production of export crops at the expense of basic food grains. Sharp reductions in subsidies for basic grains, combined with the lowering of trade barriers, resulted in the profitability of agriculture substantially changing in favor of export crops. This trend was further reinforced in the 1990s with the signing of the North American Free Trade Agreement (NAFTA). In Guanajuato, this resulted in a marked increase in the area dedicated to the production and export of fresh and processed fruit and vegetables, primarily irrigated with groundwater, from 10,000 ha to 50,000 ha between 1980 to 1998. During the same period, the value of vegetable exports – principally broccoli, cauliflower, garlic and asparagus – rose from US$10 million to US$170 million. Currently, Guanajuato is Mexico's leading producer of canned and frozen fruit and vegetables and also the nation's leading exporter of garlic and fresh green asparagus (Marañón and Wester, 2000).

The frozen fruits and vegetable business in Guanajuato is largely controlled by a small group of Mexican commercial farmers and multinational companies. The antecedents of this phase are located in the 1960s, with the installation in 1967 of a frozen vegetable plant near Celaya by Birds Eye, a US firm. Earlier, Del Monte, Heinz and Campbells Soup had built canning plants for the production of conserved vegetables in the Bajío and Birds Eye contracted with many of the same farmers as the canneries (Bivings and Runsten, 1992; Kamikihara, 1993; Key and Runsten, 1999). Contract farming became important because international firms could not own or rent land in Mexico until 1992 and hence had to contract with independent growers for product supply. Commercial farmers were quick to seize on the opportunities offered by vegetable production and processing, and beginning in 1975 built their own freezing plants or entered into partnerships with the US firms. Through vertical integration these farmers came to dominate the industry and used contract farming to increase the inflow to their processing plants (Key and Runsten, 1999).

Towards the end of the 1990s, the commercial vegetable sector consisted of around 600 large producers and 21 packaging industries. Most vegetables are irrigated with groundwater, as the processing plants mainly sign contracts with farmers that irrigate their vegetables with groundwater. Another reason why vegetables are irrigated with groundwater is that the surface irrigation systems in Guanajuato are not flexible enough in their water deliveries. Lastly, the high quality standards that the US government has set for agricultural imports imply that producers have to irrigate with groundwater.

The effect of the two phases of agrarian change in Guanajuato has been a ten-fold increase in the area under groundwater irrigation between 1960 and the present. The number of groundwater wells continued to increase, from some 10,000 in 1982 to around 17,000 in 2000. Based on his long-term research on groundwater in South Asia, Tushaar Shah has developed a progression of groundwater socio-ecologies consisting of four phases: (1) groundwater potential unleashed with the rise of tubewell technology followed by (2) an agrarian boom, that leads to increasing exploitation of the resource until (3) it reaches unsustainable levels that finally causes (4) the socio-ecology to collapse because restraint is not exercised on time (Shah *et al.,* 2003). The groundwater situation in Guanajuato quite accurately follows this progression, although phases 2, 3 and 4 partly overlap. Already by the early 1980s groundwater use had reached unsustainable levels, characterized by a sustained decline in groundwater levels and increasing costs for farmers and society at large. However, the agricultural boom continued and the signs of collapse were selective. In most regions of the state wells have dried out, or have started showing water quality problems. This has hit poorer farmers the hardest, who cannot afford to deepen or reposition their wells. This has led to an active market in groundwater permits, with commercial farmers buying up the permits of dry wells and obtaining permission to deepen or reposition these wells. Although according to official data no new wells were drilled after 2000, unregistered wells continue to be sunk. Scott and Shah (2004: 158) mention that in 2001, according to an informal association of Guanajuato well drillers, over 1,000 wells were drilled, of which only one-quarter had official permission to reposition existing wells. Thus, the irrigated agricultural frontier in Guanajuato continues to expand and collapse appears to still be some way off.

State attempts to regulate groundwater extractions

According to García y García "The seriousness of the fall in groundwater levels in the Bajío has been pointed out now for more than 20 years, however, the results of the actions taken to resolve this problem, both by private parties and by the government, have been disastrous" (1998: 160).[118] The aquifer overexploitation in Guanajuato some ten years on continues to bear out the truth of this statement. This raises the question why attempts to regulate and reduce groundwater use have been ineffective, even though aquifer depletion in Guanajuato was already identified as a serious issue in the 1950s and it was prohibited to sink any new wells in most of the state's aquifers since 1964. To further unravel how

[118] "la gravedad del abatimiento de los niveles freáticos en el Bajío, ha sido señalada hace 20 años, sin embargo los resultados de las acciones para resolver el problema tanto de particulares, como gubernamentales han sido funestos."

the aquifers of Guanajuato became overexploited the following analyzes the characteristics of groundwater legislation and governance in the past fifty years.

The legal framework for groundwater management in Mexico has undergone various changes since the 1940s. The main legal issue has been whether groundwater is national or private property and to what extent the federal government can regulate its use. Although Article 27 of the Mexican Constitution states that water is national property, the original version of 1917 did not differentiate between surface and groundwater. In part, this was because groundwater was not being used very much at that time. Because the Constitution did not specify that groundwater was national property, the groundwater articles of the civil code of 1884 remained in force. These articles clearly stated that the owner of overlying land was free to prospect for and use the water underlying his land. Article 11 of the *Ley de Aguas de Propiedad Nacional* (Law of the Waters of National Property), which was passed in 1929, reaffirmed the right of landowners to freely use groundwater as did the *Ley de Aguas de Propiedad Nacional* of 1934. Hence, groundwater was not defined as national property, making it difficult for the state to regulate its use (Aboites, 1998).

The increasing use of groundwater in the first half of the 20th century in Mexico gave rise to the common negative effects associated with groundwater depletion, such as land subsidence and declines in groundwater levels. To strengthen its control over groundwater development, the federal hydrocracy undertook efforts to turn groundwater into national property. In 1945, Paragraph 5 of Article 27 of the Mexican Constitution was amended, to read as follows:

> Groundwater may be freely brought to the surface through artificial works and appropriated by the owner of the land, but, when it is in the public interest or if it affects the supply of other users the Federal Government may regulate its extraction and utilization, and even establish prohibited areas [*vedas*], in accordance to that which applies for other waters of national property. (Delgado, 1998: 49)[119]

This amendment was an important change in groundwater legislation in Mexico as it made it possible for the hydrocracy to actively intervene in the regulation of groundwater use, in particular through the establishment of *vedas*. If an area was placed under *veda* this meant that it was prohibited to sink new wells without prior permission from the federal government. However, the amendment did not go so far as to make groundwater national property (Arreguín, 1998).

Based on this amendment a groundwater law formulated by the SRH was passed in 1948 and updated in 1956, to increase the hydrocracy's control over groundwater. These laws decreed that over-exploited aquifers had to be regulated, *vedas* established and groundwater extractions limited to the safe yields of aquifers. Similarly, the Federal Water Law issued in 1972, specified that the SRH should establish *vedas* and regulate groundwater pumping through the issuing of permits, as well as draw up rules and regulations for aquifers placed under *veda* to reduce extractions. Thus, already in 1948

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[119] "Las aguas del subsuelo pueden ser libremente alumbradas mediante obras artificiales y apropiarse por el dueño del terreno; pero cuando lo exija el interés público o se afecten otros aprovechamientos, el Ejecutivo Federal podrá reglamentar su extracción y utilización, y aún establecer zonas vedadas, al igual que para las demás aguas de propiedad nacional."

Mexico had a robust groundwater law, providing ample scope for regulating groundwater extractions and arresting aquifer depletion. The principals contained in the 1948 law were reaffirmed in subsequent laws, further strengthening the mandate and powers of the SRH to regulate groundwater extractions.

However, these laws were only very partially applied. The regulations for the 1948 and 1972 laws were never issued, making it difficult to apply them according to SRH officials. Regulations for the 1956 law were passed and provided a basis for establishing *vedas*, but its application was allegedly restricted due to the lack of a clear definition of safe yields (Arreguín, 1998). Thus, while the government had a strong legal instrument to control aquifer over-exploitation through the establishment of *vedas*, this instrument was weakly applied. Until the 1970s, *vedas* were established without a precise knowledge of aquifer characteristics. Consequently, only restricted areas in which groundwater depletion was very evident were placed under *veda*. Faced with the *vedas*, many farmers drilled wells in neighboring zones that were not prohibited but that relied on water of the same aquifer.

In addition, according to retired SRH officials, it was next to impossible to supervise and monitor the large number of wells in the areas placed under *veda* and to locate illegal wells. One interviewed SRH official opined that the *veda* was not an adequate mechanism to control the number of wells drilled, as farmers simply saw it as a message from the federal government that they could no longer freely bring groundwater to the surface, but needed a permit to do so. This made it possible to estimate the number of groundwater users, but not to control groundwater extractions. Besides the claims of corruption by SRH field supervisors, the *vedas* also did not work because of regular amnesties decreed by the Mexican president. These amnesties allowed farmers to register their "illegal" pumps, based on the reasoning that they would then not have to pay fines and bribes. Thus, the federal government continued to grant permits for groundwater use in Guanajuato, notwithstanding the *vedas*.

Another important legal instrument for groundwater regulation was the requirement to draw up rules and regulations reducing groundwater extractions in areas placed under *veda*. Without these rules and regulations, the *veda* could not enter into effect. However, according to Peña and Arreguín, "The formulation of regulations for prohibited zones [*vedas*] has been and is the Achilles Heel of the management and administration of groundwater in Mexico" (1999: 2-6).[120] Since the 1948 law the SRH was required to draw up rules and regulations for areas placed under *veda*, based on the safe yield of an aquifer. However, until the 1970s how to determine the safe yield of an aquifer was not clearly defined and hence SRH officials did not have a technical basis to proceed with the regulations. Consequently, very few of the regulations for the areas placed under *veda* were drawn up (Arreguín, 1998).

The sustained overexploitation of Guanajuato's aquifers clearly shows that the intent of the hydrocracy was not to reduce groundwater overexploitation, but to use the regulatory instrument of the *veda* to bring groundwater use under its control, thereby opening up

[120] "Las reglamentaciones de las zonas de veda han sido y son el Talón de Aquiles en el manejo y administración del agua suterránea en México."

avenues to extract rents. Between 1948 and 1964, ten *veda* decrees were issued in Guanajuato, prohibiting the drilling of new wells in the Bajío and in the north of the state, and in 1983 the entire state of Guanajuato was placed under a strict *veda* (Vázquez, 1999). However, the hydrocracy made little effort to tackle unauthorized groundwater abstractions and preferred to "legalize" irregular pumps by providing their owners with a permit at a price, or simply by not carrying out inspections in the field. The drive for development dominated over law enforcement (Foster *et al.,* 2004) and consequently the *vedas* had little effect on the number of wells in Guanajuato that increased from some 2,000 in 1960 to more than 16,500 in 1997 (Guerrero, 1998) and exceeded 17,200 in 2002. Interviews suggest that these figures are conservative, with informed estimates indicating that there are around 19,600 wells in the state, of which around 500 wells are for urban and domestic water supply and around 500 wells for industrial use. Of these wells around 16,000 are registered in REPDA, 2,000 are in the process of being regularized and the rest are irregular.

It is clear that attempts at state regulation of groundwater extractions through *vedas* were subordinated to the needs of continued economic growth and political stability. According to retired SRH officials, the political and bureaucratic will to apply the existing legislation was weak, as the protection of the aquifers would have entailed slowing down economic growth. Thus, the government actively supported the expansion of the agricultural frontier by providing incentives such as subsidized credit and electricity and direct support for well drilling and equipment installation from the 1940s to the early 1980s. It also condoned the drilling of new wells and regularly decreed amnesties allowing farmers to "regularize" their "irregular" wells.

Electricity subsidies and groundwater demand management

Besides the weak enforcement of *vedas* and direct federal government support for well drilling, the widespread availability of electricity connections combined with cheap electricity has strongly contributed to the increasing levels of groundwater pumping in Guanajuato. Most pumps used for extracting groundwater in Guanajuato are powered by electricity, have a capacity of 75 to 150 HP and discharge from 20 to 60 l/s. In Mexico a special tariff is applied for agricultural electricity, termed tariff 9, which is subsidized by the federal government. In the late 1990s, electricity tariffs for agriculture were about one-third of the production costs of electricity and substantially lower than domestic and industrial tariffs (Palacios, 1999). This resulted in an estimated subsidy of around US$ 592 million in 2000 (Scott and Shah, 2004) that was fully born by the CFE (Federal Electricity Commission), a public enterprise owned by the federal government. Through the subsidized electricity prices the federal government provided a strong incentive to farmers to maximize the volumes pumped, as the capital investment in a well is much higher than operating costs.

That electricity pricing has a direct impact on pumping levels became clear in the early 1990s, when electricity prices for agricultural use more than doubled in real terms, from

M$ 0.21 per kWh in 1990 to M$ 0.54 per kWh in 1992 (Palacios, 1999).[121] This reduction in subsidies formed part of the NAFTA negotiation process and the intention was to phase out the subsidies completely. One of the immediate effects of the higher electricity tariffs was a sharp drop in agricultural electricity consumption, from around 72 GWh in 1989 to 57 GWh in 1992 (Palacios, 1999). However, after October 1993 the tariff was not adjusted for inflation and dropped due to the high inflation of 1994 to M$ 0.32 per kWh in 1995, to remain around M$ 0.31 per kWh in constant prices from 1995 to 2003 (Scott *et al.*, 2004). Consequently, the agricultural energy consumption increased from around 57 GWh in 1992 to 75 GWh in 1996. While in 1990 and 1991 Salinas had the political power to push through a strong reduction in the subsidies, by 1994 it proved impossible to form a political coalition to raise the tariff in line with inflation. The strong opposition in Congress of agricultural representatives made any action on this front impossible throughout the 1990s. Also, it was argued that farmers had already lost nearly all subsidies and to compete under NAFTA could not afford to pay higher prices for electricity. It was only in 2003 that a new initiative to reduce the electricity subsidies made some headway. This is given more attention in section 7.4.

The electricity subsidies sharply highlight the contradictory policies of the federal government concerning groundwater. Even if the *vedas* had been strictly enforced, and well drilling programs curtailed, it is likely that the large subsidies for agricultural electricity would have led to aquifer depletion. The combination of an unbridled growth in pumps and the large electricity subsidies ensured that this happened. While concerned hydrocrats succeeded in developing a strong legal framework for groundwater regulation, this did not result in a reversal of aquifer depletion. The argument made by Scott and Shah (2004) that electrical energy pricing can be an effective mechanism to address groundwater overdraft is born out by the reduction in electricity subsidies in the early 1990s in Mexico. However, it proved very difficult to sustain the phasing out of electricity subsidies, as large commercial farmers strongly protested against it and their representatives in Congress blocked any attempts to raise tariff 9. Although electricity pricing is a very powerful tool to regulate demand for groundwater, politically it is very difficult to use. Another attempt by the federal government to reduce the demand for groundwater has been through programs to increase the water use efficiency of groundwater irrigation systems. Whether this has made a dent in groundwater overexploitation is a question we turn to next.

Groundwater irrigation modernization programs

Since the early 1990s, the federal and state governments have heavily invested in reducing the demand for groundwater through the "technification" of groundwater irrigation systems. This was pursued through subsidized programs for precision land leveling, the revision of pumps and the conversion to sprinkler and drip irrigation and piped conveyance systems. Before these programs, most groundwater irrigation systems consisted of earthen canals and water was applied to the field in furrows or basins. This

[121] In May 1990, tariff 9 was raised by 148%, and from November 1990 onwards the tariff rose by 3% a month. In February 1993 this was reduced to 0.5% per month, and in October 1993 the compounded tariff rise was suspended completely. (CNA, 1994e: 3)

led to repeated calls by irrigation experts and hydrocrats to increase the efficiency of groundwater use, as the overall efficiency of groundwater irrigation systems was said to be around 35%. It was claimed that through the "modernization" of the irrigation systems, an efficiency of 68% could be reached and that hence farmers would only need to pump half the amount of water to irrigate the same area. The sense of urgency that something needed to be done about aquifer depletion, combined with the failure of the *vedas* and the political difficulty of reducing electricity subsidies, resulted in the "irrigation efficiency" approach becoming very popular. What also helped was that this program had very low political costs and showed that the government was doing something to help farmers.

In the early 1990s, the federal government initiated two new subsidy programs to reduce the demand for groundwater: *Uso Eficiente del Agua y la Energía* (Efficient Use of Water and Energy) and *Fertirrigación* (Fertirrigation). The first focused on improving the electromechanical efficiency of pumps as wells as on-farm irrigation efficiencies, while the second aimed at increasing the efficiency of groundwater use in agriculture. The logic behind these programs was that they would offset the reduction in subsidies on tariff 9 and lead to less groundwater extractions, as farmers' pumps would be more efficient, and there would be less conveyance and application losses from pump to crop. These two programs consisted of the federal government covering 25% to 50% of the costs, while the farmer was expected to cover the rest. Many state governments also stepped in to cover 25% of the costs, thus providing farmers with a 50% to 75% subsidy.

The Guanajuato government also invested in the *Fertirrigación* program, through its ministry of agriculture, and focused on plot leveling with laser technology and the installation of piped conveyance systems and sprinkler and drip irrigation systems. The objective of the program was to restore the equilibrium of aquifer levels and increase the productivity of the agricultural sector (FAO-SAGAR, 1999: 3). To achieve this aim it was calculated that it would be necessary to reduce agricultural groundwater extractions by 700 hm^3. It was thought possible to achieve this by technifying the full area under groundwater irrigation in the state (250,000 ha). From 1996 to 2003 the program benefited around 7,500 users and 32,500 ha with precision plot leveling and around 28,000 users and 140,500 ha with the installation of irrigation equipment in Guanajuato.[122] Most of the resources were used for installing low pressure surge valve pipes for furrow irrigation (*riego por compuertas*), which entails the piped distribution of water up to the plot, covering 90% of the area benefited by the program. Sprinkler irrigation only accounted for 6% and drip irrigation for 4% of the benefited area. Farmers actively participated in the program as it was clear that the technology on offer would reduce water requirements and because the government subsidized the cost of the equipment for 50%.

The claimed water savings of these programs are a matter of debate, but are placed at 357 to 525 hm^3/year (FAO-SAGAR, 1999). This calculation is based on the assumptions that the installed irrigation equipment reduces groundwater extractions by 40% due to higher water conveyance and application efficiencies and that there is no expansion of the irrigated area (FAO-SAGAR, 1999). However, these theoretical water savings are not reflected in a reduction in groundwater extractions in the aquifer studies. This raises

[122] Unpublished data provided by the Guanajuato Ministry of Agriculture, on file with the author.

questions about the effectiveness of irrigation modernization programs for reducing groundwater exploitation. Improvements in irrigation efficiencies often do lead to higher water productivity (both in kg and \$ per m^3), but do not necessarily lead to less groundwater extractions, because:

a) it often makes the expansion of the irrigation command area feasible, due to the capacity of pressurized water delivery and because more water is available; and
b) it facilitates the introduction of higher-value crops that often use more water and at the same time provide a higher return, making it possible for farmers to deepen wells and continue pumping regardless of increasing pumping costs.

In interviews conducted in 1999 and 2000 with government officials, farmers and agroindustrialists, it was roundly admitted that the investments in irrigation equipment was leading to more pumping instead of less. By improving water conveyance and application efficiencies, the program led to farmers having up to twice as much water available as before, which many used to expand their area under irrigation. Thus, in many cases the total area irrigated per well has increased, while pumping has not decreased. To reduce groundwater extractions through the efficiency approach it would be necessary to downsize pump capacity (Scott and Shah, 2004), but it is very unlikely that government agencies could achieve this, in light of the other regulatory problems surrounding groundwater irrigation. Although improving irrigation efficiencies has led to more pumping, farmers, equipment suppliers and government agencies remain firmly committed to the efficiency approach, based on the argument that it will reduce groundwater extractions. Although this is not the case, the program provides selected farmers with access to state resources and the state ministry of agriculture can claim to be doing something about groundwater overexploitation. As will become clearer in the following sections, large commercial farmers have strong links with the Guanajuato ministry of agriculture and are quite pleased to use the government subsidies to improve their agricultural operations.

The picture that emerges of groundwater overexploitation in Guanajuato is rather bleak. The regulatory approach has not worked, nor have attempts to reduce demand for groundwater through improving irrigation efficiencies or reducing electricity subsidies. Rather, the higher irrigation efficiencies have actually led to an expansion of the area irrigated and to more pumping. From a farmer’s perspective this is a good thing, as it leads to more income at lower costs, but it has not helped to reduce aquifer depletion. If government attempts to regulate groundwater have not resulted in less pumping, is user self-regulation then the answer? The next section turns to this question.

7.3 Towards User Self-Regulation for Groundwater Management

From late 1996 onwards, the state of Guanajuato has attempted to regulate groundwater use through the formation of Technical Water Councils (*Consejos Técnicos de Aguas*; COTAS), as a complement to state regulation and groundwater demand reduction programs. This section analyzes the emergence and development of the COTAS up to 2000 and questions why they did not achieve reductions in groundwater extractions. In its struggles with the federal government, the Guanajuato government initiated the COTAS as part of an institutional project to strengthen its control over water. Through the formation of COTAS, Guanajuato attempted to script a prominent role for itself in groundwater management. However, the struggles between the federal and state government significantly hindered the efforts to form autonomous and powerful COTAS. There was also no demand for COTAS by groundwater users, in particular by cities, industries and the large commercial farmers, and their hasty formation precluded the development of active user participation.

Early attempts at user self-regulation

In January 1993, the five states in the Lerma-Chapala Basin and the federal government signed a coordination agreement to regulate groundwater use in the Basin (CNA, 1993b). This agreement was reached in the River Basin Council and was partly based on experiences with the Querétaro aquifer, where the CNA had been involved with developing an aquifer user committee since the early 1990s. The agreement contained an action program for establishing rules and regulations for each aquifer and for organizing users in *Grupos de Preservación del Acuífero* (Aquifer Preservation Groups), to reach agreements on reductions in extractions (CNA, 1993b). The action program set out a tight timeline: by mid-1994 all the aquifers in the Basin would have regulations and the estimated 10,000 "irregular" wells in the Basin would either be legalized or disconnected (Mestre, 1993). However, this proved much too ambitious and very little was achieved on the ground. In part, this was because the CNA did not physically control the water extraction infrastructure (the wells), as it did in the case of surface water (the dams), making it difficult to reach agreement on and enforce reductions in extractions. More importantly, the amount of time and work needed to bring groundwater users to the table was severely underestimated.

As an outflow of the 1993 coordination agreement, the CNA started promoting the formation of *Comités Técnicos de Aguas Subterráneas* (COTAS; Technical Committees for Groundwater) in selected aquifers in the Basin in 1995. This reflected a more general policy of the CNA towards groundwater regulation that developed in the early 1990s. This policy was based on the recognition that the old, top-down regulatory approach of declaring *vedas* had not worked and that the participation of groundwater users was necessary to reach consensus on reductions of groundwater extractions. The experiences with IMT played a strong role in the emergence of the new groundwater policy. Although COTAS were not mentioned in the 1992 water law, Article 76 of the 1994 water law regulations stated that:

> In the regulated zones [*vedas*], "The Commission" will promote the participation of and agreement between the users of the respective zones to establish the mechanisms or actions that contribute to the enforcement of the "Law", of the present "Regulation" and, as the case may be, of the specific regulations established for those zones. (CNA, 1994c: 110)[123]

[123] "En las zonas reglamentadas, "La Comisión" promoverá la participación y concertación con los usuarios de las zonas respectivas para establecer los mecanismos o acciones que coadyuven a la vigilancia del cumplimiento de la "Ley", del presente "Reglamento" y, en su caso, de los reglamentos específicos que se establezcan en esas zonas."

The efforts of the CNA initially focused on the Querétaro aquifer, where aquifer users had started to organize themselves towards the end of the 1980s, as they were concerned with the growing water scarcity for urban and industrial use. The CNA and the Querétaro State Water Commission were also actively involved in developing an aquifer management program. This resulted in several activities to save water, through the modernization of irrigation systems, the relocation of wells and the use of treated wastewater. It also led to the formulation of the rules and regulations for the Querétaro aquifer in January 1997, which contained a paragraph on the establishment of a COTAS. The CNA was to be the president of the COTAS, with a long list of government agencies, municipalities and user representatives as members (CNA, 1997b). The tasks of the COTAS were listed as collaborating with the CNA in applying the aquifer rules and regulations, reporting any infractions of the regulations to the CNA and receiving requests, denouncements and complaints from groundwater users and making these know to the CNA. In short, the COTAS was to: "Favor, promote and organize interinstitutional coordination and user participation to carry out actions and programs aimed at the efficient use of water and the preservation of the Querétaro Aquifer" (CNA, 1997b: 8).[124] In February 1998, the Querétaro COTAS was formally constituted along these lines.

Through the establishment of COTAS the CNA aimed to stimulate the organized participation of aquifer users so that agreements for reversing groundwater extractions could be reached. However, as no specific mention of COTAS was made in the water law, there was much ambiguity about their characteristics, mandate and structure. Between 1995 and 2000, the CNA did not publish a policy document outlining the structure and tasks of the COTAS or indicating how they should be formed. However, during this period it became clear that the CNA did not intend the COTAS to be autonomous organizations with an elected board and a manager, as is the case with the WUAs in the transferred irrigation districts. Instead, they were to be consultative bodies in which aquifer users, government water agencies and organized groups from civil society (such as universities, research institutes and NGOs) would interact concerning groundwater management, under the auspices of the CNA. In addition, they were designed as organizations without legal status or decision-making powers, whose agreements could be ignored by the CNA (Palacios and Martínez, 1999).

The first COTAS in Guanajuato

While the CNA was experimenting with setting up COTAS in Querétaro and other parts of Mexico, in late 1996 Guanajuato's *Secretaría de Desarrollo Agropecuario y Rural* (SDAyR; Ministry of Agricultural and Rural Development) started the formation of what where then still called *Comités Técnicos de Aguas Subterráneas* in the Celaya and Laguna Seca aquifers. The CNA was not involved in this initiative, which was an unheard of development, as until then the CNA had been in firm control of water management. The SDAyR, and in particular its secretary, Javier Usabiaga, took the lead in forming the two COTAS. Interestingly, Usabiaga owned large tracts of irrigated land in the Celaya and

[124] "Propiciar, promover y organizar la coordinación interinstitucional y la participación de los usuarios para llevar a cabo acciones y programas orientados al uso eficiente del agua y a la preservación del Acuífero de Querétaro."

Laguna Seca aquifers, of at least 3,000 ha, although much higher figures of 11,500 ha have also been reported (Espinosa, 2003). Most of this land was irrigated with groundwater, so it has been suggested that he had a personal interest in setting up the COTAS to reduce groundwater extractions, so that his farms would continue to have sufficient groundwater. However, much larger political processes were at work, of which the COTAS formed only one exponent.

On 28 May 1995, Vicente Fox of the PAN[125] was elected governor of Guanajuato, with 58.1% of the vote (Valencia-García, 1998). This was a momentous change, as it was the first time that a non-PRI candidate was formally elected governor of Guanajuato. In the 1991 governor elections Fox had also run as the PAN candidate, but lost. However, complaints by the opposition parties that the elections had been marred by fraud and large street protests led to intense political negotiations. These resulted in Salinas forcing the resignation of the PRI candidate and appointing a PAN politician as interim governor, but not Vicente Fox (Camp, 1999). These events steeled Fox in his determination to become governor, in which he succeeded in 1995. From the day Fox took office, on 26 June 1995, he set out to do things differently from the PRI and in particular to challenge the federal government. His program focused on economic growth and education and was strongly influenced by the "reinventing government" agenda and management theory. He had also set his sights on the presidency and carefully planned his tenure as governor as a platform for the presidential elections in 2000. To make a running chance, Fox publicly announced his presidential candidacy in July 1997, to have sufficient time to develop his campaign.

A central component of Fox's political project was water, over which he wanted to wrest control from the federal government. He openly accused the CNA of corruption and boldly declared in 1995 that he could solve Guanajuato's water problems in no time if authority over water was delegated to the state. In June 1996 he declared that: "Guanajuato gets more benefits from the waters that flow into the state from Michoacán and the state of Mexico than from the water it delivers to Jalisco. Therefore, we will try to reform the covenant [the Lerma-Chapala Basin surface water allocation agreement] to get total and absolute freedom within the state of Guanajuato to solve our water issues and not be dependent on the Federal Government."[126] Already in 1991, during his gubernatorial campaign, Fox had seriously questioned the Lerma-Chapala coordination agreement signed in 1989. To develop his political project concerning water, Fox focused on strengthening CEASG and SDAyR, so that these state institutions could stand up to the CNA. He appointed Vicente Guerrero, the director of the Leon municipal water company, as the DG of CEASG and Javier Usabiaga, a large commercial farmer, as his Minister of Agriculture. Fox's own background was also in commercial agriculture with a vegetable

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[125] The PAN was formed in 1939 as a conservative and pro-business catholic party by disgruntled PRI elites who opposed the populist policies of President Cárdenas (1934-1940). Until 1988, it secured on average 13% of the vote for Congress and served as a pressure group within the corporatist PRI regime. In the 1980s it evolved into a strong opposition party through the influx of industrialists, businessmen, commercial farmers and neo-liberal politicians, called "neo-Panistas", that fled the PRI after the 1982 crisis. (Camp, 1999)

[126] Marco Alaníz, El Sol, 28 July 1996, page 12.

farm covering 250 ha of irrigated land and a brother owning a large vegetable packaging plant (Granados-Chapa, 2000).

In this political context, the SDAyR started the formation of two COTAS in late 1996, when it contracted IMTA to assist in the formation of COTAS for the Laguna Seca and Celaya aquifers. The aim of this initiative was to stimulate the participation of the aquifer users in reaching a consensus on how to reduce groundwater extractions (IMTA, 1998). At the time, there was no established procedure for creating COTAS and it was not clear what their attributes would be, hence SDAyR and IMTA embarked on an open-ended process to form the COTAS. Although there were several initiatives throughout the country led by the CNA for forming COTAS, SDAyR and IMTA felt that the CNA approach was too centrally directed, with insufficient interactions with stakeholders. Hence, SDAyR firmly took the lead in Guanajuato and initiated a bottom up process to form the COTAS.

The formation of the COTAS formed part of Usabiaga's plans to transform the SDAyR into the main water agency in the state. He was the leader of an informal network of large commercial farmers and had been actively involved in the transfer of the Alto Rio Lerma irrigation district in 1992. As part of the transfer negotiations, he had argued that the control of the Solis dam should also be transferred to the water users and that the large commercial farmers were much more capable than the CNA to manage the irrigation district. He strongly believed that water management should be a state affair and that the CNA should delegate its functions to the state level, in particular to SDAyR. Usabiaga reasoned that as irrigation was the largest water user, SDAyR should have the lead in water management in the state, leaving potable water and sanitation to CEASG. This led to struggles with both the CNA and CEASG, but Usabiaga was confident that his good relationship with Fox and his extensive networks within the agricultural sector in Guanajuato would result in SDAyR becoming the main water agency in Guanajuato.

To initiate the COTAS formation process in the Celaya aquifer, SDAyR and IMTA held a meeting with municipal presidents, water users and officials from state government agencies related to water in early 1997. In this meeting the need to establish a negotiation space in which aquifer users and government agencies could come together to discuss groundwater problems and to design strategies to tackle groundwater overexploitation was stressed. In August 1997, CNA's national coordinator of river basin councils became quite angry when he heard about SDAyR efforts to organize COTAS and demanded that IMTA be removed from the process. The CNA placed great pressure on SDAyR to cancel the election of user representatives to the COTAS and demanded that the structure of the COTAS had to be changed in line with the Querétaro COTAS. However, SDAyR remained steadfast and suggested to form a *Grupo Promotor*, consisting of representatives of government agencies (CNA, SDAyR, SAGAR, CEASG) and the municipal presidents, to discuss these issues. IMTA held several workshops with this group to formulate action strategies and to determine the appropriate forms of representation in the COTAS. A similar process was followed in the Laguna Seca aquifer.

The *Grupo Promotor* placed great emphasis on the mode of representation in the to be formed COTAS. The aim was to have an ample representation of all aquifer users, but at the same time to keep the number of representatives manageable. Attention was also paid to the proportional representation between government agencies and aquifer users, to ensure that there would not be an imposition of measures by government. Various proposals were made concerning the composition of the COTAS, which were extensively discussed in the *Grupo Promotor*. The final proposals were presented at a large assembly of aquifer users, where it was agreed that representation would be based on water use sectors (and not on the amount of groundwater used), with one user representative per sector from each municipality (five in the case of the Celaya aquifer). The following sectors were defined: water supply companies, urban water users, rural water users, industrial water use and services, while for agricultural water use a distinction was made between *ejido* and commercial farmers. This yielded a total of 35 user representatives, of which each sector would elect one representative to sit on the COTAS board. It was also decided to have nine government representatives on the board, two from the federal government (CNA, SAGAR), two from the state government (SDAyR, CEASG) and the five municipal presidents. Once this was agreed on, the *Grupo Promotor* invited water users to elect their representatives in each municipality. An overall meeting was then held in which the board member for each use sector was elected. The other four representatives of each sector then took place in Working Groups, as deputies. It was decided that the overall structure of the Celaya COTAS would consist of three tiers:

1. the aquifer users and the municipalities;
2. the working groups per sector and a *Grupo Coordinador*, consisting of staff from the four government agencies; and
3. the seven user representatives and a *Grupo Consultivo*, consisting of the nine government representatives, together forming the board of the COTAS.

SDAyR supported the participation of aquifer users in the formation of the COTAS, which it perceived to be a long-term process. Bringing together the different water users in each of the five municipalities and agreeing on the overall structure of the Celaya COTAS took nearly one year. In Laguna Seca a similar process was followed, although a slightly different structure was arrived at. In SDAyRs and IMTAs perspective, the formation of the COTAS was to be a "bottom-up" process in which the aquifer users would gain a clear understanding of the graveness of groundwater depletion and based on this understanding would collectively discuss ways to resolve this problem. In contrast to the Querétaro COTAS, where the CNA was the president, SDAyR wanted the COTAS to be more autonomous, with the users electing the representatives and the president. Although the CNA formed part of the board of the Celaya COTAS, the statutes of the COTAS clearly stated that the user representatives would elect the president, while the secretary would be elected by all the members of the COTAS with voting rights. SDAyR also had a very different conception of the COTAS than the CNA. While the Querétaro COTAS was basically an auxiliary committee of the CNA, a very senior SDAyR official stated the following concerning the COTAS:

> For SDAyR the COTAS should give out a recommendation for the repositioning of wells, after a technical study has been made of the current well and the new one (…), seeing as the authority "doesn't know a thing" about this. Concerning the concessions, the COTAS should also give out a recommendation, based on the situation of the aquifer. Where it concerns sanctions, the COTAS should also make recommendations, considering the infractions of the law and the rules and regulations of the aquifer. A crucial aspect for the COTAS is the approval of their

> internal rules and regulations, in which norms should be included for the transfer of groundwater concessions not only for volumes but also for water rights between the different types of users, with the aim to promote a water market.[127]

After nearly a year of deliberations, the two COTAS were formally constituted on 28 November 1997, in the presence of Vicente Fox and dignitaries from the CNA, SDAyR, IMTA and CEASG. Fox used this opportunity to announce that 1998 would be the "Year of Water" in Guanajuato, in which many more COTAS would be formed. The efforts by SDAyR to bring together many different parties in the COTAS, without the CNA being in the lead, had shown that the federal government could be challenged. In late 1996 the COTAS were an uncertain gamble and their formation was not yet a serious part of Fox's political project. However, by late 1997 they had become a vehicle through which control over water could be wrested from the federal government. However, the two COTAS had not yet started work on finding ways to reduce groundwater extractions and their attributes and legal standing remained unclear. How this changed between 1998 and 2000 is analyzed in the next section.

CEASG steps in

In early 1998, the responsibility for the formation and supervision of the COTAS was transferred to the *Comisión Estatal de Agua y Saneamiento de Guanajuato* (CEASG; Guanajuato State Water and Sanitation Commission) and SDAyR was relieved of its responsibilities concerning the COTAS. The move to CEASG formed part of the *nuevo federalismo* (new federalism) process, initiated during President Zedillo's *sexenio* (1994-2000), which consisted of decentralizing government responsibilities, programs and resources from the federal to the state level. In the water sector this entailed that the State Water Commissions would receive more responsibilities in water management. Formed in 1991 by the state legislature to provide potable water, sewage and sanitation services, until 1996 CEASG primarily functioned as a financial mediator between the federal government and municipalities, mainly for domestic water supply projects, and was largely bypassed by the CNA in all other spheres of water management.

As part of his political project, Fox seized on the opportunity to strengthen CEASG and to broaden its mandate from domestic water and sanitation to all aspects of water management. He decided that it was to become the main water agency in the state that would promote integrated water management and a new relationship between the user and the resource, termed a "new water culture" (*nueva cultura de agua*). CEASG's mandate was substantially broadened in 1996, to read as follows: "to create or favor the conditions for comprehensive water management in the state, with the coordinated participation of government agencies and civil society, with a focus based on solidarity and subsidiarity, under the model of sustainable development (CEAG, 2006: 11).[128] This implied that CEASG had to broaden its field of action and had to be strengthened financially and technically.

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[127] Interview held on 19 August 1999 in Celaya.

[128] "de crear o propiciar las condiciones para el manejo integral del agua en la entidad, con la participación coordinada de autoridades y sociedad civil, con un enfoque solidario y subsidiario, bajo el modelo de desarrollo sostenible."

From 1996 to 1998, the organizational structure of CEASG was changed, to reflect its new mandate, and a large number of water professionals were hired. Two new General Directorates were formed, on for planning and the other for social participation. The *Gestión Social* directorate focused on forming the COTAS and promoting user participation, while the planning directorate focused on groundwater research and on formulating the *Plan Estatal Hidráulico 2000-2025*, published in 2000. Thus, CEASG went from an organization with very limited functions in 1995, to a water agency that could defend the state's water interests and act as a valid interlocutor with federal agencies by 2000. For example, starting in 1996 CEASG represented Guanajuato in the Lerma-Chapala River Basin Council.

The formation of the COTAS was a crucial component of CEASG's institutional project, namely to become the main water agency in Guanajuato, at the expense of the CNA. Understandably, SDAyR was distinctly displeased that the responsibility to organize the COTAS was shifted to CEASG and that SDAyR was not to become the main water agency. As part of his political calculations, Fox believed that it would be better to strengthen CEASG and Usabiaga failed to convince Fox otherwise. Thus, the rivalry between agriculture and the hydrocracy at the federal level repeated itself in Guanajuato, although in a different guise. The strained relationship between SDAyR and CEASG is reflected in the following comments from a very senior SDAyR official:[129]

> CEASG is promoting an organization that serves as an excuse to demonstrate citizen participation, which does not correspond to a comprehensive vision of the problem. CEASG is looking for an organization that "guards numbers" and it has an administrative perspective on the participatory process. On the contrary, for SDAyR the COTAS should be an organization that " takes actions" as evidenced by the example of Laguna Seca, where they are trying to undertake actions pertaining to water conservation, aquifer recharge, surveillance, promoting a water culture and the promotion of citizen participation based on an inclusive and permanent calling together of water users, especially agricultural producers, to strengthen the organization.
>
> It was initially Fox's idea to create a Department of Water Resources […] that would identify problems and define actions concerning municipal water supply, contamination and irrigation. Its vision was to be based on water and not agriculture or an administrative perspective. But he made a mistake in selecting the one responsible, who without a doubt is an excellent professional and administrator, but who does not have a comprehensive vision of the water issue. […] All of his actions are taken from an administrative perspective, including the process of organizing the COTAS, without considering that people, especially agrarian producers, are apathetic and do not automatically participate in a new organization.

The removal of SDAyR from the formation of the COTAS entailed that large commercial farmers were harder to involve in the COTAS formation process. CEASG was urban in its

[129] The interview was held on 19 August 1999, some 20 months after CEASG had become responsible for forming the COTAS.

outlook and did not initially have strong connections with the large commercial farmers. While Usabiaga had the power to convince farmers, both large and small, and could bring them together to reach agreements, CEASG did not have this capacity. There was little love lost between CEASG and SDAyR and this rivalry continued to undermine the effectiveness of the COTAS until 2006.

COTAS according to CEASG

The move to CEASG led to several changes in the structure of the COTAS. The most salient difference was that CEASG decided to form *Consejos Técnicos de Aguas* (COTAS) with only water user representatives on the COTAS board, instead of *Comités Técnicos de Aguas Subterráneas*. These councils were to consist of all water users that would work together to achieve integrated water management in their region, focusing on both surface and groundwater, and on quantity as well as quality aspects. A consultative group consisting of government agencies was to provide advice to the COTAS board. Also, the COTAS were to have a technical office run by a manager, to support the COTAS board. What remained the same was the problematic relationship with the CNA, which was not involved in the formation process.

In the CEASG model, the membership of the COTAS was to consist of all the water users of an aquifer, defined as those extracting surface or groundwater for agricultural, industrial or commercial use, while urban inhabitants would be represented in the COTAS through the municipal water supply companies (Guerrero, 1998). CEASG was quite clear that the COTAS should be a legally recognized local water management organization that would focus on regulating and conserving water. Most importantly, the COTAS were to reverse aquifer overexploitation and recover groundwater levels by reaching agreements on aquifer management and agreeing on actions to regulate, conserve and efficiently use water (Guerrero, 1998). To achieve these goals it was foreseen that the COTAS would:

- Propose aquifer rules and regulations for the sustainable use of aquifers
- Propose a local hydraulic plan and participate in the State Hydraulic Plan
- Participate in the granting of water concessions
- Monitor the aquifer rules and regulations and the volumes of water extracted.

CEASG did not go so far as to suggest that the COTAS should become a water authority with full user control over the aquifers. However, it clearly did not have a consultative body in mind, which was the model the CNA was pursuing. In the CNA model, the COTAS were a mixed organization of government agencies and user representatives focusing on groundwater only, whose main task was to collaborate with the CNA in formulating the rules and regulations of an aquifer. However, the COTAS would not participate in the granting of water concessions and could only make suggestions to the CNA. A final important difference between the two models was that CEASG intended the COTAS to be financially and administratively independent and completely directed by water users.

The formation of the COTAS in Guanajuato

Besides changes in the structure and objectives of the COTAS, the move to CEASG also changed their formation process. The extensive process followed by SDAyR was replaced by a much quicker approach focused on showing results. By the end of 1998, CEASG had constituted six COTAS in addition to the two already formed in Celaya and Laguna Seca.

The remaining six were formed in 1999, bringing the total number of COTAS in Guanajuato to fourteen, to cover all the aquifers in the state. To crown this work, the *Consejo Estatal Hidráulico* (CEH; State Hydraulic Council) was formed on 22 October 1999, as the representative body of all water users in the state. It consisted of the presidents of the 14 COTAS, as well as representatives of the two irrigation districts in the state and four irrigation units. Both the COTAS and the CEH were formed as civil associations, to ensure that they were legally recognized.

CEASG defined three phases for the establishment of COTAS in Guanajuato: legal constitution, establishment of aquifer regulations and organizational development. It aimed to finish the first two phases by the end of 2000 and succeeded in completing the first phase by the end of 1999. However, the second phase of establishing rules and regulations for the aquifers was still on-going in 2007, as for this the support of the CNA was needed. Concerning the formation process, based on interviews conducted with CEASG officials, consultants, farmers and aquifer user representatives in 2000, it became clear that the participation of aquifer users, especially farmers, in the formation of the COTAS was restricted. For example, in three COTAS studied, with around 2,500, 1,400 and 1,950 groundwater wells each, only a total of 300, 115 and 40 users respectively were involved in the formation process. In part this was due to a lack of reliable information on the actual pumpers in the aquifer and due to a lack of infrastructure and human resources on the part of CEASG, making it difficult to summon all the users. However, it also appeared that initially CEASG did not see the formation of the COTAS as a long-term process based on extensive user participation, but rather was in a hurry to have all of them constituted by the year 2000.

CEASG did not opt for a large-scale convocation of the users but only invited the leaders of diverse organizations to participate in the formation process of the COTAS. In the majority of cases, the representatives of the agriculture sector in the COTAS were commercial farmers or agroindustrialists and the social sector (*ejidos*) was largely bypassed. Besides the three agriculture representatives on the COTAS board, three representatives each for the industrial, potable water and services sectors were selected. Thus, although agriculture uses around 80% of groundwater, it only has 25% weight in the COTAS board. The representatives of industry were drawn from either multinational companies such as General Motors, Coca Cola and Danone, or from large Mexican companies such as PEMEX. The potable water representatives were the municipal water companies. This structural misbalance in the composition of the COTAS, while bringing together all the water use sectors, was to have a marked effect on their development. In particular, the large industries, commercial farmers and municipal water companies all claimed that they were already using water very efficiently and that it was the agrarian producers, or small farmers, that were to blame for groundwater overexploitation.

Thus, the formation process of the COTAS did not bring together all the pumpers in an aquifer but rather only built on a small group of perceived leaders. CEASG chose to first form the COTAS and to then expand user participation. However, by neglecting to bring together all the aquifer users at the start, and to arrive at a shared understanding of the problems facing the aquifer and the possible solutions, the COTAS were not designed and owned by the water users. Later on, this proved to be an obstacle for the consolidation of the COTAS. The lack of an adequate representation of all the groundwater users in the COTAS made it difficult to reach consensus on reductions in groundwater extractions and many users did not see the COTAS as user organizations, but as an extension of government. Thus, the approach followed in forming the COTAS, namely sticking to timelines without giving sufficient space to reaching agreement between users, restricted their effectiveness. However, through their creation CEASG created new domains of water governance under its control. By late 1999 the whole state of Guanajuato fell under COTAS, under the supervision of CEASG, that would work to achieve integrated water management in their respective areas.

The CNA strikes back

The creation of COTAS by CEASG was a direct affront to the CNA, which viewed itself as the principal water authority in the country and strongly believed it was responsible for forming COTAS. While the SDAyR had reluctantly involved the CNA, CEASG developed a more adversarial role in its relationship with the CNA and excluded the CNA and all other government agencies from the COTAS general assembly and board. On the other hand, the CNA was very reluctant to provide information to the COTAS, especially concerning the number and location of groundwater pumps and their owners. It also tried to stall the formation of COTAS in Guanajuato, based on the legal argument that the CNA should be in charge of this process as the representative of the federal government. In particular, the CNA did not permit the COTAS to play a role, even in an advisory capacity, in the granting of new groundwater concessions or the regularization of existing wells.

The regularization of "irregular" wells, and more generally the granting of groundwater concessions, became an important issue in early 2000. The federal ministry of finance issued a decree that went into effect on 1 January 2000 stipulating that all agricultural groundwater users paying tariff 9 for their electricity needed to present the CFE with a copy of their concession title before June 2000.[130] If not, they would be reclassified in an unsubsidized tariff. This decree followed on a presidential decree published in October 1995, which contained an amnesty of one year for agricultural pump owners to regularize their irregular wells and to obtain a concession title.[131] This also applied to aquifers placed under *veda*. A second decree followed in October 1996 extending the amnesty until the end of 1998, thus giving irregular well owners more than three years to regularize their wells. Nonetheless, the January 2000 decree caused much commotion among groundwater users in Guanajuato and an emergency meeting of the CEH was called on 11 February 2000 to discuss the issue with the CNA. This provided an opportunity for the CNA to work together with the COTAS and CEASG and to start discussions with aquifer users on reducing groundwater extractions. As many users still needed to regularize their wells, there was momentum to bring together all the aquifer users and to develop the rules and regulations

[130] "Acuerdo que autoriza el ajuste a las tarifas para suministro y venta de energía eléctrica" decreed by the minister of finance on 24 December 1999 and published in the Diario Oficial on 30 December 1999.

[131] "Decreto mediante el cual se otorgan facilidades administrativas y se condonan contribuciones a los usuarios de aguas nacionales y sus bienes públicos inherentes, que realicen actividades de carácter agrícola, silvícola, pecuario y acuícola" published in the Diario Oficial on 11 October 1995.

of the aquifer together with them and the COTAS. At the time, the board members of the CEH and COTAS wanted to start these negotiations with the CNA, but at the CEH meeting the CNA representative resolutely ruled out this possibility and urged the owners of irregular wells to approach the CNA individually to regularize their wells. However, due to the "costs" involved, many users were reluctant to do this.

The costs of drilling a new well and installing a pump in Guanajuato are variable, depending on drilling depth and the type of pump and transformer installed. However, as a rule of thumb, drilling a well and installing the casing is said to cost around US$200 per meter, while equipment costs are around US$40,000. Most wells in Guanajuato are drilled to a depth of 150 to 300 m, giving an approximate indication of the initial investment cost. Added to this is the cost of obtaining a groundwater concession title. It is difficult to legally obtain a concession for a new well in Guanajuato, as all aquifers have been placed under *veda*. Exceptions are made for municipal and industrial wells, but not for new agricultural wells. However, it is possible to obtain permits for deepening or repositioning wells and also for regularizing "irregular" wells if it can be proven that they fall under one of the presidential amnesties. Hence, there are mechanisms to obtain a concession title and to get a well registered in REPDA. Although this is a very sensitive topic, several well-informed people indicated that the cost of obtaining a concession title for an irregular well is anywhere between US$1,500 to US$10,000, depending on how complicated the situation is. As these are illegal payments, this is a risky and complicated procedure and hence many farmers choose not to register their wells.

This suggests that the CNA draws rents from the regularization of irregular wells and thus has an interest in new wells being sunk. The effort by CEASG to form COTAS that would be actively involved in the granting of groundwater concessions and would work to bring clarity to the number of groundwater users and the location of pumps was an unwelcome development. Thus, not only the challenge of CEASG to the CNA as the principal water authority in Guanajuato, but also the active role it had in mind for the COTAS to regulate groundwater extractions led the CNA to resist the formation of autonomous COTAS.

Concluding remarks

This section has analyzed the formation of COTAS in Guanajuato from 1996 to 2000. Although they were successfully created, their objective to reduce groundwater overexploitation through user self-regulation did not receive much attention. Rather, the analysis shows that they formed part of a political and institutional project of the state government to gain larger control over water management in Guanajuato. In this it was only partly successful, as the CNA remained in control of groundwater concessions, and largely ignored the COTAS. Also, the move from SDAyR to CEASG restricted the effectiveness of the COTAS. Usabiaga intended that the COTAS would become responsible for monitoring and regulating groundwater concession titles and that agricultural water users would have the largest vote in the COTAS. When the COTAS moved to CEASG many large commercial farmers lost interest, as it was clear that the COTAS would not have any real influence over groundwater extractions. Thus, the politics of administration significantly reduced the prospects of the COTAS. However, based on the experiences in Guanajuato, the structure of the COTAS was defined at the national level in August 2000 in the rules and regulations for river basin councils (CNA, 2000a). In these rules, the COTAS are defined as user organizations serving as auxiliary organs of the River Basin Councils. Their membership consists of all the water users of an aquifer and their structure and tasks is identical to the CEASG model, expect that they only focus on groundwater. Thus, the CNA only forms part of the Consultative Group and if the COTAS wish, the CNA can also serve as the Technical Office (*Gerencia Técnica*) of the COTAS. However, this office can also filled by a state government representative, or by somebody appointed by the users (CNA, 2000a). That CEASG succeeded in defining the structure of the COTAS at the national level was an important achievement and showed that it was becoming an important actor in water management.

7.4 Tackling Powerful Pumpers: The Politics of Groundwater in Guanajuato

The formation of 14 COTAS by 2000 covering all of Guanajuato's aquifers, and the election of Vicente Fox as President on 2 July 2000, raised high hopes for the coming years. It was anticipated that the COTAS would take off as an innovative institutional model and that their consolidation would lead to sustained reductions in groundwater extractions. It was also hoped that the rivalry with the CNA would become less and that Fox would seriously delegate responsibilities and resources to the state level. However, the consolidation of the COTAS between 2000 and 2006 did not translate into concerted efforts to reduce groundwater use. The rivalry with the CNA continued and the COTAS were not delegated the authority to manage their aquifers. More importantly, reducing groundwater extractions would have implied tackling the political economy of groundwater use. This would have entailed curtailing the groundwater use of large commercial farmers, who controlled segments of the state machinery, and other large pumpers such as cities and industries. These powerful pumpers did not become actively involved in the COTAS and developed a discourse blaming smallholders for the aquifer problems.

From user self-regulation to service windows

The development of the 14 COTAS in Guanajuato from 2000 to 2006 strongly depended on the continued support of CEAG,[132] which continued to pay for their office costs, staff, vehicles and computers. From 1998 to 2004, this funding came directly from the Guanajuato state budget, while from 2005 onwards the funding was drawn from a World Bank loan to Guanajuato. As the COTAS were user organizations, CEAG cast itself in a facilitating role, supporting the development of the COTAS. This created tensions, however, as the grants to the COTAS were based on annual working programs agreed on between the COTAS board and CEAG. In the eyes of many water users active in the COTAS, as well as most of the board members and COTAS managers, this meant that the COTAS were working for CEAG, to achieve the objectives defined by CEAG. This perception increased in 2005, when the salaries of the COTAS staff were made conditional based on whether the activities and objectives established in the annual working programs between CEAG and the COTAS were achieved. This was necessary, however, as CEAG needed to account for the

[132] In 2000 CEASG changed its name into *Comisión Estatal del Agua de Guanajuato* (CEAG).

taxpayers' money it was using to fund the COTAS. However, without funding from CEAG most of the COTAS would have ceased to exist rather quickly, according to both COTAS members and CEAG, suggesting that the COTAS had not become autonomous user organizations by 2006.

CEAG's efforts to strengthen the COTAS from 2000 to 2006 focused on increasing user participation and formulating a groundwater management model. While the original aim had been to formulate aquifer rules and regulations by 2000, the focus on reducing groundwater extractions moved to the background. Rather, the COTAS were recast as "consensus-building spaces where integrated water management models and programs are to be implemented" (Sandoval, 2004a: 9-10). This loss of focus was related to the lack of a real delegation of authority by the CNA to CEAG and the COTAS, and thus the COTAS could not play a more active role in reducing groundwater extractions. However, behind this vague formulation an astute strategy was developed by CEAG to achieve both autonomous user organizations and reductions in groundwater extractions. This consisted of developing a "groundwater management model" that built on the aquifer studies supervised and updated by CEAG and the ongoing activities with the COTAS. In the words of the then executive secretary of CEAG:

> bearing in mind that all these activities [developed by the COTAS] can, in the end, result in the establishment of a local organization which is reliable and morally authoritative enough to perform effectively a set of concrete actions that will achieve results in terms of aquifer renovation. The groundwater management model was designed to be instrumental in reaching this goal. (Sandoval, 2004a: 11-12)

CEAG developed the groundwater management model in 2002, in coordination with the COTAS, to focus on concrete actions that would have a large impact on groundwater extractions and foster social participation. The model consisted of nine elements that together would lead to less groundwater extraction. The first two elements had already been developed between 1998 and 2002 and consisted of the extensive aquifer studies and the database developed by CEAG and the COTAS on the number and location of groundwater wells. As part of its aquifer studies, CEAG identified more than 15,700 groundwater wells (many of which were not registered in REPDA) and this data was transferred to the COTAS who further extended and updated the groundwater wells database. The third element consisted of the monitoring of aquifer levels. Starting in 1998, CEAG set up a groundwater monitoring network that grew to 12 deep observation wells and 955 pilot wells, for which the COTAS collect the static level readings twice a year. Based on the aquifer studies, depletion cones were identified in the aquifers and a pilot zone covering between 50 to 100 km^2 and 100 to 300 users was established in 13 COTAS while 7 pilot zones were established in the Celaya COTAS.

Based on the wells database, the COTAS identified the groundwater users in the pilot zones and initiated an intensive process of working with the users to identify and reach agreement on a list of measures to reduce groundwater extractions. This program mainly focused on agriculture and sought to channel the various government support programs for irrigation modernization through the COTAS to these pilot zones. The intention was to produce the same or more crops with less water and energy, hence at a lower cost. Once the measures had been agreed on and funded, the users were requested to form aquifer monitoring committees, to monitor aquifer levels and evaluate the results of the interventions. They were also urged to install meters on their pumps and to carefully monitor pumping hours and electricity use. The long term objective was that the pilot zones would gradually be expanded, to cover the whole aquifer. Only then would the work start on drawing up the rules and regulations of the aquifers, as CEAG believed that groundwater users would only support and implement the regulations after investments had been made in social participation and water use efficiency.

As a result of the groundwater management model, the number of users that became a member of the COTAS rose from 225 in 2000 to 8,610 in 2006 (of an estimated 18,000 groundwater users) and 20 aquifer monitoring committees were formed (CEAG, 2006). The COTAS were also very actively involved in training around 5,300 users in water issues, together with government agencies, and extensive information campaigns on the "new water culture" were held. Another important achievement of the COTAS is that each has updated and verified the database on groundwater wells, in the process identifying many irregular wells. Lastly, for many farmers the COTAS have become an important help desk or service window that supports them in their interactions with government agencies. Especially concerning groundwater concession titles, the COTAS play an important role as intermediary between farmers and the CNA and the CFE, both for obtaining and renewing the titles (most titles are valid for ten years). The COTAS have also become intermediaries for users wishing to modernize their irrigation systems, and many, including the current president of the CEH, would like to see this role expanded.

Based on the support from CEAG the COTAS matured between 2000 and 2006 and their position and tasks became clearer. However, they did not achieve significant reductions in groundwater extractions or lead to user self-regulation. While their service window function is useful to many users, and the aquifer monitoring committees have led to raised awareness, they have not become full-fledged user organizations in which strategies for reducing groundwater overexploitation have been devised. Most of the participation and decision making remains restricted to the members of the COTAS board and many users see the COTAS as an intermediary organization closing linked to the government and not as a user organization. One of the most debated topics in the boards of the COTAS is the lack of legal authority to manage groundwater. To date, the CNA resolutely clings to its position as the water authority and has not delegated any authority to the COTAS. To move towards user self-regulation it is necessary that the COTAS receive delegated authority to manage their aquifers and that high volume extractors actively participate in the COTAS.

Powerful pumpers: commercial farmers, cities and industries

The COTAS lack of legal authority restricted their appeal to large groundwater extractors, such as commercial farmers, cities and industries. These powerful pumpers directly interact with the CNA concerning concession titles and do not see themselves as being responsible for groundwater overexploitation. Most cities and industries perceive the COTAS as a talk shop of little relevance to them. They argue that as agriculture is the largest groundwater user, and a very inefficient one at that, it should solve the problem. This stance was made possible because the COTAS did not have any legal powers to control the groundwater extractions of cities and industries, and because of the strong political support for continued urban and industrial growth. Providing piped water to urban settlements is very important politically, because of the large vote banks in the cities and the unrest in neighborhoods without a secure water supply. Also, a large effort was made by CEAG to strengthen the municipal water companies and to decrease the amount of urban water lost due to leakage. Thus, the cities argued that they were working hard to use water efficiently.

Similarly, the establishment of new industries is important politically, as the Guanajuato government wants to be seen as promoting economic growth by bringing in factories and assembly plants. These plants need groundwater, the most famous example being the General Motors (GM) plant built in Silao in the early 1990s. A reason for GM to choose Guanajuato was that it could relatively easily access groundwater. At present, the GM plant has a closed water system with no discharges, as do several of the other multinationals in Guanajuato. Although urban (15%) and industrial (1.8%) groundwater use is much lower than agriculture (83.2%), Scott *et al.* (2001) calculated that their extractions are increasing by 4.1% a year. They are powerful actors that have succeeded in legitimizing their claim on water and increasing their levels of groundwater extraction.

The position of the large commercial farmers is more diverse and complex. They largely depend on groundwater for their agricultural production, but have shown a lack of interest in the COTAS. While some of them were elected to the COTAS boards, they did not actively pursue the formulation of rules and regulations for the aquifers and for reducing groundwater extractions. As most of these farmers operate highly modernized irrigation systems and produce profitable crops, they feel they have already contributed to preserving the aquifers. They developed a discourse blaming the CNA for continued mismanagement of groundwater and small farmers for inefficient use of groundwater. In this discourse, the large commercial farmers are portrayed as highly efficient irrigators producing valuable export crops and generating employment, while the small farmers are portrayed as wasting water. Thus, many large producers are biding their time and are quite content to buy out small farmers (their land and pumps, preferably with concession titles) when pumping depths become too deep for small farmers.

The fact that the COTAS did not receive the authority to directly manage the aquifers made them less attractive to the large producers. The move from SDAyR to CEASG in 1998 weakened the COTAS before they were created, as this removed them from the control of Usabiaga's network. Although many of the agricultural representatives on the COTAS were large commercial farmers, they were maneuvered there to monitor how the COTAS would develop. When it became clear in the early 2000s that the COTAS would not become autonomous user organizations like the WUAs in the irrigation districts, most large producers lost interest and instead focused on their relationships with the CNA and the federal and state ministries of agriculture. However, if the COTAS are to become effective the large producers will need to actively participate in them, as they are the largest groundwater extractors. To stabilize the aquifers at least a 30% reduction in groundwater extractions will be needed. As the rate of groundwater extractions by cities and industries will continue to increase, this reduction will largely have to come from the commercial farmers.

Electricity pricing and groundwater concession titles

Although the COTAS did not become the success hoped for during Fox's *sexenio*, the federal government did make an effort to reduce electricity subsidies. In December 2002, the Chamber of Deputies passed the Rural Energy Law, which established a new single-rate tariff of M$ 0.300 (US$ 0.0316) per kWh called 9CU. This tariff would be raised by M$ 0.020 per year. To qualify for this electricity rate users needed to present a valid groundwater concession title to the CFE. The law also established an Annual Energy Limit (AEL) in kWh/year for each well. Users exceeding this AEL need to pay the regular 9 and 9M tariff for the excess energy they use, which was set to increase at 2% per month, equivalent to 26.8% per year (Scott and Shah, 2004). This initiative followed on early attempts to reduce electricity subsidies and the various presidential amnesties given to groundwater users to register their wells, as described in sections 7.2 and 7.3. While initially agricultural groundwater users falling in tariff 9 had to present their concession title to CFE by June 2000, this deadline was extended several times, to October 2002. The new rural energy law clearly stated that users without a concession title have to pay the regular, commercial tariff for electricity.

The rural energy law has led to an increase in the price of agricultural electricity and in 2007 the 9CU tariff was M$ 0.380 per kWh. The 9 and 9M tariff had risen substantially, from M$ 0.300 per kWh in January 2003 to M$ 0.871 per kWh in July 2007 for the first 5,000 kWh (CFE, 2007). However, enforcement of the AEL has proven difficult and many farmers without a concession title continue to pay the tariff 9 rate as CFE has conducted few field visits to enforce the new tariffs. Also, the rent-seeking surrounding the granting of concession titles continues, leading to newly drilled wells obtaining the 9CU tariff.

Another effort of the federal government to regulate groundwater extractions consists of recovering groundwater concessions from willing sellers. For this, the federal ministry of agriculture, with Usabiaga as its minister, formulated a Water Rights Adjustment Program published in the Official Gazette in March 2003. Through this program the federal government can recover groundwater concession titles from willing sellers, thereby reducing the amount of groundwater extracted. For Guanajuato this program only applied to ARLID and not the whole state. The price for buying back the concession was set by the federal government at US$250 for every thousand cubic meters of groundwater concessioned by the CNA, which is actually on the low side as in 2007 the going price in Guanajuato for one thousand cubic meters was around US$750.

Although the water rights adjustment program looks promising on paper, it has functioned to increase the number of wells drilled. Although hard data on this are not available, interviews with farmers and COTAS technical staff brought out the following mechanisms (Hoogesteger, 2004). On the one hand farmers with concession titles but with wells that have run dry have used the program to sell their concession title to the federal government and then used the money to deepen their wells. In other cases, farmers have sold part of their concession to the federal government, but have not reduced their extractions. Both these mechanisms are possible as the volumes extracted are not strictly supervised by the CNA and because the federal ministry of agriculture manages this program, thus bypassing the CNA.

Another important mechanism leading to more wells being drilled is the separation of land and water rights contained in the national water law, which means that all or part of a groundwater concession title can be sold to a buyer that will pump from the same aquifer. While previously large commercial farmers and real-estate developers had to buy land to obtain the groundwater concession title for that land, concession titles can now be sold without selling the land. A very active market for groundwater concessions has developed in Guanajuato, with urban developers buying part of a groundwater concession from farmers and then obtaining permission from the CNA to drill a new well with a concession title for urban use in the same aquifer. The farmers continue pumping the same volumes as before, while the urban developers tend to pump more than their concessioned titles. The extent of these practices is unclear, but interviews suggest they are widespread in Guanajuato. Lastly, farmers use the possibility to buy groundwater concessions to legalize an already existing "irregular" well, by going to the CNA and presenting the old well as a new well that has been drilled to make use of a concession title that has been bought. In many cases, the sellers of the concession title continue to pump as before, thus leading to an increase in groundwater extractions. In this manner, the market in groundwater concession titles functions to legalize irregular wells and to increase the number of wells drilled.

Moving towards groundwater districts

The failure to reduce groundwater extractions in Guanajuato is starting to have consequences. There are many stories of wells that have already run dry and that have not been deepened or repositioned because the costs are too high or the risk too great that water will not be struck. Although no hard data is available, interviews suggest that a consolidation trend has started, with poorer farmers no longer pumping groundwater due to the costs involved. This "auto-regulation" is also affecting larger farmers dedicated to producing cereals and fodder crops, where high input costs and low prices are leading to bankruptcies. As a result, farmers with capital (mainly producing vegetables) have started buying up wells and land, to expand their operations. This is not leading to less pumping, but is leading to a reduction of the number of groundwater users.

In 2000, I concluded that the COTAS were a recent institutional innovation and that it was too early to evaluate if they would be effective in arresting groundwater depletion (Marañón and Wester, 2000). I suggested that the doubts surrounding the COTAS attributes and tasks was characteristic of the formative phase in institutional change processes, but in the case of Guanajuato was more charged as it was linked with the larger political struggle surrounding the decentralization of water management responsibilities from the federal to the state level. I identified the following issues as crucial for their viability and for the transfer of groundwater management from the state to aquifer users:

- What will be their degree of autonomy from the government?
- What procedures will they design for arriving at consensus between their members?
- What will be the role of the COTAS in the granting of groundwater concessions and how will they enforce reductions in groundwater extractions?

These questions are still highly relevant in 2007. Although the COTAS are an innovative approach to groundwater management, they have not yet achieved sustained reductions in groundwater extractions. Current discussions in the COTAS focus on installing sprinkler and drip irrigation systems to save groundwater, but negotiations to reach agreement on reductions in groundwater extractions have not yet started. In addition, new pumps continue to be installed and regularized through extra-legal means. The reluctance of the government to impose strict pumping limits and the continued race to the pumphouse by farmers bodes ill for Guanajuato's aquifers. Nonetheless, the COTAS continue to form a platform for groundwater users in Guanajuato to find solutions for the vexing problem of groundwater depletion. To move forward, groundwater users would need to devise aquifer agreements with substantially lower levels of groundwater extractions, either through an adjudication of pumping rights on the basis of mutual prescription or through a negotiated downward adjustment of groundwater concessions with the federal government. However, this would require far-reaching institutional changes.

During my research in Guanajuato in 2006 and 2007, COTAS board members and CEAG officials frequently commented that for the COTAS to have an impact they need to have more authority. The WUAs in the transferred irrigation districts were frequently referred to as a promising model for groundwater management. Thus, many of the groundwater actors in Guanajuato want to convert the COTAS into groundwater management districts with delegated authority to regulate groundwater extractions. In this model, the groundwater districts would receive the delegated authority to advise on and approve the granting of groundwater concessions in collaboration with the CNA and the legal capacity to fine pumpers extracting more than their concessioned volume and to close illegal wells. Also, to fund the COTAS, groundwater users would have to pay an annual fee based on the volume extracted. To make this possible, the mandate of the COTAS would need to be expanded, so that they would become legally responsible for the registration and regularization of wells, the formulation and enforcement of aquifer rules and regulations and the monitoring of groundwater extractions. At present, the COTAS are already involved in these three areas, but they do not have the legal authority to arrive at and enforce decisions in these areas. Whether the COTAS will become groundwater districts with delegated authority will strongly depend on CNA's willingness to cede this water governance domain to the groundwater users. The experiences of the past ten years in this regard are not hopeful.

7.5 Conclusions

In closed river basins such as the Lerma-Chapala Basin, water use exceeds annual renewable water availability. Although annual variations in rainfall alleviate or exacerbate surface water availability in the short-term, the medium and long-term effects of water overexploitation are more significant for groundwater supplies. A condition of low surface water supply can be reversed in just one year of high rainfall and runoff, whereas the accumulated deficit of years of aquifer depletion will similarly take years to reverse. The state of Guanajuato's aquifers is critical and the available groundwater storage that can be utilized profitably in agriculture is rapidly dwindling. This is worrisome, as groundwater accounts for nearly 60% of agricultural water use in Guanajuato.

The attempts in Guanajuato to regulate groundwater use through user self-regulation have not resulted in reductions in groundwater extractions. There are various reasons for this, which can be summarized by stating that the attempted reordering of the mode of control over groundwater through COTAS and CEAG was made to fail by a more durable mode of ordering. Manifestations of this more durable mode of ordering are individual water users who continue to have nearly unfettered control over their pumps, a federal government that continues to provide cheap electricity to agriculture and a hydrocracy that actively seeks rents through the legalization of illegal pumps. Also, next to nothing is being done to enforce existing regulations and halt new wells being drilled. This chapter suggests that these strategies remain in place and are stronger than attempts to reduce groundwater use as they strengthen two central concerns of the Mexican state, namely accumulation (increasing earnings through export agriculture and industrialization) and legitimacy (providing production subsidies to potentially unruly farmers and domestic water to powerful voting constituencies). Thus, the attempts to reduce groundwater overexploitation in Guanajuato were impeded by the political economy of groundwater use. Three reasons for the non-regulation of groundwater stand out:

1. the politics of administration, in which struggles between the Guanajuato and federal government obstructed efforts to reduce groundwater use;
2. the lack of efforts by cities or industry to decrease groundwater use and political support for their continued growth, by which these powerful actors succeeded in legitimizing their claim on water and increasing their levels of groundwater extraction; and
3. the dynamics of the embedded state, in which the objectives of the state of Guanajuato to stimulate economic growth were stronger than the need to achieve sustainable groundwater management, which would have meant curtailing groundwater use of large commercial farmers, who controlled segments of the state machinery.

This suggests that the aquifers in Guanajuato remain over-exploited as the majority of the actors involved in groundwater management have a stake in the situation remaining as it is. As long as there is no pressure from powerful pumpers to restrict groundwater extractions, the state will not undertake initiatives that really hurt. The analysis shows that institutional arrangements for groundwater management consist of a meshwork of state regulation, market forces and individual groundwater users. Readjusting this meshwork to achieve sustainable groundwater extractions is proving very difficult, due to the political economy of groundwater use. Supply augmentation through recharge and other means are important first steps, but at some point in the change process towards sustainable groundwater management the stakeholders will need to face the situation; i.e. extractions will need to come down. This will require a mix of regulatory and participatory approaches, coupled with changes in the demand behavior of water users. Users, who hold the ultimate decision on how much to pump, will need to accept regulatory controls by government, coupled with self devised and mutually imposed controls developed through user self-regulation.

In Guanajuato, it has proven very difficult to regulate groundwater through *vedas* or through user self-regulation. However, the situation is not hopeless. A way forward could be to convert the COTAS into groundwater districts with delegated authority over groundwater extractions. This could be achieved by negotiating a concession contract between the COTAS and the CNA and CEAG, in which groundwater users assume the responsibility to reduce groundwater extractions and are delegated the authority to do so. In the concession contract, all the water right concessions of an aquifer would be bundled and granted to the COTAS. Although the volume of the bundled concession would most probably exceed the sustainable yield of the aquifer, in itself this should not be a problem as water rights in Mexico are based on the proportional appropriation doctrine. Hence, annual extraction volumes assigned to groundwater users can legally be reduced to reflect the sustainable yield of the aquifer as long as this is done proportionately. A clause to this effect is already included in the current groundwater concession titles, which states that the concession holder is obliged to adjust the volumes extracted if the aquifer is overexploited. The bundled concession would make the COTAS responsible for ensuring that extractions do not exceed the sustainable yield of the aquifer. To do so, the groundwater users assembled in a COTAS would need to reach agreement on the downward adjustment of groundwater extractions. This groundwater allocation program would then need to be approved and monitored by CEAG and the CNA, and if extractions exceed the agreed allocations then the COTAS as a whole could be fined. The enforcement of the allocation program would be in the hands of the COTAS, who would need to devise monitoring programs to ensure that individual users do not pump more than their allocated share. To accomplish this institutional change will be a complicated process and fundamentally depends on whether the CNA will delegate authority to the COTAS. However, the alternative is continued groundwater overexploitation, spelling economic ruin for most groundwater users in the short to medium term.

8

Coming Full Circle: The Politics of Surface Water Allocation in the Lerma-Chapala Basin

This chapter shows that reducing primary water use in closed river basins is very difficult, even if serious efforts are made to arrive at negotiated agreements. It brings out that managing water based on river basins and increasing stakeholder participation in water governance, while important measures, are insufficient to mediate the controversies and complexities that characterize water governance in closed basins. This chapter focuses on the intensely political nature of water resources management, to show that the legacies of political and bureaucratic practices in Mexico intertwined with the social-material practices of water control in the Lerma-Chapala Basin constrain the possibilities for reducing water use. It also shows that variable rainfall and declining Lake water levels are constitutive elements of river basin politics, based on the remarkable parallels between the political dynamics surrounding the first Lake Chapala crisis in the 1950s and the events that unfolded between 2000 and 2005.

To make its argument, this chapter analyzes the politics of surface water allocation in the Lerma-Chapala Basin after 2000, in particular water transfers from irrigation districts to Lake Chapala and the negotiation processes surrounding the revision of the 1991 water allocation agreement. With the election of Fox as president in July 2000 there were high hopes that the problems in the Basin would be resolved rapidly and that a deeper decentralization of water management would occur. However, the continued decline of Lake Chapala from 1999 onwards and the water transfers to the Lake led to increased conflicts between states and water users in the Basin, and complicated the renegotiation of the 1991 agreement. Although a new agreement was signed in 2004, no provisions were made for environmental flows or for compensations to farmers for reductions in water allocations. This brings out how difficult it is to readjust water allocations after basin closure, let alone reduce water use and secure environmental water requirements, even if parties are willing to negotiate.

8.1 Introduction

Since 1999, negotiation processes concerning surface water allocation have dominated the Lerma-Chapala RBC. While providing a forum for states and farmer representatives to interact, in the eyes of many the RBC was too constrained by the CNA to play an effective role in conflict resolution. The positions assumed by those defending Lake Chapala and those defending agricultural interests hardened in the early 2000s because of the continued decline of Lake Chapala and the attempts by the CNA to reduce water use upstream, through reduced allocations to irrigation districts and water transfers to Lake Chapala. The growing influence of new water actors in the Basin, such as state water commissions and WUAs, combined with the larger political transition process in Mexico, further complicated reaching a negotiated agreement on surface water allocation mechanisms. The CNA was no longer able to mediate the conflicting interests in the Basin, as it had in the early 1990s. However, it also did not transform itself into an impartial facilitator and regulator, due to the legacy of the bureaucratic-authoritarian state in Mexico and the centralized water management of the past. While Lake Chapala was a mirror reflecting the effects of water use in the Basin, the Basin as a whole reflected the larger political changes in Mexico.

The analysis in this chapter shows that the mediation of water allocation controversies in closed basins is an eminently political process that revolves around matters of choice (who gets how much water). It also strongly depends on collaboration. This is so because water resources management readily gives rise to intractable or “wicked” problems (Rittel and Webber, 1973), especially where competition for water is acute. Wicked problems are clusters of interrelated problems, characterized by high levels of uncertainty and a diversity of competing values and decision stakes (Rittel and Webber, 1973). Crucially, wicked problems cannot be solved by any single organization acting alone and are intractable, since what constitutes a solution for one group of individuals entails the generation of a new problem for another. They are also characterized by high levels of cognitive uncertainty (lack of knowledge), strategic uncertainty (divergent strategies of many actors, based on divergent perceptions of the problem and its solutions) and institutional uncertainty (decisions made in many different policy arenas, by different actors) (van Bueren *et al.*, 2003). As wicked problems are characterized by competing perceptions and values, and often also involve power disparities, they enter the realm of politics, understood here broadly as the forum for choosing among values and the process through which relations of power are constituted, negotiated and reproduced (cf. Mollinga, 2001).

With river basin closure the interdependencies between stakeholders, the water resource base and institutional arrangements increase, leading to greater complexity in water management. Dealing with uncertainty and complexity points towards collaborative management and away from the command-and-control administration characteristic of centralized management by a single authority (Rogers *et al.*, 2000). In situations of skewed access to water the social-material practices of water control are critically important in perpetuating wicked problems. Mutual collaboration at the domain level is an appropriate response to the interdependence characteristic of water management. For clarity, domain here is defined as the set of stakeholders joined by a wicked problem while collaboration is seen as an emergent process whereby two or more stakeholders share their appreciations and capacities to address a problem that they cannot solve individually (Gray, 1985). The emergence and growth of collaborative relationships is again highly political, consisting of a negotiation process in which stakeholders with differential access to and control over resources struggle for legitimacy and pursue their interests through strategic alliances (Edmunds and Wollenberg, 2001). While these negotiations result in a negotiated order, this order is not necessarily democratic, equitable or inclusive.

Based on these insights, this chapter offers an interpretive reading of the controversies, conflicts and complexities surrounding surface water allocation in the Lerma-Chapala Basin after 2000. Section 8.2 describes the water transfers to Lake Chapala and analyzes the attempts by farmer representatives to influence water allocation and decision-making at the river basin level through the creation of a new working group in the River Basin Council. The renegotiation of the 1991 allocation agreement is analyzed in section 8.3, focusing on the confrontation between two constellations of interests, the urban-environmental one in Jalisco and the agricultural one, primarily in Guanajuato. This section shows that the negotiation process was more than simply a conflict between the countryside and the city, or between Jalisco and Guanajuato. The bureaucratic struggles between federal agencies, primarily the CNA, SEMARNAT[133] and SAGARPA, the weakness of the Fox administration, and the lack of further decentralization in the water sector, became recursively linked with the Lake Chapala crisis and the water allocation negotiation process. Thanks to good rains in 2003 and 2004, and the issue-linkage achieved between the construction of two new dams and the water allocation agreement, a new water allocation covenant was signed in December 2004. The chapter concludes that reducing consumptive water use in closed river basins is very difficult, as multi-stakeholder processes for reaching negotiated agreements between interdependent stakeholders are intensely political, fragile and steeped in struggle.

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[133] In 2000 the ministry of the environment was renamed SEMARNAT (*Secretaría de Medio Ambiente y Recursos Naturales*), with the P of *pesca* moving to the ministry of agriculture that was renamed SAGARPA (*Secretaría de Agricultura, Ganadería, Desarrollo Rural y Pesca*).

The material on which this chapter is based was collected through collaborative research and during visits to Mexico between 2000 and 2006, supplemented with an analysis of policy documents, newspaper articles and literature.[134] Although I was not present at many of the events that occurred during this period and did not succeed in interviewing some of the key actors, especially from Jalisco, the collaborative research generated sufficient material for this chapter. During this period I wrote several papers together with others that this chapter partly draws on (see Wester *et al.*, 2004b, 2007, 2008).

8.2 Water Transfers and Farmer Initiatives to Save Water

The hydrological cycle strongly influences river basin politics and the controversies and conflicts between water institutions and users. This section shows how two years of significantly less than average rainfall (494 mm in 1999 and 561 mm in 2000) had a deep impact on events in the Lerma-Chapala Basin. The imminent drying up of Lake Chapala led to demands from the Jalisco government and environmental groups to transfer water from irrigation districts to the Lake, while farmers mobilized to protect and save "their" water. In the ensuing conflict both groups managed to secure part of the water they wanted, with four water transfers taking place to the Lake between November 1999 and December 2003, while at the same time irrigation districts in Guanajuato obtained higher water allocations than warranted under the 1991 allocation agreement. Although the Jalisco government could claim it was doing all it could to save the Lake, the water transfers were a short term strategy that severely reduced the goodwill of farmer representatives to renegotiate the 1991 water allocation agreement and damaged the reputation and legitimacy of the CNA. A "positive" outcome of the transfers was that farmer representatives became actively involved in negotiations at the river basin level and developed an initiative to switch to less water demanding crops.

Water transfers from irrigation districts to Lake Chapala

The years of less than average rainfall that occurred from 1996 to 2000 brought out the weaknesses of the 1991 surface water allocation agreement. From November 1990 to November 1995 rainfall averaged 749 mm, slightly above the long term average of 722 mm (CNA, 1991d, 1992, 1993, 1994, 1995), but from November 1995 to November 2000 rainfall averaged 632 mm (CNA, 1996, 1997, 1998, 1999, 2000d). Although the CNA applied the allocation rules of the 1991 allocation agreement, Lake Chapala lost more than 75% of its volume between October 1995 and July 2002, dropping from 4,828 hm^3 to 1,138 hm^3 (see Figure 8.1). Until the end of 1997 the Lake remained above 3,000 hm^3, but dropped to 2,070 hm^3 in July 1998. Due to high rainfall (811 mm) in the second half of 1998 the Lake recovered to 3,360 hm^3 in November 1998 and appeared to be out of the danger zone. However, the very low rainfall levels in 1999 and 2000, combined with the

[134] Together with Gabriela Monsalvo I conducted research on farmer representation on the RBC and the water transfers and with Sergio Vargas and Eric Mollard on the renegotiation of the 1991 allocation agreement. The MSc research by Hans Paters and Rubén Borge also provided important insights for this chapter. I gratefully acknowledge their permission to use our collaborative research findings for this chapter, while taking full responsibility for its content.

highest volume of water allocated and used under the 1991 agreement in 1999 (see Table 8.1), saw the Lake drop to below 2,000 hm^3 in June 2000. Although rainfall in 2001 and 2002 was above average (743 mm and 804 mm, respectively), the Lake continued to decline, dropping to its second lowest level in a hundred years on 28 June 2002, at 1,138 hm^3, and only recovering to 1,902 hm^3 by the end of the year.

The decline of Lake Chapala led to intense controversies, with environmentalists and the Jalisco government blaming the upstream irrigation districts in Guanajuato for using too much water. However, throughout this period the WUAs in the irrigation districts consistently used less water than allocated to them, according to CNA data. As the CNA controls the dams in the irrigation districts and the WUAs double-check the amount of water entering their districts, these data are quite reliable. However, surface water use in the irrigation units, which use around 35% of the Basin's surface water, and direct pumping from the Río Lerma and Lake Chapala is hardly controlled by the CNA and hence is probably higher than reflected in official figures. Table 8.1 supports this suggestion, showing that the volumes used in the irrigation units according to the CNA are frequently the same as the allocated volume. Lastly, the 1991 allocation agreement itself contributed to the decline of Lake Chapala. Alberto Güitrón, a respected hydrologist from IMTA and one of the main contributors to the new water allocation covenant signed in December 2004 (see section 8.3), lists the following faults of the 1991 agreement:

- overestimation of surface water availability, as it was based on hydrological data from 1950 to 1979, a relatively wet period,
- underestimation of the irrigated area and water withdrawals in irrigation units,
- underestimation of the effects of recently constructed dams on surface runoff,
- inadequate allocation algorithms for years of low rainfall (Güitrón, 2005: 36-37).

Besides these faults, Güitrón mentions that CNA's lack of control over water withdrawals in critical areas of the Basin combined with the filling of reservoirs above their normal maximum storage level negatively affected Lake Chapala. The 1991 agreement was designed on the assumption that the reservoirs in the Basin would fill to their maximum operational capacity through carry-over storage based on the reductions in the allocations to the irrigation districts and units, and that any additional water would be discharged to Lake Chapala. However, the agreement did not explicitly define the status of carry-over storage and after irrigation management transfer the WUAs strongly pressured the CNA to store as much water as possible in the reservoirs. The status of the carry-over storage became highly contested between 1999 and 2003, when the CNA transferred unallocated and "unused" water from reservoirs to Lake Chapala.

The declines in Lake Chapala led the Jalisco government to adopt a strategy of demanding water transfers from the larger dams in the Basin to the Lake, pending the revision of the 1991 agreement it had requested at the third RBC meeting in April 1999. According to Jalisco this was necessary "to prevent irreversible damage to the ecosystem and put at risk the supply of potable water to the conurbanated zone of Guadalajara" (Dau-Flores and Aparicio-Mijares, 2006: 66).[135] The first time Jalisco insisted on a water transfer was

[135] "para prevenir un daño irreversible al ecosistema y poner en riesgo al suministro de agua potable a la zona conurbada de Guadalajara."

during the MEG water allocation meeting of November 1999, in which it was decided to transfer 200 hm^3 from Solís dam, the main water source of ARLID, to Lake Chapala. The transfer was possible as the amount of water stored in the Solís reservoir was larger than the amount of water allocated to ARLID based on the 1991 allocation agreement. The surface runoff generated in Guanajuato in 1999 was relatively low (70% of average), leading to an allocation of 648.42 hm^3 for ARLID, while runoff in the Upper Lerma region had been around normal, resulting in a full Solís reservoir. Following the MEG meeting, the CNA released 200 hm^3 from the Solís reservoir, of which 170 hm^3 reached Lake Chapala (Dau-Flores and Aparicio-Mijares, 2006: 67). Although farmers from Guanajuato protested, the CNA argued that the transfer was legal because it did not impinge on the volume allocated to the irrigation districts based on the 1991 agreement. As surface water is national property, and the CNA as the federal water authority has the legal power to decide where to store surface water, the CNA argued that it could transfer the unallocated or excess water stored in the Solís reservoir to Lake Chapala.

The reduced allocations to ARLID resulted in some 20,000 ha out of 77,000 ha not being irrigated with surface water in the winter season of 1999/2000. Four of the WUAs decided not to irrigate at all and in the other seven WUAs it was decided that only 3 ha per farmer could be irrigated. For many of the better off farmers who could switch to groundwater, this was not too problematic, but for poorer farmers who mainly rely on surface water, the consequences were serious. In addition, many poor farmers who pump return flows from the Río Lerma were hit hard as the use of this precarious source of water was prohibited and enforced through army patrols along the river. It the eyes of the farmers the reduced allocation to ARLID was the result of the water transfers to Lake Chapala, as there had been enough water in the Solís reservoir to provide for ARLID's full allocation of 955 $hm^3\ a^{-1}$. In addition, several of the WUA presidents argued that the excess water in Solís reservoir was actually water they had saved by using less water than allocated to them (see Table 8.1). From November 1991 to November 1999 the volume of water used in ARLID was 242 hm^3 less than allocated to the district, lending credence to their claim. Thus, farmers felt that "their" water was being stolen and it was unacceptable to them that the excess water stored in the Solís reservoir was transferred to Lake Chapala.

For the 2000-2001 allocation cycle no water transfers were planned, but the allocations to the irrigation districts and units, at 2,251 hm^3, were the lowest since the signing of the 1991 allocation agreement. During the annual MEG water allocation meeting, held on 15 November 2000, the Guanajuato representative surprised the CNA by disputing the figure of the surface runoff generated in Guanajuato in the preceding year. In 1999, CEAG had installed an automatic gauging station in Corrales, upstream of the point where the Río Lerma leaves Guanajuato, and claimed that its measurements showed that 101.75 hm^3 more water had left Guanajuato than measured by the CNA. After a revision of the data, the CNA increased the figure of the surface runoff generated in Guanajuato from 796.17 hm^3 to 851.1 hm^3 and as a result the volume allocated to ARLID was increased by 51.75 hm^3 to a total of 538.94 hm^3 (CNA, 2000d). Nonetheless, the surface water allocations for the 2000-2001 cycle were so low that the WUAs decided to let 200,000 ha out of a total of 235,000 ha in the irrigation districts lie fallow during the winter season and to only irrigate during the summer season. This was reflected in the amount of water used in the 2000-2001 cycle, which was only 782 hm^3 for all the irrigation districts in the Basin.

Table 8.1. Volumes of surface water allocated to irrigation districts and units in the Lerma-Chapala Basin (1991-2003)

Allocation Cycle	Average Nov 1991 - Oct 96		1996-97		1997-98		1998-99		1999-00		2000-01		2001-02		2002-03		Average Nov 1996 - Oct 03	
Rainfall (mm a^{-1})	714.5		645.8		810.9		494.3		560.7		742.7		803.8		951.8		715.7	
Surface Water (hm^3 a^{-1})	Allocated	Used	Allocated	Used	Allocated	Used	Allocated	Used	Allocated	Used	Allocated	Used	Allocated	Used	Allocated	Used	Allocated	Used
Irrigation Districts																		
ID 033	90.00	67.92	90.00	54.96	73.98	66.18	90.00	69.24	80.00	63.80	80.00	53.09	80.00	55.32	80.00	57.27	82.00	59.98
ID 011	915.00	916.82	785.70	754.73	504.00	318.62	955.00	920.43	648.42	633.32	538.94	329.78	529.28	726.54	657.65	625.36	659.86	615.54
ID 085	124.00	92.94	91.40	84.84	36.00	22.56	124.00	154.91	57.06	50.80	70.42	46.32	76.05	50.57	84.79	88.37	77.10	71.20
ID 022	8.00	5.94	8.00	3.29	6.55	1.27	8.00	6.20	7.67	4.65	7.36	0.73	8.00	7.20	8.00	6.46	7.65	4.26
ID 024	170.00	94.66	170.00	111.48	99.48	56.11	170.00	90.46	116.87	78.33	111.94	76.86	120.00	68.98	120.00	91.99	129.76	82.03
ID 045	90.00	69.46	90.00	79.56	49.69	58.19	81.50	77.19	58.38	52.24	55.92	60.92	60.00	58.85	60.00	56.21	65.07	63.31
ID 061	200.00	147.70	200.00	168.87	165.65	145.07	200.00	143.33	194.54	156.46	186.36	126.28	200.00	195.37	200.00	172.48	192.36	158.27
ID 087	220.20	220.30	180.00	181.00	180.00	178.32	201.00	232.88	227.08	159.82	180.00	84.51	233.00	147.40	233.00	170.98	204.87	164.99
ID 013	136.00	111.90	136.00	112.49	102.47	97.28	115.00	97.63	54.56	31.84	2.79	3.45	8.61	8.12	21.30	10.42	62.96	51.60
Total	**1953.20**	**1727.64**	**1751.10**	**1551.22**	**1217.82**	**943.60**	**1944.50**	**1792.27**	**1444.58**	**1231.26**	**1233.73**	**781.94**	**1314.94**	**1318.35**	**1464.74**	**1279.54**	**1481.63**	**1271.17**
Irrigation Units																		
Mexico	241.00	181.74	241.00	147.18	222.93	199.43	241.00	185.40	241.00	192.19	241.00	241.00	241.00	241.00	241.00	241.00	238.42	206.74
Queretaro	65.00	57.78	65.00	57.58	65.00	50.36	65.00	58.94	65.00	55.40	65.00	65.00	65.00	65.00	65.00	65.00	65.00	59.61
Guanajuato	523.00	488.30	523.00	500.62	306.05	193.37	523.00	521.23	350.01	339.41	275.76	275.76	299.57	299.57	336.56	336.56	373.42	352.36
Michoacan	464.00	357.48	464.00	389.67	384.50	336.64	464.00	368.57	451.82	337.45	432.76	432.76	464.00	464.00	464.00	464.00	446.44	399.01
Jalisco	157.00	141.32	157.00	129.86	118.30	112.30	154.60	141.25	62.91	36.71	3.06	3.06	9.79	9.79	24.46	24.46	75.73	65.35
Total	**1450.00**	**1226.62**	**1450.00**	**1224.91**	**1096.78**	**892.10**	**1447.60**	**1275.39**	**1170.74**	**961.16**	**1017.58**	**1017.58**	**1079.36**	**1079.36**	**1131.02**	**1131.02**	**1199.01**	**1083.07**
Guadalajara City	232.20	209.04	240.00	187.65	240.00	196.93	240.00	197.51	240.00	180.84	189.60	154.60	190.00	165.70	190.00	162.06	218.51	177.90
Grand Total	**3635.40**	**3163.30**	**3441.10**	**2963.78**	**2554.60**	**2032.63**	**3632.10**	**3265.17**	**2855.32**	**2373.26**	**2440.91**	**1954.12**	**2584.30**	**2563.41**	**2785.76**	**2572.62**	**2899.16**	**2532.14**

Sources: CNA (1991-2003).

In the summer of 2001 Lake Chapala had dropped to its lowest levels in 50 years and there was grave concern in Jalisco that the Lake would completely dry up. Due to relatively good rainfall in 2001 (743 mm) and the low level of water use during the 2000-01 cycle, dam storage in the Basin had increased markedly. After the preliminary allocations for the 2001-02 cycle had been determined, a volume of 500 hm^3 remained available in the main dams of the Basin. This triggered the Jalisco representative on the RBC to demand a transfer of 700 hm^3 to the Lake, 300 hm^3 so that the Lake would regain the level of the year before and 400 hm^3 to start the recuperation of the Lake. Guanajuato, on the other hand, requested that 900 hm^3 be allocated to ARLID, based on the 1,000 hm^3 stored in the Tepuxtepec and Solís reservoirs. Jalisco then moderated its position and requested that 500 hm^3 be transferred to the Lake (CNA, 2001: 13). Through intense negotiations, this amount was reduced to 270 hm^3, of which 250 hm^3 was to be transferred from Solís dam and 20 from Melchor Ocampo dam (CNA, 2001). However, during the MEG meeting held in November 2001 it was also decided that ARLID would receive an additional 250 hm^3, above its regular allocation based on the 1991 agreement, in recognition of its efforts to save water. This deal was closely linked to the efforts by WUA presidents to gain a larger say in the River Basin Council, described in more detail below.

In mid November the CNA started the transfer that was planned to last for 60 days. However, on 11 December 2001 some 2,000 farmers from the La Piedad *módulo* of ID087 blocked the main road from Guanajuato to Michoacán for several hours, protesting against the transfer and demanding irrigation water. The same day the transfer was stopped and the farmers of La Piedad were assured that they could irrigate in the 2001/2002 winter season. During the first part of this transfer 171 hm^3 was released from Solís of which 147 hm^3 arrived in Lake Chapala (Dau-Flores and Aparicio-Mijares, 2006: 67). On 12 April 2002, when the irrigation season had ended, the CNA reinitiated the transfer, but this time farmers from ARLID protested and on 5 May closed the Lomo de Toro barrage on the Río Lerma to divert water to Lake Yuriria. Based on discharge measurements, they argued that more water was being transferred to Lake Chapala than agreed on. The next day a large number of farmers gathered at the CNA office in Celaya and a meeting was held between Vicente Guerrero, head of the CNA Guanajuato office, Miguel Angel Solis, undersecretary of the Guanajuato ministry of agriculture, Manuel Cano Ledesma, president of the SRL of ARLID, and WUA presidents.[136] At this meeting it was decided to stop the transfer immediately. During the second part of the transfer 99 hm^3 was released from Solís, of which 75 hm^3 reached Lake Chapala (Dau-Flores and Aparicio-Mijares, 2006: 67).

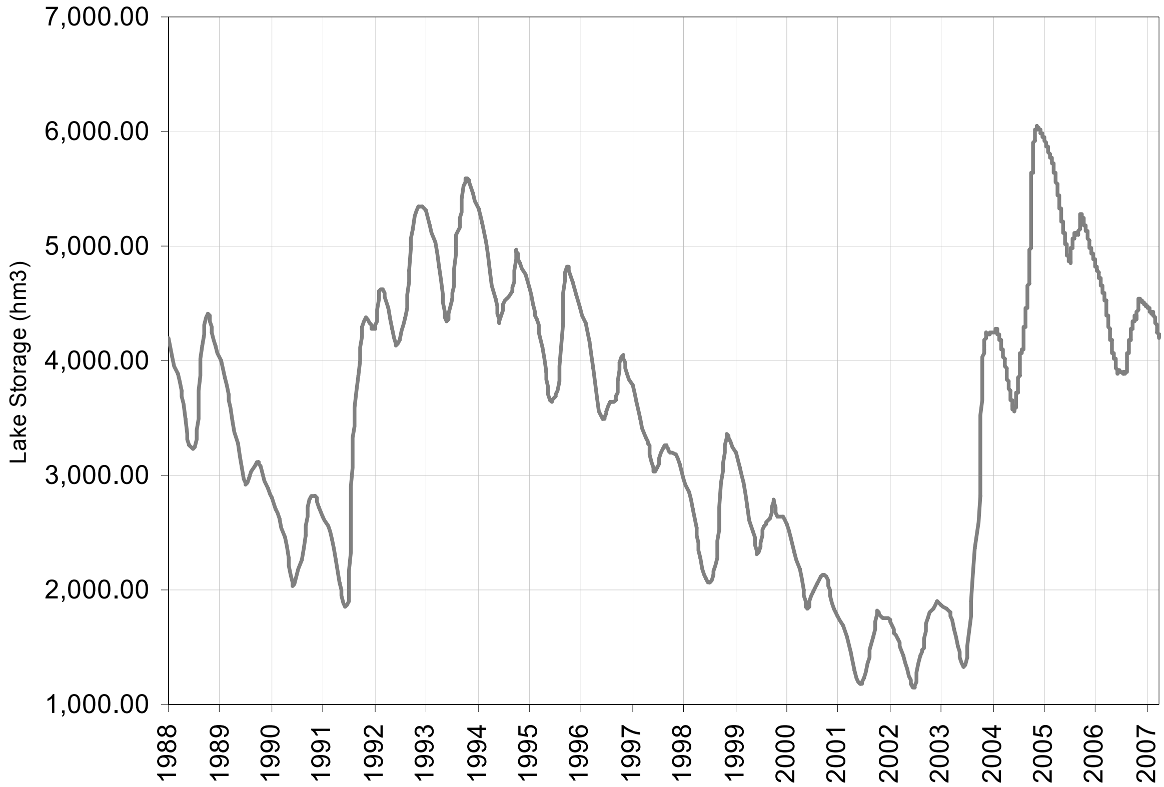
Despite the transfers of 1999 and 2001, the Lake dropped to its second lowest level in a hundred years in July 2002 and it was feared that the Lake would fall completely dry. Thus, in the MEG meeting on 21 November 2002, the CNA announced that another water transfer of 280 hm^3 would take place during the summer of 2003. Of this transfer, 20.50 hm^3 was to come from smaller dams in Jalisco, 235.33 hm^3 from Solis and other dams in Guanajuato and 24.17 hm^3 from dams in Mexico. The transfers from the Jalisco dams took place in December 2002, but having learned from the previous transfer, the CNA announced that the transfers from Guanajuato would take place in June 2003. During the summer of 2003, unexpectedly heavy rains coincided with this water transfer, causing

[136] El Correo de Guanajuato, 7 May 2002.

floods in many parts of the Basin. Instead of being accused of taking irrigation water from farmers, the CNA was blamed for aggravating flooding through the water transfer. During the transfer, farmers from Guanajuato occupied the CNA office and diverted water in transit from Solís dam to Lake Chapala to Lake Yuriria to express their fury and to lessen the flooding.

The very good rains of 2003, with 952 mm some 32% above average, led to a spectacular recovery of Lake Chapala, with stored volumes jumping from 1,330 hm^3 in June 2003 to 4,250 hm^3 in January 2004 (see Figure 8.1). However, this did not cool down tempers. In November 2003, the Jalisco representative on the RBC again demanded the transfer of water from upstream dams to Lake Chapala, fuelling the anger of farmer representatives and further straining the relationship with Guanajuato. Nonetheless, the CNA announced that 205 hm^3 would be transferred, representing 50% of the unallocated water stored in the Basin's reservoirs, and on 27 November 2003 opened Solís dam. However, the CNA tried to cover up that this was a transfer, arguing that is was necessary for the hydraulic security of Solís Dam. The WUAs of ARLID, La Begoña (ID085) and the Pastor Ortiz *módulo* of ID087 did not buy into this excuse and for the first time took the issue to court on 12 December 2003. The judge of the Celaya district court ruled in favor of the farmers and ordered that the transfer be stopped. However, by the time the judge had forbidden the transfer, the water had already flowed, with 174 hm^3 reaching Lake Chapala. This fourth transfer was to be the last one, as a new water allocation covenant was signed in December 2004 that included stricter rules on reservoir management, such that any unallocated water or storage above normal operational levels had to be passed on to Lake Chapala.

Figure 8.1. Lake Chapala volumes from 1988 to 2007



Under pressure from Jalisco, 955 hm^3 were transferred from reservoirs in the Basin to Lake Chapala between 1999 and 2004, of which 817 hm^3 arrived. Although these water transfers were insufficient to "save" the Lake and could be seen as an instance of symbol politics, they did have consequences. Firstly, around 100,000 ha could have been irrigated with this "excess" water. The reduced allocations to the irrigation districts negatively affected farmers' livelihoods, the larger agricultural economy and the performance of the WUAs, who solely depend for their income on irrigation service fees. In addition, the leadership of the WUAs was severely questioned by water users because of the lack of water for irrigation, although there was water available. Secondly, Jalisco could claim that it was saving the Lake, as without the transfers Lake Chapala would have dropped to 746 hm^3 in July 2002, 208 hm^3 less than the lowest level in 1955 (Dau-Flores and Aparicio-Mijares, 2006: 68). Thirdly, the CNA reaffirmed its position as the central decision-maker in the Basin, although the transfers damaged its legitimacy and reputation. Another consequence of the transfers was that farmer representatives became actively involved in negotiations at the river basin level and developed an initiative to switch to less water demanding crops. The following details how this initiative fared.

Farmer initiatives to save water: the GTEPAI experience

As irrigated agriculture is a large part of the problem of water overexploitation in the Lerma-Chapala Basin it also needs to be a large part of the solution. Decreasing the amount of water depleted in the Basin can be achieved by growing less water demanding crops, by negotiating water allocation agreements that partly satisfy all the interests involved in water management and by strictly controlling water withdrawals. However, the confrontational stance adopted by the parties involved in the water allocation conflict in the Basin precluded attempts at mutual collaboration. This is brought out by the attempts of farmer representatives to save water and to increase their role in decision-making in the RBC. One attempt consisted of an initiative to bring together all the WUAs in the Basin to form a specialized working group in the RBC that focused on comprehensive agricultural planning and the promotion of less water demanding crops. Another attempt, mainly by the WUAs from Guanajuato, was to gain a larger say in the renegotiation of the 1991 water allocation agreement, thereby "saving" their water. This section focuses on the first attempt, while the renegotiation process is detailed in section 8.3.

Irrigated agriculture uses some 80% of the surface water in the Lerma-Chapala Basin, but before 2000 water users did not actively participate in the River Basin Council or in negotiations on water allocations. As detailed in Chapter 5, the RBC was originally a government initiative and it was only in January 1999 that water user representatives formally obtained a seat on the RBC, through a selection procedure strongly controlled by the CNA. In the case of agriculture, a farmer from Jalisco – Raúl Medina de Wit – was appointed. This representative was to speak for around 80% of water use in the Basin, but only held one of the 12 votes on the council and was unknown to nearly all the estimated 188,000 agricultural water users in the Basin. That Medina de Wit was from Jalisco, with a farm on the shores of Lake Chapala, suggests that the CNA selected him as they assumed he would be in favor of measures to save the Lake, such as water transfers. In 1996 he became the president of the Jamay WUA in ID013 (Estado de Jalisco) and worked closely with Engineer Ochoa, who was still the head of the La Barca rural development district. In

1998 he was elected president of the Lake Chapala Watershed Commission,[137] and together with Ochoa created a working group in the commission on agricultural planning. The main problem in the irrigation districts in the Lake Chapala Watershed (ID024, ID013 and ID087) was the lack of surface water due to reduced water allocations (see Table 8.1), hence Medina de Wit and Ochoa promoted the planting of more remunerative, less water demanding crops, such as barley and chickpeas. When Medina de Wit became the agriculture user representative on the RBC in early 1999, he started looking for ways to expand this program to the entire Basin.

Before 1999, none of the WUA leaders in ARLID were involved in the RBC and most of them were not aware of the 1991 water allocation agreement. However, the water transfer of November 1999 changed this. During an ARLID Hydraulic Committee meeting held in November 1999 the WUA presidents strongly questioned the transfer and demanded to know from the CNA why their allocation was so low, although there was enough water in the Solís reservoir to cover their full concession. The CNA Guanajuato state delegate then explained the 1991 water allocation agreement and that the CNA had the right to transfer unallocated water. This came as a surprise to the WUA presidents and they requested to be more fully informed about the RBC and the 1991 agreement. This happened in a meeting on 8 May 2000, when Medina de Wit and Ochoa came to the ARLID SRL office to meet with the WUA presidents from Guanajuato. Until then, WUAs had only dealt with the CNA and there were no horizontal linkages between WUAs from different irrigation districts.

The initiative to hold the May meeting was taken by IWMI researchers, who had met with Medina de Wit in early 2000, and had suggested bringing him into contact with WUAs from ARLID. When the suggestion was made to the SRL president to meet with the agricultural water user representative on the RBC, who was also the Jalisco water user representative and president of the Lake Chapala Watershed Commission, his sardonic response was to ask if this water user representative was a CNA official. The original idea was to hold a small meeting, to see how the WUA presidents could work together. However, the CNA Guanajuato office heard about the meeting and decided to convene the ARLID Hydraulic Committee, inviting not only WUA board members from ID011 and ID085, but also the Guanajuato minister of agricultural and other state officials and a group of officials from CNA's regional office.

In the presence of Guanajuato's agricultural elite an official from the CNA regional office gave a presentation on the RBC and the election procedure of water user representatives and then presented Medina de Wit as the representative for agricultural water use. Those present strongly questioned why the representative was from Jalisco, arguing that as Guanajuato covers 47% of the Basin and uses the most water the representatives should be from Guanajuato. They also strongly questioned the CNA, demanding to know who was the Guanajuato agricultural water use representative on the Basin Users Assembly and why they did not know anything about the election of representatives. Lastly, doubts were raised whether Medina de Wit was really a farmer and if his position as representative on the RBC was a political appointment. In short, the meeting was very tense and the lack of

[137] This Commission was formed as part of the Lerma-Chapala River Basin Council in 1998, to improve water resources management in the direct watershed of Lake Chapala.

answers from the CNA infuriated those present. However, the WUA presidents did agree to meet with Medina de Wit again, to discuss ways to strengthen their position in the RBC. Another outcome of the meeting was that Guanajuato's *Consejo Estatal Hidráulico* developed a procedure for the election of Guanajuato's representative to the Basin User Assembly, with the ARLID SRL president being elected on 10 November 2000.

Between June and November 2000, Medina de Wit convened three meetings with WUA presidents from Jalisco, Michoacán and Guanajuato to discuss the water transfers and the reduced water allocations to irrigation. In the fourth meeting on 17 November 2000 the agricultural water user representatives from Mexico and Querétaro also attended. The CNA and other government agencies did not attend these meetings, with the exception of Eng Ochoa from SAGAR who actively supported the initiative. At these meetings it was agreed that the WUAs would work together to switch to less water demanding crops, both to save water and to show to the RBC that they wanted to contribute constructively to resolving the problems in the Basin. It was also agreed that they would form a new working group in the RBC that would focus on comprehensive agricultural planning and strengthening the participation of water users in river basin management. The CNA and the state governments were requested to fund this initiative, to both establish an office and a basin-wide water savings program, but these requests were turned down.

During the MEG meeting of 15 November 2000, Medina de Wit requested the formation of a new working group in the RBC, the *Grupo de Trabajo Especializado en Planeación Agrícola Integral* (GTEPAI, Specialized Working Group on Comprehensive Agricultural Planning), under his leadership. This was the first working group of the RBC that was formed by water users and did not consist of government officials. The MEG agreed in principle and on 6 December 2000 the first formal meeting of GTEPAI was held, with the agricultural water user representatives of the five states incorporated as its members.[138] GTEPAIs objective was defined as identifying and offering to farmers viable and profitable cropping and marketing options under conditions of water scarcity, especially in the winter season. To achieve its objective it was stressed that GTEPAI aimed to promote coordinated and shared action between government agencies, research institutes, agricultural companies and farmers. The following list of actions was agreed on:

- Create a directory of agricultural water users in the Basin;
- Create a directory of federal and state officials working on water and agriculture in the Basin;
- Create mechanisms to quickly and timely obtain information from the CNA on water allocations for the next year and transmit this information to water users, to have sufficient time for agricultural planning in relation to water availability, thus answering the primary question of farmers: how much water for how much land?; and
- Establish links with agricultural companies to negotiate collective growing contracts, thus answering the question: what price for which crops?[139]

[138] However, GTEPAI was never formally constituted and recognized as a working group of the RBC.

[139] From the minutes of the installation meeting of GTEPAI (Miercoles 06 de Diciembre, 1a. Relatoría de Sesión de Instalación y 1a. Reunión de Trabajo del Grupo de Trabajo Especializado en Planeación Agrícola Integral del Consejo de Cuenca Lerma-Chapala). On file with the author.

From late 2000 until mid 2001 GTEPAI held 17 meetings throughout the Basin, at which Medina de Wit and Ochoa were always present. They brought together farmers, government agencies, agro-industries and research institutes to elaborate a Crop and Marketing Catalogue. This Catalogue set out which crops could profitably be grown under each of the three water allocation policies of the 1991 treaty and linked these with cropping contracts from agro-industries. In August 2001 the federal ministry of agriculture (SAGARPA) started to actively participate in GTEPAI meetings, while the CNA showed little interest. The cooperation of government agencies, agro-industries and producers in GTEPAI resulted in a change of cropping patterns for the winter season of 2001/2002. Throughout the Basin, GTEPAI facilitated the conversion from wheat (four irrigation turns) to barley (three irrigation turns) on 47,000 ha, from wheat to chickpea (two irrigation turns) on 5,000 ha and from wheat to safflower and canola (one irrigation turn) on another 5,000 ha (Paters, 2004). This resulted in a record production of barley, reduced imports for breweries and claimed water savings of 60 hm^3. The influence of GTEPAI in the RBC became clear in November 2001, when the second water transfer was announced by the CNA. Partly in recognition of GTEPAI's water saving efforts, ARLID was awarded an additional 250 hm^3 above its normal allocation. Also, not only Medina de Wit participated in the MEG meetings but most of GTEPAI's members did, including the president of ARLID. However, environmental NGOs and the Jalisco government continued to blame irrigated agriculture for the decline of Lake Chapala and in the course of 2002 the representative of agricultural water use on the RBC came under increasing attacks in the media in Jalisco.

In the second half of 2002 the GTEPAI initiative started to flounder. Although work started on establishing growing contracts for the 2002/2003 season, farmers from ARLID were less interested in growing barley, as there had been problems with harvest payments. The end came in November 2002, when the CNA announced that another water transfer of 280 hm^3 was to take place during the summer of 2003. Simultaneously, the representative of agricultural water use on the RBC (who was also the leader of GTEPAI) was pressured to resign from the RBC. The disappointment of farmer representatives and others involved with GTEPAI was such that they decided to dissolve GTEPAI and to revert to interest group politics. In January 2003 the CNA regional office organized the third assembly of water user representatives in Guadalajara, where new user representatives for the RBC were elected. The president of the ARLID SRL was elected as the representative of agricultural water use, to take the place of Medina de Wit. In 2003, the renegotiation of the 1991 allocation agreement and the third water transfer fully occupied the new representative and efforts to change to less water demanding crops throughout the Basin ceased. Instead, the commercial farmers in ARLID assumed a more antagonistic position towards "saving" Lake Chapala and Jalisco and formed a block with Guanajuato state officials to influence the water allocation negotiation process in their favor, as will be shown in section 8.3.

As mentioned in Chapter 5, the formation of WUAs in the irrigation districts entailed the creation of new organizational spaces that became nodes in the flows of power in water management. This was especially the case for ARLID, where an interest group of large commercial farmers had grown since the 1970s. These farmers, who also own parts of the marketing and processing chains of agricultural products, have a strong influence in the WUAs in ARLID, without necessarily occupying board positions. Vargas and Mollard put forward the thesis that the WUAs in ARLID "have been converted into a new corporatist space by this interest group [the large commercial farmers]; these farmers have reconstituted the collapse of state corporatism into a private corporatism" (2005: 71).[140] Several of these farmers went on to occupy important government positions during Fox's *sexenio*, such as Javier Usabiaga as federal minister of agriculture and others as Guanajuato state minister of agriculture. In addition, the underminister of water in Guanajuato and the state representative on the RBC since 2001 is strongly linked to this interest group. In 2003 this network strongly mobilized to influence the water allocation negotiation process and dropped the GTEPAI initiative as it has served its purpose.

The GTEPAI initiative was an attempt to redefine the relationship between water users and the hydrocracy and was a test of CNA's commitment to social participation. It transformed the ineffectual and ceremonial position of the agricultural water user representatives on the Basin Users Assembly into a working group that established horizontal linkages between irrigation districts in the Basin and improved the participation of farmer representatives in the RBC. However, it was largely restricted to WUA board members and did not involve the irrigation units or smaller farmers. Nonetheless, the crop conversions achieved by GTEPAI, leading to claimed water savings of 60 hm^3, suggests that much more could have been achieved if this initiative had been continued. However, the politics of water resources management in the Lerma-Chapala Basin were such that GTEPAI was disbanded. Its attempts to link the hydrocracy and agricultural bureaucracy through comprehensive agricultural planning based on water availability proved too ambitious, while it was not sufficiently linked in with power politics to serve as an adequate vehicle to renegotiate the 1991 allocation agreement.

Concluding remarks

As water management tends to be highly centralized in many countries, with hydrocracies dominating decision-making, the experiences with increased stakeholder participation in river basin management in the Lerma-Chapala Basin are not particularly encouraging. The rise and demise of the GTEPAI initiative teaches important lessons about multi-stakeholder decision-making processes in water resources management. It shows that an increase in stakeholder participation, not completely under the control of the CNA, has taken place in water management since the start of the Mexican water reforms, reflecting wider changes in Mexican society. However, this is a fragile process, which is easily derailed by power politics and interest group behavior. While agricultural water users were initially willing to save water and negotiate agreements on surface water allocations based on the recognition of interdependence, the antagonistic position of the Jalisco government and the reluctance of the CNA to fully support social participation complicated the negotiations and undermined the legitimacy of the RBC. The perception that the federal water agency was siding with Jalisco, through its approval of water transfers from irrigation to Lake Chapala, further weakened the RBC. However, the actors in the RBC did succeed in negotiating a new water allocation agreement that was signed towards the end of 2004. The following section details how this agreement was reached.

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[140] "se han convertido en un nuevo espacio corporativo para este grupo de interés; estos agricultores se reconstituyen al desorganizarse el corporativismo estatal en un corporativismo privado."

8.3 Reaching an Agreement on Surface Water Allocations

This section analyzes the renegotiation process of the 1991 water allocation agreement, to explore how negotiated agreements can be reached even in conditions of very partial collaboration where negotiating parties adopt a confrontational stance. An important element in the negotiation process was the role played by a "neutral" outsider (in this case a research institute) in achieving consensus on hydrological data and allocation algorithms in the drawn-out negotiations that took place in the River Basin Council between the states in the Basin and the CNA. The most crucial factors that led to a new agreement, however, were the very good rains of 2003 and 2004 and the issue-linkage achieved between the construction of two new dams and the signing of a new water allocation covenant. As part of the water allocation controversy, more actors became involved in river basin politics, such as environmental NGOs, the Jalisco State Water Commission and farmer representatives. This led to a hardening of the conflict, but also to more robustness in decision-making in the Basin. However, while a new water allocation covenant was signed in December 2004, deeper issues were not dealt with, such as guaranteeing a minimum environmental base flow in the river and compensating farmers for water transferred out of agriculture for urban and environmental use. This section first presents the round of failed negotiations that followed on the formulation of a new master plan for the Basin and then describes the second round that did lead to a negotiated agreement.

A new master plan for the Basin: ecological restoration and new dams

River basin politics in the Lerma-Chapala Basin from 2000 to 2005 consisted of several intertwined strands. The most noticeable was the confrontation between two constellations of interests, the urban-environmental one in Jalisco and the agricultural one, primarily in Guanajuato, due to falling Lake levels. However, the water allocation controversy was more than simply a conflict between the countryside and the city, or between the state governments of Jalisco and Guanajuato. The bureaucratic struggles between the CNA and its mother ministry, SEMARNAT, and with the federal ministry of agriculture (SAGARPA), combined with the weakness of the Fox administration and the water transfers to the Lake, strongly influenced the water allocation negotiation process. In return, the controversies and conflicts in the Lerma-Chapala Basin had an impact at the national level, straining the relationship between the CNA and SAGARPA and delaying the passage of a new water law.

The drying up of Lake Chapala in the early 2000s coincided with major political changes in Mexico. The first non-PRI candidate – Vicente Fox – was elected president on 2 July 2000 and assumed office in December 2000. His election slogan had been *Ya! El Cambio* (Enough Already! The Change), later reduced to only *Ya!*, and his administration was termed the government of change.[141] Hopes were high that things would really change, although the PAN had not won a majority in Congress or the Senate.[142] However, to win the

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[141] As his term progressed and nothing much changed this led to political jokes such as "everything changes, but nothing has changed" and "the pre-cambrico era" to refer to the good old PRI days.

[142] Many voters had been reluctant to give Fox too much power, and had voted for a different party in Congress, with PRI gaining 209 seats, PAN 207 and the PRD 54. The split in the Senate was more pronounced, with PRI gaining 60 seats, PAN 46 and the PRD 15. (Rubio, 2004: 11)

elections Fox had assembled a diverse coalition that he attempted to placate when forming his cabinet, which led to "an incoherent cabinet with contradictory priorities and agendas [which] was based not on a plan to govern effectively but on his [Fox's] perceived need to keep his various constituencies close-by" (Rubio, 2004: 17). As his minister of agriculture he appointed Javier Usabiaga, the largest commercial farmer from Guanajuato, who was critical of the CNA. As his minister for the environment he appointed Víctor Lichtinger, an agricultural economist who had been the executive director of the tripartite Commission for Environmental Cooperation established under NAFTA. Fox's choice for the DG of the CNA – Cristóbal Jaime Jáquez – was surprising as he was not a civil engineer or water resources planner, but a manager who had been the CEO of Coca Cola de México, of the soft-drinks and mineral water division of Grupo Industrial Visa and lastly of the Grupo Industrial Lala, the largest dairy company in Mexico. These three men did not succeed in establishing good working relationships and especially the infighting between SEMARNAT and the CNA, which renamed itself Conagua,[143] affected the Lerma-Chapala Basin.

In 1994, the CNA had been moved from the ministry of agriculture to the ministry of the environment (SEMARNAT), based on the argument that water is a natural resource. However, the relationship between the two during Zedillo's administration (1994-2000) was strained because CNA's budget was three times that of its mother ministry and as a deconcentrated agency it was largely autonomous in its operations. This did not improve after 2000. Shortly after Fox assumed office a *Cruzada Nacional por el Bosque y el Agua* (National Crusade for Forests and Water) was launched by the ministry of the environment, with water being declared an issue of national security. The frustration of SEMARNAT officials with the CNA, and the continued deterioration of Lake Chapala and the overall environmental degradation of the Lerma-Chapala Basin, led SEMARNAT to launch a new initiative as part of the National Crusade; the *Plan Maestro para la Sustentabilidad de la Cuenca Lerma-Chapala* (Master Plan for the Sustainability of the Lerma-Chapala Basin). Through this initiative, SEMARNAT aimed to subordinate the CNA and gain a much larger say in the Lerma-Chapala Basin by developing a master plan for the ecological restoration of the Basin and the recuperation of Lake Chapala. By December 2001 a draft version of this plan was presented to the five states in the Basin, outlining four groups of actions:

1. **Legal framework**: establish a special legal framework for the Lerma-Chapala Basin to ensure its ecological restoration and the recuperation of its hydrological equilibrium; revise the 1991 water allocation agreement, reform and consolidate the RBC;
2. **Requirements**: installation of a modern hydro-meteorological measurement network; elaboration of a comprehensive record of all surface and groundwater users in the Basin, registration in the Public Register of Water Rights;
3. **Structural Change for Saving Water and the Recuperation of Natural Resources**: sustainable water supply to the cities of Guadalajara and León; program for saving water and sustainable agriculture; program for urban water use, policies and instruments for fostering sustainability and the hydrological equilibrium; and
4. **Ecological Restoration**: program for targeted reforestation, soil conservation and the preservation of biodiversity. (SEMARNAT, 2001)

[143] Again, this led to predictable jokes, such as *Conagua nos dega sin agua* (Conagua leaves us without water) as *con agua* means with water.

The Master Plan largely bypassed the planning efforts undertaken by the CNA since the mid 1990s, which had resulted in the publication of the short term (2001-2006) and long term (2001-2025) hydraulic programs of the Basin, and was much more ambitious in its objectives. Besides the emphasis on ecological restoration and sustainability, an important component of the Master Plan was the improvement of the urban water supply of Guadalajara and León (Guanajuato's largest city). The main issue in Guadalajara was that it abstracted large volumes of water from Lake Chapala, but due to more than 40 % leakage in its water supply system had insufficient water for its population. To stop the abstractions from Lake Chapala the Master Plan proposed the construction of a new dam (the Arcediano Dam) on the Río Santiago, with a federal contribution of US$700 million. In the case of León, which draws its urban water from severely overexploited aquifers, it was proposed to import water from the Río Verde, a tributary of the Río Santiago, by constructing the San Nicolás Dam with a federal commitment of US$400 million. The Master Plan stressed that federal funding was conditional to the cities reducing leakage to less than 25%, full cost recovery from inhabitants and achieving the full treatment of wastewater (at the time Guadalajara did not treat its wastewater at all).

Through the Master Plan, the ministry of the environment aimed to achieve a policy breakthrough by reaching a consensus between the five states and a wide range of water users and institutions in the Basin to work towards ecological sustainability. The CNA reacted negatively to the Master Plan, as it threatened its position of primary decision-maker in the Basin. The states in the Basin and especially Guanajuato also reacted negatively, as it appeared that the Master Plan was being imposed by the federal government and would grant it extensive powers through the creation of a special legal framework for the Basin. Another perception was that the Master Plan was too closely linked to the Jalisco government. Hence, no public consultations were held on the Plan and it was not formally approved, although SEMARNAT continued working on a program for the ecological restoration of the Basin. However, elements of the Plan were continued, such as establishing a separate legal framework for the Basin, and especially the proposed construction of the two new dams proved very popular.

The struggles surrounding the acceptance of the Master Plan and the lack of progress in rescuing Lake Chapala motivated a PRI senator from Jalisco to submit a decree initiative to the Senate in September 2002 to declare the Lerma-Chapala-Santiago Basin an ecological restoration zone and water reserve. This decree entailed SEMARNAT assuming complete control over the water resources of the Basin, in effect canceling existing water concessions and granting extensive powers to the federal government to take decisions unilaterally. The minister of the environment supported this law initiative, as did environmental NGOs from Jalisco, which led to heated debates in the press and especially angered Guanajuato. Although the Senate approved the decree in December 2002, the Congress did not support the decree initiative and it was not published. The attempts by SEMARNAT to force a policy breakthrough in the Lerma-Chapala Basin and to shift the locus of decision-making away from the CNA, by linking the wicked problem of water allocation in the Basin with the much larger issue of ecological restoration, failed. Thus, it was left to the CNA and the five states in the Basin to arrive at a negotiated agreement along more conventional lines, namely by revising the 1991 allocation agreement so that more water would flow to Lake Chapala. However, even this proved quite difficult.

In April 1999 the members of the RBC had agreed to revise the 1991 allocation agreement, which led to the signing of an updated version of the agreement in August 2000, as described in Chapter 5. This agreement set out a period of 180 days to revise the allocation algorithms, but the water transfers and the growing conflicts in the Basin led to delays in honoring this commitment. The initial approach chosen by the CNA in 2001 to revise the allocation algorithms was to develop a *reglamento* (regulation) for water use in the Lerma-Chapala Basin, based on the 1991 allocation agreement.[144] The CNA hired IMTA in 2001 to conduct a technical study on the regulation of the Lerma-Chapala Basin, which was published in July 2002 (IMTA, 2002b). The main recommendation of IMTA was to devise a *reglamento* as a complement to the existing 1991 allocation agreement, containing larger restrictions in the volumes allocated to irrigation under the *critical* allocation policy. Based on the IMTA study the CNA formulated the *reglamento* with the intention that it would be published as a presidential decree. This would make the *reglamento* legally binding, in contrast to the 1991 allocation agreement, which as a coordination agreement has less legal force. However, before submitting the *reglamento* to the president, the CNA sought the approval of the states in the Basin.

The draft *reglamento* was presented by the CNA in August 2002 during a MEG meeting to which water user representatives had not been invited. However, the regulations had not been included on the agenda of the meeting and those present strongly protested against CNA's brusque attempt to get the new *reglamento* approved without extensive consultations. However, the CNA argued that IMTA's technical study clearly demonstrated that the *reglamento* was in the pubic interest and that there was no need to further discuss the document. The president of ARLID, although not invited to the meeting, was present and requested time for water users to review the regulations. The CNA granted him one week to present the comments of the water users (Castelló-Santamaria, 2003). The major issue was that the *reglamento* proposed a reduction of the volumes allocated under the 1991 agreement by 40% in a very dry year (less than 85% of average rainfall), if the level of Lake Chapala was less than 3,100 hm^3 on 1 October or less than 2,000 hm^3 on 1 June. This was unacceptable to Guanajuato and to the farmer representatives, while on the other hand Jalisco wanted the restrictions to be applied if Lake Chapala fell below 4,500 hm^3. As both Jalisco and Guanajuato rejected the *reglamento* it was never published, as it was clear to the CNA that the president would not support it. The experiences with the revision of the 1991 allocation agreement up to mid 2002 led the DG of CEAG to remark that:

> The River Basin Council should be a coordinating body to which the states come with qualified people to make proposals concerning the hydraulic planning and programming of the region. However, in reality it has been converted into a rubber stamping body of the proposals designed by companies contracted by the CNA, in part due to the indifference of some of the states and the lack of support by state governments. (Sandoval *et al.*, 2002: 19)[145]

[144] The full title of this regulation is *Reglamento para la Preservación, Distribución y Explotación, Uso o Aprovechamiento de las Aguas de la Cuenca Lerma-Chapala* (Regulation for the preservation, distribution and exploitation, use or storage of the waters in the Lerma-Chapala Basin).

[145] "El Consejo de Cuenca debe ser una instancia de coordinación a la cual los estados acuden con elementos suficientes para hacer propuestas en materia de planeación y programación hidráulica en

In the conflict over Lake Chapala and surface water allocation, the State Water Commissions played an increasingly important role, especially from Jalisco and Guanajuato. As detailed in Chapter 7, the Guanajuato State Water Commission (CEAG) was formed in 1991 and by 2000 was a mature organization with qualified staff that could question CNA's proposals and hydrological studies. In 2001 a new governor was elected in Jalisco – Francisco Ramírez-Acuña of the PAN – who accorded high priority to saving Lake Chapala and improving the water supply to Guadalajara. He created the *Comisión Estatal de Aguas y Saneamiento de Jalisco* (CEAS-Jalisco: Jalisco State Water and Sanitation Commission) in May 2001 and appointed Enrique Dau-Flores as its DG. Interestingly, staff that had been dismissed from the CNA regional office in 2002 went to work for CEAS-Jalisco and other competent staff was quickly recruited. Dau-Flores became Jalisco's representative on the RBC in 2001 and quickly started promoting the water transfers to Lake Chapala and the revision of the 1991 allocation agreement. Another important development was that a new director for the CNA regional office was appointed in 2002, namely Raúl Antonio Iglesias-Benítez, who had previously been Francisco de P. Sandoval's private secretary. This further strengthened the impression that the CNA regional office was siding with Jalisco in the water allocation conflict.

By mid 2002 the controversies and conflicts surrounding water allocation in the Basin had become very intense. The position of the parties in the conflict, which show striking parallels with the first Lake Chapala crisis, can be summarized as follows. The government of Jalisco vocally defended Lake Chapala, supported by environmental groups and universities from Guadalajara. It demanded that the Lake should never drop below 4,500 hm^3 and insisted on water transfers to the Lake pending the revision of the 1991 allocation agreement. It presented the construction of the Arcediano Dam as Jalisco's contribution to saving the Lake, but did not take any initiatives to reduce water leakages in Guadalajara or curtail direct pumping from the Lake for irrigation. Guanajuato, on the other hand, through CEAG and the state ministry of agriculture, defended its farmers' right to water and argued that more water was leaving Guanajuato to Jalisco then entered it from the state of Mexico. In the negotiations, Guanajuato placed emphasis on regulating water use in irrigation and on respecting the water concessions granted by the federal government to irrigation districts and units. It argued that the water transfers to Lake Chapala were not a sustainable solution to rescuing the Lake and had very negative impacts on farmer livelihoods and the agricultural economy if farmers were not compensated for the water transferred out of agriculture. In short, the two states adopted a confrontational stance, precluding attempts at mutual collaboration based on the recognition of interdependence.

Arriving at a *Política Óptima Conjunta*: renegotiating water allocations

While the water transfers to Lake Chapala continued, and the efforts by SEMARNAT and environmental NGOs to declare the Lerma-Chapala Basin an ecological restoration zone floundered, a parallel process in the River Basin Council was initiated to revise the 1991

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la región. No obstante, en los hechos se ha convertido en una instancia de validación de las propuestas diseñadas bajo contrato por empresas para la CNA, en parte debido a la indiferencia de algunas entidades federativas y a la falta de apoya por parte de los gobiernos estatales."

water allocation agreement. In this negotiation process the controversies and conflicts in the Basin came together, such as the conflict between agricultural interests and those defending the Lake, the decentralization struggles between the CNA and the states in the Basin and the clash between a technocratic, expert-driven approach to allocating water and a negotiated agreement approach. The first attempts to revise the 1991 agreement, through the imposition of a *reglamento* by the CNA failed, as detailed above. However, this failed negotiation strategy laid the foundation for a new round of negotiations based on the development of a new dynamic simulation model of the Basin that led to the signing of a water allocation covenant in late 2004. Güitrón (2005), an IMTA hydrologist actively involved in the negotiations, has identified three phases in the negotiation process, namely (i) the construction of the model's legitimacy in 2002, (ii) the window of collective decision-making in 2003, and (iii) the phase of increasing complexity in 2004. This section describes these three phases of the negotiation process and analyzes the role of the dynamic simulation model of the Basin in reaching a negotiated agreement.

In March 2002 the Jalisco representative on the RBC requested a full revision of the 1991 allocation agreement and not just the formulation of regulations for very dry years. Based on this request, the MEG of the RBC decided to form a new working group, called the *Grupo de Ordenamiento y Distribución* (GOD; Ordering and Distribution Group)[146] to revise the 1991 allocation agreement. This group consisted of government officials of the five states in the Basin, consultants hired by Jalisco and Guanajuato and the CNA. To develop consensus in this group it was decided to contract a "neutral" outsider to execute the hydrological studies and develop a new water allocation model. In the previous attempts to revise the 1991 agreement the CNA had directly contracted with the consultant who had developed the hydrological model underlying the 1991 agreement and presented the outcomes to the states for approval. This had led to inconclusive debates on the rainfall series used, as they were presented on a monthly basis, and missing rainfall data were assumed to be zero. Also, the perceived imposition of the studies by the CNA on the states in the Basin, especially by Guanajuato, and the lack of transparency precluded reaching agreement on new allocation algorithms. Thus, the CNA and GOD decided to contract IMTA, Mexico's water research institute, to develop a new dynamic simulation model of the Basin based on extensive hydrological studies to arrive at an optimal water allocation policy. This proved important, as IMTA took on the role of a "neutral" player that could provide the negotiation parties with updated and revised hydrological data and water allocation scenarios.

The first phase of the negotiation process consisted of developing a dynamic simulation model of the Basin and constructing its legitimacy. Based on 17 GOD meetings from March to December 2002, IMTA developed the new model, which it presented towards the end of 2002 (IMTA, 2002a). This dynamic simulation model made it possible to simulate the hydrological behavior of the Basin under different rainfall levels and the effects of water allocation scenarios on Lake Chapala. The model contained 17 sub-basins, nine reservoirs (including Lake Chapala and Yuriria), eight irrigation districts, nine cities (including Guadalajara) and 20 of the most important of the 40 aquifers in the Basin. To

[146] The literal translation of *ordenamiento* is putting in order or tidying up, but in this context it has connotations with regulating and creating order, through government control over water use.

simulate the Basin, the model consisted of six interlinked modules for each of the 17 sub-basins and for the Basin as a whole. Based on the daily rainfall record from 1945 to 2001, these modules calculated daily surface runoff, aquifer balances and reservoir balances, as well as crop water requirements and water allocations to irrigation districts and units based on the 1991 allocation agreement (IMTA, 2002a). The design of the dynamic simulation model made it possible to develop water allocation scenarios based on the requests from GOD members, leading to 13 scenarios by the end of 2002. These scenarios consisted of combinations of reduced water allocations under the 1991 agreement, increased irrigation efficiencies, impacts of the *reglamento*, the construction of a control dike in Lake Chapala to reduce its size and water transfers to Lake Chapala.

During the first phase the members of GOD rapidly accepted the design and calibration of the dynamic simulation model. The first obstacle in the negotiations concerned the reliability and accuracy of the rainfall data used by IMTA as input for the model. Especially Guanajuato objected to the series of rainfall data, leading to a thorough revision and recalculation of daily rainfall data by IMTA for the years 1945 to 2001. This took more than six months, with IMTA experts regularly attending GOD meetings to discuss progress, but in the end the revised rainfall database was accepted and gained legitimacy. Other issues raised in 2002 were the inclusion of irrigation units in the model and the calculation of daily crop water requirements. By August 2002 GOD affirmed the basic soundness of the model, although further revisions were requested, making it possible for IMTA to present seven initial water allocation scenarios based on the dynamic simulation model to GOD. This led to a small breakthrough in the negotiations, as it showed that Jalisco's demand for a full Lake was unreasonable and that the Lake would not fully recover even if no water was allocated to irrigation, but that this strongly depended on rainfall levels. Thus, the dynamic simulation model rapidly attained legitimacy and agreement on rainfall data was reached. That it could be used to develop water allocation scenarios further strengthened its legitimacy. However, reaching agreement on new allocation algorithms was to take another two years.

The initial seven scenarios developed by IMTA were all based on variations of the 1991 allocation agreement. When presented to GOD in August 2002, its members requested other scenarios, which led to the development of six additional scenarios. For example, Jalisco requested scenario 9, which consisted of a 10% reduction of the volumes allocated under the 1991 agreement and the transfer of any unallocated water to Lake Chapala. However, when the scenarios were presented to GOD in October 2002, they were strongly criticized by the states, primarily Jalisco and Guanajuato (IMTA, 2002a). This coincided with the third water transfer to Lake Chapala and negotiations came to a halt. The main issue concerning the scenarios was that most of them required irrigated agriculture to use less water, either by reductions in allocations or through increased efficiencies, which was unacceptable to Guanajuato. Also, the proposal to include Lake Chapala as a water user with an annual water allocation in the new water allocation agreement was rejected by Guanajuato, as well as the inclusion of water transfers to Lake Chapala in the scenarios. Several other scenarios included the construction of a control dike in Lake Chapala, to reduce the size of the Lake, thus increasing its depth and decreasing evaporation losses, but this was unacceptable to Jalisco. To break the impasse, Guanajuato requested the execution of socio-economic and environmental impact studies of the scenarios, which the other GOD members agreed to. IMTA and others were contracted by the CNA to conduct these difficult studies, with the result becoming available in December 2003. Although these studies took a year to complete, they proved important for reaching an agreement as detailed below.

The water allocation negotiations entered their second phase in 2003, termed the collective decision-making window by Güitrón (2005). However, no decisions were made, although extensive discussions took place in GOD between the states in the Basin and the CNA on the water allocation scenarios developed by IMTA. Water user representatives were not involved in GOD, but they were informed about the progress with the negotiations, with IMTA giving presentations of the scenarios in various irrigation districts. By mid 2003 consensus was reached on the series of rainfall data and the soundness of the hydrological models for the sub-basins, but Guanajuato announced that it would not sign a new water allocation agreement in 2003. Jalisco, meanwhile, continued to demand more water for Lake Chapala and was not ready to compromise. The heavy rainfall in the summer of 2003 averted a further escalation of the conflict, but did not directly lead to its resolution. Which of the water allocation scenarios developed with the model was to be chosen as the basis for the new water allocation agreement remained strongly contested. While the various supplementary studies and the validation of the rainfall data were important in creating consensus, they can also be seen as delay tactics that were used to stall taking a decision on the scenarios. However, Guanajuato's persistent requests to validate and modify the simulation model and to study the socio-economic impacts of the scenarios were also legitimate, as the outcomes of the negotiations could have major impacts on irrigated agriculture in Guanajuato. While a challenge to the model, the resolution of these requests strengthened the model and increased its legitimacy.

While not much progress was being made in the negotiations, IMTA continued to work on the socio-economic and environmental impact studies of the water allocation scenarios. Of the 13 original scenarios approved by GOD, three were dropped because they included the construction of a dike in Lake Chapala, which proved politically infeasible. All the remaining scenarios showed a higher net benefit than the base scenario of continuing with the application of the 1991 agreement, but the scenario with the highest net benefit consisted of allocating the largest amount of water to irrigation (IMTA, 2003). Under this scenario Lake Chapala would fall below 3,100 hm^3 in 27 years out of 52, the most of all the scenarios, and hence was unacceptable to Jalisco (IMTA, 2002a). This led IMTA to develop an optimization model as a complement to the dynamic simulation model of the Basin that could generate new water allocation scenarios based on the impact studies. This model optimized the amount of water that could be allocated to irrigation in the long term based on water availability, while maintaining Lake Chapala above a specified volume (Güitrón, 2005). Towards the end of 2003, IMTA presented five new water allocation scenarios based on the optimization model, including three variants of scenario 9, a scenario proposed by Guanajuato and a scenario termed the *Política Óptima Conjunta* (POC; Joint Optimal Policy) (IMTA, 2003). The scenarios were developed further in the early months of 2004, but the water transfers to Lake Chapala in December 2003 nearly derailed the negotiation process, with Guanajuato threatening to withdraw from the negotiations. This ushered in the third phase of the negotiation process, that of increasing complexities.

The water transfers of December 2003, as the previous transfers, are difficult to understand as they seriously jeopardized the renegotiation of the 1991 allocation agreement. It is clear that Jalisco strongly supported the transfers, but it is much less clear why the CNA agreed to them. This becomes even less clear if the larger political setting is taken into account, with both PAN governors in Jalisco and Guanajuato and a PAN president. Although Fox had vocally defended Guanajuato's right to water when he was governor, after he became president he remained silent on the water allocation conflict in the Lerma-Chapala Basin. As president he could not openly support Guanajuato, although his minister of agriculture did openly speak out against the transfers. The electoral importance of Guadalajara, and internal PAN politics, also made a resolution of the water allocation conflict difficult. Towards the end of 2003 Fox made changes in his cabinet, appointing Alberto Cárdenas-Jiménez, a former governor of Jalisco, as the new SEMARNAT minister and Felipe Calderon as the minister of energy. Both these men were later to run for PAN presidential candidate in 2006, with Felipe Calderon winning the PAN ticket and becoming Mexico's next president in 2006. The appointment of Cárdenas-Jiménez brought new urgency to the resolution of the water allocation conflict and Fox made it known to the CNA that a new agreement should be signed in early 2004.

Behind the scenes the revision of the surface water agreement also became linked to negotiations surrounding the construction of two new dams in the Santiago Basin, both located in Jalisco. The Arcediano dam is to provide Guadalajara with water, so that the city can stop withdrawing water from Lake Chapala. The San Nicolás dam will be located on a tributary of the Río Santiago – the Río Verde – and will provide León, the largest city in Guanajuato, with water. However, to receive this water Guanajuato must guarantee that it will allow the return flows of León to flow to Lake Chapala. The discussions on the financing of these dams increasingly became linked to the water allocation negotiations, to such an extent that political brokerage at high levels was needed to reach a simultaneous deal on both issues. In early 2004 Fox made the allocation of federal funds to the construction of these two dams conditional to the signing of a new water allocation agreement (Campillo, 2004).

Thus, the last phase of the negotiations was entered into under a charged political atmosphere. The CNA announced that an agreement had to be signed by May 2004, or else it would unilaterally decide on the water allocations. In late April 2004 the MEG of the River Basin Council met and the new water allocation scenarios developed by IMTA were presented. During the meeting the CNA regional manager repeatedly tried to hold a vote on the scenario to be selected for defining new allocation algorithms, although this had not been included on the meeting's agenda. He forced a vote and with four votes against by Guanajuato and the user representatives of agriculture, industry and urban water supply scenario 9a was chosen, which entailed that all of the unallocated water in reservoirs needed to be discharged to Lake Chapala.[147] It was also decided that the River Basin Council would meet on 3 June 2004 to sign the new water allocation agreement.

[147] Minutes of the 75th MEG meeting, held on 23 April 2004 in Querétaro. On file with the author.

This unilateral imposition by the CNA led to vigorous protests, with the Guanajuato government going to the DG of the CNA to protest and threatening to withdraw from the River Basin Council. Also, the farmer representative argued that scenario 9a could not be implemented because it included water transfers, which had been declared illegal by the Celaya district court. It is also rumored that a secret meeting was held in May 2004 between president Fox and the governors of Jalisco and Guanajuato to reach an agreement on the water allocations. At the next MEG meeting on 13 and 14 May 2004 the CNA Regional Office admitted that it was important to find solutions based on consensus instead of majority voting and presented the POC as the best water allocation scenario. The innovation in the POC was the elimination of the concept of transfers. Instead, it entailed that the volume stored in the reservoirs of the Basin would not exceed the normal capacity of the reservoirs and that any excess storage water would be discharged to Lake Chapala. It also determined that notwithstanding Lake Chapala's volumes, farmers would receive at least 50% of their concessioned volume (based on the dynamic simulation model, it was forecast that this would occur in 13 years out of 52 years). Also, in the POC the level of Lake Chapala would never fall below 2,000 hm^3. The June meeting of the RBC was cancelled and all parties were given until the end of September to analyze the POC and its consequences. However, the CNA stressed that a new agreement had to be signed before November 2004, or else the CNA would decide unilaterally on the water allocations.

The good rains of 2004, with Lake Chapala reaching 75% of its capacity in November, helped pave the way for the signing of a new surface water allocation covenant in December 2004. The revised agreement entails further reductions in allocations to irrigation if water levels in Lake Chapala are low, but it does not explicitly contain provisions for environmental flows or water transfers to the Lake. The resistance of farmer representatives to the new covenant reduced after the presentation of the POC, but they did request the inclusion of an article in the covenant that the model would be revised each year. The pressure exerted by the president and the issue-linkage with the construction of new dams were also important elements that led to the signing of the new covenant. Lastly, the three year negotiation process led to the development of a dynamic simulation model and numerous water allocation scenarios that became more robust and durable as they were challenged by Guanajuato and farmer representatives. The role IMTA played as an independent party to the negotiation process was crucial for the legitimacy of the hydrological model, although Guanajuato questioned it right up to the signing of the new covenant. Although the confrontational stance adopted by the conflicting parties did not lead to mutual collaboration, it did lead to joint learning and an incipient recognition of interdependence. However, without the good rains of 2003 and 2004 the story would have been quite different.

8.4 Conclusions

This chapter has shown that it is very difficult to reduce primary water use in closed river basins, even if serious efforts are made to arrive at negotiated agreements. Although it could be argued that the new surface water covenant implicitly includes provisions for environmental flows, as its aim is to ensure sufficient inflow to Lake Chapala, it relies on reservoirs not being filled above normal storage capacity to achieve this. Establishing hard guarantees for environmental flows as conventionally understood – a minimum and continuous river flow regime for the protection of aquatic ecosystems – will be extremely difficult, as the negotiations to date show, and would require much stronger vigilance of extractions from the river. If the goal is to maintain Lake Chapala, a larger part of the Basin's water will need to be allocated to the environment. However, as this chapter has shown, the legacies of the authoritarian-bureaucratic state in Mexico intertwined with the social-material practices of water control in the Lerma-Chapala Basin constrain the possibilities for reducing water use. The renegotiation of the 1991 agreement and attempts by farmer representatives to increase their role in basin level decision-making highlights that the hydrocracy remained reluctant to more fully decentralize water resources management and to allow for fuller social participation. Through the water transfers and the negotiation process the CNA reaffirmed and strengthened its position as the primary decision maker in the Basin, but due to the loss of legitimacy this entailed this weakened its capacity to regulate actual surface water use in the field.

The controversies, conflicts and negotiations surrounding surface water allocation in the Lerma-Chapala Basin from 2000 to 2004 strongly bring out the tensions and contradictions in the decentralization of water resources management. In 1991 the CNA had been able to mediate the conflicts between the states in the Basin, all governed by the PRI, and succeeded in drafting a water allocation agreement in less than a year. Although this entailed serious negotiations, WUAs and State Water Commissions did not yet exist and the CNA was establishing itself as the sole federal water authority in the country. By 2000, a degree of decentralization had taken place, with the creation of WUAs, State Water Commissions and the River Basin Council, and cautious attempts to increase stakeholder participation in river basin management. These new actors challenged the authority of the CNA and argued for further decentralization. Larger political processes in Mexico, with the election of PAN governors and a PAN president and the transformation of corporatist mechanisms, further increased the complexity of water resources management. Thus, the political playing field has changed quite dramatically in the past 15 years, in which farmer representatives and state governments can block unilateral decisions by the federal hydrocracy. However, the legacy of the highly centralized water management of the past has precluded a deeper shift from unicentric to polycentric water resources management and complicated reaching a negotiated agreement on surface water allocation mechanisms.

The analysis in this chapter shows that the federal hydrocracy could no longer impose its authority on the actors in the Basin and that it had to explore different negotiation strategies to resolve the water allocation conflict in the Basin. However, senior CNA officials and the Jalisco government continued to operate from an administrative-technocratic perspective and were very wary to increase the involvement of stakeholders in the negotiation process. Rather, Jalisco frequently called on the CNA to exercise its authority and to regulate water use in the Basin. This contrasted with the position of CEAG that was in favor of a "mixed-interactive" approach with ample stakeholder participation to solving the water allocation conflict in the Basin (Sandoval, 2002, 2004b). Several middle level CNA officials also supported this approach and were in favor of further decentralization. The position of the farmer representatives and the Guanajuato ministry of agriculture were defensive and focused more on interest politics, after the GTEPAI initiative had been made to fail by the CNA and Jalisco. Thus, although water resources management had become more polycentric, the confrontational stance that developed between interest constellations and the different perspectives on governance processes made it difficult to move towards mutual collaboration based on the recognition of interdependence. Although the actors reached a negotiated agreement on water allocations, no small achievement as this chapter has shown, the underlying wicked problem of water overexploitation was not resolved and thus it is highly probable that a new round of negotiations will be necessary when the next series of dry years occur.

The introduction of this chapter stated that to resolve wicked problems conflicting parties need to acknowledge their interdependence to start down the road of mutual collaboration. If not, the problem will keep repeating itself, leading to a vicious cycle of conflicts and a repetition of moves (Termeer and Kessener, 2007). To achieve a breakthrough in stagnated policy processes, the three empirically derived phases in the development of mutual collaboration identified by Gray (1985), namely problem setting, direction setting and structuring, provide a roadmap. To arrive at collaborative water management it is crucial that during the problem setting phase legitimate stakeholders are identified, these stakeholders come to recognize their interdependence and choose a legitimate and skilled convener to facilitate the process. In the case of the Lerma-Chapala Basin, the conflicting parties looked to the CNA to play the role of facilitator. However, it did not transform itself into a skilled facilitator and arbitrator, due to the legacy of the bureaucratic-authoritarian state in Mexico and the highly centralized management of water in the past. As a result, the direction setting phase – when stakeholders arrive at a shared appreciation of the problems they face and develop a joint understanding of the desired future state of their domain – only very partially occurred. This chapter may seem to suggest that a benevolent state and the absence of interest politics is necessary to resolve wicked problems, but a deeper reading brings out that to arrive at mutual collaboration an explicit recognition of the intensely political nature of water resources management is necessary.

Discussion and Conclusions

The above photo shows a sunset over Lake Chapala in October 2004. After two years of high rainfall the Lake had refilled to around 75% of its capacity and the surface water allocation controversy had subsided. However, the underlying wicked problem of water overexploitation had not been dealt with and thus the next time a series of drier years occurs there is a real chance that there will be no Lake left for the sun to set on. This thesis set out to understand the creation of water overexploitation and the articulation of water reforms and how they interrelate. It has done so by analyzing the histories of the interactions between water users, water technologies and the hydrocracy in its various incarnations in the Lerma-Chapala Basin. Based on the previous chapters, the following sets out the conclusions of this thesis grouped around the three research themes and four research objectives presented in Chapter 1. Section 9.1 presents the more striking findings of the thesis on water resources management in the Lerma-Chapala Basin and reflects on the creation of water overexploitation due to the hydraulic mission. Conclusions on the articulation of water reforms and the struggles surrounding decentralization are drawn in section 9.2, while section 9.3 presents conclusions on the politics of the rescaling of water governance to the river basin level and the importance of water allocation.

9.1 Hydrosocial Interactions in the Lerma-Chapala Basin

The histories of water reforms and water overexploitation in the Lerma-Chapala Basin presented in the preceding chapters highlights the intensely political nature of water reforms and the difficulties in reducing water overexploitation in a closed basin. This thesis has shown how the hydraulic mission, embedded in the various manifestations of the hydrocracy in Mexico, led to the "overbuilding" of the Lerma-Chapala Basin and water overexploitation. It has argued that to understand how this continues to inform current water reforms, the study of the histories of water development by hydrocracies is crucial.

An important finding is that the main assumption underlying this thesis, namely that river basin closure is an important driver of water reforms, needs to be qualified. This thesis clearly shows that water overexploitation is the outcome of the hydraulic mission and partly shows that this leads to adjustments by water users at field level to water scarcity. However, the relationship between water reforms and water overexploitation is less direct and certainly not one-on-one. While the second Lake Chapala crisis led to the signing of the 1989 coordination agreement, the 1991 surface water allocation agreement and the creation of the River Basin Council, these initiatives were not only responses to water overexploitation. Rather, the efforts by the CNA to turn the Lerma-Chapala Basin into a domain of water governance can be seen as attempts by the hydrocracy to strengthen its control over water, water users and water infrastructure. The other major water reforms, such as the reconstitution of the hydrocracy through the creation of the CNA and the reordering of modes of water control through IMT were not related to water overexploitation, but did strongly influence developments in the Lerma-Chapala Basin. Thus, the articulation of water reforms was only partially influenced by water overexploitation and as shown in Chapters 5 and 8 the hydrocracy did not make a concerted effort to reduce consumptive water use. A more in-depth discussion of this issue is presented in section 9.2.

The closure of the Lerma-Chapala Basin is a combination of increasing human pressures on water and climatic fluctuations. Between 1930 and 2000, the irrigated area increased fivefold according to official statistics, and possibly by a factor of 7.5,[148] while population also increased fivefold during this period. However, as shown in Chapter 2, the creation of water overexploitation in the Basin was not an automatic process, but the deliberate outcome of the hydraulic mission of the federal government's hydrocracy. However, the hydrocracy was not the only carrier of the hydraulic mission and was strongly supported in its efforts to achieve the fullest utilization of water for the greatness of Mexico by state governments and water users. The conviction that every drop of water evaporating from Lake Chapala is a "waste" is still very strong today among farmers and hydrocrats and partly explains the lack of concerted efforts to reduce consumptive water use in irrigated agriculture. Also, if Lake Chapala had not been the main source of water for Guadalajara it is doubtful whether the state of Jalisco would have made an effort to "rescue" the Lake.

[148] The area irrigated between 1980 and 2001 is a matter of debate, with estimates ranging from 628,000 ha (CNA/MW, 1999) to more than 1 million ha (INE, 2003) per year.

Another important finding of this thesis is that it is probable that the first and second Lake Chapala crises would not have occurred if no abstractions from the Lake had taken place. This is an important point, as throughout the years hydrocrats have argued that the cyclical declines in Lake Chapala were due to years of drought. While years of less rainfall obviously lead to lower inflows to the Lake, the abstraction of 750 $hm^3\ a^{-1}$ from the Lake during the 1940s and 50s for hydroelectricity generation clearly caused the first Lake Chapala crisis. However, if these abstractions had not taken place, then the temporary halt on the construction and expansion of irrigation schemes in the Basin during the 1950s may not have occurred and more water would most likely have been withdrawn by irrigation. In any case, the relatively wet period in the 1960s and 70s made it possible for the hydrocracy to execute the water infrastructure development plans it had formulated since the 1930s. Especially the elevation of the crest of Solís dam in 1982 was important, as this significantly increased storage capacity in the Middle Lerma region. This coincided with the start of the second Lake Chapala crisis and it is probable that the increased storage capacity of the dam, combined with lower levels of rainfall, had a strong impact on the inflows to Lake Chapala. However, irrigation is also not fully to blame for the second Lake Chapala crisis. From 1980 to 2001 the overall negative annual storage change of the Lake was 191 $hm^3\ a^{-1}$, while withdrawals from the Lake for Guadalajara's water supply were at least 240 $hm^3\ a^{-1}$ and possibly as high as 450 hm^3 per year. Without these withdrawals the declines in the Lake would have been less severe, but on the other hand might have resulted in more water being used by upstream irrigation districts.

What is clear is that water in the Basin is overexploited, with an estimated negative average annual storage change in aquifers of 1,336 $hm^3\ a^{-1}$ and 191 $hm^3\ a^{-1}$ in Lake Chapala. This deficit of 1,527 $hm^3\ a^{-1}$ is equal to 24.5% of the annually renewable water, after the out-of-basin transfers to Mexico City and Guadalajara and evaporation from water bodies have been subtracted, indicating the level of overexploitation. However, in decision making available surface water is assumed to be higher than it actually is. This is because evaporation from water bodies is not subtracted from available runoff. As average runoff in the Basin excluding the closed Pátzcuaro and Cuitzeo sub-basins is 4,907 $hm^3\ a^{-1}$ and officially concessioned maximum surface water withdrawals are 4,001 $hm^3\ a^{-1}$, this suggests that there is enough water to meet demands on average. However, reservoir and lake evaporation is 1,824 $hm^3\ a^{-1}$ on average, implying that there is only 3,083 $hm^3\ a^{-1}$ available. These figures are the official ones published by the CNA (Poder Ejecutivo Federal, 2004), and so the hydrocracy is well aware of the level of water overexploitation. While the surface water allocation agreement is a fine-tuned instrument that calculates water allocations based on actual surface runoff of the previous year, the above figures indicate that there is no slack in the Basin. Hence, the Basin is very sensitive to climatic fluctuations, with lower than average rainfall directly translating into reduced inflows to the Lake and less water storage in the Basin. Several years of good rainfall are then needed to increase storage in the Basin and only with exceptionally high rainfall does the volume of the Lake increase markedly. Thus, the sensitivity of the Basin to rainfall variation has increased due to basin closure. To reduce this sensitivity consumptive water use needs to be lowered, but this necessity has not stood at the center of water reforms.

The three responses to river basin closure identified by Molle (2003), namely allocation, conservation and supply augmentation, are clearly in evidence in the Lerma-Chapala

Basin. Concerning conservation, the hydrocracy has mainly focused on improving irrigation efficiencies through irrigation modernization programs, both for surface and groundwater. Water users have responded to basin closure by widespread pumping from drainage canals and direct pumping from the rivers and Lake Chapala, or by switching to groundwater irrigation. While these efforts may have improved efficiencies at the local level, they have not led to identifiable "wet" water savings at the basin level. Interestingly, no attempts have been made to change the operational management of the irrigation districts, for example by changing to rotational water delivery. This provides real scope for increasing the area under irrigation with the same amount of water, or reducing the amount of water used to irrigate the same area. However, the managers and presidents of the WUAs have been very reluctant to change water delivery procedures, as this would seriously erode their support base among water users (cf. Kloezen, 2002). Another conservation measure has been to switch to less water consuming crops, for example as under the GTEPAI initiative, or to let land lie fallow if there is not enough water for an irrigation season, but this has not been strongly supported by the government.

As shown in Chapters 5 and 8, the main response to basin closure has been the formulation of surface water allocation mechanisms at the basin level, resulting in the 1991 surface water allocation agreement and its amendment in 2004. That these mechanisms have been created is no small achievement, as brought out by the prolonged negotiation process analyzed in Chapter 8. However, the Lake was not explicitly included in these agreements as a water user and was treated as a residual user after other demands had been met. More generally, environmental water requirements were not included in the agreements and achieving these flows would require a much larger reduction in agricultural water use of around 25% at the minimum. This is clearly one bridge too far for the current hydrosocial-networks in the Basin and the hydrocracy, the state governments and the agricultural water users have not even started considering this issue. For this the legacy of the hydraulic mission is still too strong. Lastly, mechanisms for compensating farmers for water transferred out of agriculture were not included in the agreements. In closed basins inter-sectoral transfers are very likely to occur and it will generally be the irrigation sector that will need to cede water (cf. Molle and Berkoff, 2006). An important issue in closed river basins is how to deal with these transfers in a just and equitable manner, especially for the large volumes that will need to be dedicated to the environment.

A common response to basin closure is to capture more water through supply augmentation, by building more dams, drilling more tubewells or by importing water from neighboring basins (Molle *et al.*, 2007). The option to reopen the closed Lerma-Chapala Basin through inter-basin transfers is being pursued through the construction of two new dams in the neighboring Río Santiago and Río Verde Basins, while the Lerma-Chapala Basin continues to serve as a source area for inter-basin transfers to Mexico City and Guadalajara. Both dams are being constructed for urban water use, with the Arcediano dam on the Río Santiago intended to replace the withdrawals from Lake Chapala for Guadalajara, while the San Nicolás dam on the Río Verde will provide León with water. However, it is unlikely that the planned inter-basin transfers will lead to a reduction of water overexploitation. Without a strict regulation of direct pumping from rivers, the return flows from León will not reach Lake Chapala, while Guadalajara will be tempted to continue pumping water from Lake Chapala. As the city will continue to grow, and no efforts are being made to reduce leakages in the municipal water networks, it is probable that the Chapala-Guadalajara aqueduct will continue to be used, just like the Atequiza-Las Pintas aqueduct continues to be used. Although the two new dams will provide more water in the short term, over the longer term it is likely that the extra water will be depleted, at a high cost to the source area and the national treasury.

A more serious issue than surface water overexploitation in the Lerma-Chapala Basin is the serious overdraft of its aquifers. This is because a condition of low surface water supply can be reversed in a few years of high rainfall, whereas the accumulated deficit of years of aquifer depletion will take as many years to reverse. Chapter 7 concluded that the aquifers in Guanajuato remain overexploited as the majority of the actors involved in groundwater management have a stake in the situation remaining as it is. The durability and span of the hydrosocial-networks configured around groundwater use are such that they have caused the attempts to reduce groundwater extractions to fail. Nonetheless, placing aquifer management in the hands of the aquifer users, under the supervision of state water commissions and the CNA, shows more promise of reducing extractions than the current system of *vedas* and federal regulation. Bundling extraction rights in an aquifer and concessioning this to a COTAS is feasible under the Mexican water law, but this has not been considered. More generally, CNA's obstruction of the COTAS in Guanajuato casts doubts on how serious the hydrocracy is about reducing water overexploitation.

The most striking finding of this thesis is how difficult it is to reduce consumptive water use in closed river basins, even if a range of water reforms are attempted and serious efforts are made to arrive at negotiated agreements on surface water allocation mechanisms. This thesis shows that establishing a river basin council, legislating a water law based on IWRM principles, establishing tradable water rights, transferring irrigation management to water users, regulating water use through permits and concessions, increasing stakeholder participation, increasing irrigation efficiencies and creating a strong government water agency, and implementing all of these reforms with strong political will and not as paper exercises, are insufficient, although possibly necessary, measures to deal with river basin closure. Chapters 5, 7 and 8 bring out that it is the legacies of the authoritarian-bureaucratic state in Mexico intertwined with the social-material practices of water control in the Lerma-Chapala Basin that constrain the possibilities for reducing water use. The conceptual approach used in this thesis helps to further elucidate this.

A first part of the answer as to why it is so difficult to reduce consumptive water use is because of the "overbuilding" of the Basin and the hydrosocial-networks constituted around and by the hydraulic infrastructure in the Basin. Water resources management in the Lerma-Chapala Basin revolves around modes of ordering water control, that is the configurations and associations of water users, infrastructure and water constituting the hydrosocial-networks. The construction of hydraulic infrastructure tends to ensure that water is withdrawn from the hydrological cycle into the hydrosocial cycle, thereby creating constituencies dependent on water for their livelihoods. For example, the widespread hydraulic modifications to Lake Chapala changed it from a natural Lake into a managed storage reservoir on which Guadalajara depends for its urban water supply. The political and economic repercussions are such that it is very difficult to reduce withdrawals from the Lake, while the existence of the Chapala-Guadalajara aqueduct provides "easy" water that precludes attempts to increase water delivery efficiencies in the city. Similarly, the dams, irrigation canals and tubewells constructed in the Basin have led to the development of numerous hydrosocial-networks that are bent on continuing the abstraction of water for irrigation. Left to their own devices, these hydrosocial-networks will withdraw as much water as they can.

In this conceptualization of water use in the Basin, the question is where the hydrocracy fits in. The larger dams in the Basin are fully controlled by the hydrocracy and thus it forms a part of the hydrosocial-networks linked to the larger dams. However, the hydrocracy only very partly controls the smaller dams, tubewells and pumps on the river and its enrollment of these hydrosocial-networks is very partial. Although the hydrocracy controls the larger dams in the Basin, there is a limit to how much water it can withhold from the irrigation districts. This is related to the concession titles, the water allocation agreement and the political pressure the hydrosocial-networks can bring to bear on it if their water access is threatened. Although the hydrocracy has tried to reorder the modes of water control, primarily where it concerns surface water through the allocation agreement, it has not attempted to significantly reduce consumptive water use. In this it formed a double alliance with both the farmers in the Middle Lerma region and Guadalajara, as shown in Chapter 8, and attempted to keep the water flowing for both without too many cutbacks, while blaming the Lake Chapala crisis on a drought. This finding shows many similarities to Waller's analysis of the resistance to water reforms in the Imperial Valley in California, where "the characteristics of Imperial Valley's water management regime ultimately allowed District experts and elites to retain control over what has largely been a hesitant, piecemeal process of reform. For this reason, (…) the actions taken to date to correct Southern California's water scarcity problem have not significantly changed the very regime which allowed the recent crisis to begin with" (1994: 38).

With river basin closure, the competition for access to water becomes more severe. In the Lerma-Chapala Basin many of the poorer farmers are losing or have lost their access to surface and groundwater, while environmental water requirements are not being met. However, meeting the water needs of poor people and safeguarding environmental water requirements are not policy objectives in Mexico. It would appear that the opposite is the case, as the hydrocracy is not combating the current *de facto* concentration of water rights in the hands of the few. This raises serious questions about the objectives of water reforms, as discussed in the next section.

9.2 The Articulation of Water Reforms

In this thesis I have shown that water reforms are sociopolitical processes. Based on detailed sociopolitical case studies of irrigation reform processes in seven countries, Mollinga and Bolding (2004) identified three important research themes in the study of water reforms. These are the resilience of irrigation bureaucracies, the role of international funding agencies in promoting reforms and the capture and transformation of reform policies by local elites. This thesis has contributed to this research agenda by focusing on policy articulation and the role of the Mexican hydrocracy in water reforms. It has done so with the objective to increase the understanding of water reforms as sociopolitical processes and the challenges posed by water overexploitation. Two related research objectives were to better understand the resilience of hydrocracies and the apparent contradiction between context-specific and strategic water reforms and continued water overexploitation. The following presents the main findings of the thesis concerning these objectives and water reforms more generally.

This thesis defined water reforms as public policies and programs that are assembled to change or transform in a qualitative manner existing water policies, institutions, organizations and governance arrangements. To study how reforms are assembled and made to succeed or fail, the concept of policy articulation was introduced, while to study the effects of water reforms it was asked how they reorder modes of water control and constitute new domains of water governance. The analysis contained in the preceding chapters clearly brings out that water reforms are sociopolitical processes and that they lead to the redefinition of boundaries and domains of governance and the construction of new entities, such as water users, WUAs and River Basin Councils to fill these domains. It also shows the very active role of the hydrocracy in policy articulation and that water reforms do not just happen, or are inevitable, but are largely intentional attempts, most frequently driven by the hydrocracy, to change existing water governance arrangements. Thus, it is necessary to conceive of water reforms as effects of specific political and bureaucratic policy practices and experiences. This entails analyzing how policy actors engage in their institutional reproduction through articulating water reforms and how the commitment to reforms and the political will to implement them are generated through policy articulation processes.

In the case of Mexico the hydrocracy did not passively resist reforms, or engage in paper exercises, but was the lead actor in the articulation of water reforms. This was most apparent in the attempts to reconstitute the hydrocracy and in the articulation of IMT, as analyzed in Chapters 3 and 4, as well as in the attempts to turn the Lerma-Chapala Basin into a domain of governance, as analyzed in Chapters 5 and 8. What is striking about these instances of reform is that the policies were only formulated in an official sense while they were being implemented, or even after the fact. For example, the IMT policy was formalized in 1991, after experimentation in the field, and similarly the policy to establish River Basin Councils throughout Mexico was only formalized in 1996, after more than six years of experimentation in the Lerma-Chapala Basin. Another interesting element of these reforms was the role of international funding agencies. While the hydrocracy worked closely with international funding agencies to obtain funding for these reforms, they were certainly not imposed from the outside. Rather, as shown in this thesis, the articulation of water reforms in Mexico was largely driven by internal political and bureaucratic dynamics in the country, in which the hydrocracy succeeded in enrolling international funding agencies. This suggests that the influence of international funding agencies is limited if their policy agendas are not supported by and do not create benefits for the hydrocracy.

This thesis has shown that the hydrocracy engaged in the articulation of water reforms to strengthen its bureaucratic autonomy and control over domains of water governance. However, as the chapters have shown, this was always a heavily contested process, by other federal bureaucracies, state governments and water users, and the reforms were never automatic or inevitable. Thus, to understand water reforms as sociopolitical processes it is helpful to widen the definition of policy makers to all the policy actors involved in making a policy. Not only senior government officials, national level politicians or staff of international funding agencies are policy makers, but also the farmers, governors, regional leaders and bureaucracy staff that make or break a policy are policy makers.

The active role of the Mexican hydrocracy in the articulation of water reforms shows that it did not resist all forms of change, but that it was only supportive of change processes it initiated and controlled and that contributed to strengthening its autonomy. This was most clearly brought out by the attempts of the state of Guanajuato to increase its role in groundwater management, as analyzed in Chapter 7, and the struggles surrounding the decentralization of water resources management to the river basin and state level. Thus, the water reforms enacted by the hydrocracy were focused on retaining and expanding its power and autonomy. Although the first dimension of the hydraulic mission, namely the full utilization of water resources, has become somewhat weaker in Mexico the hydrocracy has retained its construction focus, although now the focus is on urban water supply, wastewater treatment plants, the modernization of irrigation systems and inter-basin transfers. The second dimension of the hydraulic mission, namely that the federal government should be in charge of water resources management, has remained very strong. This may sound paradoxical in the case of IMT, which is frequently presented as a withdrawal of the state, but as argued in Chapters 3 and 4 IMT in Mexico served to strengthen the hydrocracy's control over the irrigation districts. Besides the resistance of the hydrocracy to any forms of change that would reduce its mandate or authority, it also showed a remarkable disinterest in making environmental sustainability and social equity the priorities of water reforms. These issues have simply not been on its policy agenda, as shown in Chapter 8 for the struggles between the hydrocracy and the ministry of the environment concerning the environmental restoration of the Lerma-Chapala Basin.

While the water reforms attempted in the Lerma-Chapala Basin were context-specific, process based and strategic, they did not lead to a reduction of water overexploitation. The short answer as to why this is so is because this was not the objective of the water reforms in the Basin. As discussed above, the hydrocracy formed an alliance with both the large, commercial farmers in the Middle Lerma region and the urban-industrial interests in Guadalajara. It has attempted to keep both these powerful interests satisfied by avoiding cutting back the amount of water they use too much. Besides the political pressures brought to bear on the hydrocracy, it was very difficult for the hydrocracy to reduce consumptive water use due to the legacy of the overbuilding of the Basin and the over-granting of water concessions. The sum of all the surface and groundwater concessions in the Basin substantially exceeds annual renewable water availability, even without including environmental water requirements, but this has not translated into efforts by the hydrocracy to buy back concessions or to proportionally reduce the volumes awarded under the concessions. Legally it can do this, but the pressure from water users in the Basin is to use more water, not less. However, as analyzed in Chapter 8, the commercial farmers in the Middle Lerma region were willing to negotiate a reduction in their concessions, but only if this was tied to a canal lining program to reduce seepage losses.

The political economy and the financial interests linked to water (urban growth, industry, commercial agriculture) strongly influence water reform processes. This not only concerns the capture and transformation of reforms by local elites, but raises much larger questions about elite capture of the state, the degree of state autonomy and the relationship between the hydrocracy and power elites. This thesis has only scratched the surface in this regard, but it is clear that to reduce water overexploitation in closed basins it is necessary to explicitly recognize the political economy of water use and to find ways to bring powerful interests to the negotiating table. How difficult it is to do this is brought out by this thesis.

To study water reform processes I have further developed several concepts to broaden the sociotechnical approach to water resources management. These include the hydraulic mission, modes of ordering, hydrosocial-networks, policy articulation and domains of water governance. The value of these concepts can be judged by the descriptions that they helped to generate in the content chapters of this thesis. Modes of ordering and hydrosocial-networks are an attempt to find an impartial vocabulary to analyze the social and the technical without making a priori distinctions between them and help to focus on processes rather than outcomes.

To investigate how policy processes are "powered" I have focused on policy articulation, instead of "alignment of interests" (Mollinga and Bolding, 2004) or "policy games" (van Bueren *et al.*, 2003). Mollinga and Bolding (2004) suggest to focus on "alignment of interests" as it better expresses the purposiveness of policy processes and shows that interests need to be aligned to bring policy into existence and to make it "work". While I agree with this, I find the focus on interests too narrow and the term alignment too suggestive of a "master-actor" doing the aligning. The strength of the policy articulation concept is that it shows how policies are made more or less durable or "real" through the interactions between numerous policy actors and their mutual enrolments. A similar concept to policy articulation is "policy games" defined as "a series of interactions between actors that focus on influencing problem formulations, solutions, and procedures regarding an approach to a specific policy issue" (van Bueren *et al.*, 2003: 195). In policy games there are different rounds characterized by impasses and breakthroughs that determine the conditions for the next round, with substantive decisions, changed strategies and institutional effects as outcomes. Although I largely agree with the analytical approach presented in van Bueren *et al.* (2003), I find the use of the term "games" too frivolous to refer to policy processes and their focus too much on policy formulation and not how policies travel "in the field". In contrast, policy articulation follows a policy throughout its life cycle and brings out how policy is made in practice.

9.3 Reflections on River Basin Politics

> If the river is the focal point for planning, should not the institutions charged with implementing the programme be given basin-wide authority? Any number of organizational arrangements – from interdepartmental committees to autonomous basin authorities – are possible. Two requirements are essential: first, provision of an organizational framework under which unified planning and administration can take place and second, continuity in the planning, construction and operating phases. *The*

> *organizational framework attractive to water resource planners is the single unified basin agency with full authority for dealing with all the basin's water and related resource problems*. (Le Marquand, 1989: 128; emphasis added)

The fourth objective of this thesis was to stimulate debate on river basin politics, based on a concern that the political dimensions of river basin management are glossed over or ignored in water policy debates. The belief that a river basin agency should have the full authority to deal with all the water problems in a river basin is deeply rooted in the water sector and not many seem to be concerned about its authoritarian and even dictatorial overtones. This reflects the modernist conviction that strong government agencies staffed by scientifically trained experts should be delegated responsibilities for policy design and implementation in natural resources management, thus keeping politics out (Norgaard, 1994). For hydrocracies the river basin forms an ideal territorial unit over which they can rule, based on the argument that nature has determined that this is the scale at which water should be managed. This thesis has shown that the argument that river basins are the natural units for water management is deeply political. The delineation of river basin boundaries, the structuring of stakeholder representation and the creation of institutional arrangements for river basin management are political processes that revolve around matters of choice. An explicit recognition of the political dimension of river basin management is necessary so that institutions and procedures can be created that ensure that the political process in river basins is democratic and inclusive. However, the fact that Wengert already made this observation in 1957 (see footnote 23 on page 16) is not much cause for optimism (Wengert, 1957).

The struggles surrounding decentralization in the Lerma-Chapala Basin and the lack of democratic procedures to arrive at decisions concerning river basin management, as analyzed in Chapters 5 to 8, bring out that the Mexican hydrocracy sees river basins as its dominion over which it should rule. While a River Basin Council was created in the Lerma-Chapala Basin, initially only with government representatives, and later also water user representatives, this council has very few decision-making powers. Thus, it was not given the authority to approve the budgets of CNA's regional office and the water taxes collected in the Basin were not retained in the Basin but flowed to CNA's central office. Although proposals to move to a bi-modal form of river basin management have been debated since 1992, they have been successfully resisted by the CNA during the various revisions of the national water law.[149] The decentralization of water resources management to the river basin level, through the creation of 13 regional CNA offices based on administrative-hydrological boundaries and 25 River Basin Councils, is not what it

[149] The strong resistance of the federal hydrocracy to further decentralization became very apparent when the overall amendment of the national water law approved in April 2004 was largely cancelled by Congress in September 2007. The 2004 version of the law, largely drafted by the office of the president and not the CNA, had stipulated that the 13 CNA regional offices would become autonomous *organismos de cuenca* (river basin organisms or agencies) falling directly under the CNA DG and that would serve as technical agencies in support of the River Basin Councils. The Councils were given a larger mandate and role in water resources management, although not budgetary authority. The CNA was given 18 months from April 2004 to formulate and publish the revised regulations of the national water law and to form the 13 river basin agencies. However, it dragged its feet, and in September 2007 the amendments were cancelled.

appears. Based on the analysis of the Lerma-Chapala Basin, this thesis suggests that by turning river basins into domains of governance, the CNA is attempting to strengthen its role and to counter the growing role and power of states in water resources management. Scott and Banister (2007) come to a similar conclusion. Thus, the decentralization struggle continues and although some space has been created for the participation of water users and state governments in river basin management, the CNA remains firmly in control.

Another area where the CNA has retained strong control is in water allocation and the accompanying data collection and management. This relates to both the granting and registration of water concessions and the annual allocation of surface water in the Lerma-Chapala Basin. A large part of the water allocation controversy analyzed in Chapter 8 revolved around access to hydrological data, which the CNA only partly made available. For example, historical and current data on dam storage levels are very difficult to access and certainly not in the public domain. The same is true for the runoff and water use data that are used as input for the water allocation algorithms. Nobody has access to these data, including state governments and water user representatives, except for a few select CNA officials. Its control over hydrological data is an important element of the hydrocracy's power and is an interesting area for future research. However, this is not to suggest that the hydrocracy has much control over actual water use. Although not analyzed in detail in the preceding chapters, it is clear that the CNA has very little control over water use in the irrigation units and direct pumping from the river.

As detailed in this thesis, with river basin closure the interdependencies among stakeholders, the water cycle, aquatic ecosystems and institutional arrangements increase, leading to amplified turbulence and greater complexity in water governance. Although a large body of literature has developed on river basin management, hardly any attention has been given to the challenges this poses for moving towards socially and environmentally just water governance. This thesis has highlighted the following issues:

- The overexploitation of primary water sources leads to environmental degradation through the destruction of aquatic ecosystems, the depletion of aquifers and the generation of polluted wastewater flows (both industrial/urban effluents and agricultural drainage effluents). In closed river basins the only way to reverse these trends is to consume less primary water and to make judicious use of derivative water (wastewater and agricultural return flows).
- Alleviating poverty through the creation of new hydraulic property (Coward, 1986) becomes very difficult as primary water sources are already fully committed and frequently under the control of the relatively better off. Creating new water entitlements for the poor can therefore only be realized through renegotiating water entitlements.
- The lack of possibilities to develop new water supplies and perceptions that agriculture is a "low value" use of water leads to increasing inter-sectoral water transfers, frequently extra-legal, one-way transfers from agriculture to industry and domestic use, as well as intra-sectoral transfers in agriculture to economically higher-value crops and from small farmers to large, commercial farmers.
- Without clear agreement on water rights and effective enforcement, it is relatively easy for poor people, such as smallholder irrigation farmers, to lose access to water.

These issues point to the crucial importance of water allocation mechanisms and validate Allan's (2006) observation that water allocation is so central to water resources management that we should be speaking of IWRAM instead of IWRM. Chapters 5, 7 and 8 clearly bring out how politically contested water allocation can be in a closed river basin and how difficult it is to make adjustments to existing allocation mechanisms. In the Lerma-Chapala Basin the amount of water concessioned, both surface and groundwater, is substantially higher than renewably available water. For groundwater this thesis has recommended that aquifer users be given a much larger role in managing their aquifers so that they can start a process of reaching collective agreements on reducing their pumping levels. For surface water compensation mechanisms could be designed by which farmers are paid to fallow their land during drought years, thus freeing up water for other uses. Also, to increase transparency in surface water allocation, a small first step could be that the CNA publishes all its hydrological data on the internet, including water withdrawals by irrigation districts.

The era of water resources development was characterized by a consensus on the desirability of the hydraulic mission, of the need to "make the desert bloom", and the problems it dealt with could be classified as "tame". Lach *et al.* (2005) discuss the progression from "tame" to "wicked" water problems in the USA and the responses by hydrocracies from controlling tame problems through the construction of hydraulic infrastructure to attempting to domesticate wicked problems through coordination and risk spreading by involving more organizations in water resources management. In this transition "instead of invisible water agencies providing services with little controversy, challenges to system practices and decisions about allocation and supply in overbuilt systems become increasingly controversial and commonplace" (Lack *et al.*, 2005: 8). This thesis has shown that this is clearly the case in the Lerma-Chapala Basin and that parts of the water reforms can be seen as attempts to domesticate the wicked problems in this closed basin. The cognitive, social and political complexities in closed basins are such that no easy (or difficult) to implement blueprints are available to resolve wicked water resources management problems. This thesis suggests that the explicit recognition of the deeply political and contentious nature of water reforms is a necessary first step for working towards a socially and environmentally just governance of water resources.

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Annex A: List of Publications

Publications (co)-authored by Philippus Wester as part of this Ph.D. research.

Refereed Publications

Wester, Philippus and Edwin Rap. (forthcoming). "The practices and politics of making policy: The case of irrigation management transfer in Mexico." Submitted to *Water Alternatives*.

Warner, Jeroen, Philippus Wester and Alex Bolding. (forthcoming). "Going with the flow? Just how natural are MSPs, IWRM and river basins for water management." Submitted to *Water Policy*.

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Non-Refereed Publications

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Annex B. Water Management Stakeholders in the Lerma-Chapala Basin

This annex summarizes the water resources management stakeholders in the Lerma-Chapala Basin in 2000, and largely reflects the current situation. It distinguishes between water use sectors and different levels of water management: the national level, the basin/sub-basin level, the state level, the system level and the user level. The organizations and stakeholders involved in the abstraction, use and disposal of water in the Lerma-Chapala Basin are presented in Table B.1, while more details on their responsibilities is given in Table B.2. These tables were developed together with Martin Burton.

Table B.1. Organizations involved in water management

Acronym	Stakeholder	Sectors
	National Level Organizations	
SEMARAP	Ministry of Environment, Natural Resources and Fisheries	Env
CNA-HQ	National Water Commission –Headquarters	All
SAGAR	Ministry of Agriculture, Livestock and Rural Development (Secretaría de Agricultura, Ganadería y Desarrollo Rural)	IrrAg
CFE	Federal Electricity Commission (Comisión Federal de Electricidad)	Ind
	Basin and Sub-basin Level Organizations	
CNA-Reg	CNA-Regional Office (Basin Office)	All
CdC	Consejo de Cuenca (River Basin Council)	All
COTAS	Comités or Consejos Técnicos de Aguas (Subterráneas)	All
CH	Comité Hidráulico de Distritos de Riego (Hydraulic Committee)	IrrAg
	State Level Organizations	
CEASG	State Water (Supply) and Sanitation Commissions (5)	Dom
SDAyR	State Ministries of Agriculture (5)	IrrAg
CNA-State	CNA-State Office (5)	All
CNA-District	CNA-Irrigation District Office (8)	IrrAg
CEH	Consejo Estatal Hidráulico in Guanajuato	All
	System Level Organizations	
MWSU WSC	Municipal Water Supply Utilities Water Supply Companies	Dom
SRL	Limited Responsibility Society	IrrAg
WUA-ID	Water User Associations in Irrigation Districts	IrrAg
WUA-IU	Water User Associations in Irrigation Units	IrrAg
PIF	Private irrigation farms	IrrAg
	Water Users Level	
IrFarm	Irrigation farmers	
DryFarm	Dryland farmers	
UrbPop	Urban population	
RurPop	Rural population	
Ind	Industry	
Fish	Fisheries	

IrrAg = Irrigated Agriculture, Dom = Domestic, Ind = Industry, Env = Environment

Table B.2. Water management stakeholders in the Lerma-Chapala Basin

Stakeholder	Functions
Federal Level Organizations	
Federal Parliament	Approves laws and has a committee on water issues
Ministry of Environment, Natural Resources and Fisheries (SEMARNAP)	The mother ministry of the CNA. Responsible for: ▪ Setting overall norms pertaining to wastewater and other natural resources and ensuring their enforcement. ▪ Overall policy-making, implementation and enforcement concerning the environment. ▪ Organize, direct and regulate "hydrological works" in river basins and administer, control and regulate the exploitation of river basins through the CNA.
National Water Commission (CNA)-Headquarters	Falls under SEMARNAP as a deconcentrated agency. Overall responsibility for executing SEMARNAP's mandate in water management implying overall responsibility for the water sector, including policy and water quality. Sets policies, defines legal framework, collects water levies from users. Specific responsibilities at the national level include: ▪ Ensure that the National Water Law is adhered to. ▪ Formulate and update the National Water Program and ensure its execution. ▪ Manage the nation's waters and act as its custodian. ▪ Grant, modify or cancel concessions, permits or allocations to the nation's waters and wastewater disposal permits. ▪ Maintain the Public Register of Water Rights, noting all concessions, permits and allocations. ▪ Monitor water abstractions, quality of wastewater disposals, as well as users compliance with their legal obligations. ▪ Define sanctions when users violate applicable regulations. ▪ Conciliation or arbitration in water conflicts. ▪ Promote the efficient use of water and its conservation in all phases of the hydrological cycle. ▪ Stimulate and support the development of urban and rural domestic water supply, drainage and sanitation networks, including the treatment and reuse of wastewater. Contract or concession service provision in these cases. ▪ Stimulate and support the development and management of irrigation and drainage systems and storm and flood protection works. Contract or concession service provision in these cases.
Ministry of Agriculture, Livestock and Rural Development (SAGAR; Secretaría de Agricultura, Ganadería y Desarrollo Rural)	Overall responsibility for the agricultural sector. Plays a small role in the Irrigation Districts, but more so in the Irrigation Units. Was previously the mother ministry of CNA. ▪ Program and propose the construction of small-scale irrigation systems, monitor the maintenance of small water harvesting structures.
Federal Electricity Commission (CFE; Comisión Federal de Electricidad)	Manages dams used for hydro-power.
Basin and Sub-basin Level Organizations	
CNA-Regional Office (Basin Office)	The CNA has 13 regional offices since 1998, defined along basin boundaries. A relatively "decentralized" office with overall

	responsibility for water in a basin. According to CNA's Organization Manual (1996), its functions are: ▪ Organize, direct and control CNA's actions at the regional level concerning the planning, execution, control and evaluation of the Regional Water Plan. As such, assist the CNA state offices and headquarters. ▪ Supervise and execute, if necessary, technical engineering studies (civil, agricultural, topographical and design) necessary for the elaboration, evaluation and integration of hydraulic development projects. ▪ Integrate, revise and validate information pertaining to requests for water concessions (users), allocations (municipalities) and permits (groundwater and wastewater), emit those that fall in its competency and forward to HQ those that do not. ▪ Supervise the Public Registry for Water Rights offices at the state level, ensuring that all legal and regulatory instruments are applied appropriately and consolidate and send to HQ all information necessary to keep the Registry updated at the national level. ▪ Coordinate and assist the CNA state office in their collection of water levies from users. ▪ Integrate and update the programs for the operation, maintenance, rehabilitation of the irrigation districts, technified rainfed agriculture and the potabilizacion of drinking water, as well as for the water treatment plants. ▪ Ensure the application of all legal and regulatory instruments pertaining to the extraction and use of national waters and establish restricted zones and reserves when necessary. ▪ Supervise and assist in the operation of the hydrometric and climatic measuring networks. ▪ Enforce the application of legal dispositions concerning water pollution and wastewater discharges. ▪ Provide legal and technical support to the CNA state offices.
Consejo de Cuenca (River Basin Council) consisting of: Governors of the States / CNA president / User Representatives / Regional User Committees / User Assembly / Technical Working Group	Defined in Article 13 of the national water law as a body for coordination and consensus-building between representatives of the federal, state and municipal governments as well as water users of different sectors, with the aim to formulate and promote the execution of programs for improving water management in the basin. These parties share the responsibility for allocating water resources and fostering integrated water management at the basin level and formulating and sanctioning regional water plans.
Comités or Consejos Técnicos de Aguas (Subterráneas) (COTAS)	Aquifer management councils being set up by the CNA and by CEASG (Guanajuato) as coordinating bodies for groundwater management. CNA is responsible for groundwater and needs to give permits to well owners. However, many illegal pumps and no effective control. COTAS are being set up to bring all stakeholders to the table to discuss ways to reduce pumping.
Comité Hidráulico de Distritos de Riego (Hydraulic Committee)	Coordinating body at the irrigation district level, comprised of the presidents of the WUAs plus representatives from the CNA and the state in which the irrigation district is located. According to Article 66 of the national water law this committee is a mediating and coordinating body, whose structure and mode of operation are to be defined in the regulations of the respective irrigation districts. The responsibility of this committee as set out in the law is to formulate and propose the regulations of the district and monitor their application. Additional tasks as set out in Article 99 of the regulations of the water law include: ▪ the resolution of disputes between water users and between WUAs; ▪ being aware of and monitoring the maintenance programs in the irrigation district; ▪ being aware of the annual irrigation plans and their execution; and ▪ being aware of and commenting on how water fees are determined and collected by WUAs.

	Formally, the chief engineer of the district chairs the hydraulic committee meetings. Although legally the hydraulic committee is only a coordinating body, in some irrigation districts it has become a serious decision making body pertaining to district wide water allocation and setting of water fee levels.
State Level Organizations	
State Parliament (5)	Approve state laws, including water laws and approve domestic water rates.
State Water (Supply) and Sanitation Commissions (5) e.g. CEASG	Decentralized bodies at the state level, independent of the Federal Government but answering to the State government, to: ▪ Coordinate the actions of the three levels of government for the integrated management of urban and rural domestic water supply, sanitation and drainage. ▪ Elaborate and update the State Water Supply and Sanitation Plan in coordination with Federal agencies. ▪ Formulate the State Water Plan. ▪ Execute the necessary works for the administration and operation of water supply and sanitation service provision. ▪ Promote the development of technical, administrative and financially autonomous water supply and sanitation utilities at the municipal level. ▪ Assist the public water utilities in creating and updating water tariffs, in accord with the costs generated by the service provision. ▪ Do the necessary to obtain federal funds for water supply and sanitation works in the state.
State Ministries of Agriculture (5) e.g. SDAyR	Overall responsibility for agricultural development in the State. ▪ Promote and ensure, based on coordination agreements with the Federal Government, the participation of the State in federal programs concerning the development of water resources for the agricultural sector. ▪ Elaborate aquifer studies that allow for the corroboration of extraction volumes from aquifers.
CNA-State Office (5)	CNA has 31 state offices, falling under both the regional office and federal headquarters. According to CNA's Organization Manual (1996), its functions are: ▪ Coordinate and execute water policies and the Hydraulic Program at the state level, as well as operate hydraulic infrastructure and manage the nations water in terms of quality, distribution and efficient use at the state level. ▪ Execute technical engineering studies (civil, agricultural, topographical and design) necessary for the elaboration, evaluation and integration of hydraulic development projects. ▪ Execute construction projects for irrigation, domestic water, drainage and sanitation. ▪ Capture requests for water concessions (users), allocations (municipalities) and permits (groundwater and wastewater) for the use of national water and the exploitation of federal zones, emit those that fall in its competency and forward to the Regional Office those that do not. ▪ Elaborate and update the Public Registry for Water Rights at the state level and send to the Regional Office all information necessary to keep the Registry updated at the regional level. ▪ Collect, register and inform the Regional Office on the income collected through water levies from users. ▪ Operate, maintain and rehabilitate the irrigation districts, technified rainfed agriculture and the potabilizacion of drinking water, as well as water treatment plants. ▪ Supervise the extraction and use of national waters and ensure that restricted zones and reserves are respected. ▪ Ensure that wastewater discharges are made conform their authorization. ▪ Realize studies and analysis of water quality and environmental impact previous to the execution of hydraulic works.

	▪ Operate the hydrometric and climatic measuring networks.
CNA-Irrigation District Office (8)	According to the 1992 water law and the WUA's concession titles CNA remains the highest authority in the irrigation districts with the following responsibilities and powers: ▪ To determine and notify the WUAs on the 1st of November of each year the volume of water they will be assigned for the coming year; ▪ To operate and maintain the dams and headworks of the irrigation district and also the main system if SRLs have not been established; ▪ To approve the water fee levels, that should be determined by the WUAs according to the procedures outlined by the CNA in Annex 5 of the concession title; ▪ To establish, revise and modify the instructions for the operation, administration and maintenance of the *módulo*, in consultation with the WUA; ▪ To approve the WUAs and SRLs annual maintenance plan and ensure that it is carried out satisfactorily; ▪ To supervise the maintenance of the secondary and main system infrastructure by the WUAs and SRLs; ▪ To indicate to the WUAs and SRLs the information they need to send to CNA concerning the maintenance of the infrastructure; ▪ To participate in the General Assembly of the WUAs and the SRLs with the right to speak but not to vote; and ▪ To cancel the concession title or to refuse to renew it if it deems the performance of the WUAs or SRLs unsatisfactory
Consejo Estatal Hidráulico (CEH) in Guanajuato	A new body, whose functions the law has not regulated yet. The State of Guanajuato sees it as the highest coordination body at the state level, consisting of user representatives and State officials for water management in the state. Apex body of the COTAS.
Municipal Level	
OOA = Organismos de Operadores de Agua (Municipal Water Supply Utilities or Water Supply Companies)	Public services pertaining to domestic water supply, sanitation and drainage have been delegated to the municipalities in Mexico under article 115 of the Constitution. Municipalities may provide these services directly (through administrative agencies or deconcentrated agencies), through decentralized public agencies (public utilities) based on concession and coordination covenants as well as through concessions to private companies.
User organizations	
Limited Responsibility Society (SRL)	Federation of WUAs at the irrigation district level whose general assembly is made up of the presidents of the WUAs falling in the irrigation district in question. Main responsibilities: ▪ distribute water from the headworks to the WUAs, ▪ discharge of any excess water to the drainage system ▪ maintain the concessioned infrastructure.
Water User Associations (WUAs) in Irrigation Districts	Based on the concession granted to them by the CNA, WUAs legally assume the responsibility to operate, maintain and administer their módulos. Their specific responsibilities are: ▪ Develop and enforce bylaws that detail procedures for water distribution, system maintenance and investment in infrastructure, cost recovery, and for dealing with complaints and sanctions. ▪ Collect irrigation service fees that fully cover the O&M and administration costs of the WUA.

	▪ Pay CNA a percentage of the revenues from fee collection for CNA services related to O&M of the dams, headworks and main canal system (if the O&M of the main system has not been transferred to an SRL). ▪ Prepare annual operation and maintenance plans and budgets. These plans and budgets and statements have to be sent to CNA for approval and recommendations for improvements.
Water User Associations (WUAs) in Irrigation Units	Develop their own procedures to manage their irrigation schemes. If they want to receive subsidies from the government a formal WUA needs to be created, along similar lines as for WUAs in irrigation districts.
COTAS	See above, under basin and sub-basin organizations.
Water Users	
Irrigation farmers	Make a living out of using water.
Dryland farmers	Make a living out of using water.
Livestock farmers	Make a living out of using water.
Urban population	Make a living out of using water.
Rural population	Make a living out of using water.
Industry	Make a living out of using water.
Fisheries	Make a living out of using water.

Summary

This thesis investigates the histories and relationships between water overexploitation, water reforms and institutional transformations in the Lerma-Chapala Basin in central Mexico. In particular it focuses on the role of the hydraulic bureaucracy (hydrocracy) in the creation of water overexploitation and in the articulation of water reforms. It shows how water reforms have reordered modes of water control and transformed domains of water governance in the Lerma-Chapala Basin, but have not led to a reduction of water overexploitation. Three main themes are developed in the thesis, namely 1) the links between the hydraulic mission, hydrocracies and river basin closure, 2) water reforms and decentralization, and 3) water allocation and river basin politics.

This thesis conceives of water reforms as sociopolitical processes and analyses the historical, political and bureaucratic processes that engender and sustain water reforms. Such an analysis, which centers on policy actors and policy articulation, clarifies why water reforms are effectuated and how alliances are negotiated through which reforms gather momentum, or are made to fail. Grounded in the notion that water resources management is politically contested and that policies embody the governing ambitions of bureaucracies, this thesis argues that water reforms are not "inevitable". Rather, they are produced by particular constellations and have particular effects, such as reordering modes of water control. To understand the making of water overexploitation and the articulation of water reforms it is necessary to analyze the histories of the relationships between water users, water technologies and the government agencies mediating water control. The spatial and material dimensions of hydrosocial-networks form an integral part of these histories. Such a sociotechnical perspective on water reforms is developed in this thesis to analyze changes in water governance in the Lerma-Chapala Basin.

From a water perspective, the Lerma-Chapala Basin is in serious trouble, with water use at unsustainable levels. It provides a striking example of the complexities of water reforms in closed river basins, where consumptive water use is close to or even exceeds the level of renewable water availability. It is also a basin in which many of the policy prescriptions emphasized in international water debates, such as irrigation management transfer, integrated river basin management and increasing stakeholder participation in water management, have been applied. However, in contrast to many other countries, the water reforms pursued in Mexico and the Lerma-Chapala Basin were largely context-specific and process based. Nonetheless, the Basin is still faced with water overexploitation and a complicated transition from centralized water management to one in which states and water users have a larger say.

This thesis contributes to increasing the understanding of water reforms as sociopolitical processes. In particular, it sets out to elucidate the apparent contradiction between sustained attempts at context-specific, process based and strategic water reforms and continued water overexploitation and environmental degradation. This is necessary as very little research has focused on water reforms as sociopolitical processes and is important for understanding how environmental sustainability and social equity can become

priorities in water reforms. This thesis shows that the answer lies in the inherently political and contentious nature of water reforms. It also shows how, through the interactions between policy actors such as hydrocrats, water users and politicians, as well as infrastructure and rainfall, water reforms are made to succeed or fail.

In Chapter 2, a historical analysis of the creation of water overexploitation in the Lerma-Chapala Basin brings out how water resources development is a recursive process in which hydrocracies, water infrastructure, water and water users mutually constitute each other. Between the 1920s and 1970s, the construction of irrigation schemes and river basin development in the Lerma-Chapala Basin, coupled with the bureaucratic-authoritarian character of the Mexican state and the hydraulic mission of its hydrocracy, led to water overexploitation and the strengthening of state control over water, water users and space. This process also deeply transformed agricultural production and agrarian relations, resulting in the creation of irrigation constituencies bent on maintaining and increasing their access to water. Through highlighting these processes, Chapter 2 provides historical depth to the main themes dealt with in this thesis.

A major rupture for the hydrocracy in Mexico was the merger of the ministry of hydraulic resources with the ministry of agriculture in 1976 and the dissolution of the river basin commissions. Chapter 3 analyses how this merger reduced the autonomy of the hydrocracy and resulted in bureaucratic struggles and a politically expressed demand for renewed autonomy on the part of the hydrocrats. The chapter focuses on policy articulation to elucidate how the historical, political and bureaucratic transformations relating to water in Mexico between 1976 and 1988 led to the consolidation of a water reform package and the reconstitution of the hydrocracy in 1989. It argues that the composition of the Mexican water reforms and the commitment to them emerged from a protracted and contingent process of bureaucratic struggles and political accommodations that was strongly driven by the hydrocracy's quest for renewed autonomy and its ambition to be the sole water authority in Mexico.

Chapter 4 analyses the articulation of the Irrigation Management Transfer (IMT) policy in Mexico in the early 1990s, focusing on its emergence, standardization and acceleration. It argues that much policy making actually takes place during policy implementation and that policy making is a continuous and on-going process that is potentially self-reinforcing, but often fragile and reversible in practice. This argument is constructed by showing that the articulation of the irrigation transfer policy was not an uncontested process but one that resulted from interactions between policy actors such as hydrocrats, water user leaders, politicians and international lending agencies. This led to the development of a standardized policy package, consisting of specific policy techniques. These techniques were assembled in response to distributed trials of strength: experiments, consultations and clashes in the field and negotiations at the national and international level. Feedback and centering mechanisms coordinated by the hydrocracy led to a convergence of distributed experiences and ideas on how to make transfer work, which contributed to the acceleration of the transfer process. The analysis shows that paradoxically through IMT the hydrocracy regained control over the irrigation districts and strengthened its position as Mexico's sole water authority.

Chapter 5 details the major water reforms of the 1990s as they played out in the Lerma-Chapala Basin. These reforms, such as irrigation management transfer and river basin management, were intimately linked with the overriding concern of the hydrocracy to regain its autonomy. Through these reforms, the hydrocracy regained discursive hegemony in the definition of water problems in the Lerma-Chapala Basin in the early 1990s. However, the dynamics of these reforms, which entailed a shift from authoritarian and centralized government to distributed governance, coupled with larger changes in Mexican society, resulted in institutional gridlock in the late 1990s and increased water use. While the hydrocracy furthered its territorial and governmental ambitions by using the concept of river basins as the natural units for water management, it only very partially succeeded in increasing its control over actual water use. The chapter concludes that to reduce water overexploitation, deeper shifts in governance are needed based on collaboration, combined with an equitable approach to the curtailment of primary water use.

Chapter 6 focuses on stakeholder representation in river basin management. It argues that increasing the capacity of water users to influence decision-making is crucial in river basin management reforms. It assesses emerging forums for river basin management in Mexico and South Africa and concludes that the pace of democratization of water management in both is slow. Mexico is characterized by continued government dominance and attempts to include already organized stakeholders in decision-making, while substantive stakeholder representation is lacking. South Africa is placing emphasis on social mobilization and transformation, leading to a slower implementation process and struggles over the redistribution of resources. While not a panacea, moving from stakeholder participation to substantive stakeholder representation in river basin management holds more promise of achieving equitable water management.

Chapter 7 analyzes attempts to reduce groundwater overexploitation in the Lerma-Chapala Basin, particularly in Guanajuato State, through a combination of state regulation and user self-regulation. It argues that the political economy of groundwater use is a strong impediment to reducing groundwater overexploitation. Thus, individual water users continue to have nearly unfettered control over their pumps, the federal government continues to provide cheap electricity to agriculture and the hydrocracy seeks rents through the legalization of illegal pumps. This chapter suggests that these strategies remain in place and are stronger than attempts to reduce groundwater use as the majority of the actors involved in groundwater management have a stake in the situation remaining as it is. Three reasons for the continued overexploitation of groundwater stand out:

1. the politics of administration, in which struggles between the Guanajuato and federal government obstructed efforts to reduce groundwater use;
2. the lack of efforts by cities or industry to decrease groundwater use and political support for their continued growth, by which these powerful actors succeeded in legitimizing their claim on water and increasing their levels of groundwater extraction; and
3. the dynamics of the embedded state, in which the objective of the state of Guanajuato to stimulate economic growth was stronger than the need to achieve sustainable groundwater management, which would have meant curtailing groundwater use of large commercial farmers, who controlled segments of the state machinery.

Chapter 8 continues the analysis started in Chapter 5 by focusing on the politics of surface water management in the Basin after 2000, in particular water transfers from irrigation districts to Lake Chapala and the negotiation processes surrounding the revision of the 1991 water allocation agreement. The continued decline of Lake Chapala from 1999 onwards and the water transfers to the Lake led to increased conflicts between states and water users in the Basin and complicated renegotiating the 1991 agreement. The changing dynamics of water user representation in water governance from the field to the basin are explored through an analysis of a farmer initiative to influence decision making at the river basin level in response to the water transfers. While a new water allocation agreement was signed in 2004, no provisions were made for environmental flows or for compensations to farmers for reductions in water allocations. This brings out how difficult it is to readjust water allocations after basin closure, let alone reduce water use and secure environmental water requirements, even if parties are willing to negotiate.

Chapter 9 presents the main findings and conclusions of the thesis. Two important findings are that the articulation of water reforms was only very partially driven by river basin closure and that the reforms did not lead to a reduction of water overexploitation. Rather, the sociopolitical analysis in this thesis of the water reforms pursued in the Lerma-Chapala Basin brings out that an important driver of the water reforms was the objective of the hydrocracy to strengthen its bureaucratic autonomy and control over domains of water governance. The active role of the Mexican hydrocracy in the articulation of water reforms shows that it supported change processes that it initiated and controlled and that would bring benefits to the hydrocracy. Its marked disinterest in making environmental sustainability and social equity the priorities of water reforms needs to be seen in this light. As long as these concerns do not bring benefits to the hydrocracy, and without strong political and social pressures being brought to bear on the hydrocracy to make these concerns its priorities, water overexploitation and the further concentration of water rights will continue. The thesis concludes that an explicit recognition of the powerful interests linked to water use and finding ways to bring these interests to the negotiating table is a necessary first step for making the "water transition".

Resumen

Esta tesis investiga las historias y relaciones entre la sobreexplotación del agua, las reformas hídricas y las transformaciones institucionales en la cuenca Lerma-Chapala en el centro de México. En particular, se enfoca en el rol de la burocracia hidráulica (*hidrocracia*) en la articulación de reformas hídricas y en la creación de regímenes de sobreexplotación del agua. Muestra como las reformas hídricas han reorganizado los regímenes de control de aguas y transformado los dominios de la gestión del agua en la cuenca Lerma-Chapala, sin que esto haya llevado a una reducción en la sobreexplotación del agua. Esta tesis desarrolla tres temas principales: 1) los vínculos entre la misión hidráulica, las hidrocracias y la creación de sobreexplotación del agua, 2) reformas hídricas y descentralización, y 3) el reparto de aguas y las políticas de cuenca.

Esta tesis conceptualiza las reformas hídricas como procesos sociopolíticos y analiza los procesos históricos, políticos y burocráticos que las crean y mantienen. Un análisis de esta índole, centrado en actores de políticas y la articulación de estas, clarifica el porque las reformas hídricas son implementadas y cómo estas con base en alianzas negociadas pueden cobrar momento o fracasar. Basado en la noción de que el manejo de los recursos hídricos es políticamente disputado, y que las políticas representan las ambiciones gobernantes de las burocracias, esta tesis establece que las reformas hídricas no son "inevitables". En su lugar, son producidas por constelaciones particulares y tienen efectos particulares, tales como el reordenamiento de formas y arreglos de control de agua. Para entender la creación de la sobreexplotación del agua y la articulación de reformas hídricas es necesario analizar las historias de las relaciones entre usuarios de agua, tecnologías de agua y las agencias gubernamentales que median el control del agua. Las dimensiones espaciales y materiales de redes-hidrosociales forman parte integral de estas historias. Tal perspectiva sociotécnica de las reformas hídricas es desarrollada en esta tesis para analizar cambios en la gestión del agua en la cuenca Lerma-Chapala.

Desde una perspectiva hídrica, y en razón a un nivel de uso de agua insostenible, la cuenca Lerma-Chapala esta en serios problemas. Dicha cuenca es un ejemplo sobresaliente de la complejidad implícita en las reformas hídricas en cuencas cerradas donde el consumo de agua esta cerca o rebasa el nivel renovable de disponibilidad del recurso. Lerma-Chapala es también una cuenca en la cual muchas de las prescripciones de políticas de agua subrayadas en debates internacionales tales como la transferencia de los sistemas de riego, el manejo integrado de cuencas y el incremento de la participación de los usuarios en la gestión del agua han sido aplicadas. No obstante, en contraste con muchos otros países, las reformas hídricas seguidas en México, y la cuenca Lerma-Chapala en particular, han sido en gran medida orientadas por un contexto y proceso local. A pesar de las reformas, la cuenca todavía está confrontada con la sobreexplotación del agua y una compleja transición de un manejo centralizado de los recursos hídricos a uno en el cual los estados y usuarios de agua tienen mayor poder de decisión.

Esta tesis contribuye a un mejor entendimiento de reformas hídricas como procesos sociopolíticos. En particular, se empeña en explicar la aparente contradicción entre

intentos sostenidos que buscan soluciones a contextos y procesos específicos y la persistente sobreexplotación del agua y la degradación ambiental. Esto es necesario dado que muy pocas investigaciones se han enfocado en reformas hídricas como procesos sociopolíticos. Además, es importante para entender como la sostenibilidad ambiental y equidad social pueden convertirse en prioridad en las reformas hídricas. Esta tesis muestra que la respuesta se encuentra en la naturaleza inherentemente política y disputada de las reformas hídricas. También muestra como, a través de las interacciones entre los actores de política tales como hidrócratas, usuarios y políticos, al igual que infraestructura y precipitación, las reformas hídricas se crean para fracasar o funcionar exitosamente.

En el segundo capítulo un análisis histórico de la creación de la sobreexplotación de los recursos hídricos en la cuenca Lerma-Chapala muestra como el desarrollo de los recursos hídricos es un proceso interactivo en el cual hidrocracias, infraestructura hidráulica, agua y usuarios de agua se constituyen mutuamente entre sí. Entre las décadas de 1920 y1970, la construcción de sistemas de riego y el desarrollo económico y social de la cuenca Lerma-Chapala, aunado al carácter autoritario de la burocracia del estado Mexicano y la misión hidráulica de la hidrocracia, llevó a la sobreexplotación y al fortalecimiento del control estatal sobre el agua, los usuarios del agua y el territorio. Este proceso también transformó profundamente la producción agrícola y las relaciones agrarias, resultando en la creación de comunidades de riego empeñadas en mantener e incrementar su acceso al agua. Subrayando estos procesos, el segundo capítulo da una profundización histórica a los temas principales que se tratan en esta tesis.

Una gran ruptura para la hidrocracia en México fue la fusión del secretaria de recursos hidráulicos con el secretaria de agricultura en 1976 y la disolución de las comisiones de cuencas. El tercer capítulo analiza cómo esta fusión redujo la autonomía de la hidrocracia y resultó en conflictos burocráticos y una solicitud política expresa para recobrarla. El capítulo se enfoca en la articulación de políticas para esclarecer como las transformaciones históricas, políticas y burocráticas relacionadas al agua en México entre 1976 y 1988 llevaron a la consolidación de un paquete de reforma hídrica y la reconstitución de la hidrocracia en 1989. El capítulo argumenta que la estructura de la reformas hídricas Mexicanas y la dedicación a ellas emergió de un proceso largo y disputado de negociaciones burocráticas y reacomodos políticos que fueron fuertemente empujados por la búsqueda de una renovada autonomía de la hidrocracia y su ambición de ser la única autoridad hídrica en México.

El capítulo cuatro analiza la articulación de la política de Transferencia de los Sistemas de Riego (imt por sus ciclas en inglés) en México a principios de la década de 1990, centrándose en su surgimiento, estandarización y aceleración. Argumenta que mucha de la política que se hace se va creando durante el proceso de implementación y que la creación de ésta es en proceso continuo que es potencialmente auto-determinativo, pero en muchas ocasiones frágil y reversible en la práctica. Este argumento se construye mostrando que la articulación de la política de transferencia no fue un proceso no debatido sino uno resultante de interacciones entre actores de política tales como hidrócratas, líderes de los usuarios de agua, políticos y agencias donantes internacionales. Esto llevó al desarrollo de un paquete estandarizado de políticas compuesto por técnicas de política específicas. Estas técnicas fueron creadas en respuesta a confrontaciones de poder distribuidas tales como experimentos, consultas, choques en el campo y negociaciones a nivel nacional e internacional. La retroalimentación y mecanismos de centralización coordinados por la hidrocracia llevaron a la convergencia de experiencias distribuidas en el país e ideas sobre cómo hacer que la transferencia funcione, lo cual contribuyó a la aceleración del proceso de transferencia. El análisis muestra que paradójicamente a través del imt la hidrocracia retomó el control sobre los distritos de riego y fortaleció su posición como la autoridad única del agua en México.

El quinto capítulo explica en detalle las mayores reformas hídricas de los 1990s y como estas fueron implementadas y funcionaron en la cuenca Lerma-Chapala. Estas reformas, tales como imt y el manejo de cuencas hidrográficas, fueron ligadas inmediatamente con la prevaleciente preocupación de la hidrocracia de recuperar su autonomía. A través de estas reformas, la hidrocracia recuperó su hegemonía discursiva en la definición de los problemas del agua en la cuenca Lerma-Chapala desde principios del los 1990s. Sin embargo, las dinámicas de estas reformas, que implicaban una transición de un gobierno autoritario y centralista a una gobernanza distribuida que, aunada a cambios más trascendentes en la sociedad mexicana, resultaron en una traba institucional a finales de 1990s y a un incremento en el uso del agua. Mientras la hidrocracia continuaba con sus ambiciones territoriales y gubernamentales usando el concepto de cuencas como los límites naturales para el manejo del agua, logró solo parcialmente incrementar su control sobre el uso del agua. El capítulo concluye que para reducir la sobreexplotación del agua se necesitan transformaciones más profundas en la gobernabilidad de esta, basadas en la colaboración y en un acercamiento equitativo a una reducción del uso primario del agua.

El sexto capítulo se centra en la representación de actores en el manejo de cuencas. Argumenta que incrementar la capacidad de los usuarios de influenciar la toma de decisiones es imprescindible en reformas de manejo de cuencas. Evalúa foros emergentes para el manejo de cuencas en México y África del Sur y concluye que la velocidad de democratización del manejo del agua en ambos es lenta. México se caracteriza por un continuado dominio del gobierno, intentos por incluir actores ya organizados en el proceso de toma de decisiones y una limitada representación substancial de los actores. África del Sur, por el otro lado, enfatiza el rol de la movilización social y la transformación lo cual lleva a un proceso de implementación más lento y conflictos sobre la redistribución de los recursos. Aunque no sea una panacea, desplazarse de participación de actores a una representación sustantiva de los actores en el manejo de cuencas es prometedor para llegar a un manejo del agua equitativo.

El capítulo siete analiza intentos por reducir la sobreexplotación del agua subterránea en la cuenca Lerma-Chapala, en especial en el estado de Guanajuato, a través de una combinación de regulación del estado y auto-regulación por los usuarios. Establece que la economía política del agua subterránea es una gran traba para reducir la sobreexplotación. Así los usuarios privados del agua siguen teniendo un control casi total sobre sus bombas, el gobierno federal sigue proveyendo electricidad altamente subsidiada al sector agrario y la hidrocracia saca provecho de la legalización de pozos ilegales. Este capítulo sugiere que estas estrategias persisten y son más fuertes que intentos de reducir el uso del agua subterránea puesto que la mayoría de los actores involucrados en el manejo del agua subterránea tienen intereses para que la situación se mantenga tal y como está. Tres razones para la continuada sobreexplotación sobresalen:

1. las políticas de administración, en las cuales conflictos entre el gobierno estatal de Guanajuato y el gobierno federal han frenado intentos de reducir el uso del agua subterránea.
2. la falta de esfuerzo por parte de las ciudades y las industrias de reducir el uso del agua subterránea y el soporte político a su sostenido crecimiento, por medio de los cuales estos poderosos actores legitiman sus reclamos sobre el agua e incrementan sus niveles de extracción; y
3. las dinámicas del gobierno establecido, en el cual el objetivo del estado de Guanajuato de estimular el crecimiento económico ha sido más fuerte que la necesidad de llegar a niveles de explotación sostenibles. Llegar a niveles sostenibles de explotación hubiera implicado reducir el uso del agua subterránea de grandes agricultores comerciales quienes controlan parte del aparato político del estado.

El capítulo ocho continua el análisis iniciado en el capítulo cinco al enfocarse en las políticas del agua superficial en la cuenca después del año 2000, en especial los trasvases de los distritos de riego al Lago de Chapala y el proceso de negociación que surgió alrededor de la revisión del acuerdo de distribución de aguas de 1991. La continua reducción de los niveles del lago Chapala desde 1999 y los trasvases al lago llevaron a un incremento de los conflictos entre los estados y los usuarios del agua en la cuenca y complicó renegociar el acuerdo de 1991. Las cambiantes dinámicas de la representación de los usuarios en la gestión del agua desde el campo a la cuenca se exploran a través del análisis de una iniciativa de productores para influenciar el proceso de toma de decisiones al nivel de la cuenca en respuesta a los trasvases. Mientras que un nuevo acuerdo de distribución de aguas se firmó en el 2004, no se hicieron provisiones para flujos ambientales o para la compensación al sector agrícola por reducciones a su dotación en el reparto de aguas. Esto muestra que tan difícil es reajustar la distribución de aguas después de que una cuenca se cierra, sin mencionar aun una reducción en el uso del agua y asegurar los requerimientos medioambientales de agua, aun si los involucrados están dispuestos a negociar.

En noveno capítulo presenta los resultados y conclusiones de ésta tesis. Dos importantes resultados son que la articulación de reformas hídricas fue solamente parcialmente dirigida por el cerramiento de la cuenca y que las reformas no llevaron a una reducción de la sobreexplotación. En lugar de esto, el análisis sociopolítico que elabora esta tesis sobre las reformas hídricas que se llevaron a cabo en la cuenca Lerma-Chapala muestra que un importante factor de empuje de las reformas hídricas fue la intensión de la hidrocracia de fortalecer su autonomía burocrática y control sobre dominios en la gestión del agua. El activo papel de la hidrocracia Mexicana en al articulación de las reformas hídricas muestra que apoyó procesos de cambio que ella misma inició y controló y que traería beneficios para la hidrocracia. Su marcado desinterés en hacer de la equidad social y la sustentabilidad ambiental prioridades de las reformas hídricas tiene que ser visto bajo esta perspectiva. En tanto que estas preocupaciones no tengan beneficios para la hidrocracia, y sin una fuerte presión social y política que recaiga en la hidrocracia para hacer estas preocupaciones su prioridad, la sobreexplotación del agua y una continuada acumulación de derechos de agua seguirá. La tesis concluye que un reconocimiento explícito de los poderosos intereses ligados al uso del agua y la búsqueda de estrategias para llevar estos intereses a la mesa de negociación es el primer paso necesario para hacer la "transición hídrica".

Samenvatting

Dit proefschrift onderzoekt de geschiedenissen en de relaties tussen overmatig watergebruik, waterhervormingen en institutionele transformaties in het Lerma-Chapala stroomgebied in centraal Mexico. Het concentreert zich in het bijzonder op de rol van de hydraulische bureaucratie (hydrocratie) in het ontstaan van overmatig watergebruik en het verwezenlijken van waterhervormingen. Hierbij laat het zien hoe waterhervormingen de verschillende manieren van waterbeheer en de domeinen van waterbestuur hebben geherstructureerd zonder het probleem van overmatig watergebruik te verminderen. Drie hoofdthema's worden in het proefschrift uitgewerkt: 1) de relatie tussen de hydraulische missie, hydrocratieën en overmatig watergebruik, 2) waterhervormingen en de-centralisatie, en 3) waterallocatie en de beheerspolitiek van stroomgebieden.

Deze studie beschouwt waterhervormingen als sociaal-politieke processen. Zij analyseert de historische, politieke en bureaucratische processen die leiden tot de verwezenlijking van waterhervormingen. Deze analyse, die zich richt op beleidsactoren en beleidsarticulatie, verduidelijkt waarom waterhervormingen ingezet worden en hoe allianties ontstaan die de hervormingen wel dan niet tot een succes maken. Er van uitgaande dat waterbeheer een politiek verschijnsel is en dat beleid de ambities van bureaucratieën om te heersen belichamen, beargumenteert deze thesis dat waterhervormingen niet "onvermijdelijk" zijn. Zij worden in gang gezet door specifieke constellaties en hebben gevolgen voor bijvoorbeeld de manier waarop het waterbeheer wordt vormgegeven. Om te kunnen begrijpen hoe overmatig watergebruik ontstaat en waterhervormingen worden ingezet, is het noodzakelijk meer te weten van de historische ontwikkeling van de relaties tussen watergebruikers, watertechnologie en overheids-diensten die gezamenlijk het waterbeheer vormgeven. De ruimtelijke en materiële dimensies van hydro-sociale netwerken vormen een wezenlijk onderdeel van deze geschiedenis. In deze thesis wordt dit sociaal-technisch perspectief op waterhervormingen ontwikkeld om de veranderingen van het waterbeheer in het Lerma-Chapala stroomgebied te kunnen analyseren.

Vanuit een waterperspectief bezien, bevindt het Lerma-Chapala stroomgebied zich in ernstige problemen: het verbruik van water is veel te hoog om daarmee door te gaan. Het is een opvallend voorbeeld van de complexiteit van waterhervormingen in gesloten stroomgebieden waarin het consumptieve verbruik van water de grens van duurzaamheid nadert of zelfs overschrijdt. In dit stroomgebied zijn vele beleidsvoorschriften, die in internationale waterdebatten worden benadrukt, toegepast. Enkele voorbeelden hiervan zijn de overdracht van het irrigatiebeheer aan boeren, geïntegreerd waterbeheer op stroomgebiedniveau en toename van de gebruikersparticipatie bij het waterbeheer. In tegenstelling tot vele andere landen zijn de waterhervormingen die in Mexico en met name in het Lerma-Chapala stroomgebied werden ingezet, voor een groot deel contextspecifiek en procesmatig van aard. Maar toch blijft het stroomgebied geconfronteerd met overmatig watergebruik en is de transitie van gecentraliseerd waterbeheer naar meer participatief waterbeheer waarin deelstaten en watergebruikers een grotere rol spelen ingewikkeld.

Dit proefschrift draagt bij aan een verder begrip van waterhervormingen als sociaal-politieke processen. Het belicht in het bijzonder de schijnbare tegenstelling tussen de (pogingen om tot) contextspecifieke, procesmatige en strategische waterhervormingen (te komen) en het voortdurende overmatige watergebruik en milieudegradatie. Tot nu toe heeft er zeer weinig onderzoek plaatsgevonden dat waterhervormingen als sociaal-politieke processen bestudeert. Toch is dat van groot belang om er achter te komen hoe ecologische duurzaamheid en sociale gelijkheid prioriteiten kunnen worden bij waterhervormingen. Deze studie laat zien dat het antwoord hierop gezocht moet worden in de inherent politieke en controversiële aard van deze hervormingen. Zij laat eveneens zien hoe waterhervormingen een succes worden of juist falen door de interacties tussen beleidsactoren, zoals hydrocraten, watergebruikers en politici, als ook de infrastructuur en regenval.

Hoofdstuk 2 analyseert de ontstaansgeschiedenis van overmatig waterverbruik in het Lerma-Chapala stroomgebied en laat zien dat de exploitatie van water een recursief proces is waarin hydrocratieën, water infrastructuur, het water zelf en watergebruikers elkaar wederzijds constitueren. Tussen de jaren ’20 en de jaren ’70 van de 20ste eeuw leidden de aanleg van irrigatiestelsels, de ontwikkeling van het Lerma-Chapala stroomgebied, het bureaucratisch-autoritaire karakter van de Mexicaanse staat en de hydraulische missie van de hydrocratie tot het overmatig gebruik van water en een sterker overheidsgezag over water, de watergebruikers en het landelijk gebied. Dit proces zette een diepgaande transformatie van het landbouwproductiesysteem en het agrarisch bestel in gang. Dit resulteerde in de formatie van irrigatiedistricten die erop gebrand waren hun toegang tot water te handhaven of zelfs te vergroten. Door deze processen te belichten, verschaft hoofdstuk 2 historische diepgang aan de drie hoofdthema’s van dit proefschrift.

De fusie van het ministerie van hydraulische natuurbronnen met het ministerie van landbouw in 1976 en de ontbinding van de stroomgebiedsbesturen vormen een breukvlak in de geschiedenis van de hydrocratie. Hoofdstuk 3 analyseert in welke mate deze fusie de autonomie van de hydrocratie aantastte en aanleiding gaf tot bureaucratische broedertwisten en een politiek uitgesproken verlangen naar een hernieuwde autonomie voor de hydrocraten. Het hoofdstuk concentreert zich op beleidsprocessen die plaatsvonden in de watersector van Mexico tussen 1976 en 1988, om te laten zien hoe historische, politieke en bureaucratische transformaties de opmaat vormden voor de consolidatie van een waterhervormingspolitiek en het herstel van de hydrocratie in 1989. Het laat zien dat de samenstelling van de Mexicaanse waterhervormingen en de steun voor die hervormingen het voortvloeisel waren van een langdurig en hevig proces van bureaucratische twisten en politieke compromissen. Dit proces werd sterk beïnvloed door de zucht naar hernieuwde autonomie van de hydrocratie en haar ambitie de enige waterautoriteit in Mexico te zijn.

Hoofdstuk 4 analyseert het ontstaan, de standaardisatie en de versnelde uitvoering van de overdracht van irrigatiebeheer aan watergebruikers (afk. IMT) in Mexico gedurende de vroege jaren ’90. Het toont dat veel beleidsvorming eigenlijk tijdens de implementatiefase van dit beleid plaatsvindt. Beleidsvorming is een ononderbroken en voortschrijdend proces dat in theorie zichzelf kan versterken, maar in de praktijk vaak kwetsbaar en omkeerbaar is. Dit punt wordt gemaakt door aan te tonen dat de uitkristallisatie van het irrigatie-overdrachtsbeleid niet zonder slag of stoot tot stand kwam. Het beleid wordt gezien als een voortvloeisel van interacties tussen beleidsactoren zoals de hydrocraten, het leiderschap van de watergebruikers, de politici en internationale financiële instellingen. Deze interacties hebben aanleiding gegeven tot het ontwikkelen van een gestandaardiseerd pakket aan beleidsmaatregelen met een aantal specifieke beleidsinstrumenten. Deze instrumenten zijn ontwikkeld op verschillende manieren en getest op verschillende locaties. Het gaat hierbij om experimenten, consultaties en confrontaties in het veld maar ook om onderhandelingen op nationaal en internationaal niveau. Alle ervaringen en ideeën over de vraag hoe de overdracht van het irrigatiebeheer kon worden bewerkstelligd, zijn aan de coördinerende hydrocratie teruggekoppeld; zij was het centrale informatie-verzamelpunt. Door deze centrale coördinatie is het overdrachtsproces versneld. Paradoxaal genoeg, toont de analyse dat de hydrocratie middels het IMT-beleid haar controle over de irrigatiedistricten herwon en haar positie als enig watergezag van Mexico versterkte.

Hoofdstuk 5 belicht gedetailleerd hoe de belangrijkste waterhervormingen van de jaren ’90 zich in het Lerma-Chapala stroomgebied ontwikkelden. Hierin wordt duidelijk dat de hervormingen, zoals de overdracht van de irrigatiedistricten en waterbeheer op het niveau van het stroomgebied, sterk waren vervlochten met het alles overheersende belang van de hydrocratie om haar autonomie te herwinnen. In het begin van de jaren ’90 had de hydrocratie de discursieve hegemonie om de waterproblemen in het Lerma-Chapala stroomgebied te kunnen definiëren herwonnen. Aan het eind van de jaren ’90 ontstond er echter een institutionele patstelling en een verhoogd watergebruik vanwege de hervormingen, die een verschuiving behelsden van een autoritaire en centrale overheid naar een meer gedecentraliseerde bestuur, en grote veranderingen in de Mexicaanse samenleving. De hydrocratie, die er in slaagde haar territoriale en bestuurlijke zeggenschap te vergroten door rivierstroomgebieden te poneren als de natuurlijke eenheid van waterbeheer, slaagde er maar slechts zeer ten dele in de controle over het daadwerkelijke watergebruik uit te oefenen. Het hoofdstuk concludeert dat er ingrijpendere veranderingen in het bestuur nodig zijn, gebaseerd op samenwerking en redelijkheid, om te kunnen komen tot een afname van het watergebruik en een eerlijke reductie van het primaire watergebruik.

Hoofdstuk 6 stelt de representatie van watergebruikers bij het beheer van het stroomgebied centraal. Het laat zien dat een toename van zeggenschap bij watergebruikers essentieel is bij hervormingen van het beheer van stroomgebieden. In een evaluatie van de opkomst van fora voor het beheer van stroomgebieden in zowel Mexico als Zuid-Afrika wordt getoond dat het tempo van de democratisering van waterbeheer in beide gevallen laag ligt. In Mexico wordt de situatie gekenmerkt door voortdurende overheidsbemoeienis. Er wordt wel geprobeerd om organisaties van reeds gemobiliseerde watergebruikers bij de besluitvorming te betrekken maar wezenlijke vertegenwoordiging van deze organisaties ontbreekt. In Zuid-Afrika wordt de nadruk gelegd op sociale mobilisatie en transformatie. Dit zorgt voor een langer implementatieproces en strijd over de herverdeling van middelen. Geconcludeerd wordt dat de kans op een eerlijke waterverdeling verhoogd wordt indien een verschuiving van medezeggenschap naar volwaardige vertegenwoordiging van watergebruikers in het beheer van de stroomgebieden bewerkstelligd wordt.

Hoofdstuk 7 analyseert de pogingen van de deelstaat Guanajuato om te komen tot een afname van de onttrekking van grondwater in het Lerma-Chapala stroomgebied middels een combinatie van overheidswetgeving en zelfregulering door gebruikers. Het laat zien dat de politieke economie van grondwatergebruik een groot obstakel vormt bij pogingen het probleem van overmatig grondwaterverbruik op te lossen. Zo blijven individuele watergebruikers de baas over hun pompen, blijft de federale overheid goedkope elektriciteit aan de landbouwsector verstrekken en blijft de hydrocratie van smeergeld profiteren middels het legaliseren van onwettige pompen. Dit hoofdstuk suggereert dat deze strategieën intact blijven en weerbarstiger blijken dan het resultaat van de pogingen om een afname van het grondwatergebruik te bewerkstelligen. De verklaring hiervoor ligt in het feit dat een meerderheid van de bij het grondwaterbeheer betrokken actoren direct belang hebben bij een voortzetting van de huidige situatie. Drie redenen voor het voortdurende overmatige gebruik van grondwater komen naar voren:

1. bestuurlijke twisten, waardoor de reductie van het grondwatergebruik niet werd behaald vanwege de strijd tussen de deelstaat Guanajuato en de federale overheid;
2. het gebrek aan inzet bij de steden en industrie om het gebruik van grondwater te verminderen en de politieke steun om zich hiervoor niet in te hoeven zetten maar verder te kunnen groeien. Door deze politieke steun konden deze machtige spelers hun claim op het water rechtvaardigen en zakte het peil van het grondwater steeds verder; en
3. de dynamiek van het deelstatenbestel, waardoor het belang bij economische groei van de deelstaat Guanajuato het belang van een duurzaam grondwaterheer overstijgt. Hiervoor zou het namelijk noodzakelijk zijn een limiet te stellen aan het grondwatergebruik door commerciële boeren, die echter delen van het staatsapparaat in handen hebben waardoor het stellen van een limiet niet haalbaar is gebleken.

In hoofdstuk 8 wordt de draad opgepakt van de analyse uit hoofdstuk 5. Hier staat de politieke strijd vanaf het jaar 2000 over het beheer van oppervlaktewater in het stroomgebied centraal. Het hoofdstuk concentreert zich in het bijzonder op de overheveling van water vanuit de irrigatiedistricten naar het meer van Chapala en de onderhandelingsprocessen rond de herziening van het waterverdelingakkoord uit 1991. De continue daling van het waterpeil in het meer van Chapala vanaf 1999 en het overhevelen van water naar het meer leidden tot een verhoogd aantal conflicten tussen deelstaten en watergebruikers van het stroomgebied. Deze conflicten maakten de onderhandelingen over de herziening van het akkoord uit 1991 behoorlijk ingewikkeld. Aan de hand van een analyse van een boereninitiatief om het besluitvormingsproces op het niveau van het stroomgebied te beïnvloeden naar aanleiding van de water overhevelingen, wordt de dynamiek van de representatie van gebruikers in het waterbeheer op verschillende niveaus (van veld tot op stroomgebiedniveau) belicht. Ondanks de ingewikkelde onderhandelingen is het gelukt een nieuw waterverdelingakkoord af te sluiten in 2004. Hierin zijn echter geen bepalingen opgenomen om water voor het milieu te reserveren of een compensatie te regelen voor boeren die water moeten afstaan. Hiermee wordt aangetoond hoe moeilijk het is om waterallocaties in een ‘gesloten’ stroomgebied te wijzigen, laat staan het watergebruik te verminderen en water voor het milieu te reserveren, zelfs als belanghebbende partijen tot onderhandelingen bereid zijn.

Hoofdstuk 9 presenteert de belangrijkste bevindingen en conclusies van de thesis. Twee belangrijke bevindingen zijn dat ten eerste de waterhervormingen maar zeer ten dele werden geïnspireerd door de 'sluiting van het stroomgebied' en ten tweede dat de hervormingen niet hebben geleid tot een afname van het overmatige watergebruik. De sociaal-politieke analyse van de water hervormingen in Lerma-Chapala laat zien dat juist het streven van de hydrocratie om haar bureaucratische autonomie en haar zeggenschap over het waterbeheer te versterken, een belangrijke inspiratiebron was voor de hervormingen. De nauwe betrokkenheid van de Mexicaanse hydrocratie bij de uitwerking van het hervormingsbeleid toont dat het bereid was steun te verlenen aan veranderingsprocessen die geïnitieerd en geregisseerd werden door haarzelf en die haar voordelen zouden opleveren. Haar opvallende desinteresse om prioriteit te geven aan ecologische duurzaamheid en sociale rechtvaardigheid moet in dit licht worden gezien. Zolang het aandacht besteden aan deze twee thema's geen voordelen oplevert voor de hydrocratie en zolang er geen sterke politieke en sociale druk wordt uitgeoefend op de hydrocratie om hier wel prioriteit aan te geven, zal overmatig watergebruik en verdere concentratie van waterrechten de realiteit blijven. Dit proefschrift concludeert dat een expliciete erkenning van de krachtige belangen die verbonden zijn met het gebruik van water en het vinden van manieren om deze belangen tijdens onderhandelingen boven tafel te krijgen een noodzakelijke eerste stap vormen voor het maken van de 'water transitie'.

Curriculum Vitae

Philippus Wester was born on 27 December 1967 in The Hague, the Netherlands. At the age of seven he went with his parents to Papua New Guinea, to live in Ukarumpa in the Eastern Highlands Province until June 1984. Here he attended Aiyura Primary School and Ukarumpa High School, and as a teenager had the salutary experience of working as a coffee picker on a coffee plantation. After returning to the Netherlands in 1984 he completed his secondary education in Roosendaal and enrolled at Wageningen Agricultural University to study *Tropische Cultuurtechniek* (Tropical Land and Water Use) in September 1987. During his studies he specialized in irrigation water management, development sociology, technology studies and the history of Latin America. His first thesis research (in 1991) consisted of a literature study on technology development and actor-network theory. The outcomes of this thesis provided the theoretical framework for his second thesis research, conducted in 1992, that focused on the effects of state disengagement on the performance of farmer-managed irrigation schemes in the Middle Valley of the Senegal River. His third thesis research took him to the North West Frontier Province in Pakistan in 1993, where he studied irrigation water management in the Kabul River Canal irrigation scheme. He graduated in January 1994 with distinction.

His first job was as an irrigation researcher with the International Institute for Land Reclamation and Improvement (ILRI) in Wageningen. In October 1995 he went to Bangladesh as an associate expert water management with the Dutch Ministry of Foreign Affairs, where he worked in the Systems Rehabilitation Project of the Bangladesh Water Development Board until April 1998. During this period he studied water management practices in flood control and drainage systems and contributed to drafting the country's Guidelines for Participatory Water Management. From May 1998 to June 2000 he worked for the International Water Management Institute (IWMI) in Mexico in the Lerma-Chapala Basin as a water management researcher, focusing on stakeholder participation in river basin management, the institutional design of aquifer management councils and the responses of WUAs in recently transferred irrigation systems to water transfers out of irrigated agriculture. This research provided the foundation for his Ph.D. thesis. Returning to the Netherlands in July 2000, he joined the Irrigation and Water Engineering group of Wageningen University as a visiting researcher. In July 2001 he was appointed Assistant Professor Water Reforms with the Irrigation and Water Engineering group, with his teaching and research focusing on institutional change processes in the irrigation and water sector and river basin management. He also continued research on the Lerma-Chapala Basin and dedicated most of 2007 to writing his Ph.D. thesis.

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