DRAFT

Report No. 36942-MX

MEXICO
Water Public Expenditure Review

September 4, 2006

Colombia and Mexico Country Department
Latin America and the Caribbean Region

Document of the World Bank

CURRENCY EQUIVALENTS

(Exchange Rate Effective February 24, 2006)

Currency Unit = Mexican Pesos (MXN)
US$1 = 10.4706 MXN
1 MXN = US$ 0.0955054

FISCAL YEAR
January 1 – December 31

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ABBREVIATIONS AND ACRONYMS

AAA	Analytical And Advisory Activities	*Actividades Analíticas y Consultivas*
ANEAS	National Association of Fresh Water and Sewage Utilities Companies of Mexico	*Asociación Nacional De Empresas De Agua Y Saneamiento De México*
APAZU	Drinking Water n Urban Zone	*Agua Potable Y Saneamiento en Zonas Urbanas*
BANOBRAS	National Bank of Public Works	*Banco Nacional de Obras y Servicios Públicos*
BC	Basin Councils	*Consejos De Cuenca*
BA	Basin Agencies	*Organismos De Cuenca*
CAS	Country Assistance Strategy	
CEA	State Water Commissions	*Comisiones Estatales De Agua*
COFEPRIS	Federal Commission For The Protection Against Sanitary Risks	*Comisión Federal Para La Protección Contra Riesgos Sanitarios*
CONAGUA	National Water Commission	*Comisión Nacional Del Agua,*
COPLADE	Development Planning Committees	*Comités De Planeación Para El Desarrollo*
COTAS	Groundwater Technical Committees	*Comités Técnicos De Aguas Subterráneas*
ET	Evapotranspiration	
FAIS	Fund for Social Infrastructure	*Apoyo Para La Infraestructura Social*
FFL	Federal Fiscal Law	*Código Fiscal*
FIVAGUA	Water Valuation Trust Funds	*Fidecomisos De Valoración Del Agua*
GDP	Gross Domestic Product	*Producto Interno Brugo*
GoS	Government Of. Sonora	*Gobierno de Sonora*
ID	Irrigation Districts	*Distritos De Riego*
IDB	Inter American Development Bank	*Banco Interamericano De Desarrollo*
IMTA	Mexican Institute Of Water Technology	*Instituto Mexicano de Tecnologia*
IPER	Infrastructure Public Expenditure Review	*Revisión Del Gasto Público De la Infraestructura*
IWRM	Integrated Water Resources Management	*Administración Integrada De Recursos De Agua*
IU	Irrigation Units	*Unidades De Riego*
LFD	Federal Fiscal Law	*Ley Federal De Derechos*
NRW	Non-Revenue Water	*Agua de no-renta*
NSIP	New System of Public Investment	*Nuevo Sistema De Inversión Pública*
NWL	National Waters Law	*Ley Nacional de Aguas*
OECD	Organization for Economic Co-operation and Development	*Organización para la Cooperación Económica y el Desarrollo*
OO	Municipalities And Water Utilities	*Organismos Operadores de Agua*

PAC	Alliance With Rural Area	*Alianza Para El Campo*
PADUA	Water Rights Acquisition Program	*Programa De Adquisición De Derechos De Agua*
PER	Public Expenditure Review	*Revisión Del Gasto Público De la Infraestructura*
PRODDER	Water Rights Devolution Program	*Programa De Devolución De Derechos*
PROMAGUA	Fund for the Modernization of Water Agencies	*Fondo Para La Modernización De Organismos Operadores De Agua*
PROMMA	Water Resources Management Project	*Proyecto De Modernización Del Manejo Del Agua*
PROSSAPYS	Drinking Water And Sanitation Services In Rural Communities	*Programa Para La Sostenibilidad De Los Servicios De Agua Potable Y Saneamiento En Comunidades Rurales*
PSP	Private Sector Participation.	*Participación del Sector Privado*
RBM	River Basin Management	*Administración de Cuencas*
REPDA	Public Water Rights Registry	*Departamento del Registro Público de Derechos de Agua*
SAGARPA	Ministry Of Agriculture, Livestock, Food, Rural Development And Fisheries	*Secretaria de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación*
SEDESOL	Ministry of Social Development	*Secretaria De Desarrollo Socia*
SEMARNAT	Secretariat Of Environment And Natural Resources	*Secretaría Del Medio Ambiente Y Recursos Naturales*
SFA	Water Financial System	*Sistema Financiero Del Agua*
SHCP	Ministry of Finance and Public Credit	*Secretaría De Hacienda Y Crédito Público*
WRAP	Water Rights Adjustment Program	*Programa de Derechos de Agua*
WRM	Water Resource Management	*Manejo de Recursos de Agua*
WRPR		
WUA	Water User Associations	*Asociación De Consumidores de Agua*

PREFACE

The Mexico Country Assistance Strategy (CAS, 2004) identified water resource management as Mexico's most urgent environmental problem today, and one that impacts heavily on the economy. Consequently the CAS has 5 lending projects in the water area—the Irrigated Agriculture Modernization Project (2004), Decentralized Infrastructure Project (2004), Environment Development Policy Loan II (2005), Water Supply and Sanitation Technical Assistance Loan (2005), Integrated Management of Basins and Aquifer Project (2007)—and two AAA products. There is a programmatic AAA on Assessment of Policy Interventions in the Water Sector (2005 and 2006) and this Water Public Expenditure Review (2006), which follow on the Mexico PER (2004) and the Infrastructure PER (2005).

In 2004, Mexico passed a major modification to the Water Law, calling for a new water financing system (*sistema financiero del agua)* and the creation and empowerment of Basin Agencies *(organismos de cuenca*), but the government has not yet implemented the law, including the issuance of regulations. Since there are several competing interpretations of the law, the latter will be key to determining how water resources management and development will take place, including the new institutional arrangements and the level of decentralization.

The purpose of this AAA, therefore, as agreed with the government, is to analyze the allocation of resources—hydrologic and financial—in order to understand how best to implement the new law. To do this, the report examines the sub-sectoral themes of water supply and sanitation and irrigation and drainage, as well as the overall water resource and fiscal management issues for the sector. The report opens with an overview of the water sector and water resources management issues. The following chapter analyzes pricing and revenue collection, expenditures, planning, programming and budget management. The final chapter makes recommendations regarding implementing the institutional and financial provisions of the water law under a stage-based approach. Along these lines, this report could be used as a vehicle in workshops and other venues for furthering the sector dialogue and building consensus about the reform strategy. An annex provides some insights about how other countries deal with these issues.

The Under-Secretary of Finance for Expenditure, Carlos Hurtado, has been the official counterpart for this study, with close support coming from two of his key deputies, Luis Alberto Ibarra and Pablo Reyes and their staff. They have been most helpful in providing the necessary documentation for the study. Staff in CONAGUA also deserve recognition for organizing and providing valuable information, without which the report would not have been possible.

Acknowledgments

The Bank team working on the report comprised Steven Webb, Gustavo Saltiel, Douglas Olson, (co-team leaders), Musa Asad, Christian Gonzalez, Hector Garduño, Jonathan Halpern, Marie-Laure Lajaunie, Greg Landreth, Shelley Mcmillan, Eduardo Mestre, Manuel Schiffler, Yurie Tanimichi Hoberg, and Nicole Maywah. Patricia Holt and Gloria DeHaven did the document preparation. Ethel Sennhauser, Anna Wellenstein, and David Rosenblatt—the sector leaders for ESSD, FPSI, and PREM—provided guidance to the team at many junctures. Yasuhiko Matsuda and Karin Kemper provided peer review comments

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EXECUTIVE SUMMARY

Mexico has critical and urgent water related problems including the overexploitation and contamination of surface water and groundwater resources in the regions where most of the people reside and where the great majority of the GDP is generated. Groundwater overexploitation is perhaps the most serious water resources management issue. About 100 aquifers in the central and northern part of the country are being overexploited, with water tables dropping 1 to 4 meters per year. In some areas, essentially all sectors depend on groundwater, and the unsustainable water use regimen will constrain economic development and have serious social impacts. The poor often suffer the most, because they are less able to deal with the added costs associated with falling water tables and water pollution.

Water issues are both very complex and very important in Mexico, because they sit at the conjunction of economic development, public finance, infrastructure investment, environmental sustainability, and social justice. They are linked to public finance in three ways — raising resources, providing resources for investment and operations, and setting fees that affect the incentives for using water. The decisions about water investment have a lasting physical impact on what happens with water, as well as major social impacts. The scarcity of water in many parts of the country means that sometimes more water for one sector results in less water (and a different development path) in another sector and for the environment. The national patrimony relating to the ecosystem and groundwater often ends up last in line—as everyone generally agrees on their importance but objects to having his allocation of water or fiscal subsidy be reduced or to paying for wastewater treatment. Finally, making water and water services available equitably to households is a key element in the social justice to which Mexicans aspire. The report aims to integrate the views of the water sector through these different lenses, and to suggest how to improve the management of the sector and thus to make decisions more coherent.

Dimensions of Water Needs

Demands for water and water service delivery come from three areas: households, productive activity, and the environment—each with its distinct rationale and challenges in the Mexican context.

- Household needs for water follow an equity rationale—access for everyone. Mexico has done well in getting at least minimal access for almost everyone, but the quality of service, especially to the poor, is usually well below the OECD average, and the quality of delivered water is often not in compliance with the Mexican drinking water standards. In many cases, the poor end up paying more than the non-poor for small volumes of water; beyond this, only some cities in Mexico (such as Monterrey, Tijuana and Leon) have achieved full cost recovery, but most have not.

- The demand for water for productive activity and economic development follows an efficiency rationale. An ideal system would distribute water to equalize its marginal economic value across productive activities, which would also have approximate maximization of job creation. In practice, low-value uses of water take a lot, even in water scarce areas, while water is expensive or rationed to other uses with high value and high employment per unit of water. Within industry and commerce, the fees and tariffs are high enough to move water allocation toward this goal but, looking economy-wide and especially with respect to agriculture, where consumption is subsidized and tariffs are very low, Mexico is far from the efficient frontier. Agriculture should and always will get substantial amounts of water, but the heavy usage in low-value crops in water scarce areas is inefficient, given the alternate needs. Currently, the only moves toward rectifying the inter-sectoral imbalances are in the marketing of water rights in scarce areas; so far this is only at a small margin of the water economy.

- Environmental demands for water are based on protecting Mexico's national patrimony of healthy and diverse ecosystems, and groundwater reservoirs. But the ecosystem does not pay a tariff or receive a defined allocation; it gets the water left behind by households and productive sectors and their return flows of water after use. The Mexican water law does include the environment as a water user, but there is little practical experience in this regard, and public policy has only just begun to address this issue directly.

Overall expenditure in the water sector approached MxP40 billion in 2004, or 0.5 percent of GDP. Of this amount, the public sector spends over MxP33 billion, which is close to 2.5 percent of Mexico's budget[1] and the private sector about MxP 4 billion. A significant share of resources spent in the sector, including both investment and recurrent expenditures, come directly or indirectly from water users. The biggest single spender is the National Water Commission (*Comisión Nacional del Agua* -CONAGUA), with about 30 percent of total expenditures in the water sector. CONAGUA's influence in the water sector is even larger, as its programs leverage additional financial resources through cost sharing arrangements from states, municipalities and water users.

About half of CONAGUA resources are spent on water supply and sanitation infrastructure, a quarter in the irrigation sub-sector and another quarter on central administration and overall water resources management, including flood control. CONAGUA fiscal resources totaled MxP13.5 billion in 2004. About 60 percent of this came from fees and charges recovered from water users and polluters (channeled through SHCP), and the balance, 40 per cent, came from the general federal tax resources (below 0.1 per cent of GDP). In other words, the general budget pays for all of the CONAGUA central administration and water resource management and pays for part of the spending executed in the various water regions. About four -fifths of CONAGUA's total regional spending (and transfers to local entities), which is mostly investment, is covered by water-use fees. This nation-wide average, however, covers wide variation and cross

[1] This estimate is based upon information from CNA, several state governments, surveys of municipal mayors, and a study by INEGI in 1999.

subsidies across regions. Some water regions collect more than they receive from CONAGUA, like Lerma-Santiago-Pacifico, Rio Bravo, Cuencas Centrales del Norte, and Golfo-Centro, while others receive more than they collect, like Baja California, Pacifico Norte, and Valle de Mexico.

The biggest problems in Mexico's water sector are the over-exploitation and quality degradation of water resources, low quality service and gaps in coverage of water supply and sanitation for low-income households, the excess use of water by irrigation in areas of scarcity and for low-value crops, and the inadequate proportioning of spending between investment and operation and maintenance (O&M).

Water supply and sanitation service (WSS) is primarily a municipal issue, although federal, state, and eventually basin-level policy also plays a role. Municipalities compete with other users for scarce water resources, and untreated urban wastewater is a major source of pollution to the nation's water bodies. Mexico's key WSS challenges lie in improving the quality and operating efficiency of services, including better wastewater collection and treatment and increasing access to the poor in rural and peri-urban areas. The WSS sub-sector falls short of generating sufficient revenues to cover full costs and is the primary beneficiary of federal and state investment subsidies within the water sector. There is, however, substantial scope to increase WSS self-financing through reduced operating and investment costs, improved billing and collection and tariff increases.

> ***In order to reach the universal coverage for WSS and improve the quality of services, including better wastewater collection and treatment, Mexico needs to invest more and better. The "net" public transfer to the sector may not need to be increased, as there is substantial scope to increase cost recovery and future investment needs are in line with recent investment levels. The highest priority would be to use existing funding more efficiently, by reducing unit costs and focusing more on rehabilitation and maintenance of the systems. Any new additional funds should be used to facilitate access of the poor to the service, extend coverage in small localities and increase wastewater treatment. Given Mexico's presently high unit costs for connecting and serving households, the level of resources and timing required to meet the social goals of universal coverage depend on improving the efficiency of the use of funds and the delivery mechanism for those resources. Moreover, delivering service to the poor need not be costly, and relaxing technical norms governing choice of technology have proven their worth in other countries (for example, using condominial systems).***
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> ***To get municipal WSS investments to focus on the needs of the poor and to improve sustainability, it would help to generalize the practice of a few states that set rules for municipal allocation of the social investment fund in Ramo 33(FAIS) funds. For instance the state of Puebla allows a municipality to use FAIS to finance investments in the municipal seat only if WSS coverage is virtually complete in the rural communities. A similar approach could foster efficiency and improve the quality of service delivery, and wastewater treatment.***

Irrigation. The main challenge facing the agriculture sector is *to increase its competitiveness* in the context of the 15-year phase out of tariffs and quotas (ending in 2008) with the USA and Canada and the multiplication of Free Trade Agreements between the USA and regional competitors, which erodes Mexico's preferential treatment, while preventing the degradation of natural resources (especially water) and reducing rural poverty. In this context, *improving the performance of irrigated agriculture and water resources management is critical*, as (a) irrigation is the main source of agricultural exports and agricultural jobs; (b) irrigated agriculture, including the production of high value crops for exports, relies on unsustainable use of water resources and (c) the scope to improve irrigated agriculture (land, labor and water) productivity is high. Some of the policy interventions to support the competitiveness of agricultural production in the context of trade liberalization have fostered the degradation of water resources. Conversely, the degradation of water resources constrains the competitiveness of the Mexican agriculture and indeed, of the rest of the economy.

Irrigation has received subsidized tax-financed investment, low water tariffs, zero water use fee (in accordance with the Federal Rights Law), a low subsidized electricity price for pumping, and import restrictions and duties on agricultural products. This has gone on for a long time and led to the heavy use of water for low value crops in areas of water scarcity. The distortions of the water subsidy have become incorporated into the value of land, other agricultural investments, and the corporatist political representation. Where water is drawn from wells, as in the drier regions, the effective price includes equipment and electricity for pumping, but a heavy subsidy for electricity to agriculture significantly reduces this potential incentive for conservation. One study[2] estimates that eliminating the electricity subsidy would reduce overexploitation of groundwater resources by about 20 per cent in water-scarce areas. Thus, farmers irrigate low-value crops like wheat, corn, sorghum and alfalfa, while much higher value uses in agriculture and industry face water shortages. Indeed, most of the high-value crops produced for exports, which provided most of the dynamism in crop production in recent years, rely on unsustainable groundwater abstraction. The high water demand of the agricultural sector in the northern part of the country puts pressure on the expansion of the industry and service sectors.

While the level of financial self-sufficiency has substantially increased in irrigation since the 90's through the transfer of most O&M responsibilities to farmers and the introduction of cost-sharing arrangements for investments, irrigation still falls short of generating sufficient revenues to cover O&M costs, making the sustainability of irrigation infrastructure dependant on continued government subsidies.

> ***To immediately end "subsidies" and other support measures encouraging water abstraction is politically difficult. Thus, it will be important to have a plan to reorient the subsidies toward incentives to reduce water consumption to sustainable levels while ensuring that the poor receive a significant portion of the benefits.***

[2] Agriculture Demand for Groundwater in Mexico, Background Paper prepared for the economic assessment of policy interventions in the water sector, World Bank, 2006.

The price of water is one of the many policies that the government controls to cope with the problem of water scarcity. However, inadequate water pricing has not promoted water use efficiency, but rather boosted water demand and fostered the over-exploitation of water resources. It is recommended to : (a) reduce, eliminate or decouple the energy subsidy to the use of electricity, increasing energy prices and returning an equivalent amount in cash or other compensation to the poor farmers; (b) increase water tariffs in irrigation districts (IDs) to the full cost of operation and maintenance and include in the tariff a small water use fee for irrigation, starting in the irrigation districts IDs that suffer the most from water resources scarcity and (c) generalize measurement and volumetric water charging.

Investments in rehabilitation and modernization of existing irrigation systems in water-scarce areas for the continued production of low-value crops need to be carefully analyzed, and will often not be economically justified, except for very low-cost systems, especially when taking into account agricultural market conditions and the costs of depleting the water resources. Large existing surface water irrigation systems, such as those of the IDs, have considerable sunk costs and low O&M costs, which make them the most likely to be able to continue to compete in the production of low-value crops after 2008.

Some low-cost modernization investments may be justified in IDs for surface water irrigation of low-value crops. Because of the high social costs and other risks that could result from the abandonment of these large irrigation areas due to non-competitiveness of low-value crop production after 2008, there is an urgent need for CONAGUA and SAGARPA to carefully analyze how costs can be minimized and yields maximized in these areas. A careful analysis of permissible subsidies that could be directed towards sustaining these irrigation systems and agricultural production in these areas is also urgently needed.

Farmers in water scarce areas with groundwater overexploitation problems will need to shift their practices to less water-consumptive activities (such as grazing, rainfed agriculture or intensive irrigation of high-value crops in smaller areas) which will require investment and training. The amount of water used in low-value agriculture will need to be greatly reduced in groundwater overexploitation areas, moving towards higher-value agriculture on smaller modernized irrigation areas and towards other higher-value economic uses. This should increase the total value added and employment in rural areas, with poverty-reducing effects.

Investments in improving and expanding rainfed and low-cost supplemental irrigated agriculture in more humid areas should receive more emphasis, because of the lower costs, availability of water, and potential benefits to poor farmers.

These changes would need to be agreed through consensus-building efforts and reflected in enforceable water rights adjustments, especially in areas of common landholding (ejidos).

Improving the efficiency of existing irrigation systems on existing lands will not by itself solve the systemic problem of water scarcity, because these local efficiency improvements eliminate infiltration and operational "losses" that replenish water resources of the area. Rather than saving water, efficiency improvements in this way can increase water consumption. Efficiency improvements should still be undertaken, but they should take into account the need to reduce the **net** extraction of water, if resources are already overexploited.

Making water rights marketable. There is a water rights registry in Mexico that covers 95 per cent of all water users, which is an impressive accomplishment. Eventually it could help address the water use efficiency problem, letting the market rather than government fees push up the perceived marginal value and allowing a farmer to capture the capital value of his water allocation. The amount of the water rights greatly exceeds sustainable levels in water scarce areas, however, and in addition, there are still a number of errors in the records, and there is little effective enforcement.

Making the system work will require cleaning up records; reducing the registered water allocations to be consistent with the actual amount of water available; implementing a complete administrative system to measure and control water usage; and setting up transparent market-clearing and enforcement mechanisms. Regulations should make sure that water rights relate to the net (consumptive) water use and not the gross water extraction. This will ensure that improvements in efficiency (such as leakage reductions) do not result in higher depletions.

Water quality. With 94 per cent of Mexico's water bodies polluted, the economic cost of water pollution was estimated at US$6 billion a year. This is mainly explained by the inadequate treatment of industrial and municipal wastewater.

Addressing the water pollution problems will require increasing investment and recurrent spending in wastewater collection and treatment. The water pollution penalty charge, if properly enforced, could provide an incentive as well as a financial mechanism to support much needed investments in this neglecting sector.

Investment bias. The allocation of funds at all levels is biased towards investments with inadequate funding of operation and maintenance. Emergency spending after disasters (sometimes resulting from inadequate maintenance) usually get priority over preventive measures, which are more cost effective. There are strong political reasons for these biases, so ***strong norms with some central enforcement are needed to ensure an adequate funding mix.***

The relationships between water demands and policies vary widely, depending on the local mix of urbanization, agriculture and industry, as well as income levels and water availability. This creates numerous complex systems within a large diverse country like Mexico. At the national level it is difficult to achieve the necessary coordination across the sub-sectors of water.

> ***Thus, more local coordination is needed, and international experience from countries such as Spain, France, Australia, Indonesia, and Canada indicate that integrated water resources management and planning works best at the level of the river basin or aquifer.***

Options for Reforming Mexico's Water-Sector Institutions

Public institutions have legal and historical contexts that demand respect. Therefore, in Mexico the existing organization of CONAGUA and the current legal framework are the key starting points for any institutional change.

The current legal framework for water calls for the creation of Basin Agencies – BAs — that would be deconcentrated parts of CONAGUA (descended from CONAGUA's present Regional Offices - *Gerencias Regionales*). It also calls for Basin Councils – BCs to bring representatives of BAs into discussion and agreement with other stakeholders.

CONAGUA, especially at the central level has many experienced and technically sophisticated staff, who can function in a variety of institutional settings. In recent years, the technical capacity in CONAGUA's regional offices has declined; most of the best people are now in the central offices. To accomplish the deconcentration envisioned in the law, some of the managers and technical specialists at the central level could fill positions in the regional offices as they are converted to BAs. This could help reduce the over-staffing and the resistance of the central offices to the deconcentration. Local stakeholders already have some valuable organizational capital. Furthermore, many municipal water companies, irrigation districts, and state water agencies have strong staff and technical capacities. In addition, there are a number of active Basin Councils – BCs (*Consejos de Cuenca*) and Aquifer Committees (Comités Técnicos de Aguas Subterráneas – COTAS) that are beginning to play active, important roles in WRM.

As all water uses (including the environment) share the same limited water resources within a basin, the river basin is the most appropriate unit for these activities. It is therefore within the context of river basin level planning that the water use and financial trade offs need to be evaluated and prioritized with the participation of all stakeholders.

Although there has been some good basin-level water resources planning in Mexico, there is a disconnect between this planning and the annual budgeting and programming process. Different programs (e.g. irrigation, water supply and sanitation) are managed at the central level and implemented in accordance with operating rules that are not adequately related to the basin planning activities. The NWL calls for the development of ***Integrated Water Resource Management Plans (IWRM***). The starting point for IWRM Plans is a determination of the amount and quality of water that is required to

meet environmental sustainability needs and then determine the amount and quality of water that is available for consumptive uses of water (irrigation, municipal use, and industrial use), giving priority to domestic use. In areas where there is presently overexploitation of water resources and poor quality water this will require reducing net extractions of water (i.e. evapotranspiration) for these uses to sustainable levels and improving water quality as determined through the water balance and water quality analyses. In addition to the objective of achieving sustainable water resources management, the IWRM Plans need to support economic development ensuring adequate water resources for high-value growth needs; and ensure that benefits are equitably shared and in particular that the poor benefit and are not negatively impacted.

One option towards improving water resources planning and management in the spirit of Mexico's legal framework would be for ***technical and financial planning (IWRM plans) and annual budgeting and programming to start at the river basin level under the leadership of the BAs and with the participation through the BCs of other federal entities, the states and municipalities, the water users and other stakeholders. The BAs would decide on the amount and destination of funds and would then submit their budget proposals (including revenues and expenditures), generated under clear rules established by CONAGUA central and / or SCHP, to CONAGUA central who would consolidate them and then incorporate them into the budget approval process.***

Making water resources management and the operation of the basin institutions effective would require a phased approach. Eventually the BAs would take-over the decision-making for budgeting and planning for virtually all the revenue and spending for their respective basins. Since the NWL provides for BAs to do integrated water management, planning and budgeting, this would not require legal devolution from CONAGUA, only reassignment within the organization and non-binding responsiveness to local interests—via BCs.

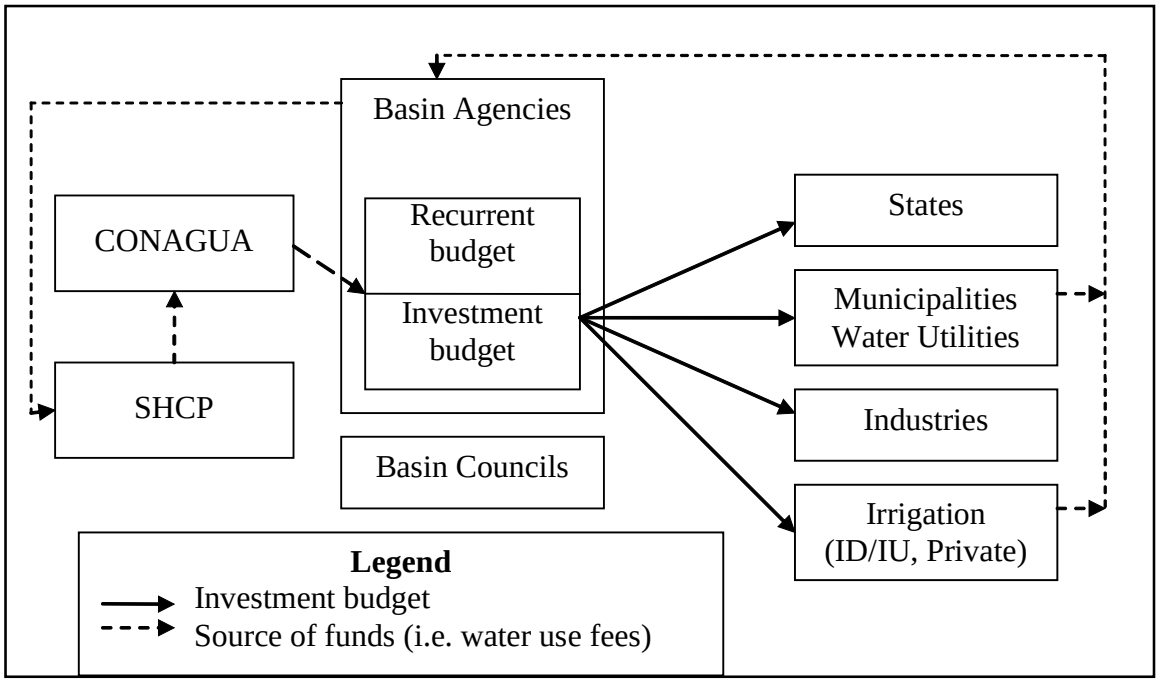
CONAGUA would remain in charge of federal water sector spending and would retain a large influence over what the local governments do in the sector, but, the regional (basin) branches of CONAGUA, rather than the sectoral departments at the central level, would make the major decisions based on strong input and consensus within the BCs. In addition, CONAGUA's budget would then not be divided sectorally, and distributed geographically across Mexico via sectoral programs. Under this proposed deconcentration arrangement, CONAGUA at the central level would mainly provide technical advice, guidelines and supervision for the planning and budgeting processes. The allocations to the basins would primarily be based on the amounts of water fees collected in their areas (from all users) and second, on a compensation formula for basins with high poverty and low revenue bases.

Within the basins, through decentralization, states, municipalities and irrigation districts/units through water user organizations would take on most of the investment and operating responsibilities for water related infrastructure. Most of the federal funding for investments would be assigned for transfer to these entities, who would then be responsible for implementation of the investments. The federal transfers for a basin would be a single allocation bringing together funds that currently originate from several

disparate federal programs. BAs would present indicative plans for future years to assure a sustainable program, with corresponding water budgets (non-binding) for the states and municipalities, to reflect coordination horizontally. These federal transfers could be channeled and administered through the basin agencies budgets or through basin-level Trust Funds (*fideicomisos*), which have a strong history as effective institutional arrangements in Mexico.

Under the first option, the budget of every basin agency would include resources to cover the basin agency current and capital expenditures as well as the federal investment subsidies transferred to states, municipalities, irrigation districts and irrigation units within the basin, for activities that they would be responsible for implementing in accordance with the annual basin action plan. The annual budget of the basin agency would be based on the annual action plan that would be derived from the 10-year rolling IWRM plans for the basin. The figure below depicts the proposed arrangements to channel and administer the federal resources transferred through CONAGUA to support the implementation of the IWRM plans.

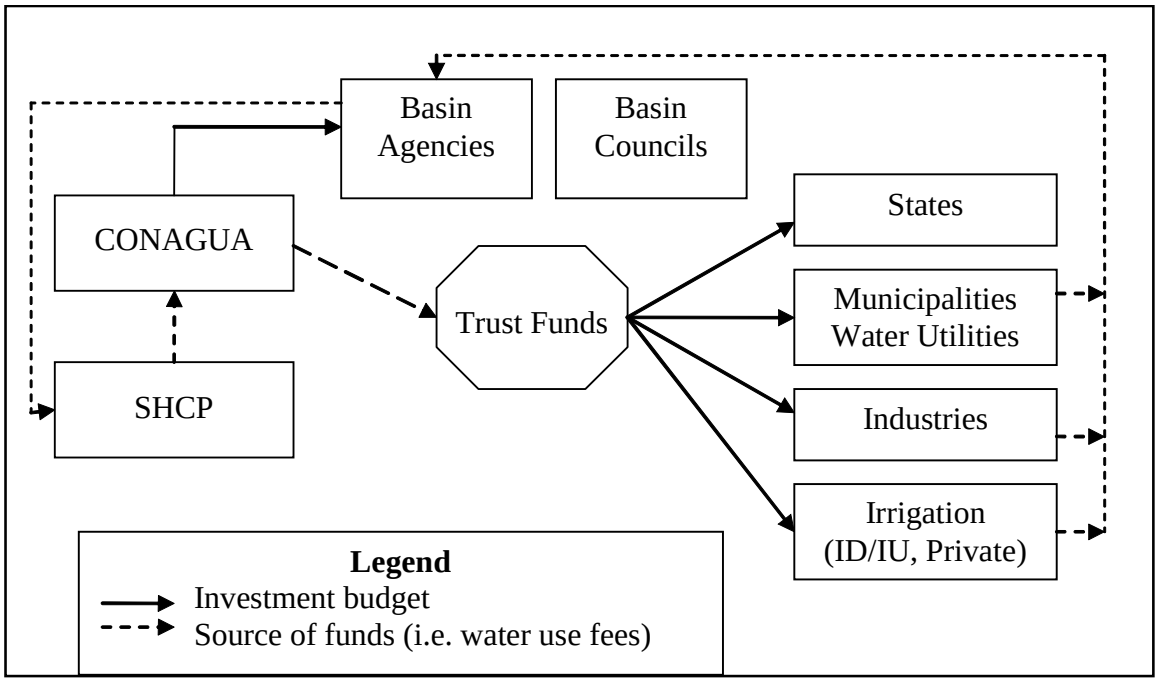
Proposed flows of investment funds – Basin agency budget option



Under the second option, a Water Valuation Trust Fund (*Fidecomisos de Valoración del Agua* - FIVAGUA) would be set-up in each basin to channel and administer the financial resources from the federal budget and, possibly other sources, to support the implementation of the investments foreseen in the basin/aquifer IWRM plans. CONAGUA would thus channel funding for IWRM-based investment programs and actions to basin-level trust funds which would then send funds to Municipalities, States, and Irrigation Districts and Units. Trust Funds would not cover current expenditures. CONAGUA would still transfer directly (i.e. not through Trust Funds) to each Basin agency financial resources to cover expenses related to its daily operational purposes and small investment expenditures for which BAs are responsible. The figure below depicts

the proposed arrangements to channel and administer the investment resources from the various sources to support the implementation of the IWRM plans.

Proposed flows of investment funds – Trust Fund option



The decisions relating to setting water fee and water tariff rates may remain centralized in the initial stages of the reform process, but relatively soon the BAs should also be responsible for decision about pricing, because they are well-placed in terms of understanding local interests and linking the revenue-pricing decisions with the spending decisions.

Moving forward this decentralization/deconcentration approach would require greater accountability and better information on performance outcomes. CONAGUA at the central level would play an important oversight role to ensure sound basin and aquifer-level planning, programming, implementation, operation and maintenance and monitoring and evaluation. Better performance tracking and information disclosure would also be required.

Financing the IWRM plans. The ideal that 'Water Pays for Water' (full cost recovery), envisioned in the water law, is still a way from realization at both the basin and the national levels. Mexico has in place a system of charging and collecting water use fees, bulk water charges and pollution penalty charges that generates a large amount of financial resources that can be used for investments and other actions to improve WRM. Fee collections in about half of the basins are sufficient to cover capital expenditures. In the northwestern states, there is a substantial deficit, because of large investments in irrigation, but the strength of industry and commerce, the potential for implementing a small agriculture water use fee, and a better enforcement of the pollution penalty charge

could substantially increase revenues in these areas. Poor states of the south have more modest deficits, which could be covered in part with general taxes.

The basic principles for the scenarios presented in Chapter 3 for budgeting and expenditures are that : (1) ***all fiscal revenues from water use fees, bulk water charges and pollution penalty charges would be returned to the basins*** to finance programs and actions as defined in the basins' integrated water resource management plan, and thereby provide incentives for increasing collections and rationalizing collections with expenditures; (2) ***CONAGUA central's budget would be reduced and more resources would be provided to the basins*** to support deconcentration and decentralization; (3) ***responsibility for setting water use fees and pollution penalty charges and for planning investment and management programs would be transferred in a phased manner to the Basin Agencies/Basin Councils***, who should in turn explore increases in water user fee rates in order to provide incentives for water conservation and sufficient resources for the planned water resources management and investments actions; and (4) ***relatively rich regions would eventually finance all their water related expenditures from their own fee collection***; poor regions with large investment needs and small potential for increasing fee collections would still get some subsidies from the national tax resources.

In order to move toward the goal of "water pays for water", as envisioned in the water law and to align the financing with deconcentration to BAs and decentralization to states, municipalities and irrigation districts/units: ***(a) collections and some prices need to be increased, especially in the northern and central areas***[3] ***and (b) rules would need to specify the amount of general federal tax resources that would be allocated for: (i) CONAGUA at the central level and (ii) to basins (with high poverty) that lack the potential to cover their own costs*** (Basins that simply fail to collect the water fees would not be subsidized).

Phased approach to water sector reform in Mexico. ***In implementing the proposed reform, it would be best to start with some pilot areas, and then expand to other locations, learning from experience***. International experience suggests that the first pilots should include the basins with strong technical capacity, local interest in basin-wide issues (like water scarcity), democratic tradition, and fiscal revenues that closely match expenditures (in order to avoid a large fiscal shock to the national water budget). Since the current distribution of fiscal resources presumably differs from the desired formulas for taxes and subsidies, transition rules would need to factor in the time needed to address any imbalances, while maintaining adequate incentives throughout the transition process.

The proposals and recommendations presented in this document are in line with Mexican government policies and approaches that have been developed over many years, and are now reflected in the current legal framework. The time is right to move to the next logical step in this process, which is to deconcentrate and decentralize most planning, programming, investment and operational responsibilities to basin organizations, state and municipal governments, and irrigation districts/units. Although many technical and

[3] Article 14 BIS 5 XV

institutional pieces are in place to support this reform, it will not be easy. A roadmap needs to be developed and agreed with detailed steps, responsibilities and timeframes. The World Bank stands ready to enter into a dialog and provide assistance to Mexican counterparts throughout this process, as it has in the past.

1. An Overview of the water sector

o Water resources management (WRM) is one of Mexico's most urgent environmental and resource problems, and one that imposes heavy costs on the economy. The population has quadrupled from 25 million in 1950 to over 106 million in June 2005. Whereas growth has occurred nationwide, it has been greater in the semi-arid and arid north, northwest, and central regions, which are precisely the regions with greater economic activity and where water is scarce. The resulting increased demand for water, combined with more intensive use of water (stimulated in part by price distortions and relatively weak monitoring and enforcement arrangements), has led to the overexploitation and contamination of freshwater resources and insufficient water availability to support ecosystem. Water is rapidly becoming a serious constraint to growth in many areas. The present situation is clearly not sustainable in the medium and long term. If not addressed soon, this situation will become an obstacle to continued economic development and will have serious social impacts including the possible abandonment of important parts of the country by significant parts of the population. The following section gives a brief overview of the institutional framework and of the 2004 amendment of the national water law. It also describes the current status of the water sector in Mexico, including a number of the most pressing challenges facing the water sector and the main instruments used to address them. It then proposes some elements for a better management of water resources.

INSTITUTIONAL AND LEGAL FRAMEWORK

o Three groups of institutions have been assigned the main responsibilities in the sector: (a) the National Water Commission (*Comision Nacional del Agua* - CONAGUA) at the federal level, (b) the States through the Water Commissions (*Comisiones Estatales de Agua* - CEAs), and (c) at the local level, the municipalities and water utilities (*organismos operadores* - OOs), as well as the Irrigation Districts and Units.

Water Resources Management

o CONAGUA is the apex institution of the water sector. CONAGUA is formally under the authority of the Ministry of Environment and Natural Resources (*Secretaría del Medio Ambiente y Recursos Naturales*, SEMARNAT), but enjoys considerable de facto autonomy. Created in 1989, it now has 17,000 employees, most of who work in the agency's 13 regional offices and 32 state offices. CONAGUA is the sole federal authority responsible for WRM, including water policy, water rights administration, planning, irrigation and drainage development, water supply and sanitation, and emergency and disaster management (prevention and response) particularly with respect to flooding. CONAGUA plays a key role in administering the

financial flows of the overall sector, including for WRM, irrigation, and water supply and sanitation.

- In the mid-1990s, CONAGUA was reorganized to include 13 Regional Offices with hydrologic boundaries based on river basins. In this document these are referred to as "hydrographic regions" or more generally as "basins". Each hydrographic region contains one or more basins. This reorganization laid the groundwork for deconcentration and decentralization of WRM. The 13 hydrographic regions that will have Basin Agencies established are:

I. Península de Baja California
II. Noroeste
III. Pacífico Norte
IV. Balsas
V. Pacífico Sur
VI. Río Bravo
VII. Cuencas Centrales del Norte
VIII. Lerma-Santiago-Pacífico
IX. Golfo Norte
X. Golfo Centro
XI. Frontera Sur
XII. Península de Yucatán
XIII. Aguas del Valle de México y Sistema Cutzamala

- The 13 hydrographic regions all face challenges related to both surface and groundwater considering water quantity, water quality, and flood and drought management. The northern and central regions have overexploitation problems and face high competition for scarce water resources. The Península de Yucatán region is unique in that it has almost no surface water, but large relatively undertapped groundwater resources. All regions have some water quality problems, but in heavily industrialized regions including: Valle de México, Lerma-Santiago-Pacífico, and Península de Baja California the problems are more serious. Flooding is a problem in all regions caused by intense rainfall and tropical cyclone activity. Paradoxically the hurricanes that occasionally hit northern regions can cause a lot of damage, but also are an important source of water to fill reservoirs and recharge aquifers. Northern water scarce regions have the added complication of experiencing periodic droughts that are sometimes severe and prolonged.

- Almost all states have created State Water Commissions (*Comisión Estatal de Agua* - CEA) or similar entity. The CEAs are autonomous entities that usually are under the authority of the State Ministry of Public Works. Their attributions differ widely among states. They all have some authority and responsibility in WRM. Some also have responsibilities in irrigation and in the provision of water supply and sanitation services, such as technical assistance to municipalities and irrigation districts and units, monitoring of the performance of service providers, operation of water distribution systems and bulk water supply.

Water supply and Sanitation

o A variety of institutional arrangements for WSS service provision can be found. Most large cities and some smaller towns have created decentralized municipal service providers (*organismos operadores*) with varying degrees of independence. In most smaller municipalities, WSS services are performed directly by a municipal department. In rural areas, water services are provided directly by local governments or by users associations. In some cases, the CEA provides services in rural areas at the request of villages or municipalities.

o Despite the important and increasing role of the actors at the state and local level in the WSS sub-sector, CONAGUA remains the sector's dominant player in terms of policies, subsidies programs and norms.

Irrigation and drainage

o In Mexico, there are three main types of irrigation systems: the irrigation districts, the irrigation units and small private irrigation schemes. Despite an increasing role of farmers, CONAGUA remains the sector's dominant player in terms of policies, subsidies programs and norms.

- The Irrigation Districts, covering 3.4 million ha (or 53 per cent of the irrigated area), are large-scale public irrigation schemes supplied mainly with surface water. The responsibility for their operation and maintenance has been transferred to water users associations (*Asociaciones Civiles de Usuarios - WUAs*) in the 90's, except for 5 per cent of the area that is still operated by CONAGUA as well as some of the upstream infrastructure such as dams and large canals. Most investments are partially financed by CONAGUA and undertaken by the WUAs. Other investments are implemented directly by CONAGUA with 100 per cent financing.

- The Irrigation Units, covering about 2 million ha (or 32 per cent of the irrigated area), are smaller public irrigation schemes, supplied from both surface and groundwater (mainly groundwater) and operated and maintained from their inception by farmers. Most investments are partially financed by CONAGUA and either implemented by CONAGUA, by State agencies or by WUAs.

- Small private irrigation schemes, covering about 0.9 million ha (15 per cent of the irrigation area) are supplied primarily from groundwater. Farmers directly carry out investment and operation and maintenance.

o In the 1990's most of the irrigation districts were transferred to WUAs. Along with the transfer program, the government, supported by the World Bank and the Interamerican Development Bank invested in rehabilitation and improvements to irrigation and drainage systems and in operation and maintenance equipment that was transferred to the WUAs along with the systems. This has resulted in some improvements in operation and maintenance and fewer conflicts between water users. The biggest positive result is that cost recovery for operation and maintenance has

increased from about 20 per cent of the O&M costs to about 72 per cent. Funds collected from water users through tariffs are retained by the WUAs and used to pay irrigation district personnel and materials to carry out the O&M functions. A portion of the water tariff collected by the WUAs is also used to pay CONAGUA for bulk water deliveries from large hydraulic infrastructure that was not transferred to the WUAs. Presently the federal government continues to provide subsidized resources in the amount of 50% of the costs for rehabilitation and modernization of the irrigation and drainage systems within the transferred irrigation districts. The other 50 per cent of the costs is paid by water users and state governments.

- Irrigation units are normally operated and maintained by water users. Irrigation units also receive subsidized resources for rehabilitation and modernization of the irrigation systems in the amount of 50 per cent of the costs. The other 50 per cent of the costs is paid by water users and state governments.

- Despite the fact that irrigation systems are in general operated and maintained by water users, they are still very dependent upon the government to provide continued funding for system improvements and training. The autonomy remains limited.

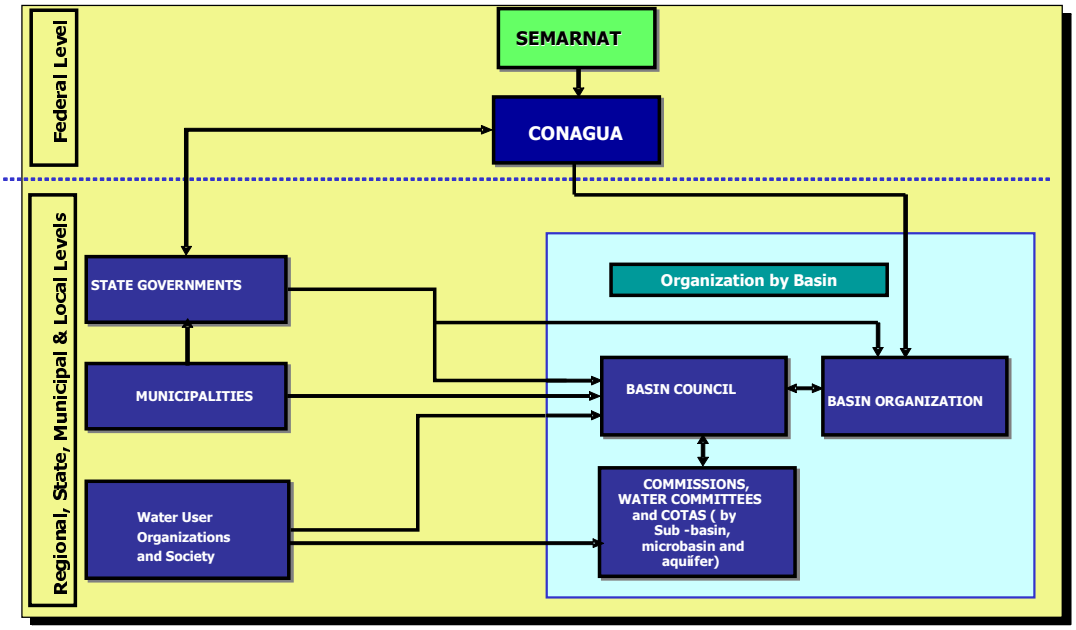
The 2004 National Water Law and the new institutional framework for WRM

- The basic philosophy underpinning the 2004 amended National Water Law (NWL) is to transfer operational and executive responsibilities from centralized CONAGUA departments to deconcentrated and decentralized entities. Eventually, CONAGUA's central-level activities would be limited to the administration of the NWL and to normative and regulatory activities. However, moving forward with the deconcentration and decentralization process will require a significant change in the institutional arrangements, as well as improvement of the sector information system and development of the sector's human resources capacity.

- The 2004 amended NWL mandates a restructuring of key functions of CONAGUA through the transfer of responsibilities from the central level to subnational entities: the Basin Agencies (*organismos de cuenca* - BA) and Basin Councils (*consejos de cuenca* - BC) that are expected to play an increasing role in the sector. Figure 1.1 depicts the institutional structures in the water sector, as called for in the NWL. How they will operate and interact remains to be specified in regulations. Chapter 3 proposes some options for this, particularly in terms of managing the federal budget for water.

- The BAs will be developed from the 13 existing Regional Offices of CONAGUA and will have much greater responsibility. There are a total of 25 BCs that have been established with the same basin boundaries as the BAs, but in some cases with two or more within the area of one BA. Some states are located entirely within the area of one BC. In other cases, one state is divided between two or more BCs. In the later case, the state participates in all of the BCs within its territory.

Figure 1.1 Institutional Arrangements by Basin or Hydrographic Region



o The BAs were conceived to be specialized units of CONAGUA with technical and administrative autonomy to exercise the functions assigned to them by law. The degree of independence vested in BAs within their designated basins grants them sufficient autonomy in managing the assets and resources allocated to them by CONAGUA.[4] The BAs will be headed by a Director General, appointed by CONAGUA central and an Advisory Council *(Consejo Consultivo)*. Each State would have a representative of the Municipal Presidents in the Advisory Council. The BA Director General would serve as the Technical Secretary of the Advisory Council. The Advisory Council would also have a designated representative from among the user representatives in the basin or from the BC(s) in the hydrographic region. This user representative would have a voice but not a vote.

o Under the new legal framework the BAs are responsible for formulating regional policy, designing programs to implement such policies, conducting studies to estimate the value of the financial resources generated within their boundaries (water use fees), recommending specific rates for water user fees as a result of those studies and finally operating the necessary mechanisms for collection of water use fees. All these functions are meant to be exercised with technical and administrative autonomy. BAs do not enjoy fiscal autonomy nor are they decentralized agencies (a status that would have allowed them to design and put in place their own measures to obtain resources and finance their activities without being subject to the federal budget planned by Ministry of

[4] 2004 National Water Law, Article 12BIS 1 (last paragraph)

Finance and Public Credit (*Secretaría de Hacienda and Crédito Público* - SHCP*).* However, the BAs have been vested with enough power to collect information, analyze it and propose priorities, how these priorities should be addressed, and estimate the resources likely to be originated within their own hydrographic regions. It appears that each BA would be best positioned to propose the most efficient allocation of resources for its own hydrographic region.

o Basin Councils are expected to guide, together with CONAGUA, the BAs' work. However BCs' decisions are not binding upon the BAs. BCs and BAs are also expected to play a key role in the administration of the Water Financial System (*Sistema Financiero del Agua* - SFA) that was introduced through the 2004 NWL amendments.[5] Under this system, CONAGUA, BAs and other administrative service deliverers are to encourage users to pay the fees for the use of national waters (including those underground) for all purposes (including for the discharge of wastewaters) as established in the Federal Rights Law.

o In terms of funding decisions, CONAGUA allocates funds to the BAs and the rules for their management and reporting of their usage and application.[6] CONAGUA also coordinates and supervises the use of the fiscal resources for administration, charging, collection and other functions related to the water use fees.[7] Simultaneously, the Advisory Council (*Consejo Consultivo*) must propose the conditions for assuring the financial resources needed to implement the programs and actions to be conducted within the hydrographic region upon coordination with CONAGUA.[8] This provides considerable allowance for a bottom-up approach regarding the decision-making process subject to approval of both CONAGUA and the subsequent endorsement of SHCP. In this regard, it is an advantage that the Advisory Council of each BA has representatives of the main Executive Ministries (including *Hacienda y Crédito Público, Desarrollo Social, Energía, Economía, Medio Ambiente y Recursos Naturales, Salud, Agricultura Ganadería Desarrollo Rural, Pesca y Alimentación and the Comisión Nacional Forestal*), representatives of the Basin's States and Municipalities and CONAGUA.

Water Financing System

o The recent modifications to the NWL introduce the Water Financing System (*Sistema Financiero del Agua* - SFA)[9]. The SFA's purpose is to support integrated water resources management (IWRM) actions without compromising the continuity or strength of other financial mechanisms with similar purposes. The SFA is expected to clearly determine the different funding sources, forms of obtaining financial resources, spending guidelines, recovery of such spending, settling of accounts and management indicators, as well as goals resulting from the application of such financial

[5] The exact role of the basin level institutions in the SFA remains to be defined through the operating rules of the new system.
[6] Art. 12 BIS 5.
[7] Art. 12 BIS 6 XXI
[8] Art 12BIS 3 IV.
[9] Arts. 111 BIS, 112 and 112 BIS

resources and instruments. According to the 2004 reforms to the law, CONAGUA will create the instruments for the SFA under the supervision of the SHCP, through regulations that remain to be published. The Federal Executive branch will provide the means and adequate framework to define and implement the SFA.

o CONAGUA has an existing programming, budgeting and financial management system, including operating rules for the various sectoral programs. This existing system, although in many ways good, does not adequately support the decentralization and deconcentration envisaged in the 2004 amended NWL, including particularly the establishment of technically and administratively autonomous BAs. As discussed in Chapter 3, rather than having sectoral programs managed from CONAGUA center, there is a need to have programs developed for each hydrographic region based on integrated WRM plans that adequately balance water use with water availability and water quality, as well as take into account water valuation and competition between uses. CONAGUA's programming, budgeting and financial management system needs to be modified to support implementation of these regional programs. The SFA should be designed in this manner, and also take into account other sources of financing in order to comprehensively deal with the overall water agenda.

STATE OF THE WATER SECTOR AND WATER RESOURCES MANAGEMENT

o Mexico has a long and well established tradition in water resources development which started in the 30s when the country began investing heavily in water storage facilities and in groundwater development to expand irrigation to about 6 million hectares by 2000, and supply water to the rapidly expanding population which grew from around 25 million in 1950 to about 106 million in 2005.

o Mexico began to focus on water resources management (WRM) in the early 70s. In 1972, the Government of Mexico entered into a tripartite agreement with the World Bank and the United Nations Development Program to prepare the 1975 National Water Plan. The resultant Plan provided a basis for water development and management during the ensuing 25 years and has proved to have been valuable in outlining the general direction for these activities. The National Water Plan was farsighted and defined the needs for the construction of new infrastructure and for improvements in WRM. The National Water Plan identified the following needs in order to improve WRM: (a) the need to develop and enact a new National Water Law; (b) the need to establish a national water authority with responsibility for developing and implementing water policy and regulations within a new National Water Law; (c) the need to carry out integrated water resources planning and management; (d) the need to increase water use efficiency and to restore and improve water quality; (e) the need to improve coordination between different public and private entities involved in water use and management; (f) the need to decentralize responsibilities and promote water user participation in planning and management; (g) the need to introduce pricing and other economic incentives to induce efficient water use and pollution abatement; (h) the need to transfer operation and maintenance responsibilities in irrigation areas to water users; and (i) the need to development research and training programs to support institutional development and improved WRM. Based on this plan, the CONAGUA and the Mexican

Institute of Water Technology (IMTA) were established in 1988; the National Water Law (*Ley Nacional de Agua* – NWL) was promulgated in 1992 and modified in 2004; irrigation and drainage systems were transferred to water user associations and responsibilities related to municipal water systems were transferred to municipalities in the 1990s. Major progress has been made in items (a), (b), (h) and (i), and some progress has been made in items (c), (d), (e), (f) and (g).

- Much is left to be done. Achieving sustainable integrated WRM is a long-term difficult process. Developing countries have had little success in attaining this goal. In many aspects of WRM and use, Mexico is at the forefront of developing countries, and because of this was selected by the international water community to host the Fourth World Water Forum in 2006. The Bank's 2003 water strategy states: "…the world's most developed countries are a long way from integrated WRM, and progress has been slow and incremental. The goal of this strategy is not to dismiss the goal of integrated WRM, but to define practical, implementable and therefore sequenced and prioritized actions which can lead to that end." Mexico with the Bank's assistance has made major progress in laying the necessary groundwork to be able to move towards integrated WRM. Particularly important in this regard are: (a) the Mexican legal framework; (b) the water rights administration system and water use fee collection system; (c) improvements in water quantity and quality monitoring and assessment; (d) water resources planning; and (e) establishment of Basin Councils and auxiliary organizations.

State of the Water Sector

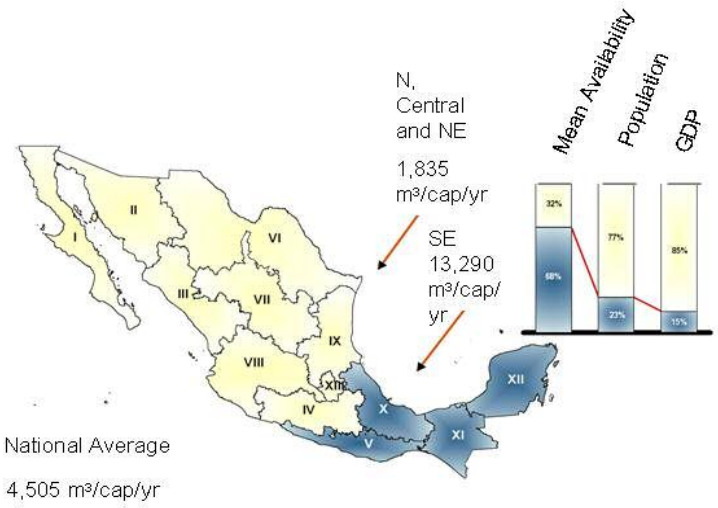
Increasing water scarcity, especially in the northern and central part of the country where most of the population lives and most of the economic activities are located.

- Mexico's average annual precipitation is estimated at 772 mm, equivalent to an annual volume of 1,528 km^3, from which a surface runoff of 394 km^3 is generated and aquifers are recharged at an average rate of 75 km^3 per year.

- As Mexico's population and economy have grown against a background of finite freshwater resources, the water availability by individuals has fallen dramatically. Annual water availability, about 17,400 m^3/hab in 1950, has fallen by about 75 per cent to about 4,550 m^3/capita today and is predicted to fall by another 15 per cent per cent to about 3,790 m^3/capita by 2025. Overall water use – domestic, industrial and agricultural – is estimated at 16 per cent of total water availability. These average figures mask important seasonal and spatial variations.

- Prolonged droughts are frequent with significant impact on agricultural production. Most importantly, the country's largest cities, industrial facilities and irrigated land are located in the central and northern part of the country, while most water resources are located in the South. Figure 1.2 shows the contrast between development and water availability.

Figure 1.2 Regional Contrast between development and water availability



o Consequently, surface runoff and groundwater recharge are increasingly insufficient to support the high growth rates of population and economic activities in those regions. This has resulted in the over-exploitation of water resources, mainly groundwater, and the planning and implementation of some schemes for transferring water among river basins.

Over-exploitation of freshwater resources

o Over-exploitation is particularly alarming in the case of groundwater. The number of overexploited aquifers has increased from 20 to 103 between 1970 and 2003 (Figure 1.4). Sixteen per cent of the aquifers are over-exploited. They supply 14 km^3/year (about half of the total groundwater abstraction) – 8 km^3/year from annual recharge and 6 km^3/year from storage accumulated during thousands of years.

o Uncontrolled and excessive abstractions including interference with other wells and springs (well pumping cost increase and yield reduction), but can also include quasi-irreversible aquifer degradation due to ingress of saline or polluted water or land subsidence and related impacts. Severe land subsidence can be seen in Mexico City, several cities in the states of Guanajuato and Aguascalientes. This has caused damages to urban infrastructure, including water and sewerage mains rupture. Sea water intrusion is occurring in aquifers located in coastal areas: over half of these aquifers (9 aquifers) are

located in the Baja California Peninsula and another 30 per cent (or 5 aquifer) in the Northwest Region (Table 1.1).

Table 1.1 Number of aquifers with salt water intrusion by Basin

N°	Region	Aquifers with Salt-Water Intrusion Total
I	Península de Baja California.	9
II	Noroeste.	5
III	Pacífico Norte	0
IV	Balsas.	0
V	Pacífico Sur.	0
VI	Río Bravo.	0
VII	Cuencas Centrales del Norte.	0
VIII	Lerma Santiago Pacífico.	1
IX	Golfo Norte.	0
X	Golfo Centro.	2
XI	Frontera Sur.	0
XII	Península de Yucatán.	0
XIII	Valle de México.	0

o Even more worrisome are the socioeconomic consequences, such as the need to abandon productive activities when the larger capital cost of completing wells of increasing depth and decreasing yield, and escalating recurrent cost associated with pumping from ever greater depth increase beyond economic feasibility. The position is likely to be far worse if unrestricted abstraction causes quasi-irreversible aquifer degradation, most notably of increases in salinity is involved. In this process the poor are the first to suffer and many immigrate to urban areas, other parts of Mexico or to other countries, mainly the USA.

o The challenge is compounded when one considers the increasing critical role groundwater plays in Mexico's economy and the supply of drinking water. Twenty-six km^3/year are abstracted from groundwater. Around 2 million ha (33 per cent of the irrigated area) are irrigated with groundwater, a significant part of which is dedicated to agricultural exports. Approximately 75 million people (three fourths of Mexico's population – 55 million in main urban centers and practically all rural dwellers) depend on groundwater as well as a large number of industries.

Box 1.1 Definition of freshwater over-exploitation

Groundwater over-exploitation can be defined in physical or economic terms. In *physical terms*, overexploitation of groundwater resources occurs when the average annual extraction exceeds the average annual recharge to the groundwater body. One can refine this by looking at the average annual **net** extraction (i.e. evapotranspiration) minus the average annual natural recharge. One can also define overexploitation of groundwater *in economic terms*—whereby the "overall cost of the negative impacts of groundwater exploitation exceed the net benefits of groundwater use."[10] The overall costs should not only include the costs associated with extracting and delivering the water (both investment and O & M & Replacement), but also the costs associated with depleting the resource. Part of the depletion cost is the present value of the increased costs related to having to dig deeper wells, install bigger pumps and use more energy as the water level goes down. There would also be a cost related to foregoing the opportunity to use the water in the future, which could be estimated as the present value of potential future benefits that could be derived from the use of the water. There are also water quality deterioration costs, and degradation of the environment costs. So, these overall costs could be very high.

Overexploitation of surface water occurs when there is insufficient surface water to meet environmental needs (lakes, wetlands, in-stream flows, coastal zone needs), e.g. Lake Chapala.[11]

- Table 1.2 shows the volume of overexploitation of aquifers, according to CONAGUA's Groundwater Management Office.

Table 1.2 Overexploited Aquifers in Mexico

Region	Recharge volume (Mm^3/year)	Overexploit. volume (Mm^3/year)	% of overexploitation
I	487.52	229.58	47.1
II	902.30	438.34	48.6
III	256.69	184.80	72.0
IV	241.41	132.05	54.7
VI	1,604.79	1077.67	67.2
VII	1,158.02	824.21	71.2
VIII	3,075.67	1,505.35	48.9
IX	663.32	73.32	11.1
XIII	597.17	106.31	17.8
TOTAL	**8,986.9**	**4,571.6**	**50.9**

Source: Asad & Garduño 2005: Table 9

- Surface waters are also over-exploited. In this case, over-exploitation occurs when there is not enough water to meet environmental needs (lakes, wetlands, in-stream flows, coastal zone needs), e.g. Lake Chapala. While there is no measurement of environmental water needs nationwide, the scope of surface over-exploitation is evident from the data showing over-allocation of freshwater resources in some river basins (see Table 1.3). This situation has caused serious social, political, and diplomatic conflicts, for example in the basins of the San Juan, Bravo, Fuerte, and San Lorenzo–Culiacán–Humaya–Mocorito Rivers.

[10] GW-MATE, Briefing Note 2, pp 4 -5.

[11] This definition is difficult to put in practice. South Africa is probably the developing country that has achieved the most in operationalizing the concept, thanks to a pragmatic National Water Act that provides for a simplified procedure when there is not enough information/financial resources/available time for a more scientifically reliable determination of the ecological reserve.

Table 1.3 Over-concession in selected irrigation districts supplied by surface water[12]

Storage	Average volume in concession entitlements (V_C)	Secure extraction volume (V_E)	Overconcession. $100*(V_C-V_E)/V_C$
	(Mm^3/year)	(Mm^3/year)	(%)
A. López Mateos Sanalona J. López Portillo Eustaquio Buelna	3,982.9	3,164.20	20.6
G. Díaz Ordaz	1,208.1	1,029.4	14.8
La Boquilla	1,076.5	826.8	23.2
Fco. I. Madero	245.8	216.5	11.9
Luis L. León	150.0	114.0	24.0
San Gabriel	105.1	74.6	29.0
Lázaro Cárdenas	976.7	915.0	6.3
Plutarco E. Calles	45.1	31.3	30.6
Constitution 1917	23.4	20.9	10.7
José T. Fabela	5.4	3.7	31.5
Tepuxtepec–Solís	800.1	745.7	6.8
Ignacio Allende	109.2	98.9	9.4
TOTALS	**8,728.3**	**7,241.0**	**17.0**

Shortages are compounded by pollution

o Untreated discharge of industrial effluents and municipal wastewater into rivers and lakes, solid waste deposits along river banks, uncontrolled seepage from unsanitary landfills and non-point pollution mainly from agriculture production – all these factors are degrading freshwater resources and imposing health risks, especially for children, the primary victims of water-borne diseases.

o Treatment of municipal and industrial wastewaters is generally inadequate. On a national level, only 35 percent of municipal wastewater and 15 percent of industrial wastewater are treated prior to discharge to water bodies. Treatment of municipal and industrial wastewaters is generally inadequate. CONAGUA estimates the economic cost of water pollution at US$6,000 million/year.

o According to the 2001 Water Quality Index, 94 percent of Mexico's water bodies are polluted. The problem is most serious in the Valle de Mexico region where 70 percent of the water bodies are highly polluted. Table 1.4 gives an assessment of the surface water quality for each basin. Figure 1.3 indicates the location of groundwater resources with higher than permissible levels of chemicals, such as contents that arsenic, fluorine, manganese, nitrates, nitrites, chrome, lead, sulfates and magnesium.

[12] VC is the annual volume stated in the concession entitlement and VE is the 'secure' annual volume that may be extracted from the dam, based on hydrological data. In many irrigation districts, VE is less than VC.

Table 1.4 Surface Water Quality per CONAGUA Administrative Region, 1998[13]

Region	Name	Not Contaminated %[1]	Acceptable %[1]	A Little Contaminated %[1]	Contaminated %[1]	Highly Contaminated %[1]	Toxins Present %[3]
		(100 - 85)[2]	(84 - 70)[2]	(69 - 50)[2]	(49 - 30)[2]	(29 - 0)[2]	NA
I	Península de Baja California	0	0	62	13	25	0
II	Noroeste	0	56	35	9	0	0
III	Pacífico Norte	0	11	75	14	0	0
IV	Balsas	22	18	50	6	0	4
V	Pacífico Sur	0	22	78	0	0	0
VI	Río Bravo	0	21	60	16	0	3
VII	Cuencas Centrales del Norte	0	25	75	0	0	0
VIII	Lerma Santiago Pacífico	0	12	52	31	5	0
IX	Golfo Norte	0	47	39	6	4	4
X	Golfo Centro	0	17	75	2	2	4
XI	Frontera Sur	4	11	71	14	0	0
XII	Península de Yucatán	0	40	60	0	0	0
XIII	Valle de México	0	0	18	64	18	0
	NATIONAL	**4**	**21**	**58**	**13**	**2**	**2**

[13] Programa Nacional Hidráulico 2001-2006. Diario Oficial de la Federación del 13/02/2002 as cited by Planeación y Proyectos de Ingeniería, SC (2003) for CONAGUA and the World Bank. "Evaluación Ambiental Estratégica del Proyecto" Proyecto de Apoyo a la Reforma del Sector de Agua y Saneamiento, Informe Final.

Figure 1.3 Groundwater resources with higher than permissible levels of chemicals

o As in other parts of the world, some water bodies in Mexico have naturally occurring high levels of arsenic. Long-term consumption of arsenic-contaminated waters can lead to changes in skin pigmentation and even skin, liver, lung and bladder cancers. A high percentage of the 650 identified aquifers are contaminated by arsenic and other toxic minerals. In overexploited aquifers, contamination tends to get worse over time as the groundwater reservoir is depleted. This poses problems when aquifers or waterbodies are used for drinking water supply. For example, concentrations of 0.09 to 0.59 mg/l of arsenic have been found in the drinking water of the Comarca Lagunera which supplies communities in the state of Coahuila and Durango. This is well beyond the maximum permissible limit of 0.05 mg/l.14

o Another chemical of significant concern found in Mexican drinking water supplies is fluorine. States with fluorine levels above the maximum permissible limit of 1.5 mg/l report skeletal and dental (fluorosis) problems in their general population. These include San Luis Potosi with a concentration of 1.6 to 4.6 mg/l, Aguascalientes at 1.5-9.0 mg/l and Durango again with 1.4 to 42.0 mg/l.

o Microbiological contamination of drinking water can include a variety of pathogenic intestinal bacteria, viruses and parasites whose presence is related to or causes illnesses. They can cause infections especially in those whose natural defenses are

[14] According to NOM-127-SSA1-1994. CONAGUA (2003) elaborated by Planeación y Proyectos de Ingeniería, SC. "Evaluación Ambiental Estratégica del Proyecto" Proyecto de Apoyo a la Reforma del Sector de Agua y Saneamiento, Informe Final.

already compromised such as the very young, the very old and hospitalized patients. The risk of dying from diarrhea in a rural area is five times greater than in urban areas.[15]

Too much water is used inefficiently

o Much of the water crisis is caused by the way water is used. Irrigation accounts today for 77 per cent of the country's water withdrawals, while commerce and industry account for 10 per cent and municipalities and domestic use 13 per cent. Agriculture is thus a crucial area in future water-use management. Irrigation efficiency is low. Urban water supply systems are also inefficient.

o This situation, coupled with inefficient WRM and the increasing demand for water in major urban areas (such as Mexico City, Monterrey, Leon, Tijuana) generates friction among users, increases the costs of infrastructure construction and operation and furthers the vicious cycle of inefficient use/inefficient allocation.

o With current trends, negative impacts are to be expected, *inter alia*, regarding (a) possibilities for attracting industries which are usually dependent on secure water supply, thus hampering continued economic development, (b) the increasing of costs for supplying water to burgeoning urban populations, and (c) the profitability of irrigation activities, especially in Irrigation Units depending on groundwater.

o Assuming continued population growth and a favorable climate for economic development, current water trends can be summarized as follows:

I. increasing water scarcity in Mexico's most developed – and developing – regions;
- increasing dependence on often overexploited groundwater sources;
- increasing water contamination due to agrochemical, industrial activities and domestic effluents;
- increasing competition between sectors for water of adequate quality; and
- increasing financing needs as a result of inefficient resource allocation and inefficient delivery of services.

Water Resources Management

o ***Despite recent significant achievements, further efforts are needed to improve the water situation.*** There have been several previous attempts to address the overexploitation and contamination problems. Based on the NWL and the water-related articles in the Federal Fiscal Law (*Ley Federal de Derechos* – LFD), which provide four types of instruments to administer the use of national waters:

- Regulatory

[15] Planeación y Proyectos de Ingeniería, SC (2003) for CONAGUA and the World Bank. "Evaluación Ambiental Estratégica del Proyecto" Proyecto de Apoyo a la Reforma del Sector de Agua y Saneamiento, Informe Final.

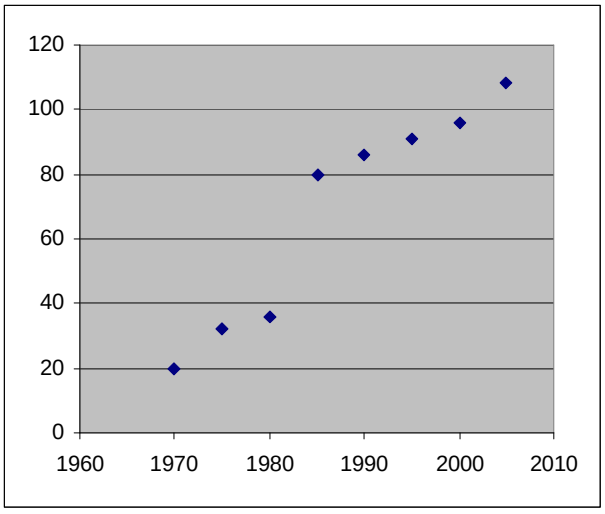
- concession entitlements for water use and their registration in the Public Water Rights Registry (REPDA)
- regulations, well-drilling prohibitions, and reserves

- Order and control
  - inspection and measurement
  - sanctions
- Economic
  - users' obligation to pay for use
  - water rights market
- Participatory
  - Water users associations
  - Basin Councils
  - Groundwater Technical Committees (COTAS)

o Mexico uses an array of *regulatory instruments* for water resources management, including water use rights and well drilling prohibition.

o Well-drilling prohibition. The approximately 100 well drilling prohibitions decrees ('*vedas*')[16] currently in effect began to be issued in 1948 and continued until the 1980s. Looking at Figure 1.4, one may observe that these decrees did not have the expected effect since the growth in the number of overexploited aquifers became more intense in from the 1980s. This is due to an increase in clandestine well drilling due to the lack of effective control and enforcement.

Figure 1.4 Evolution of number of overexploited aquifers



Source: CONAGUA 2004

o Water rights. According to the 1917 Constitution, water is a national property. The only legal means of using or exploiting national waters is through a

[16] A well-drilling prohibition order may encompass more than one aquifer, since these orders were issued generally with references to political-administrative boundaries or geographic coordinates and not in accordance with the boundaries of river basins or aquifers.

concession granted by the federal government. However, until 1992 when the National Congress approved the National Water Law (NWL), only 2,000 entitlements had been issued.

o The NWL and its regulation stated that by 1994 irregular and provisional permits must be registered in the Public Water Rights Registry (REPDA), and all users must obtain a concession entitlement and record it in the REPDA by the end of 1995. The process turned out to be complex and institutional, human and economic resources were insufficient, and thus it lasted 10 years instead of the 3 years envisaged in the legislation. Presidential decrees were issued from 1995 to 2002 to simplify administrative and fiscal authorizations and provide users with incentives to adhere promptly. The decrees indicated that concessions would be granted for 10 years, for the volumes that users stated they were using (because there was no practical way to determine actual water usage), and that such volumes would be adjusted once the Water Availability was published by means of Official Mexican Norms. The rationale was that in a ten-year period, knowledge of water availability and use would be improved and when users applied for the renewal of their concessions better decisions would be made. However, some of the earlier 10-year concessions have been renewed based on the original concession amount without adjustments.

o The outcome of such simplification of procedures, combined with intensive media campaigns and hundreds of meeting held by CONAGUA representatives with water users has been the registration of almost 350,000 water users by 2003, and CONAGUA estimates that the number of known but unregulated users is no more that 5 percent of users already registered (Table 1.5).

o The benefits of regularizing water rights through a formal concession are twofold: the user obtains legal certainty and CONAGUA obtains the basic information necessary for sound planning and management of resources. In light of international experience this is not a small achievement and is a good starting foundation.

Table 1.5 Water users registered in the REPDA in 2003

Source	Use			Hydropower	Total
	Agriculture / livestock	Public Water Supply	Self-supplied industry		
Surface Water	45,730	67,006	903	94	113,733
Groundwater	147,653	67,443	7,770	0	222,866
Total	193,383	134,449	8,673	94	336,599

Source CONAGUA 2004

o However, in numerous aquifers and river basins, the volumes with water right concessions exceed water availability. In addition, the reliability of part of the information in the REPDA is questionable. Also, there is a significant gap between what water rights entitlements say and how these rights are used and allocated on the ground.

o CONAGUA now faces the major challenge of ensuring that water concessions and allocations are based on the resource's actual availability. Indeed, over-concessioning, while not responsible for water over-exploitation which has been occurring since the 1970s, does limit the ability to use enforcement of water rights to reduce overexploitation. Another major challenge is the enforcement of the terms and conditions of each water right entitlement because of insufficient human and economic resources. This situation calls for a different approach to water rights administration, namely more earnest decentralization and greater involvement of state and municipal governments as well as water users (see *instruments of order and control*).

o An added complication is that for a water rights system to be able to reduce overexploitation, it must record three components: (a) the amount that may be extracted; (b) the amount that may be consumptively used and (c) the amount that must be returned to the local water system.

o Indeed, the amount of water extracted from a local water source can be divided into two parts: (a) the amount of water that returns or is recycled to the local water system; and (b) the amount of water that is consumptively used (evapotranspirated). When the water rights are based only on the amount of water that can be extracted, as it is in Mexico, there is a built in incentive to improve efficiency and thereby increase the portion of the water that is consumptively used and reduce the amount that is recycled. This has the overall effect of increasing the depletion of water resources and in areas where water use is already at or exceeding sustainable limits, a water rights system based purely on extraction amounts can result in increasing overexploitation as water use efficiencies are improved.

o Recording the "three components" of water use complicates the administration of water rights, because at least two of the three components of the water right need to be measured and controlled. With the recent advent of the use of remote sensing to accurately determine actual evapotranspiration, it has now become feasible to measure consumptive use. For municipal and industrial users it is possible to measure the discaharges. Such measurements in combination with extraction measurements permit administration of a water rights system based on the three components.

o The three components of water rights are also important for a water market to function well. Without this, a water user may sell a water right with a low existing consumptive use to someone with a much higher consumptive use, and thereby increase depletions.

o *Instruments of order and control.* In order for the regulatory and economic instruments to work, there needs to be an adequate system of measurement, monitoring and enforcement. Recently a number of measuring devices have been installed, but most water use is not adequately measured. Moreover, CONAGUA has limited institutional capacity to enforce laws. Despite increased field visits by CONAGUA, the number of users visited in 2004 was only about 1 percent of those registered in the REPDA. Under the modifications to the NWL issued in 2004, which calls for stricter sanctions and higher fines, the questions remain as to whether the

authority will be able to enforce them and whether the amounts of fines are so high that, instead of promoting better behavior, farmers will be forced to abandon their productive activity, or utilize water clandestinely.

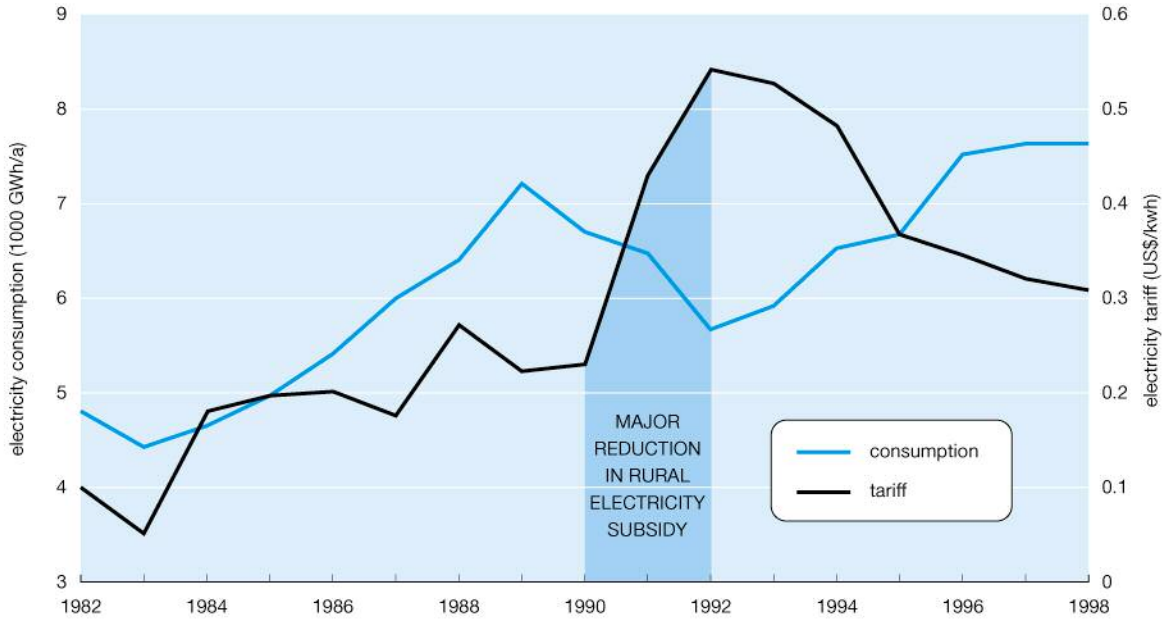
- This calls for a different approach to control and enforcement, namely more earnest decentralization and greater involvement of states, municipalities and particularly water users. This will require a change of attitude – instead of trying to get away with using water to which they are not entitled or that contributes to the overexploitation problem, water users need to become responsible for protecting the water resource for their own benefit and for future generations.

- Mexico uses an array of *economic instruments* for water resources management, including water use fees, service tariffs and water pollution penalty charges, and water markets. In addition, there are two policy issues related to the agriculture sector which have a profound impact on groundwater abstraction and could be considered as instruments for WRM: energy price subsidy for irrigation pumping and import restrictions and import duties for agricultural products.

- Energy price subsidy for irrigation pumping. In Mexico, electricity tariffs for agricultural purposes are heavily subsidized which has encouraged groundwater over-exploitation. Subsidy reduction could provide a major incentive for reducing groundwater pumping and economizing on water use. As indicated in Figure 1.4 (Kemper et al, 2003), groundwater pumping decreased markedly during the two years in which the electricity tariff was increased, but when this tariff began to decrease, consumption rose again. In addition, the electricity subsidy mainly benefits relatively rich states with serious water scarcity problems (Figure 1.5). On the other hand beginning in 2004, tariffs for irrigation pumping are higher when the volume of water extracted is beyond the concession entitlement to provide an additional incentive to comply with the water right.[17] Chapter 3 discusses an approach to reorienting this subsidy to eliminate the incentive to overuse water but not negatively impact farmers, particularly poor ones.

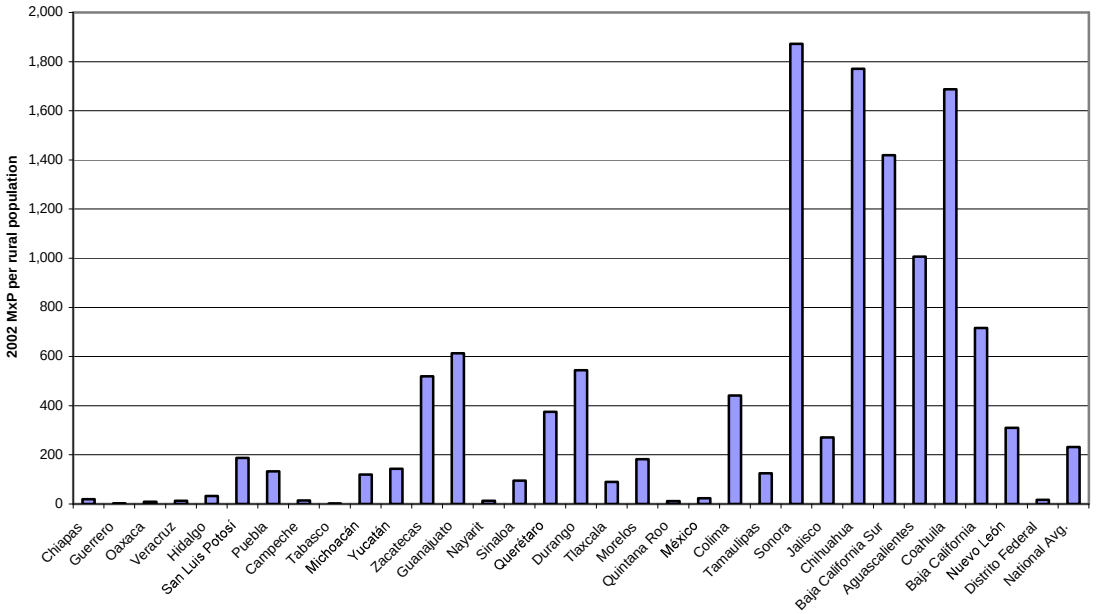
[17] A formula was established to calculate the volume of groundwater extracted based on energy consumed, thus addressing the long-standing difficulty of directly measuring water consumption.

Figure 1.5 Impact of electricity tariff variations for groundwater pumping



Source: Comisión Federal de Electricidad

Figure 1.6 Geographic Distribution of Electricity Subsidy in Agriculture, 2002



Source: World Bank Report No. 27894-MX, Public Expenditure Review, pp. 86; 150-157

o Import liberalization. Import restrictions (such as bans or quotas) and import duties on agricultural products can keep the national price of these products above international market prices. High domestic prices for agricultural products are a strong incentive to increase production, often at the expense of groundwater resources. The trend towards liberalization of agricultural markets in Mexico is expected to continue, and trade will shift agricultural production from high-cost producers to low-cost producers. To the extent that the pricing of water reflects its scarcity, agricultural production will shift from water-scarce areas to areas with rainfed production or from irrigation with more abundant resources.

o The Government of Mexico has various investment programs to use water more efficiently in irrigation. These programs seem to have achieved the goal of using *less drops per crop*, but have often increased **net** water abstraction, because the surface and groundwater users benefiting from these programs have used water savings to provide a full supply when only a partial supply was previously available, or to expand their irrigated area and plant more double crops. What has happened in many cases is water that was previously being returned to the local water system because of leaky inefficient systems is now being consumptively used by crops and so the depletion of water resources has increased. Irrigation modernization programs need to be designed in consideration of sustainably available water resources, which means in areas where there is overexploitation of water resources the net extraction (extraction minus return flows) needs to be reduced to sustainable levels. The net extraction is equivalent to the consumptive use or evapotranspiration (ET) and therefore irrigation modernization in water scarce areas needs to focus on ET reduction.

o Recently CONAGUA has been paying greater attention to this issue, particularly in irrigation districts that are partially or totally dependent on groundwater. An important success story is Irrigation District 066, Santo Domingo aquifer in Baja California Sur. This ID is totally dependent on groundwater and extractions have been reduced from over 400 to less than 170 million cubic meters per year in the past 5 years. The modernization assistance involves first determining the sustainable water availability taking into account natural recharge and reduced induced recharge from irrigation areas that will be improved. Other irrigation districts areas with groundwater use that are also being planned taking into account sustainable water yields are: Caborca, Sonora; Costa de Hermosillo, Sonora; Delicias, Chihuahua; and Pabillon, Aguascalientes. It is a difficult arduous process involving extended discussions and negotiations with water users, and it is noteworthy that good progress is being made. For Irrigation Units, that are mainly dependent on groundwater, little progress is being made in relating irrigation modernization programs with sustainable water availability because of the need to begin with aquifer-wide water balance analyses, consider competing uses and to reach a consensus at the aquifer level. Nearly all of the overexploited aquifers have a large number of irrigation units, and reaching this consensus will need to be based on participatory integrated water resources management plans prepared at the aquifer level.

o Another economic instrument for WRM is the purchase and sale of water rights. They can play an important role in curbing over-exploitation and achieving a better allocation of scarce water resources.

o The 1992 NWL provided for water markets and the 2004 version amended such provisions, to include mainly the following:

- CONAGUA must authorize all water rights transfers, including those where only the right holder changes.
- The user who transfers a water right must have a valid concession entitlement duly registered in the REPDA.
- The user who transfers a right must comply with all fiscal and administrative duties.
- CONAGUA must review water rights transfers in consideration of possible negative impacts on third parties, water resources or the environment, and based on this review may deny or impose conditions on the transfer[18].
- Groundwater must only be abstracted from the same aquifer and surface water from the same catchment.
- All or part of the concessioned volume may be transferred either permanently or for a certain period of time.
- Water rights may be transferred independently of land rights.
- Water rights for public urban water supply are non-transferable.
- CONAGUA may establish 'water banks' to manage regulated water rights transfers, following regulations that remain to be published.

o Hence, the 2004 amendments to the NWL introduced a certain degree of flexibility by allowing temporal and partial water rights transmissions and allowing landowners (e.g. farmers) to transfer water rights independently of land rights. But at the same time, transfers were made more rigid by requiring CONAGUA approval for all cases. This rigidity may hamper the agile operation of a 'water bank'.

o In several areas, the water markets although incipient and small have been quite dynamic. The performance of CONAGUA, in general insufficient and in some cases arbitrary has been a determining factor in the operation of different local markets because of its strong regulatory power. Such a discretionary exercise of this regulatory power, although perhaps justifiable in some cases, has increased uncertainty and weakened the legal security of water use rights.

o However, before there can be an adequately functioning water market, it is essential to have in place an efficient water user rights administration system with all water usage being measured and controlled and with the total water rights not exceeding sustainable allocations. If there is inadequate measurement or control, then a water user could continue to use water after having sold it. If water rights exceed sustainable levels, then the purchaser could be buying into an unsustainable situation and therefore not get a guaranteed long-term supply. If water rights are only partially being utilized, then the portion not being used may be sold. All of these scenarios currently occur in Mexico and in areas where water is presently being overexploited, such situations increase the overexploitation.

[18] This review should take into account the three components of water rights discussed above, and ensure that the consumptive use portion does not increase in water scarce areas.

o There are two additional problems with water markets in Mexico. First, sometimes people sell water rights for which they do not have proper legal entitlement. The record of the transaction, however, creates some aura of legitimacy for the new owner, thus increasing the over-commitment of water resources in scarce areas. Second, many transactions seem to result from non-economic factors, i.e. because of social or political relations between users and government entities.

o It is recommended that an effective system of water rights administration should be in place before water banks or water markets are promoted further. In addition, the following three water market issues require more empirical and interdisciplinary research:

- The impacts of water rights transactions on the technical efficiency of water use and on the reallocation of resources.
- The impacts on social equity, especially in the peasant and *ejidatario* sector.
- The relationships between transactions and integrated management of water resources, especially conflict resolution, coordination of multiple uses, internalization of externalities, and environmental protection.

o For each issue above, special attention should be given to sustainable exploitation levels and the relationship between surface and ground water and their joint management; for example, between the exploitation of aquifers and the management of reservoirs. It is recommended that in future work, key emphasis not be placed on transactions within the agricultural sector. While transactions among irrigators or within irrigation districts will continue to be an important issue, more focus needs to be placed on intersectoral scenarios and transactions. The performance and capacity of institutions to resolve different types of conflicts, and thus improve the definition and security of water rights should be evaluated in order to obtain a better understanding of the factors affecting water rights security beyond the formal entitlements. This will help to design rules and policies for more effective user participation in the implementation and monitoring of water rights adjustments.

o The most important *instrument of participation* for groundwater management are the Groundwater Technical Committees (COTAS). Since the enactment of the NWL in 1992, CONAGUA has promoted the establishment of these civil society organizations nationwide to help address the challenges of water management, especially in the overexploited aquifers. The COTAS include the users themselves and it is in their interest to manage the resource well. As of November 2003, 64 COTAS had been established around the country. The degree of maturity and results of these agencies are highly variable. As mentioned above, the COTAS will need to take on responsibilities for measuring/monitoring and enforcing water rights entitlements and discharge amounts in terms of both quantity and quality. Their future in large part depends on CONAGUA's progress in implementing the decentralization mandate of the 2004 NWL. (Garduño et al 2003).

A possible way forward to address WRM issues in Mexico

- The main conclusion drawn from the above experiences with the implementation of regulatory, order and control, economic, and participatory instruments is that, although these initiatives have achieved significant progress, it has not been long lasting. Perhaps one of the reasons is that there has not been sufficient integration among the various types of instruments used, following the belief that a single measure will solve the problems. There is also a need to establish numerical targets related to reducing the number of overexploited aquifers or the amount of surface water and groundwater overexploitation in specific basins and aquifers, as well as reducing pollution in specific water bodies. A better alternative would be to establish numerical targets and adequate benchmarking to complement measures such as those suggested in Table 1.6. The table illustrates the need to integrate measures for each of the instrument mentioned.

- It must be highlighted that the measures expected to have the greatest positive impact are involvement of water users through COTAS and Water Users Associations, and deconcentration and decentralization of WRM to Basin Agencies and Councils, state and municipal governments and irrigation ditricts and units. CONAGUA has a strong lead role to play and must provide an enabling environment for this process to be sustainable. In other words, a two focused complementary approach is required: top- down and bottom-up. Box 1.2 presents a discussion of key principles for good water resources management.

Box 1.2 The International Experience - Key principles for good water resources management

International experience shows that good WRM is both a top-down and a bottom-up undertaking. Top-down aspects include (a) establishing policies, laws, organizations, and regulations for managing water; (b) defining the availability of water and determining broad water allocations within river basins and aquifers for different sectors and political administrative entities (states, municipalities) and for the environment; (c) setting water quality standards; and (d) cross-sector and inter-provincial cooperation at the river basin and/or aquifer level.

The bottom-up aspects involve: (a) educating and mobilizing water users, as well as incorporating their views into the planning and management processes; (b) participatory planning to define a series of structural and non-structural actions to achieve sustainable integrated WRM and to optimize the economic, social and environmental benefits involving participation at the local government level, establishing more ownership, accountability and contractual relationships; (c) improving water use efficiency and water conservation in conjunction with the water users; and (d) implementing a complete system of water rights and discharge permits; registering, licensing, control and enforcing within strictly and locally defined criteria of water availability and quality objectives and environmental sustainability.

Even with the best top-down policies, the bottom-up aspects are also essential to achieve WRM improvements because effective WRM requires the direct participation of water users, including farmers, towns, cities, industries, and infrastructure operators. These actors ultimately determine how the resources will be used. Their views and incentives need to be taken into account, their responsibilities need to be defined, and their ability to carry out those responsibilities need to be strengthened when establishing rational practical WRM systems. Establishing and strengthening supplier and user organizations is important for effective involvement from the bottom-up (in particular, as these grass-roots organizations need to relate to formal institutions).

The basin needs to be the basic unit for water resources planning, development, allocation and management. This is because all water users and the natural environment in a basin are dependent on the same water resources that need to be managed and shared to the benefit of all. Basin Management is usually difficult because there are different sectors competing for the resource (agriculture, fisheries, tourism, industry, domestic, environment) represented by various governmental and private sector stakeholders and there are different governmental units (e.g. national, state, municipal) with political/ administrative boundaries that are invariably not the same as the basin. Good basin management requires establishing and strengthening effective mechanisms for managing these cross-sector and cross-jurisdictional aspects. Basin management needs to be considered as a long-term, incremental and iterative process, with the following objectives: (a) clear and strong institutional arrangements, supported by clear regulations, decrees or agreements and with well defined implementing procedures; (b) good water related data, information systems and models readily available to the basin 'partners' and those agencies and bureaus operating within the basin; (c) a complete and clear suite or package of basin-wide policies, procedures and strategies to guide water and natural resource planning, management and administration; (d) an appropriate form of communication and participation for all basin stakeholders and partners, based on a commitment to transparency; (e) basin sustainability 'performance indicators' and an agreed approach to monitor and report on how the basin is being managed and the resources consumed and protected; (f) an agreed upon plan for the bulk allocation of water (in terms of both quantity and quality and preferably for both surface and groundwater) to the various sectors taking into account both supply and demand management, as well as environmental sustainability; and (g) an effective system of water rights and discharge registry, administration, monitoring and enforcement that manages the development and use of water rights within the allocations.

Table 1.6 Integration of Measures to Achieve Sustainable Water Resources Management

TYPE OF MEASURES	MEASURE	Decrease in unit water consumption	Allocation of water to more profitable activities	More sustainable location of productive activities	Release of first-use water	Adjustment of concession entitlements to real extractions	Reduction in water extractions	SUSTAINABLE WATER RESOURCES MANAGEMENT
ECONOMIC	- Strengthening of water markets and/or water right buy backs, but based on net extraction or "consumptive use" and integrating the PADUA with other support programs geared at making agricultural production sustainable.	X	X					
	- Incentives for investments in efficient use and agricultural conversion, taking into account the concept of "real water savings"	X						
	- Fiscal incentives for reuse of wastewater		X		X			
ORDER AND CONTROL	- Active policy for expiration of volumes and screening of Public Water Rights Registry (REPDA)					X		
	Implementation of a system of measurement, enforcement and control with participation of states, municipalities and water users							
REGULATORY	- Mandatory use of waste water				X			
	- Review of zones of availability		X	X				
	- Aquifer and basin water right regulations through consensus with users - Reducing water rights concessions to sustainable levels taking into account the net extraction or consumptive use						X	
	- Banning of high water consuming crops	X	X	X				
PLANNING	- Consider all uses and current and potential sources in the aquifer or basin and its surrounding area, based on good water balance analyses and decentralizing actions to states		X	X				
	- Comprehensive analysis of surface and ground waters in the principal river basins, to understand the consequences of diverse measures from the standpoint of the entire river basin and of all users not only from the standpoint of irrigation users.		X	X	X			
MANAGEMENT	- Recharge enhancement measures based on solid scientific and experimental groundwork to assure its feasibility in terms of its cost-effectiveness.		X					
	- Improved monitoring and evaluation of in order to make adjustments to plans, investments, regulations, incentives in order to eventually achieve sustainable water resources management and use	X	X	X	X	X	X	
	- Capacity building of Basin Agencies, Basin Councils and COTAS	X	X	X	X	X	X	
PARTICIPATORY	- Involvement of Basin Councils and Groundwater Technical Committees (COTAS)	X	X	X	X	X	X	
	- Decentralization to state and municipal governments	X	X	X	X	X	X	

Source: Adapted from Cantú and Garduño 2003

2. Water sector financing

o The finances of Mexico's water sector are complex, with over a thousand public entities participating—federal agencies, state agencies, irrigation districts, municipalities and municipal water companies. There are also thousands of industrial firms and farmers that invest substantially in hydraulic infrastructure and support their O&M. None of these players acts in financial isolation; all are paying or receiving fees, tariffs and/or subsidies from other entities. The non-transparency and confusion of financial flows and incentives in the sector contributes to the inefficiency and under-provision of WSS and I&D services and to the overexploitation and contamination of scarce freshwater resources.

o This chapter gives an overview of the financial flows in the water sector, including an analysis of CONAGUA and, WSS and I&D sub-sectors financing. More specifically, for CONAGUA, this chapter analyses the degree of the sector self-financing and the possible implications of the new water law on WRM financing. For the WSS sub-sector, this chapter analyzes degree of sub-sector self-financing and the adequacy of past investment spending in quantitative and qualitative terms, as compared to sub-sector performance and priorities. For the Irrigation and Drainage sub-sector, this chapter analyzes the degree of sub-sector self-financing and the linkages between water pricing and water use efficiency. Then, it presents some of the linkages between agriculture performance; trade liberalization and policy interventions to support agriculture competitiveness and water resources degradation.

FINANCIAL FLOWS IN THE WATER SECTOR

o In Mexico, as in other countries of the world, water is being subsidized by the rest of the public sector in various ways. At the national level, the expenditures of CONAGUA exceed the revenues collected from users, although in some geographic areas the revenues collected from water users exceed the outlays of CONAGUA. The state governments collect little or no revenue from water, but have some expenses that are covered out of general revenues. The municipal governments, directly or through their enterprises, provide WSS services, and the tariff recovered from customers are supposed to cover operating expenses, including water use fees. They generate very little surplus for investment financing, which is mainly financed from other sources. In the I&D sector, O&M costs are almost entirely covered by farmers; however most investments are financed with federal subsidies.

Overview of Financial Resources

o The availability of financial data for the sector is limited, especially at the state and municipal levels. Nevertheless, the present study indicates that, in Mexico, overall expenditure in the water sector exceeded MxP 40 billion in 2004, or 0.5 percent

of GDP[19]. Of this amount, the public sector contributes over MxP 33 billion, which is close to 2.5 percent of Mexico's budget[20] and the private sector at least MxP 4 billion (Table 2.1).

Table 2.1 Mexico's financial resources (by source) for the water sector in 2004

Resources	MxP million
CONAGUA resources	**13,543**
Federal Tax Revenue	*5,791*
Payment of industries for water user fees	*4,453*
Payment of water utilities	*2,580*
Water use fees	*1,503*
Bulk water supply	*1077*
Payments of irrigation districts	*145*
Other CONAGUA revenues	*574*
Irrigators payments to Irrigation Districts for service	1224
Household payments to water operators for service [a]	12,000
FAIS transfers to municipalities	4,000
Co-financing payments by irrigation water users for investments in irrigation and drainage systems	600
Other local funding (from State Governments)	3,900
Total public Expenditures	**35,267**
Private Expenditures	4,000
Total Expenditures	**39,267**

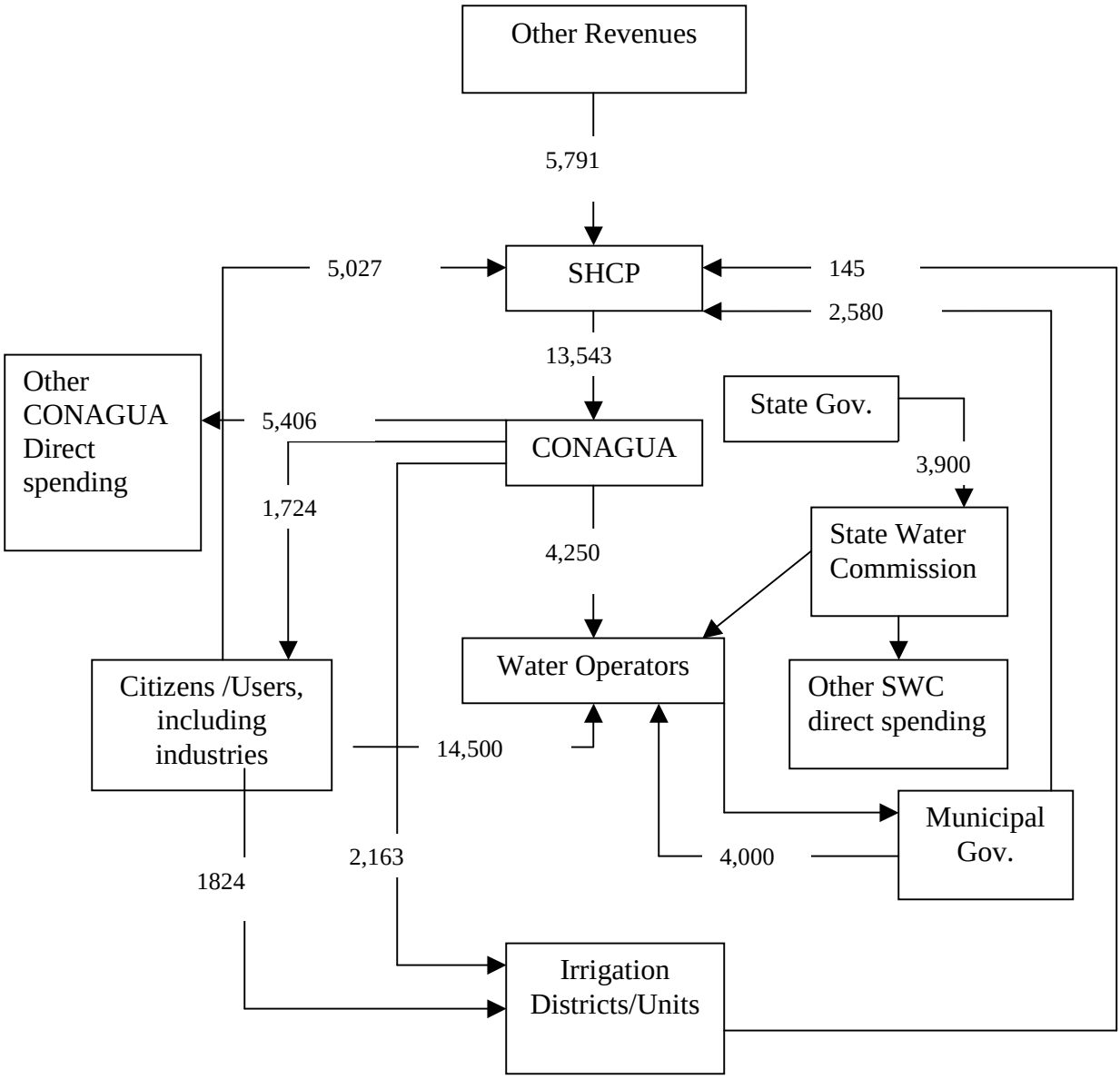
[a] This does not count the household payments that are passed along to SHCP for water-use fees.

A significant share of the resources spent in the sector, including both investment and recurrent expenditures, come directly or indirectly from water users. The biggest single spender is CONAGUA, with about 30 percent of total expenditures in the water sector. The impact of CONAGUA on the sector finances is even greater, as its programs leverage additional financial resources through cost-sharing arrangements from states, municipalities and water users in both the WSS and I&D sub-sectors. Figure 2.2 shows CONAGUA at the center of the web of Mexico's water finances. The next section focuses on CONAGUA financing.

[19] Total expenditures in the water sector is underestimated, as it does not include, for example, expenses made by the states other than through the water commissions or direct expenditures from water users (i.e. farmers and self-supplied industries).

[20] This an estimate based upon information from CONAGUA, several state governments, and an INEGI study in 1999.

Figure 2.1 Flow of Funds of the Water Sector in Mexico (2004) (MxP million)



Sources: CNA, INEGI, State governments, and Bank staff calculations

Note: Collections were estimated by using the same efficiency in billing and collection found in 1998, and by using a projected water tariff and consumption in 2004. Transfers from state governments to state water commissions were obtained for several states and obtained an average of the expenditures per capita, then we simply used the total projected population for 2004 to get a rough estimate.

CONAGUA Financing

CONAGUA Revenues

o *Sixty per cent of CONAGUA revenues, estimated at MxP 13.5 billion in 2004, comes from fees and charges recovered from water users and polluters* and channeled through SHCP, and the balance, 40 per cent, is financed from the general federal tax resources.

o *Eighty percent of the revenues collected from water users and polluters, estimated at MxP 7.6 billion in 2004, comes from the collection of the water use fees*, whose value and share in CONAGUA overall budget have been increasing over the past 10 years (Table 2.2). The other key revenue item is the sale of bulk water (16 per cent in 2004), complemented by other minor revenue items, such as the collection of water pollution charges.

Table 2.2 CONAGUA revenues by sources

(2004 MxP Million)	1994-96	1997-99	2000-02	2003	2004
Federal Revenue					
Total Fees for Water Use	*5,417.6*	*5,279.0*	*5,941.8*	*6,637.3*	*6,286.6*
Water Operators	265.6	400.4	634.0	1,535.4	1,502.9
Industry and Commerce	4,809.6	4,515.2	4,850.3	4,774.4	4,422.2
Hydroelectric Plants	308.9	335.0	414.9	292.2	330.1
Acuaculture	0.1	0.1	0.3	0.8	0.5
Leisure	33.4	28.3	42.3	34.5	30.8
Total Fees for other water related activities	*1,538.2*	*1,369.3*	*1,162.1*	*1,289.9*	*1,221.7*
Usage of water inf. For bulk water prov to urban centers and firms	1,214.1	1,203.6	1,013.3	1,147.8	1,076.9
Usage of water inf. For water districts	324.1	165.8	148.8	142.1	144.9
Other revenue	*1,062.3*	*590.7*	*398.3*	*266.5*	*243.5*
Total Federal Revenue	***8,018.2***	***7,239.0***	***7,502.2***	***8,193.7***	***7,751.7***

Source: CONAGUA

Seventy per cent of water use fees are paid by self-supplied industries and commerce which account for only 10 per cent of water withdrawals. The agriculture sector still pays practically nothing for water abstraction, while withdrawing about 80 percent of the country water resources. In 2004, revenues collected from water use fees were MxP 6.3 billion, of which 70 per cent were paid by industries and commerce, 25 per cent by water utilities and municipalities and 5 per cent by hydropower plants.

o *Water use fees from utilities represent an increasing share of CONAGUA revenue, reaching 10 per cent in 2004*. While revenues from industries have been stable over time, revenues collected from water utilities have increased eight-fold over the past decade in real terms, from MxP 189.4 million in 1994 to MxP 1,502.3 million in 2004.

o The impressive increase in water user fees collection from utilities is the result of the *Programa de Devolucion de Derechos* (Water Rights Return Program, PRODDER) introduced by the Federal Government in 2002 and managed by CONAGUA. Initially, cash-strapped utilities refused to pay the water use fees, claiming

inability to pay. To remedy this problem, PRODDER was launched, a program to return these revenues to utilities subject to certain conditions. The conditions include that for each peso returned, the utility must invest two pesos towards increased water use efficiency. The program has not only led to an increase in the collection efficiency of water use fees, but also to an increase in utilities investment. Water use fees paid directly by industries are not returned to industrial users.

- As mentioned above, self supplied industries contribute about 70 per cent of the collected water use fees. This is explained by relatively high collection efficiency and higher water use fees applied to industries. As a result, in 2004, the average water use fee collected per cubic meter used in the industry sector is 10 times higher than for water utilities (Table 2.3).

Table 2.3 Average Water Use Fees collected by user category

(2004 MxP per cubic hectometer)	1994-96	1997-99	2000-02	2003	2004
Federal Revenue					
Total Fees for Water Use	*1,155.1*	*406.7*	*424.7*	*637.1*	*535.8*
Water Operators	2,147.4	4,553.4	3,798.6	2,344.2	2,017.9
Industry and Commerce	33,629.2	26,853.9	41,008.2	39,052.2	21,404.2
Hydroelectric Plants	70.5	26.2	30.0	30.4	30.7
Acuaculture	26.3	13.3	21.2	39.0	31.6
Leisure	6,886.8	2,988.2	3,224.2	10,802.5	6,506.2

Source: CONAGUA and World Bank calculations.

The level of water use rates is differentiated according to nine geographic zones and six user categories to take into account differences in water scarcity across regions and in ability and/or willingness to pay between users. This results in about 40 different rates. Users in water scarce areas pay substantially higher charges than users in water-abundant areas.

- Self-supplied industries pay water use fee rates that are 3 to 30 times higher than water utilities. The level of this charge does not seem excessive, as total water cost represents, on average, a mere 2 per cent of the average company production cost and the water demand from industries is not very elastic (elasticity -0.3)[21].

- The largest water user by far, irrigated agriculture, is still exempt from the charges. Since 2003, however, agriculture water users that exceed their abstraction entitlement as specified in their license must pay a nominal fee for the amount used in excess (0.1 MxP/m^3 in 2004). Control and enforcement of this measure has been difficult.

[21] Source: Mexico – Assessment of Policy Interventions on the Water Sector, World Bank, 2006.

Table 2.4 Water use rates for self-supplied industries according to water resource relative availability

Relative availability	Class	Rates (MxP/m^3)
Scarcity	1	14.67
	2	11.74
	3	9.78
	4	8.07
	5	6.36
	6	5.75
	7	4.32
	8	1.54
Abundance	9	1.15

Source:DOF 2004 (The fees values are the same for 2005)

Three types of industries benefit from rebates, revised every year. In 2005, the Federal Rights Law indicated that the sugar, paper and mining industries, accounting for about 60 per cent of industrial water use, would only pay 55, 80 and 25 per cent respectively of the industrial water use fees, reducing overall revenues from industrial users by about 25 per cent. These industries have also much lower water productivity rate than the industrial average.

Table 2.5 Water use rates for various water uses

Use	Rates (MxP/m^3)	
	Class 1	Class 9
Self supplied industries	14.67	1.15
Public water supply+	0.34 – 0.67	.29 – 0.58
Recreation areas	0.008	0.0009
Aquaculture	0.002	0.0003
Hydro Power	0.003	0.003
Agriculture/livestock++	0.1	0.1

+ Water supply utilities that use more than the equivalent to 300 liters per person per day must pay the higher fee for the volume above that limit. This category includes industries and commerce supplied by the public network.
++ Users must pay only for the amount they use above their concessioned volume
Source: DOF 2004

- *More than 40 per cent of the water use fees revenues are collected in two hydrographic regions* (Lerma-Santiago-Pacifico and Valle de México), where about 30 per cent of Mexico's population lives and where most industries are located (Table 2.6). For the same reasons, about 20 per cent of water use fees are collected in two states (Mexico and Distrito Federal) (Table 2.7).

Table 2.6 Water Use Fees Collection by Hydrographic Region (2004)

	(2004 MxP million)	1996	1997-99	2000-02	2003	2004	2005
I	Península de Baja California	48.4	57.1	68.5	96.1	142.1	125.2
II	Noroeste	92.9	100.9	124.2	201.8	210.6	201.8
III	Pacífico Norte	70.0	75.6	98.0	113.3	124.0	145.1
IV	Balsas	274.6	316.7	357.5	462.0	455.6	521.7
V	Pacífico Sur	41.8	49.3	138.5	162.3	129.8	122.6
VI	Río Bravo	979.6	1,084.0	933.8	989.2	968.6	893.9
VII	Cuencas Centrales del Norte	535.6	518.3	480.9	543.6	505.2	483.1
VIII	Lerma-Santiago-Pacífico	874.2	983.5	1,188.6	1,539.4	1,330.9	1,363.6
IX	Golfo Norte	147.4	173.7	279.8	273.7	319.0	319.2
X	Golfo Centro	494.3	538.3	503.1	475.2	439.1	440.8
XI	Frontera Sur	225.9	261.2	450.5	321.5	262.2	261.7
XII	Península de Yucatán	41.8	52.7	101.5	128.2	113.8	123.0
XIII	Aguas del Valle de México y Sistema Cutzamala	998.7	1,067.8	1,217.2	1,331.0	1,285.7	1,289.1
	Total	**4,825.0**	**5,279.0**	**5,942.0**	**6,637.3**	**6,286.6**	**6,290.7**
	Average	**371.2**	**406.1**	**457.1**	**510.6**	**483.6**	**483.9**

Source: CONAGUA.

Table 2.7 Water Use Fees Collections by State

(2004 MxP million)	1996	1997-99	2000-02	2003	2004
Aguascalientes	46.3	52.6	66.4	100.7	89.8
Baja California	46.6	41.6	59.8	74.2	77.1
Baja California Sur	10.3	11.9	14.9	21.5	33.8
Campeche	1.8	2.3	2.4	6.1	11.7
Coahuila	481.4	432.7	348.9	350.9	380.5
Colima	45.5	41.9	51.0	54.8	55.8
Chiapas	157.2	233.5	300.0	153.6	141.9
Chihuahua	189.2	224.5	234.2	247.1	232.6
Distrito Federal	504.1	787.4	925.3	505.8	474.9
Durango	102.3	79.2	64.5	168.5	154.4
Guanajuato	283.9	367.6	418.8	450.1	419.5
Guerrero	30.1	37.4	46.6	70.5	67.3
Hidalgo	84.4	155.9	256.0	309.6	314.3
Jalisco	249.5	286.8	311.9	355.2	351.1
México	691.6	309.9	181.9	755.6	693.4
Michoacán	128.5	171.7	180.8	237.0	248.3
Morelos	50.4	55.9	55.7	59.8	62.8
Nayarit	9.9	23.4	33.6	46.2	52.4
Nuevo León	275.1	360.4	325.1	382.5	368.2
Oaxaca	50.2	90.8	171.3	184.1	146.4
Puebla	113.1	127.8	138.5	183.1	175.7
Querétaro	243.4	135.6	172.9	194.9	184.5
Quintana Roo	21.9	12.2	12.6	28.8	20.6
San Luis Potosí	140.4	362.4	380.5	315.4	279.5
Sinaloa	40.2	53.6	63.9	68.6	84.3
Sonora	101.0	107.2	121.2	203.6	240.3
Tabasco	73.5	104.3	146.8	167.7	114.4
Tamaulipas	108.7	149.2	206.4	302.3	262.3
Tlaxcala	22.8	31.2	36.2	43.0	44.0
Veracruz	481.7	497.0	472.3	432.3	357.1
Yucatán	16.8	37.0	78.6	94.7	85.4
Zacatecas	23.3	47.4	63.3	69.1	61.9
Total	4,825.0	5,432.1	5,942.0	6,637.3	6,286.6
Average	150.8	169.8	185.7	207.4	196.5

Source: CONAGUA.

The Water Pollution Penalty Charges, another potentially significant source of revenues to CONAGUA, generates only about 0.05 per cent of the revenues collected from users (MxP 7.3 million in 2005). This is primarily explained by low control and enforcement.

Table 2.8 Water pollution penalty charge collected

Million Pesos	2000	2001	2002	2003	2004	2005
Water pollution penalty charges	2.86	2.39	2.81	5.60	4.82	7.28

Source: CONAGUA, 2006

Water pollution penalty charges were introduced in 1996 in order to curb water pollution. Those penalty charges are only to be paid by industries and water utilities that do not

comply with the wastewater quality standards. The penalty charge was to be introduced gradually in order to leave time for the required investments to materialize, with shorter deadlines for potentially large polluters who had to meet the standards by 2000, average polluters by 2005 and small polluters by 2010. The gradual introduction of the penalty charge is described in Box 2.1 below.

Box 2.1 1996 Wastewater Effluent Standard

Parameters

Basic: Temperature, pH, oil & grease, floating solids, settleable solids, Total Suspended Solids (TSS), Biochemical Oxygen Demand (BOD), Total P, Total N
Heavy metals: As, Cd, Cu, Cr, Hg, Ni, Pb, Zn and Cyanides
Pathogens: Bacteria, viruses, fecal coliforms and helmynth eggs

Urban population	Industries & services (Tons of TSS or BOD)	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
> 50,000	> 3.0															
20,000 – 50,000	1.2 – 3.0															
2,500 – 20,000	< 1.2															

design & construction according to program
compliance with standards
If users do not comply with program and/or standards, they must pay according to the FFL

Users have to comply only with the limit values established for those pollutants they produce. The standard takes into account both the use of the receiving water body as well as its vulnerability. It incorporates gradualism, by stating that major polluters must comply in the year 2000, intermediate ones in 2005 and minor ones in 2010. However, existing plants must continue operating according to their original discharge permits or to the new standards, depending on the user's will. In case the quality of the discharge exceeds the new standard, the user can apply for a rebate to be applied to the water use fee. Polluters who exceed more than five times the limit values set for any of the parameters of the new standard, had to present one year after the standards were adopted, a design and construction program to improve their wastewater quality. The rest of them, have to present a similar program several years before their target compliance date (for instance, according to the schedule shown above, a medium-size city or industry would have to present its program by December 2000 and start complying with the standard by January 2005). Those users who present their programs on time are exempted from paying discharge fees during the construction period if they progress according to their programs.

Source: DOF 1996

Control and enforcement of the water pollution penalty charges has been weak. By 2001, most large industries and water supply utilities were not complying with wastewater quality standards and did not pay the penalty charges and by 2005, the same thing occurred with middle sized industries and water supply utilities. Twice, presidential decrees were issued to pardon arrears and push the deadlines for large and average size polluters. At the same time, starting in 2001, water pollution penalty collected from water supply utilities could be returned on a matching grant basis for investment aimed at improving/expanding wastewater collection and treatment.

Water user fees and water pollution penalty charges have had significant positive outcomes, however their potential benefits are still far from being reached. Those tools

have had significant positive outcomes, such as a substantial increase in much needed investment by water utilities and industries in order to improve water use efficiency and, to a lesser extent, wastewater treatment; and water use fees now represents a substantial and increasing share of CONAGUA revenues. However, there is still significant scope to improve water use efficiency among water utilities and domestic and industrial wastewater collection and treatment. The penalty could potentially generate important financial resources to CONAGUA as this is the case in other countries such as France (Box 2.2). However, control and enforcement of the water pollution penalty charge remains an issue. Finally, irrigation, by far the main water user, still does not pay water user fees. The law enforcement of the pollution penalty charge and the lack of water use fees for irrigation limit tremendously the potential revenues, water savings, and pollution reduction that could be generated by such a tool.

Box 2.2 Water use fees and water pollution penalty charges – The Adour Garonne Basin in France

There are six major river basins in France. These basins have been managed by separate River Basin Agencies (RBA) since 1964. The RBA provide technical and financial support (loans or grants) to municipalities, industries and farmers for investments to reduce pollution, conserve water resources or restore aquatic environments. The RBA are financially autonomous. Their budget is funded from the collection of water use fees and water pollution penalty charges from water users and polluters, as well as charges levied for the modification of the aquatic environment.

The River Basin Agency Adour-Garonne is located in the South West of France. The basin area spans over 116,000 km^2 partially covering 6 regions and 25 states. It is home to 6.5 million inhabitants grouped in 6863 municipalities, of which 1453 over 400 inhabitants. Agriculture plays a significant soci-economic role in the river basin. Irrigation covers 645,000 ha (40% of the national irrigated area) and concerns 35,000 farmers. Livestock production is also important. Agro-industries and paper industries are the biggest industrial polluters in the basin. Average annual rainfall is 650 mm

Revenues from water user fees and water pollution penalty charges totaled €142 million in 2004, of which 79 per cent were collected from municipalities, 17 per cent from industries and 4 per cent from agriculture.

Seventy-two per cent of collected revenues come from the **water pollution penalty charge** and 18 per cent from water use fees. The pollution penalty charges contributed €102 million to the agency revenues in 2004, of which 85 per cent was collected from 1775 municipalities (where 5.3 million people live), 14 per cent from 1395 industries and 1 per cent from 134 livestock producers. The amount of the charge is calculated based on the polluting load generated by 7 contaminants in the case of municipalities and industries and 2 contaminants in the case of agriculture and varies depending on the sensitivity of the environment. For municipalities, in 2006, the domestic pollution charge varied from €7.6 to 8.3 per inhabitant, and was reflected in the water bill at an average rate of **€0,276 /m^3**. The agriculture pollution penalty charge was introduced in 1994 in order extend the penalty system to diffuse agricultural pollution. For the time being, it is limited to large livestock producers and two contaminants.

The **agriculture sector** contributed €6 million to the agency revenues in 2004, of which 80 per cent (€4.3 million) was generated by water use fees for the abstraction of 1000 million m^3 by 27,000 irrigators (farmers are charged water use fees when their consumption exceeds 3000 m^3/year which covers 80 per cent of irrigators), or an average fee of **€4,3 per 1,000 m^3**. The balance, €1.7 million, was generated by the collection of the water pollution penalty charge from livestock producers.

In order to meet the 2015 European objectives in terms of water quality and tackle increasing concerns regarding water shortages and drought, the new French Water Law (2006) yet to be approved by

Parliament, will further strengthen financial incentives for water conservation and pollution reduction through a revision of the pollution penalty charge and water abstraction fees, in particular for irrigation.

***In conclusion**, there is substantial scope for increasing CONAGUA revenues from water users and polluters, thereby decreasing dependency on transfers from the general tax revenues while improving WRM. Most promising ways to increase revenues while addressing the water scarcity and pollution issues include:*

- *Improved enforcement and collection of the water pollution penalty charge*. The penalty charge is an incentive to promote investments to reduce water pollution. The penalty charge is also a huge untapped source of revenue for CONAGUA. In France, for example, most revenues of the RBA come from the pollution penalty charge: in the Adour-Garonne Basin (Box 2.2), 72% of the fees collected from water users and polluters come from the pollution penalty charge. The penalty charge rates should be set high enough and better enforced in order to be an effective incentive to reduce water pollution loads. As in the case of France, the revenues collected from the penalty charge could be returned to "polluters" in order to subsidize investments aimed at decreasing the pollution load into water bodies.

- *Introducing water use fees for irrigation*. Potential revenues are important because irrigation accounts for about 80 per cent of water withdrawals. In order to facilitate fee collection and enforcement, it is proposed to (i) introduce, first, a water user fee in the irrigation districts, as part of the water bill in areas with serious water scarcity and (ii) return the money collected to irrigation districts in the form of subsidies for investments aimed at increasing water use efficiency, a mechanism successfully introduced by PRODDER for water utilities (see para. 2.10).

- *Decreasing water use fees "rebates" for the mining, sugar and paper industries*. This could potentially increase revenues from industrial users by 25 per cent (equivalent to about 15 per cent of overall water use revenues) and improve the water productivity of these three industries which is much below the industrial average.

- *Improve efficiency of water use fee collection*

- *Raise water use fees for industries and water utilities in water scarce areas*

- *Improve measurement and volumetric charging to better induce water savings.* About 30 per cent of the municipal water users, some industrial water users and most irrigation water users do not have adequate measurement of their water use. For price to be an incentive for water conservation, water deliveries must be measured and the fees collected in relation to the volume of water used. A way to significantly promote meter installation is to introduce different ways to calculate the water abstraction charge (e.g., one based on the amount of water metered and others based on

standard, such as water consumption per ha) devised in such a way that it penalizes users not equipped with water meters. This approach was successfully implemented in France: in 2006, the French Water Basin agency Seine-Normandie charged farmers □ 0.5/m^3 (about MxP 6/m^3) for a water consumption estimated from a water meter; □0.9/m3 (about MxP 11/m^3) for a water consumption estimated from the energy bill; and about □ 20,000/ha (about MxP 240,000/ha) otherwise.

CONAGUA spending

o CONAGUA spending totaled MxP 13.5 billion in 2004. CONAGUA "influence" in the water sector is even larger, as its programs leverage additional financial resources through cost sharing arrangements from states, municipalities and water users in both the WSS and I&D sub-sectors.

o *Current expenditures have been increasing, accounting for about half of total expenditures in 2004*. CONAGUA total spending has been increasing in real terms over the past five years. In 2004, CONAGUA spent about half of its resources on current expenditures (Table 2.9).

Table 2.9 CONAGUA Expenditures by Economic Classification

(2004 MxP million)	2000	2001	2002	2003	2004
Total Expenditures	**10,300.7**	**11,170.3**	**11,106.1**	**14,119.8**	**13,542.8**
Current Expenditures	3,055.7	4,230.0	6,507.9	6,983.8	6,670.2
Capital Expenditures	7,245.1	6,940.3	4,598.2	7,136.0	6,872.6

Source: CONAGUA.

o *Inter-sectoral allocation of spending*. About half of CONAGUA resources are spent on water supply and sanitation infrastructure, a quarter in the irrigation sub-sector and another quarter on central administration and overall water resources management, including flood management (Table 2.10).

Table 2.10 CONAGUA Expenditures by program

(2004 MxP million)	2000	2001	2002	2003	2004	2005p
Total Expenditures	**10,300.7**	**7,460.7**	**11,106.1**	**14,119.8**	**13,542.8**	**16,821.4**
Water Supply and Sewage Infrastructure	**4,534.9**	**3,139.0**	**3,674.8**	**6,876.3**	**6,368.7**	**8,435.1**
Other Activities	0.0	0.0	46.3	0.0	1,021.6	899.4
Drainage of the Metropolitan area of the Valley of Mexico	0.0	72.1	221.1	323.7	92.4	23.4
Water Supply infrastructure in the northern border area (Frontera Norte)	46.7	33.0	50.1	193.7	248.8	177.9
Water Supply and Sewage in Urban Areas	20.0	559.2	16.0	0.0	14.1	28.6
Preservation and maintenance of water beds	0.0	0.0	0.0	336.0	0.0	0.0
Infrastructure in protected areas	0.0	0.0	0.0	419.3	0.0	0.0
Lerma-Chapala Basin	0.0	0.0	0.0	157.5	81.5	5.0
Water supply in Guadalajara and Leon	0.0	0.0	0.0	21.2	27.5	4.8
Management of the Hydrological System	0.0	0.0	0.0	314.5	0.0	0.0
Sustainable management of water	0.0	0.0	0.0	151.4	0.0	0.0
Operation and maintanence of systems that provide bulk water	1,499.5	1,504.4	1,420.5	1,955.2	2,245.9	2,491.6
"Devolucion de Derechos" program (PRODDER)	0.0	0.0	0.0	1,499.4	1,455.6	738.6
"Cultura del Agua" Program	0.0	0.0	0.0	0.0	0.0	11.0
"Agua Limpia" Program (PAL)	68.4	44.2	0.0	42.8	50.4	57.1
Program of water supply, sewage and drainage of urban areas	1,779.7	838.2	1,499.9	911.1	868.8	3,431.3
Program on construction and rehabilitation of water infrastructure in rural areas	1,120.5	88.0	421.0	550.4	262.1	566.3
Hydro-agriculture Infrastructure	**3,079.5**	**2,604.9**	**2,305.0**	**2,480.8**	**3,293.8**	**3,644.1**
Other Activities	0.0	0.0	0.0	0.0	753.0	625.7
Operation and Maintenance of irrigation districts	310.6	355.3	264.1	326.3	278.9	270.7
Operation and Maintenance of dams and other inf.	51.8	55.2	48.0	74.7	64.8	165.4
Rehabilitation of dams and other inf.	9.5	10.8	16.4	9.4	2.6	97.2
Lerma-Chapala Basin	0.0	0.0	0.0	86.1	70.8	218.5
Management of the Hydrological System	16.7	0.0	0.0	0.0	0.0	0.0
"Desarrollo de infraestructura de Temporal" Program	197.6	265.4	134.1	121.7	166.9	180.2
Conservation and rehabilitation of "areas de Temporal" program	0.0	0.0	0.0	61.0	89.1	92.8
Program of expansion of irrigation districts	1,309.2	891.3	765.5	568.5	784.8	862.5
Program of rehabilitation of water districts	496.2	401.6	627.1	831.3	645.6	507.7
Parcel Development Program	223.6	190.6	105.6	58.6	23.9	112.9
Efficient use of water and electricity Program	121.5	123.2	104.0	44.8	119.3	146.1
Expansion of irrigation units Program	193.3	148.6	108.8	160.7	151.9	178.1
Efficient use of hydro-agriculture infrastructure program	149.3	162.9	131.4	137.7	142.4	186.3
Administration and Water Preservation	**2,686.4**	**1,716.8**	**5,073.1**	**4,151.3**	**3,382.8**	**4,128.1**
Other Activities	1,005.0	879.2	4,216.0	4,151.3	2,156.8	2,316.5
Adquisition of goods	0.0	0.0	0.0	0.0	48.7	67.3
Conservation and maintenance of federal water beds and infrastructure	0.0	0.0	0.0	0.0	231.7	234.1
Infrastructure to protect productive areas and urban centers	1,201.2	496.4	421.1	0.0	521.0	837.5
Lerma-Chapala Basin	0.0	0.0	0.0	0.0	14.2	48.1
"Cruzada Nacional por el Bosque y el Agua"	0.0	0.0	0.0	0.0	0.0	1.3
Management of the Hydrological System	350.6	254.9	293.8	0.0	294.7	365.2
Sustainable management of water	129.5	86.4	142.3	0.0	115.6	197.1
International Water Forum	0.0	0.0	0.0	0.0	0.0	61.0

Source: CONAGUA

o From 2000 to 2005, CONAGUA spent MxP 21,139 million in *administration and overall water resources management*. Most expenditure was related to the overall administration of CONAGUA and investments in flood management.

o *Cost-effectiveness of investment in flood management could be substantially improved*. In general, CONAGUA's investments in flood management are mainly in the form of emergency post-disaster actions. Emergency investments are often not well planned and costly. Well-planned flood control and management systems that include both structural and non-structural measures can be much more effective in terms of costs (economics) and results (less damage and loss of lives). Non-structural measures, such as zoning, alarm systems and optimization computer models for operating

existing hydraulic infrastructure can bring large benefits at relatively low costs. The *Programa de modernización del manejo de Agua* (PROMMA) project supported the implementation of hydrologic forecasting systems, a good first-step towards the application of non-structural measures.

- Effective flood management also requires *inter-sectoral cooperation*, such as (a) using "vados" (river fords), instead of building high and costly highway bridges that are wiped out by heavy rains, (b) enforcing forestry regulations to impede illegal deforestation, enforcing municipal regulations to avoid illegal river bed and floodplains occupation, etc. *Land use planning and enforcement should have a high priority, not only for flood prevention but also to protect groundwater recharge areas and to control aquifer pollution.*[22]

- *About 40 per cent of CONAGUA spending takes place in 4 hydrographic regions* (Valle de Mexico, Lerma-Santiago-Pacifico, Pacifico Sur, Pacifico Norte). *More than 50 per cent of investment spending takes place in five states* (Distrito Federal, Baja California, Chihuahua, Sinaloa and Tamaulipas). Hence, the geographic distribution of resources does not follow necessarily the size (population wise) of states or hydrographic regions, nor the revenues collected from each zone. For example, in 2004 CONAGUA spent MxP 290 million in the state of Mexico, which has a population close to 15 million, and MxP 471.8 million in Sinaloa, with a population under 3 million. This is mainly because of large irrigation systems in Sinaloa with major rehabilitation and modernization investments.

[22]According to CENAPRED (Centro Nacional de Prevencion de Desastres) average annual damages due to floods are around US$700 million. Thus, the US$34 - US$434 (respectively for the trendy and sustainable scenarios budget) in the PNH 2001-2006 look quite small. In contrast, CENAPRED stating that drought effects are far worse than flood damages, their annual reports dedicate to droughts only around 1% of the space in their reports and they inform that annual average damages due to droughts are only US$40 million -- clearly an underestimated figure! See also IWRA Journal Water International March 2005, dedicated to floods, and the DFID Bulletin No. 12 Climate Change in Latin America, about hydrometeorological disasters affecting mostly the poor.

Table 2.11 CONAGUA expenditures by state

(2004 MxP million)	2003			2004		
	Current	Capital	Total	Current	Capital	Total
Total	**6,983.8**	**7,136.0**	**14,119.8**	**6,670.2**	**6,872.6**	**13,542.8**
Aguascalientes	9.8	70.1	80.0	7.8	58.9	66.7
Baja California	44.6	403.9	448.5	46.7	431.8	478.5
Baja California Sur	9.9	50.4	60.3	10.9	48.3	59.2
Campeche	10.7	18.2	28.8	9.6	61.8	71.4
Coahuila	38.1	209.6	247.6	39.2	252.4	291.5
Colima	8.7	67.9	76.6	8.6	33.6	42.2
Chiapas	26.3	152.2	178.5	23.5	175.3	198.9
Chihuahua	19.7	532.0	551.8	19.5	523.9	543.4
Distrito Federal	6,310.0	1,262.9	7,572.9	6,003.0	1,317.1	7,320.2
Durango	10.7	128.1	138.8	9.5	57.5	67.0
Guanajuato	17.5	231.8	249.4	15.9	242.2	258.1
Guerrero	17.6	148.9	166.5	13.9	95.9	109.8
Hidalgo	22.5	158.7	181.3	28.5	165.3	193.9
Jalisco	32.8	256.6	289.4	45.3	245.4	290.7
Estado de Mexico	14.0	219.7	233.8	10.6	279.6	290.2
Michoacan	20.0	201.2	221.3	19.9	234.1	254.0
Morelos	17.1	60.0	77.1	17.5	93.8	111.3
Nayarit	15.3	118.0	133.3	12.9	94.1	107.0
Nuevo Leon	35.4	360.3	395.6	35.9	143.2	179.0
Oaxaca	24.4	168.6	193.0	26.4	116.6	143.0
Puebla	12.6	127.4	140.0	12.1	90.7	102.8
Queretaro	6.5	57.6	64.1	6.8	93.5	100.4
Quintana Roo	7.9	140.7	148.6	7.9	116.2	124.0
San Luis Potosi	15.7	63.7	79.4	15.6	125.8	141.4
Sinaloa	52.2	539.1	591.3	48.3	423.5	471.8
Sonora	43.1	369.8	412.9	36.3	265.0	301.2
Tabasco	15.9	295.6	311.6	16.8	285.9	302.7
Tamaulipas	35.9	336.0	371.8	35.8	500.6	536.3
Tlaxcala	6.5	28.6	35.0	6.7	30.0	36.7
Veracruz	45.3	147.4	192.7	43.1	122.3	165.4
Yucatan	22.6	74.8	97.3	21.8	67.3	89.1
Zacatecas	14.4	136.1	150.5	13.8	81.1	94.9

Source: CONAGUA.

- *About 60 per cent of current expenditures are incurred by the central administration, while 75 per cent of investment spending takes place at the hydrographic region level.* Region XIII (Valle de México including the Cutzamala system) totals 30 per cent of total expenditures in the regions and three-quarters of regional recurrent expenditures. If this hydrographic region is excluded, there is very little variation in terms of current expenditures across hydrographic regions, but still huge variations in terms of capital expenditures.

Table 2.12 CONAGUA expenditures by hydrographic region

	Expenditures (MxP thousands)	2003 Current Exp.	2003 Capital Exp.	2003 Total	2004 Current Exp.	2004 Capital Exp.	2004 Total	2005 Current Exp.	2005 Capital Exp.	2005 Total
I	Península de Baja California	54.5	454.3	508.8	52.9	433.6	486.5	66.4	704.9	771.3
II	Noroeste	43.1	369.8	412.9	36.3	265.0	301.2	44.4	438.6	482.9
III	Pacífico Norte	67.5	657.1	724.6	57.0	423.9	480.9	101.2	909.2	1,010.4
IV	Balsas	56.2	417.2	473.4	37.8	95.2	133.0	64.8	493.2	558.0
V	Pacífico Sur	42.0	317.5	359.5	34.4	116.8	151.2	43.2	555.9	599.1
VI	Río Bravo	55.1	892.3	947.4	47.6	143.7	191.3	63.8	1,068.3	1,132.1
VII	Cuencas Centrales del Norte	63.2	473.8	537.0	45.7	98.9	144.6	32.3	183.5	215.9
VIII	Lerma-Santiago-Pacífico	75.4	684.1	759.4	68.7	249.0	317.7	83.2	1,051.1	1,134.3
IX	Golfo Norte	51.6	399.7	451.3	43.2	500.8	544.0	61.3	553.5	614.8
X	Golfo Centro	45.3	147.4	192.7	43.1	122.3	165.4	49.1	300.3	349.3
XI	Frontera Sur	42.2	447.9	490.0	40.4	461.3	501.6	52.6	710.1	762.7
XII	Península de Yucatán	41.1	233.6	274.7	32.7	67.6	100.3	48.4	340.6	389.0
XIII	Aguas del Valle de México y Sistema Cutzamala	1,815.2	1,066.1	2,881.3	2,069.1	689.2	2,758.3	2,258.1	1,273.6	3,531.8
	Central Administration	4,455.8	651.0	5,106.7	4,072.1	3,194.8	7,266.9	4,175.7	2,930.2	7,105.9
	Total	**6,908.1**	**7,211.7**	**14,119.8**	**6,680.8**	**6,862.0**	**13,542.8**	**7,144.5**	**11,513.1**	**18,657.6**

Source: CONAGUA.

- ***In conclusion***, too little information is available to analyse CONAGUA's federal spending *amount* and *allocation* across sectors (WSS, irrigation, WRM) and across hydrographic regions. It is clear however, that introducing participatory WRM at the basin level, as foreseen in the NWL and further described in Chapter 3, could improve the allocation of federal resources across sectors and regions. This will certainly lead to:

  - A transfer of current and investment expenditures from central CONAGUA to the regions, reflecting the delegation of functions from the central office to the river basin agencies. Giving today's high level of current expenditures, decentralization should occur without increasing overall current spending. A detailed evaluation of CONAGUA current spending could bring more light into this issue.

  - A reallocation of federal resources across sectors and regions, and participatory WRM at the basin level, will better reflect local investment needs, thereby improving overall sector performance in terms of efficiency, equity and sustainability. While overall investment need might increase as a result, it is believed that this should not require increase "net" federal contribution as (i) better planning and management should increase investment cost-effectiveness and (ii) there is substantial scope to increase revenues collected from users through water use fees and water penalty charges.

CONAGUA - Fiscal balance

- *Overall fiscal balance*. The transfers of the central government to CONAGUA to cover its expenses are relatively modest compared to other federal agencies. In 2004, "net" transfers from the general tax resources reached MxP 5.8 billion, accounting for 40 per cent of CONAGUA revenues (Table 2.1). In the past five years, they have been below 0.1 percent of GDP (Figure 2.2).

Figure 2.2 Trend of Balances of CONAGUA.

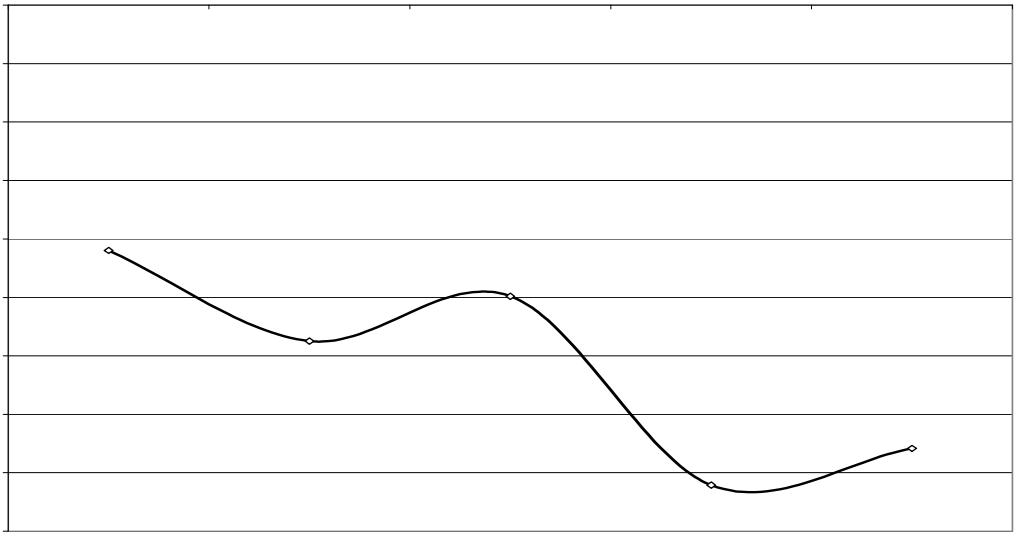


Figure 2.3 shows the average revenues and expenditures for each state from 2000 through 2004. It does not show the (large negative) balance for the Federal District home of CONAGUA central office. Figure 2.4 shows the average revenues and expenditures for each hydrographic region from 2000 through 2005. The 45 degree line shows when the balance is equilibrium; all the entities above the line are in surplus, while the ones below are in deficit. The dashed lines give a range of those entities which are relatively close to the equilibrium. Several conclusions arise from these figures:

- The North West part of the country (rich, dry states) and the southern states (poor states with abundant water) are running deficits.

- Central Mexico and the North East (middle income and some rich entities) are running surpluses.

- The states of Central Gulf and Lerma-Santiago-Pacific and Rio Bravo hydrographic regions have surpluses, which show up in the hydrographic region balances.

- The *Valle de Mexico*, with the richest households and greatest industrial concentration in the country, is running a large deficit (Figure 2.4 shows the deficit in the Valle de Mexico calculated without the central administration expenditures of CONAGUA). This indicates a need to increase water user fees collections and wastewater penalty charges in the Mexico City area.

- Poor states in the south, which are running modest deficits, may continue to need subsidies by the federal government while the other states in the North West and the states which receive large intergovernmental transfers like Tabasco and Campeche (and have large industries) should be able to raise enough revenues to cover their costs.

Figure 2.3 Trend of Balances of CONAGUA.
Averages from 2000-2004 in 2004 MxP million.

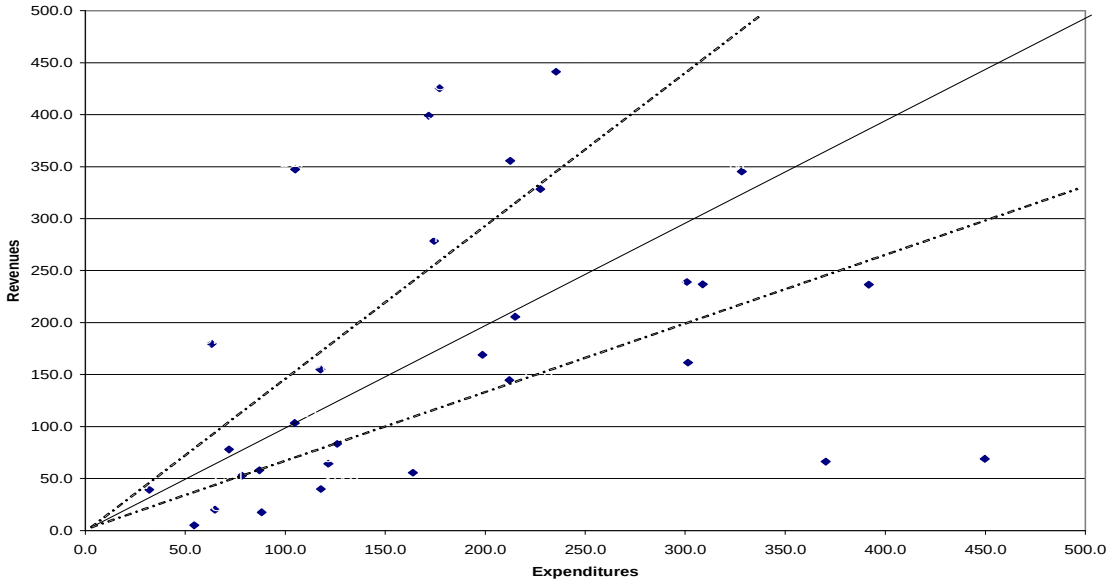
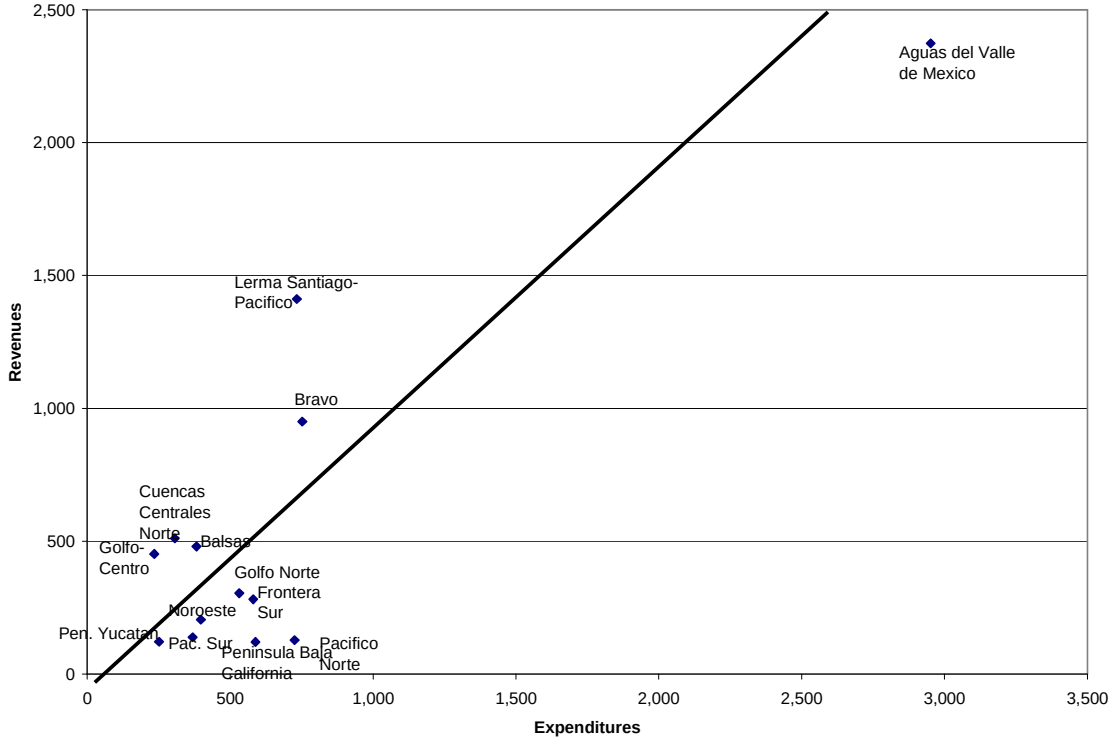


Figure 2.4 Balances of each hydrographic region.
Averages from 2003-2005 in 2004 MxP million.



Source: CONAGUA.

In conclusion, it should be possible to implement the new water law without increasing "net" federal transfers to the water sector, as there is significant scope to increase revenue collection from water users and polluters and to improve cost-effectiveness both in terms of current and investment spending. At the regional level, as functions are delegated to the basin agencies, overall expenditures will increase. This should be compensated by a decrease in spending at the central level and increased revenue collection from water users and polluters. It is also expected that allocation of federal resources between sectors and across regions will change, as a result of participatory planning and management at the basin/aquifer level, thereby increasing the overall performance of the water sector in terms of efficiency, equity and sustainability. Chapter 3 further discusses the financing implications of implementing basin level, participatory WRM through the analysis of different financing scenarios.

WATER SUPPLY AND SANITATION SUB-SECTOR FINANCING

o This section analyses the degree of sub-sector self-financing and the adequacy of past investment spending in quantitative and qualitative terms, as compared to sub-sector performance and priorities.

The sector as a whole falls short of generating sufficient revenues to cover full costs

Cost recovery

o Water tariff collections have been estimated at MxP 17.4 billion in 2004, while billed revenues have been estimated at MxP 22.8 billion in the same year.[23]

o *The sector as a whole falls far short of generating sufficient revenues to cover full costs*.[24] On average, the sector generates only a very modest cash surplus, estimated at about MxP 1 billion in 2003, which is well below the financial performance achieved by the top quartile of utilities in developing countries (Tynan and Kingdom 2002:3). Moreover, this apparent modest surplus among Mexican utilities in part reflects *shortfalls in essential spending on maintenance and modernization rather than financial viability*.

o *The aggregate figures also mask substantial variations in performance among service providers;* some depend on municipal subsidies for recurrent costs while others self-finance substantial investments. This wide variation suggests that some service providers in Mexico achieve or exceed international good practice and that high level of performance are achievable there.

o *There seems to be potential to increase tariffs*. The average tariff across users is only about half the Latin America and the Caribbean average (US$0.32 per cubic meter compared to US$0.65 per cubic meter).[25] Water service providers typically charge tariffs close to full cost recovery to industrial and commercial users and cross-subsidize residential users. On average, water tariffs for industrial and commercial users are more than four times higher than for residential users.[26] According to the 2002 Household Survey, the average share of expenditures for piped water supply in household income was 0.65 per cent, varying between 1.0 per cent for the first decile and 0.4 per cent for the

[23] CONAGUA (2006) based on a sample of 395 localities in all states.

[24] Estimates show that the sector generates a moderate "surplus" over operating costs. This does not take into account depreciation, debt service, and adequate maintenance. The accounting "surplus" thus is an illusion.

[25] For Mexico: Barocio (2004:15); for Latin America: WHO/UNICEF (2000:18). The prices are not strictly comparable, because the regional figures refer to earlier years. A comparison with average 2003 tariffs in the region may show an even larger discrepancy.

[26] INEGI (1999), I Censo de Captación, Tratamiento y Suministro de Agua. The average tariff is MxP 1.62/m3 for residencial users, Mxp 6.90/m3 for commercial users and MxP 6.76/m3 for industrial users.

tenth decile.[27] This share is low in international comparison and suggests potential to increase WSS tariffs further.

o *The sector is suffering from inadequate tariff adjustment mechanisms.* Only in few utilities, automatic tariff adjustment mechanisms are in place, linking a sector-specific price index to small tariff adjustments on a monthly basis. There is little data on average water tariff increases in Mexico, although anecdotal evidence suggests that average real tariffs remained flat or may have declined in recent years.

o *Most cities do not charge for sanitation*. In those cities where users pay for sanitation, it is typically as a small percentage share of the water bill. Given the substantial ongoing and planned increase of investments in wastewater treatment, which will go hand in hand with an increase in O&M costs, an effective cost-recovery mechanism for wastewater collection and treatment is urgently needed.

o *Average collection efficiency in Mexico estimated at 76 per cent is far below the levels achieved in developed countries, and even in many developing countries* (Table 2.13). The wide variations within Mexico again show that high levels of performance are achievable there.

Table 2.13 Collection Efficiency

Country	Year	Collection / Billing (%)
Mexico (Monterrey)	2004	98
OECD average	1996	95
Asian cities (average of 18)	2001	88
Brazil (average)	2000	87
Mexico (Hermosillo)	1999	85
Mexico (average)	**2004**	**76**
Mexico (Matamoros)	1999	45
Mexico (sample of small cities)		20

Sources: CONAGUA (2006); SMAPA (Tuxtla Gtz. O.O.) interviews (2004); Capitol Advisors Ltd. Hermosillo Case Study (1999); IDB, the Brazilian National Water Information System, and OECD, Ciudades Estratégicas (2000).

o *Metering and volumetric charging is essential to promote water conservation and reduce non-revenue water*. Thirty percent of water customers are not metered and are charged a flat rate (*cuota fija*) independent of consumption.

[27] World Bank calculations based on data from the 2002 National Survey on Household Income and Expenditure (ENIGH) by INEGI.

Three-quarters of investments are financed through public subsidies

- Total investment in the WSS sector was estimated by the World Bank (IPER, 2005) to be MxP 16.6 billion in 2003, or 0.27 per cent of GDP. This is lower than investment in other countries of the region such as Chile (0.67 per cent in 2001), Columbia (0.36 per cent in 2001) and Brazil (0.38 per cent in 2002).

- As the WSS sub-sector only generates a small cash surplus, *three-quarters of those investments are financed through public subsidies* (federal subsidies-56 per cent, states subsidies-13 per cent and municipal subsidies-6 per cent); complemented by contribution from housing developers (22 percent), which construct water and sewerage systems within their developments and which increased their investments substantially as part of large subsidized housing programs initiated in 2001. Internal cash generation and commercial credits account for only a small share of investment financing (possibly 5 percent).

- International experience shows that private sector participation (PSP) and regulation constitute interesting policy options for improving efficiency and resource mobilization. However, PSP and financing in WSS in Mexico remains lower than in its peers in Latin America (Argentina, Brazil, Chile, and Colombia). In addition, the approach to PSP in Mexico—particularly for the segments that provide service directly to retail consumers—has limited the efficiency gains that normally arise from private participation. PSP in Mexico has mostly been in upstream activities such as water and wastewater treatment plants. Mexico's lack of reform of existing service providers has limited the efficiency gains that usually occur from involving the private sector in the running of infrastructure services (improvements in commercial and technical efficiency).

- **In conclusion**, the WSS sub-sector falls short of generating sufficient revenues to cover full costs and is the primary beneficiary of federal and state investment subsidies within the water sector. There is, however, substantial scope to increase WSS self-financing through reduced operating and investment costs (i.e. increased efficiency and cost-effectiveness), improved billing and collection and tariff increases. The next paragraphs analyze the adequacy of investment spending, as compared to sub-sector performance and priorities.

Adequacy of investment spending in relation to sub-sector performance and priorities

Sub-sector performance

- *Mexico's key WSS challenges lie in improving the quality and operating efficiency of services, wastewater treatment and access to the poor.*

- *While Mexico has made steady progress in increasing the coverage of WSS, access gaps remain in smaller cities, rural areas and among indigenous people.* Approximately 90 percent of the population has access to potable water supply and safe sanitation, which is significantly beyond the average of the region. However, only 58 percent of the extreme poor had access to potable water supply in 2002 and coverage

level drops sharply from more developed urban areas through the urban periphery and smaller towns to the more remote rural areas.

Table 2.14 to Water Supply and Sanitation (1992-2004)

		National			Urban			Rural		
		1992	**2002**	**2004**	**1992**	**2002**	**2004**	**1992**	**2002**	**2004**
Water	Improved water source	80.7	89.9	90.1	92.2	96.2	94.4	50.3	70.6	75.6
	Non-improved water source	19.3	10.1	9.9	7.8	3.8	5.6	49.7	29.4	24.4
Sanitation	Improved Sanitation	65.4	77.0	91.2	81.6	91.1	95.3	22.5	34.2	75.7
	Non-improved Sanitation	6.0	3.9	1.5	4.0	1.9	1.1	11.3	9.8	2.9
	No sanitation	28.6	19.1	7.3	14.4	7.0	3.6	66.2	56.0	21.5

Source: Mexico Poverty III: Decentralized Delivery of Social and Productive Services for the Poor, World Bank, 2006

Table 2.15 Access to WSS Services by Group of Municipalities (2000)

	I (poorest)	II	III	IV (richest)	Whole Sample
% of population without improved water	28.86	10.03	4.04	2.07	11.23
% of population without sanitation	26.72	9.33	2.49	1.06	9.89
% of population living in loc. with less than 5,000 inhab.	77.02	36.28	7.95	2.75	30.97
# Municipalities	1,553	669	132	56	2,410

Source: Mexico Poverty III: Decentralized Delivery of Social and Productive Services for the Poor, World Bank, 2006 (based on Conapo information at municipal level). Percentages were weighted by population in the municipality.

o *Service quality falls short of the levels achieved in other upper-middle income countries*. The share of municipal wastewater that received some kind of treatment was only 30 per cent in 2004. According to the 2000 census, only 45 per cent of household connected to water distribution network received a continuous supply of water. While there is very limited data on drinking water quality at the tap, the intermittent supply is likely to have a negative impact on water quality (lack of water in the pipes can result in contaminates being drawn into the delivery systems), especially since a recent survey has shown that 16 percent of Mexicans with connections receive water that does not contain the required level of residual chlorine at the tap.

o *Operational efficiency falls short of the levels achieved in other upper-middle income countries*. Using non-revenue water (NRW) and water staffing levels as indicators, operating efficiency levels are low. The average level of NRW is estimated at 45 per cent in 2004, while the best performing quartile of 123 utilities in 44 developing countries achieves less than 23 per cent. The average level of staff per 1,000 connections among a sample of 35 Mexican utilities was 4.5 in 2000, suggesting ample scope for improving the situation of many overstaffed water utilities in the country.

Future WSS investment needs

o *Estimates of future investment needs are in line with past investment levels*. Past investment spending in the sector totaled 0.20 per cent of GDP per year between 2001 and 2003. In comparison, reaching universal coverage in WSS by 2015, while maintaining existing WSS systems, would require annual investment spending of 0.23 per cent of GDP (see Box 2.3).

Box 2.3 Estimates of WSS investment needs

The Infrastructure Public Expenditure Review (IPER, 2005) provides several estimates of WSS investment needs depending on the objective:

Annual investment needs based on universal service access targets.

CONAGUA estimates that MxP 12.3 billion a year, or **0.14 per cent of GDP per year**, is required to finance sector needs during 2006-29 with the objective of reaching universal access by 2029.

The World Bank (IPER, World Bank, 2005) estimates investment total needs to achieve universal coverage by 2015 at MxP 20.6 billion per year, or **0.23 per cent of GDP per year**. This includes 0.13 per cent of GDP to increase coverage and 0.1 per cent of GDP to cover the maintenance needs of existing WSS systems. This estimate relies on alternative technologies in circumstances where the price of the network connections would become prohibitive: households in low-density areas would not have accesss to sewerage connections, but alternative sanitation systems such as latrines, and a proportion of households would have access to water, but not necessarily through house connection. This estimate would be almost 25 per cent lower (0.1 per cent of GDP) assuming LAC average costs. This estimate does not include the cost of rehabilitating existing systems.

Annual investment needs based on predicted demand for WSS services. The approach developed by Fay and Yepes (2004) estimates the additional spending required to satisfy the additional demand implied by a modest growth of about 2.5 per cent a year. It suggests that Mexico would need to spend about **0.15 per cent of GDP per year** for WSS investment, including 0.06 per cent more on new WSS investments per year and 0.09 per cent for the maintenance of existing infrastructure. The equivalent estimate for LAC is 0.21 per cent, 0.08 per cent and 0.13 per cent respectively.

Source: IPER, World Bank, 2005

Future investment needs may underestimate rehabilitation and maintenance needs. The IPER indicates that investment estimates are likely to underestimate somewhat the need for maintenance and rehabilitation of existing WSS systems. Indeed, the WSS sector has suffered from years of poor maintenance and it is not possible to estimate the exact cost of rehabilitation and upgrades needed to ensure better quality of services.

On the other hand, operating efficiency and investment cost-effectivess could improve substantially, reducing future investment needs. Unit investment costs in WSS in Mexico are about 25 per cent higher than LAC average. Spending in WSS investments would have a much greater effect if also accompanied by efficiency gains. Much of the needed rehabilitation is due to insufficient maintenance over the last decade, and rehabilitation is much more costly than regular maintenance.

In conclusion, while substantial investments are needed in wastewater collection and treatment and to extend WSS service coverage in poor rural and peri-urban areas, it

appears that the "net" public transfer to the sector does not need to be increased, as (a) past investments levels are close to future investment requirements; and (b) there is substantial scope to increase WSS self-financing through reduced operating and investment costs (i.e. increased efficiency and cost-effectiveness), improved billing and collection and tariff increases.

WSS programs and sub-sector performance

o As mentioned above, most WSS investment is funded by the federal government, even though most investments are not directly made by the federal government, but by water utilities, municipalities, state governments, and private sector housing developers.

o Federal investment subsidies are channeled primarily through CONAGUA WSS programs and the Social Infrastructure Contributions Fund (*Fondo de Aportaciones para Infrastructura Social* – FAIS) programs, each accounting for about a fourth of the national WSS investments. The influence of these federal programs in WSS investments are instrumental in shaping overall WSS investments, as they drain additional resources through cost-sharing arrangements with state, municipalities and utilities.

o *CONAGUA funding*. The WSS sub-sector absorbs 50 per cent of overall CONAGUA spending. Taking into account water use fees and bulk water charges collected from the WSS sub-sector (MxP 2.57 billion in 2004), CONAGUA expenditures in the sector represented, in 2004, a "net transfer" of about MxP 3.77 billion of federal funds.

Table 2.16 CONAGUA - Water Supply and Sewage Infrastructure Expenditures

(2004 MxP million)	2000	2001	2002	2003	2004	2005p	Total
Water Supply and Sewage Infrastructure	**4,534.9**	**3,139.0**	**3,674.8**	**6,876.3**	**6,368.7**	**8,435.1**	**33,028.8**
Other Activities	0.0	0.0	46.3	0.0	1,021.6	899.4	**1,967.2**
Drainage of the Metropolitan area of the Valley of Mexico	0.0	72.1	221.1	323.7	92.4	23.4	**732.7**
Water Supply infrastructure in the northern border area	46.7	33.0	50.1	193.7	248.8	177.9	**750.2**
Water Supply and Sewage in Urban Areas	20.0	559.2	16.0	0.0	14.1	28.6	**637.9**
Preservation and maintenance of water beds	0.0	0.0	0.0	336.0	0.0	0.0	**336.0**
Infrastructure in protected areas	0.0	0.0	0.0	419.3	0.0	0.0	**419.3**
Lerma-Chapala Basin	0.0	0.0	0.0	157.5	81.5	5.0	**244.0**
Water supply in Guadalajara and Leon	0.0	0.0	0.0	21.2	27.5	4.8	**53.5**
Management of the Hydrological System	0.0	0.0	0.0	314.5	0.0	0.0	**314.5**
Sustainable management of water	0.0	0.0	0.0	151.4	0.0	0.0	**151.4**
Operation and maintanence of systems that provide bulk water	1,499.5	1,504.4	1,420.5	1,955.2	2,245.9	2,491.6	**11,117.2**
"Devolucion de Derechos" program	0.0	0.0	0.0	1,499.4	1,455.6	738.6	**3,693.7**
"Cultura del Agua" Program	0.0	0.0	0.0	0.0	0.0	11.0	**11.0**
"Agua Limpia" Program	68.4	44.2	0.0	42.8	50.4	57.1	**262.8**
Program of water supply, sewage and drainage of urban areas	1,779.7	838.2	1,499.9	911.1	868.8	3,431.3	**9,329.0**
Program on construction and rehabilitation of water infrastructure in rural areas	1,120.5	88.0	421.0	550.4	262.1	566.3	**3,008.3**

Source: CONAGUA.

o The largest programs are PRODDER and *Programa de Agua Potable, Alcantarillado y Saneamiento en Zonas Urbanas* – APAZU, accounting for MxP 2.3 billion in 2004, or 30 per cent of CONAGUA expenditures in the sector

o *FAIS program*. FAIS is responsible for about 30 per cent of the investment in the WSS sub-sector, with about MxP 4 billion in 2004. It was created in the 1990's to support the decentralization process. It is a multi-sectoral fund dedicated to

social infrastructure investments[28] and provides resources directly to municipalities (about 88 per cent of resources) and, to a lesser extent, to states (about 12 per cent of resources). Funds allocation to states and municipalities are based on a formula considering their respective level of poverty.

- As mentioned above, most federal programs require some co-funding by states, municipalities and utilities. This has effectively motivated increased investment funding from the local level, especially for those programs that are administratively uncomplicated and provide large degree of discretion for use of the funds, such as the APAZU and PRODDER. This is an important achievement because of the extreme dependence of local governments on transfers from the federal budget both reflects and reinforces the culture of lobbying for projects and funding, rather than raising own resources with accountability to local tax payers and customers.

- However, *most federal funding in the sector is neither linked to poverty levels nor to efficiency standards and thus, provides little incentives for local decisions to improve the performance* of the WSS sub-sector in terms of coverage in poor areas, service quality and operating efficiency.

- Before 2000, investments in sanitation were neglected compared to investments in water supply. Since then, this distortion has been partially corrected, in particular through a substantial increase in investments in wastewater treatment in response to federal pressure to comply with wastewater quality standards (see para. 2.15-18 on water pollution penalty charges). Investments in wastewater collection and treatment needs to further increase however.

- The share of investments allocated to rural areas declined since 2000 which may reflect the increasingly lower share of the rural population in the total population. However, rural areas, where many of the poor and indigenous people live, are lagging behind in terms of WSS coverage service quality and efficiency (see Table 2.15).

- The high average level of non-revenue water in Mexico (see para 2.50) suggests that investments in the reduction of distribution losses would be more cost-effective than investments in new bulk water supply infrastructure. It seems however that despite a stated priority for investments destined to "increase efficiency" there is still a preference for investments in bulk water supply as opposed to investments in leakage reductions.

- There is no poverty targeting in any of the federal subsidy programs for the WSS sector, except for the rural WSS program PROSSAPYS and FAIS. The lack of differentiation in co-financing requirements according to the level of marginality/proverty makes it difficult for service providers in poorer municipalities to fully tap into the federal funds. Moreover, some of the programs favor the more affluent

[28] FAIS provides federal resources for basic infrastructure: potable water, sanitation, drainage, urbanization, electricity for rural and poor urban areas, basic health and education infrastructure, housing, rural roads and rural productive infrastructure. The total amount of the Fund is a fixed amount of federal revenues.

parts of the country. For example, the *Frontera Norte* program is only available to localities within 300km of the border with the US, which happen to be the areas with the lowest degree of marginality in Mexico. PRODDER, the largest federal program dedicated to WSS, is tilted in favor of the Northern states since it is based on the water use fees collected. The water abstraction charges are set at much higher level in the arid, Northern parts of the country, so that service providers in these usually richer localities both pay more and receive more funds through this program. This bias in favor of richer localities is partly compensated by FAIS, a multi-sector fund under Ramo 33, whose importance was noted above, which is allocated according to a formula that heavily favors poorer municipalities and states.

- All programs have detailed operating rules, specifying numerous pre-conditions, layers of approvals and reporting requirements. In practice, these are sometimes not followed. This introduces undesirable element of political discretion, which likely favors states with better political connections.

- The complexity of programs makes it difficult for states and service providers with limited administrative capacity to access their benefits. A simplification of the operating rules may reduce that bias. However, the solution to that problem ultimately lies in strengthening local capacity through improving continuity of managerial staff and better insulating service providers from undue political interference at the municipal level.

- The existing programs have not brought about improvements in operating and economic efficiency. The only program that is conditional upon a commitment to structural change is PROMAGUA. PROMAGUA provides federal grants for WSS infrastructure investments to municipalities over 50,000 inhabitants, conditioned to the elaboration of a WSS Master Plan including investments to improve efficiency and coverage and the introduction of structural changes of the water operator through Private Sector Participation (PSP). However, the program has been implemented very slowly and has been criticized for being ineffective. In particular, some cities that engaged in major reforms, such as Saltillo and Hermosillo, did so without participating in PROMAGUA, while none of the participating cities have signed any contracts with the private sector so far. Now that the planning studies for a number of cities have been completed, it remains to be seen if the program will bear fruits.

- None of the programs is performance-based; that is, they do not reward service providers that have improved their performance nor do they penalize those with stagnant or deteriorating performance. Instead, all service providers that fulfill certain formal criteria (size of city, co-financing etc.) can participate. PROMAGUA, for example, even provides higher federal subsidies for service providers with lower efficiency. None of the federal programs – FAIS and CONAGUA-administrated programs - is conditional on changes in the governance structure of utilities or on policy/regulatory changes at the state level.

- There are only limited effective quality assurance and monitoring mechanisms in the federal programs. Some programs, such as FAIS, do not include

reporting requirements, making it difficult to assess their impact. Cost-Benefit Analyses are *pro forma* exercises and are not used as a screening tool. *Ex-post* evaluations are rare and, if done, lack independence and critical assessment. This hinders both accountability to the local clientele and planning at the state and federal levels.

o There are attempts to monitor outcomes both at the federal level and in some states (e.g. Guanajuato). But these efforts are hampered by several factors: (a) the poor quality of financial and technical data (for example, the lack of metering) as collected by service providers; (b) a lack of incentives to improve the quality of data and to pass them on to state and federal entities; and finally (c) aggregated data, without links to investments in specific programs.

Conclusion and Recommendations

o Mexico's key WSS challenges lie in **improving the quality and operating efficiency of services, wastewater treatment and access to the poor**.

o The WSS sub-sector is the primary beneficiary of federal and state investment subsidies within the water sector. While substantial investments are needed in wastewater collection and treatment and to extend WSS service coverage in poor rural and peri-urban areas, **the "net" public transfer to the sector does not need to be increased, as there is substantial scope to increase the sector self-financing, through improved billing and collection, tariff increase and reduce costs and future investment needs are in line with recent investment levels**.

o Addressing the above mentioned challenges will require **stronger institutional arrangements, with increased coordination and planning within and across government levels, and greater accountability.** The role of the Government in infrastructure planning has changed over time, shifting its focus from public investment programs to issues of strategic direction, decentralization, private sector participation, and financial support. Being accountable and meeting performance standards requires systems for the evaluation of large-scale federally funded programs, with respect to their efficacy and efficiency in achieving measurable quality and sustainability of service outcomes. An ex-post evaluation would provide valuable information on what strategies work and why—informing the design of future programs. Such evaluations can also help establish incentives for good performance and lead to greater transparency.

o A series of policy instruments could strengthen incentives for service providers to improve operating efficiency and service quality and better serve the poor: First, **Municipal and state water companies in many localities could be fully constituted as autonomous, commercial enterprises.**

o Second, the **incremental public funding released through greater resource efficiency should focus on three areas: (a) maintenance and rehabilitation which has been neglected, (b) strategic bottleneck infrastructure segments, such as bulk-water conveyance facilities and water and wastewater treatment plants , and (c) extension of basic services to the poor.**

o Devoting a greater share of federal resources to infrastructure for poor communities and households does not imply an absolute increase in federal spending. On the contrary, targeting subsidies to poor communities and poorer households in better-off urban areas would release substantial resources for other uses. FAIS already goes to the poorest municipalities and almost all of them could increase the share they use for water and sanitation investment (WB 2006, Mexico Poverty III, and WB 2005, IPER). Subsidies to the poor should first focus on increasing access to services and extending coverage in small localities. To the extent that consumption of these groups merits subsidization, it should be limited to satisfying minimum basic needs. Moreover, delivering service to the poor need not be costly, and relaxing technical norms governing choice of technology (for example, using condominial systems) and billing methods have proven their worth in other countries.

o **Relaxing statutory monopoly rights of the large public sector operators to permit small-scale providers to serve isolated communities** in partnership with the network utility (or the municipality), offers substantial benefits to both the utility and to households with little or no service at present.

o Even with limited competition, regulation, and financial market involvement, the government could still discipline water operators' performance by **making the size and type of transfer dependent on the progress in realizing genuine improvements in operational efficiency and service quality.** Such performance-based allocation could be applied in setting up the water financial system *(sistema financiero del agua)*, which was stipulated in the recent modifications to the national water law but is yet to be established. For performance criteria to genuinely affect resource allocation decisions, future resource availability needs to be predictable, such as through multiyear resource envelopes and budget ceilings.

o **Federal credit enhancements will be required to attract sizable sums of private funding from domestic and international sources, but their design and functioning need revision.** For sub-national projects, negative covenants may also reduce financing costs, but the enhancements will also require some kind of security based on assets or cash flow, which could take the form of state-level revolving funds. Such risk insurance and backstopping facilities should also help shift private finance toward distribution networks that interface with consumers, hence contributing to efficiency improvement.

o Arms-length **regulation of tariffs and service quality** is largely absent at present, and it could improve the incentives for public sector providers and start creating the environment that would make good use of private investment as legal opportunities for that are opened. Improving sector performance will require greater clarity and coherency on policy goals and instruments, institutional responsibilities for establishing and regulating service providers, and pricing policies commensurate with those goals. The goals should make explicit the major policy decision, such as the desired levels of access and service quality, the required levels of investments and potential sources of financing, and how noncompliance with regulations would be sanctioned. Although municipalities have primary jurisdiction for water supply and sanitation services, they

have little technical capacity for policymaking and regulation, so state agencies might need to take this role. This would offer the advantages of consistency in policy and investment planning across hydrologically and politically interdependent geographic areas, and of administrative and financial capacity and the ability to coordinate federal (and state) assistance. The *Comisiones Estatales de Agua* are well placed to carry out planning and policymaking functions, and key regulatory, monitoring, and oversight functions.

- **The new private sector participation schemes being developed and implemented by SHCP (*proyectos de prestación de servicios* – PPS) provide an opportunity to increase efficiency and reduce the scope of sovereign guarantees provided by the Federal government.** If the municipal water utilities and their regulatory arrangements are not currently strong enough to attract investors willing to mobilize capital, partial-risk guarantees from multilateral agencies might serve as a mitigant for political and regulatory risk.

- Other modifications of institutional arrangements should be considered. For investors and operators to take on some risks now borne by the government and Mexican taxpayers, they require greater predictability about future cash flows, which depend on how tariff and service standards are set and adjusted. This would imply building the capacity of state water commissions and municipal agencies in performance monitoring, planning, and the revision of retail tariffs.

- **Charge for sanitation.** Most of the cities in Mexico do not charge for sanitation. Given the needs for investment in this area, a cost recovery mechanism is necessary. To assist with the political difficulty of user charges (which some Mexican cities already have), the federal government could help finance the water treatment facility and then cover some (or all) of the debt service for utilities whose discharge of wastewater is adequately treated.

- **Increase investments to reduce distribution losses.** This type of investment is more cost-effective and would improve efficiency.

THE IRRIGATION SUB-SECTOR: COST RECOVERY, PUBLIC EXPENDITURES AND PERFORMANCE

o Irrigation covers 6.4 million ha and uses about 80 per cent of freshwater withdrawal. There are three main forms of irrigation in Mexico: (a) large-scale public irrigation schemes (irrigation districts, IDs), covering 53 per cent of the irrigated area, whose construction was financed by the federal budget and whose O&M has been almost entirely transferred to water users associations in the 90's; (b) smaller-scale "public" irrigation schemes (irrigation units, IUs), covering 31 per cent of the area, whose development was originally financed from public resources but whose O&M was the responsibility of water users from the start; and (c) private individual irrigation schemes covering 15 per cent of the agriculture area, whose development and management is the entire responsibility of individual farmers. While IDs rely primarily on surface water, IUs and private irrigation schemes are mostly supplied from groundwater. IDs grow primarily low-value crops such as cereals. IUs have a more diversified cropping mix, but still primarily grow low value crops. Most vegetables and fruit crops are grown in the private irrigation schemes.

Table 2.17 Three types of irrigation systems

Irrigation systems	Number of systems	Area (000 ha)	Source of water	Crops
Irrigation districts	82	3,396	Mostly surface water	Mostly cereals
Irrigation units	22,734	2,062	Mostly groundwater	Mixed, but with a high share of cereals
Private irrigation	16,758	894	Mostly groundwater	Mostly vegetable and fruit trees
Total	**39,574**	**6,352**		

o This section first analyzes the degree of sub-sector self-financing and the linkages between water pricing and water use efficiency. Then, it presents some of the linkages between agriculture performance; trade liberalization and policy interventions to support agriculture competitiveness and water resources degradation. It finishes with conclusions and recommendations which highlight key interventions to improve the environmental sustainability (i.e. water resources management) of agricultural production and trade.

Water pricing, cost-recovery and water use efficiency

o Irrigation pricing is used for two purposes. The first is to ensure a certain level of sector self-financing in order to minimize government operating and capital subsidies and ensure the sustainability of the infrastructure. The second purpose is to promote water use efficiency and the sustainable use of water resources. The second will only have this effect if water use is measured and charges are volumetric.

The sector as a whole falls short of generating sufficient revenues to cover full cost

Farmers cover most of the O&M costs of I&D infrastructure

o *The O&M of most irrigated infrastructure is under the responsibility of individual farmers or farmers organized in WUAs*. Only in the case of the IDs, about 5 per cent of the area is still managed directly by CONAGUA in addition to upstream infrastructure, such as dams, large canals and pumping stations. In the IUs and private irrigation schemes, farmers support the entire cost of the O&M of irrigation infrastructure. In IDs the majority of the O&M costs are paid by farmers and the rest by CONAGUA.

o *In the IDs, farmers, organized in WUAs, are in charge of the O&M of most of the irrigation infrastructure at the tertiary and secondary network levels, and, in some cases, of the primary canals as well*. In the 90's, the O&M of the tertiary and secondary networks (i.e. modules) were transferred to farmers organized in WUAs (*Asociaciones Civiles de Usuarios*). Today, 452 WUAs totaling 506,000 water users manage the irrigation infrastructure spreading over 3.3 million ha, or 95 per cent of the area covered by the IDs. In 10 IDs, WUAs, grouped in 10 *Sociedades de Responsibilidad Limitada* (SdRL), are also responsible for the management of the main canals. CONAGUA is still responsible for the head structures (dams, multiuse canals and pumping stations) and for overseeing WUAs management. Farmers pay a water tariff to cover the O&M of the WUAs, which includes a service charge (*cuota de servicio*) for bulk water deliveries from CONAGUA to partially financing expenses for O&M of head infrastructure.

o *Transfer of the O&M of irrigation infrastructure to farmers has substantially increased financial self-sufficiency in the IDs.* Between 1998 and 2002, 72 per cent of the administration and O&M costs of the 82 IDs were recovered from farmers through the water tariff, while the balance was financed by CONAGUA from other sources. More than 90 per cent[29] of farmers pay their assessed charges, primarily because they have to pay in advance for WUA services.

Table 2.18 Collection efficiency – Bulk water charge in IDs

	2000	2001	2002	2003	2004	2005
Amount collected (million pesos)	110	129	141	136	145	165
Collection efficiency (%)	89	88	90	92	92	91

Source: CONAGUA, 2006

o *Cost-recovery in the IDs is low, but in line with international practices* (Table 2.18). Low cost recovery is a common issue in the irrigation sector. When even O&M costs are not recovered from farmers create serious problems both for the irrigation agencies and for farmers in the long-run, because the sustainability of the infrastructure depends on continued government subsidies.

[29] Zekri and Easter, 2003

Table 2.19 Cost-recovery in Irrigation

	Collection rate	Percentage of cost recovered
Tunisia 1991	NA	70 per cent of O&M costs
Turkey 1998	76 per cent	37 per cent of total costs
Colombia 1996	76 per cent	52 per cent of O&M costs
Mexico 1998-2002 (IDs)	90 per cent	72 per cent of O&M costs
Morocco, 2004 (large scale irrigation)	50-60 per cent	54 to 190 per cent of O&M costs (depending on the irrigation scheme considered)
Italy 1997	NA	60 per cent of total costs
Jordan 1999	NA	50 per cent of O&M costs

Sources: Cost recovery and Water Pricing for Irrigation and Drainage Projects, World Bank, 2005 and Maroc, Réforme Institutionnelle du Secteur de la Grande Irrigation, World Bank, 2004.

- *The aggregate cost-recovery figure masks substantial variations in performance between IDs, suggesting significant scope for improvement*. Between 1998 and 2002, farmers covered more than 90 per cent of the administration and O&M in 14 out of 82 IDs (against an average of 72 per cent).

- *With current tariffs, performance in cost-recovery would be worse if maintenance requirements were properly estimated and if irrigation did not benefit from a significant electricity subsidy.*

- Irrigation benefits from a significant subsidy on electricity tariffs, which reduces its operating costs, especially in the case of groundwater pumping (i.e. IUs and private irrigation). Moreover, irrigation is not charged water use fees

- *Maintenance requirements are often underestimated, leading to a slow degradation of the irrigation infrastructure and irrigation performance.* Underestimating maintenance requirements lead to underestimated water tariffs. In other words, water tariffs are often inadequate to satisfy the maintenance needs of irrigation in the long run, especially at the module level. They are often inadequate to even cover the operating costs in times of drought.

A large share of I&D investments are financed through federal subsidies, but the introduction of cost-sharing arrangements has increased farmers contribution

- Investments in the IDs and IUs are financed primarily through public subsidies, mainly federal subsidies channeled through CONAGUA and SAGARPA, complemented by states and farmers contributions. Investments in small private irrigation schemes on the other hand, are made and financed directly by individual farmers. Indeed, the financial situation of those farmers is usually better and they have good access to credit institutions and to federal and state support for agricultural production and irrigation modernization.

- From 2000 to 2005, CONAGUA invested MxP 13,747 million in the irrigation sub-sector, or about 40 per cent of overall CONAGUA investments. Seventy percent of those investments (MxP 9.9 billion) were allocated to the IDs, which represents an average of MxP 584/ha/year and 30 per cent was allocated to the IUs which represented an average investment of MxP 370/ha/year.

o Most CONAGUA investment programs are co-financed with the States and farmers. For example, in 2005, the Irrigation and Drainage Program (*Programa Sectorial de Riego y Drenaje* –PSDR), was financed at 50 per cent by CONAGUA, 15 per cent by the States and 35 per cent by farmers and the On-farm Irrigation Development Program (*Programa de Desarollo Parcelario* – PRODEP), at 56 per cent by CONAGUA, 5 per cent by the States and 39 per cent by farmers.

Table 2.20 CONAGUA expenditures in irrigation and drainage

(2004 MxP million)	2000	2001	2002	2003	2004	2005p	Total
Investment in Hydro-agriculture inf.							
Program of rehabilitation of irrigation districts	496.2	401.6	627.1	831.3	645.6	507.7	**3,509.5**
Parcel Development Program	223.6	190.6	105.6	58.6	23.9	112.9	**715.2**
Program of expansion of irrigation districts	1,309.2	891.3	765.5	568.5	784.8	862.5	**5,181.8**
Rehabilitation of dams and other inf.	9.5	10.8	16.4	9.4	2.6	97.2	**145.9**
Lerma-Chapala Basin	0.0	0.0	0.0	86.1	70.8	218.5	**375.3**
Sub total irrigation districts	**2,038.6**	**1,494.3**	**1,514.6**	**1,553.9**	**1,527.6**	**1,798.8**	**9,927.8**
Expansion of irrigation units Program	193.3	148.6	108.8	160.7	151.9	178.1	**941.4**
Efficient use of water and electricity Program	121.5	123.2	104.0	44.8	119.3	146.1	**658.9**
Efficient use of hydro-agriculture infrastructure program	149.3	162.9	131.4	137.7	142.4	186.3	**910.0**
"Desarrollo de infraestructura de Temporal" Program	197.6	265.4	134.1	121.7	166.9	180.2	**1,065.9**
Conservation and rehabilitation of "areas de Temporal" program	0.0	0.0	0.0	61.0	89.1	92.8	**242.8**
Sub total irrigation units	**661.7**	**700.1**	**478.3**	**525.9**	**669.5**	**783.5**	**3,819.1**
Total investment in Hydro-agriculture inf.	**2,700.3**	**2,194.4**	**1,992.9**	**2,079.8**	**2,197.2**	**2,582.3**	**13,746.9**
Operation and Maintenance							
Operation and Maintenance of irrigation districts	310.6	355.3	264.1	326.3	278.9	270.7	**1,806.0**
Operation and Maintenance of dams and other inf.	51.8	55.2	48.0	74.7	64.8	165.4	**459.9**
Other Activities	16.7	0.0	0.0	0.0	753.0	625.7	**1,395.3**
Sub total Operation and Maintenance	**379.1**	**410.5**	**312.1**	**401.0**	**1,096.7**	**1,061.8**	**3,661.2**
Total Expenditures on Hydro-agriculture inf.	**3,079.5**	**2,604.9**	**2,305.0**	**2,480.8**	**3,293.8**	**3,644.1**	**17,408.1**

Source: CONAGUA

Inadequate water pricing has not fostered water use efficiency, boosting water demand and fostering the unsustainable use of water for agriculture

Area-based water tariff in the IDs have not encouraged water use efficiency and the cost-effectiveness of water delivery

o Theoretically, the WUA water tariff has a volumetric basis, but due to lack of measurement devices at tertiary level, *payments are often made on a land area basis, which does not encourage water use efficiency in the transmission and distribution networks nor at the farm level and, does not promote cost-effectiveness of water delivery*. Indeed, area-based charges do not provide an incentive for the IDs to reduce water losses because revenue is the same whatever the volume delivered to farmers. It does not provide an incentive for farmers to reduce water consumption either because, once the decision on the irrigated area is made, the water charge will be the same whatever the farmer's water consumption. Thus, overall water use under area-based tariff is usually

higher than it would be under a charge that varies with the quantity of water used. In addition, the average price of the water delivered to farmers tends to be higher due to higher levels of non-revenue water (i.e. water losses in the irrigation networks).

o Area-based pricing is not appropriate in the Mexican context. It is only appropriate in places, where water is not scarce and where meter installation is difficult and costly. Effective volumetric pricing should be pursued in all IDs because it encourages water use efficiency and cost-effectiveness of water delivery. Until water meters are installed at the tertiary level, area-based charges could be established that reflect the differences in water use by crop, season or irrigation technology, and thereby have some of the benefits of volumetric pricing in terms of improving water use efficiency at the farm level.

Highly subsidized electricity tariff and the absence of water use fees for irrigation have fostered the unsustainable use of water in agriculture

o Water use fees were established for two purposes: (a) to generate revenues for CONAGUA to finance WRM activities and (b) to promote water use efficiency, by attempting to take into account the *marginal user cost* (see Box 2.4). The marginal user cost is defined as the present value of future sacrifices implied by current water resource use. It involves the higher costs of obtaining future water supplies because more accessible and less expensive water resources are used up first. Excluding marginal user cost often results in the overuse of water resources, especially groundwater resources.

Box 2.4 The economic cost of providing irrigation water

The economic cost of providing irrigation water can be divided into three categories: (a) direct cost; (b) marginal user costs and (c) environmental cost. Direct costs refer to costs stemming from the process of capturing and delivering irrigation water, which can be broken into investment costs, plus depreciation and interest payments on investments and O&M costs. Marginal user cost is defined as the present value of future sacrifices implied by current resource use. It involves the higher costs of obtaining water supplies because more accessible and less expensive water resources are used up first. This cost is especially relevant for groundwater resources. Excluding the marginal user costs in the price of groundwater often results in groundwater over-exploitation. Environmental costs resulting from irrigation include, for example: (a) for surface water, costs associated with soil erosion and salinization, and drying up of wetlands; (b) for groundwater overexploitation, costs associated with land settlement and salt water intrusion.

Source: Cost recovery and Water Pricing, World Bank, 2005

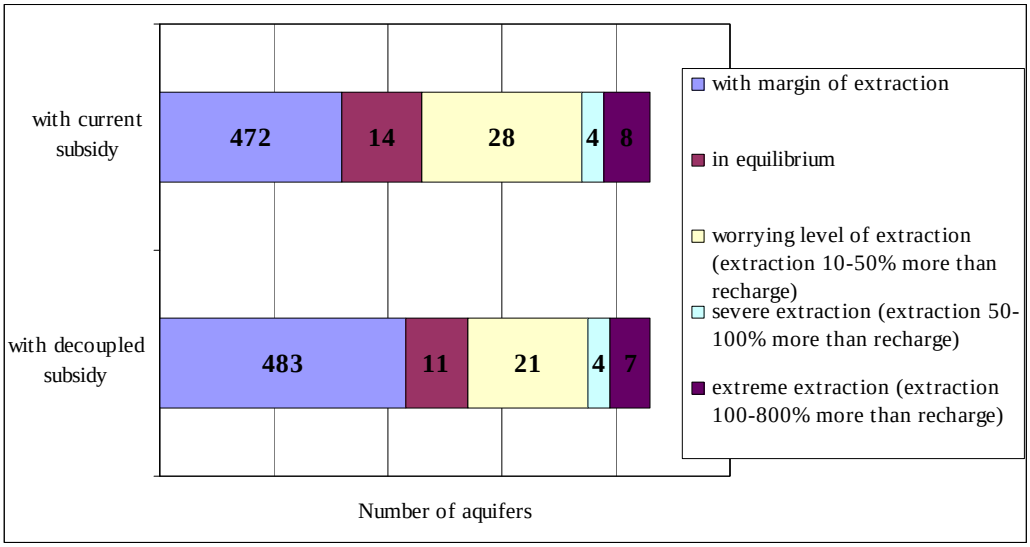
o *While irrigation is responsible for about 80 per cent of national water use and receives about 40 per cent of CONAGUA's investments, irrigation is not charged with water use fees* except when farmers are proven to exceed their water use entitlement, which is quite difficult to control and enforce. Hence, the absence of water user fees in the case of irrigation deprives WRM of an important source of revenue, and has resulted in the over-exploitation of water resources, especially groundwater resources.

o *Artificially low electricity fees create an incentive for greater water extraction*. It is estimated that the price paid by farmers for electricity is about 35 percent

of production cost[30]. This represents a total subsidy of MxP 7,300 million per year to the irrigation sector. This subsidy boosted the use of irrigation water, by making profitable the irrigation of land and low value/ high consumption crops that would not have been otherwise.

o According to a recent study "*Assessment of Policy Interventions in the Water Sector, the World Bank, 2006*", increasing the price of water by eliminating or decoupling the electricity subsidy would lead to a 15 per cent decrease in gross water abstraction in the short-term and a 19 per cent in the long-term[31]. Taking into account net water savings by assuming that the water that percolates to the ground ends-up in the same aquifer from which it was extracted, the Figure 2.5 shows that decoupling or eliminating the energy tariff subsidy would reduce the number of aquifers over-exploited from 40 to 32.

Figure 2.5 Impact on Aquifers of Decoupling/Eliminating the electricity Subsidy



Source: *Assessment of Policy Interventions in the Water Sector, the World Bank, 2006*

o Finally, the electricity subsidy is unevenly distributed among farmers, favoring the agriculture of the richer Northern states that rely heavily on groundwater irrigation for climatic reasons. The Gini coefficient of the pumping subsidy, among water users receiving the subsidy, is 0.91[32]. Of the 105,000 users receiving the subsidy, 68,000 receive an annual subsidy of less than MxP 20,000, while 33 users receive a subsidy of over MxP 500,000. Chiapas received only MxP44 million of subsidy (0.8 percent of total electricity subsidy to agricultural customers), while Oaxaca received MxP18 million (0.3 percent), and Guerrero only MxP3.6 million (0.1 percent) (World Bank 2004c).

[30] The average cost of producing electricity in Mexico is 61 cents per kWh without considering transmission costs. The fee for a farmer benefiting from a concession is 22 cents/kWh.
[31] In the short-term it is assumed that both irrigation technology and crop mixed would remain unchanged. In the long-term, it is assumed that both crop mix and irrigation technology would change.
[32] One represents one user receiving all the resources, zero represents equality.

Box 2.5 Options for decoupling the energy subsidy

As the simple elimination of the electricity subsidy might be politically difficult to implement, several decoupling options, involving compensating the farmers for the increase in the electricity tariff, were analyzed in a recent the study "*Assessment of Policy Interventions in the Water Sector"*. These options are presented below:

Alternative #1: the subsidy is decoupled only on over-exploited aquifers. The proposal is to decouple the subsidy for those users whose water is extracted from overexploited aquifers. This is the conservative alternative, since the effect would be on a relatively small group: approximately 30 per cent of users obtain their water from overexploited aquifers.

Alternative #2: the average subsidy is refunded to each farmer. This alternative is more attractive for small farmers, but could be relatively harmful for larger farmers. Each farmer would receive around MxP 69,000 per year (US$6,270). Some of the large users receive 7 times this amount, while many small users receive MxP 1,000.

Alternative #3: the subsidy is refunded according to the historical consumption of each user. This alternative would continue giving substantial benefits to those who receive a large share of the subsidy and a smaller one to those who currently have a smaller subsidy.

Alternative #4: the subsidy is refunded only to concession holders. Many groundwater users lack a water concession (i.e. 43 per cent of the 105,000 groundwater users). This alternative would have the effect of encouraging more efficient use of water and electricity. It could also generate a market for concessions and promote the regularization of groundwater concessions.

Alternative #5: the subsidy is refunded as a payment per ha. The subsidy may be refunded according to the number of cultivated hectares that each farmer holds. Similar to the previous alternatives, all users could benefit or only those holding a concession. This subsidy would benefit those who either produce more efficiently or grow crops that require less water.

Source: *Assessment of Policy Interventions in the Water Sector, the World Bank, 2006*

- *In conclusion*, the electricity subsidy coupled with the absence of water use fees for irrigation has encouraged the use of scarce water resources and is largely responsible for groundwater over-exploitation. Modification to both of these policies could lead to a significant decrease in water use in water scarce areas and represent a substantial source of revenues to the water sector (i.e. CONAGUA and water basin agencies).

- **In conclusion**, while the level of **financial self-sufficiency** has substantially increased in irrigation since the 90's through the transfer of most O&M responsibilities to farmers and the introduction of cost-sharing arrangements for investments, irrigation still falls short of generating sufficient revenues to cover full costs (see Table 2.20). More specifically:

  - In the IDs, water tariff and service fees collected from farmers cover about three-quarter of O&M costs, making the sustainability of irrigation infrastructure dependant on continued government operating subsidies through CONAGUA;

- In the IDs, water tariff and service fees underestimate maintenance requirements, leading to a slow degradation of the irrigation infrastructure and irrigation performance, especially at the module level;

- In the IDs, area-based tariff does not encourage cost-effective water delivery because it does not provide the incentive to reduce water losses;

- While the introduction of cost-sharing arrangements with farmers has increased farmers contribution to investments, most investments in IDs and IUs are financed through public subsidies. .

o The price of water is one of the many policies that the government controls to cope with the problem of water scarcity. However, inadequate water pricing has not promoted water use efficiency, but rather boosted water demand and fostered the over-exploitation of water resources:

- In addition to the operating and investment subsidies of irrigation infrastructure mentioned above, the high electricity subsidies, the absence of water use fees for irrigation and not charging marginal user costs and environmental costs reduce the actual cost of irrigation water, making profitable irrigation of crops and land that would not be otherwise, thereby **boosting water demand**. This is particularly problematic in the basins where water is scarce and groundwater is over-exploited.

- Finally, the area-based water pricing often practiced in the IDs does not encourage **water use efficiency** (at the transmission and distribution networks and farm level), increasing water demand.

o It is thus recommended to:

- increase cost-recovery level to *at least* recover fully O&M costs requirements, taking into account appropriate maintenance needs and;

- curb the over-exploitation of water resources by : (i) eliminating or decoupling the energy subsidy to the use of electricity; (ii) introducing a water use fee for irrigation, starting in the IDs that suffer the most from water resources scarcity and (iii) generalizing volumetric water pricing.

Agriculture competitiveness, water resources degradation and policy interventions

o *While agriculture is not a major sector in the Mexican economy, it is the primary user of water and is an important source of income and livelihood for the poor*. Agriculture only contributes to about 3.5 per cent of the gross value of production, 4 per cent of national exports and 2.5 per cent of imports. However, agriculture accounts for about 80 per cent of total water withdrawals, relying on the unsustainable use of water resources in the northern and central parts of the country where most of the economic activities are located and most of the people live. As the primary user of water,

agriculture is instrumental in improving overall WRM in Mexico. Agriculture is also important in the context of poverty alleviation, especially among indigenous populations. Agriculture employs 20 per cent of the labor force.

- *Irrigation is a very important element of Mexican agriculture.* Irrigated agriculture totals about 25 per cent of the cultivated area, accounts for 50 per cent of the value of agricultural production and 70 percent of agricultural exports, and employs 70 per cent of the agricultural labor force. Moreover, in large parts of the country, there is very little alternatives to irrigated agriculture, because the level of rainfall only allows the production of low-value rainfed crops or does not allow rainfed agriculture altogether.

- The main challenge facing the agriculture sector is *to increase its competitiveness* in the context of the 15-year phase out of tariffs and quotas (ending in 2008) with the USA and Canada and the multiplication of FTAs between the USA and regional competitors, which erodes Mexico's preferential treatment, while preventing the degradation of natural resources (especially water) and reducing rural poverty. In this context, *improving the performance of irrigated agriculture and water resources management is critical*, as (a) irrigation is the main source of agricultural exports and agricultural jobs; (b) irrigated agriculture, including the production of high value crops for exports, relies on unsustainable use of water resources and (c) the scope to improve irrigated agriculture land, labor and water productivity is high.

- Trade liberalization and some of the policy interventions to support the competitiveness of agricultural production have fostered the degradation of water resources. Conversely, the degradation of water resources constrains the competitiveness of the Mexican agriculture and indeed, of the rest of the economy.

- This section presents some of the linkages between agriculture performance; trade liberalization and policy interventions to support agriculture competitiveness and water resources degradation. It finishes with conclusions and recommendations which highlight key interventions to improve the environmental sustainability (i.e. water resources management) of agricultural production and trade.

Agriculture and Irrigation performance

- *Agriculture performance has been lagging behind compared to the Mexican economy as a whole.* The agriculture sector grew slower than the rest of the Mexican economy: agriculture GDP growth averaged 1.9 per cent between 1984 and 2004, against 3 per cent for the overall economy. Its shares of the GDP, the labor force and its contribution to exports, have all been decreasing over the past 20 years (Table 2.21).

Table 2.21 Share of the agriculture sector in total GDP, labor force and exports

	1980	**2004**
Share of GDP	8%	5%
Share of labor force	36%	20%
Share of total exports	13%	4%

o *An increase in yields, partly due to a shift towards higher value crops compensated somewhat for a dramatic fall in real price for food crop output*. The harvested area increased little in the 80's and nothing in the 90's, pointing to the exhaustion of the crop frontier in Mexico. Real price fell dramatically, especially in the 90's, largely as a consequence of the opening of the economy. Average yield however has increased as a result of modest and uneven improvements in the yields of individual crops, and of shifts from low to higher value crops, particularly into vegetables and fruits, away from cereals and oil crops.

Table 2.22 Yield growth rates of food crop groups in 1980-2002

Growth rates (%)	Cereals	Oil crops	Vegetables	Fruits	Tubers	Legumes
Area	0.1	-6.4	2.7	2.1	-1	1.3
Yields	1.6	0.0	1.7	0.6	2.6	0.9

Source: World Bank estimates based on SAGARPA's agricultural database, SIACON

o *The irrigated sector provided most of the dynamism to the rural economy while rainfed farming fell behind*. The irrigated area remains constant at about 5 million ha. Food crop yields in rainfed areas were stagnant in the 80's and increased somewhat in the 90's. Yields in the irrigated areas increased both in the 80's and 90's. Between 1991 and 2001, yields in irrigated area increased by 50 per cent, compared to a 23 per cent increase in rainfed areas.

o *Agriculture performance has been lagging behind major regional competitors*. Growths in land productivity and total factor productivity[33] (TFP) have been smaller than in other major LAC competitors, and with few exceptions, land and labor productivity are low compared to those countries.

- Between 1980 and 2002, land productivity grew by 30 per cent in Mexico, which can be considered reasonable performance. However, Argentina, Brazil and Colombia show increases ranging from 50 to 70 per cent and with few notable exceptions, yields are fairly low in Mexico.

- Mexico has lost momentum in agricultural efficiency. Between 1980 and 2002, annual TFP growth in Mexico was 1.5 per cent, compared to 1.7 per cent in Colombia, 2 per cent in Chile, 3.2 per cent in Brazil and 2.35 per cent in Argentina.

- Labor productivity measured by the agricultural output per worker is estimated at US$2,533 in Mexico compared to US$3,766 for all LAC region.

o *Water productivity is relatively low and varies highly among irrigated perimeters, suggesting substantial scope for improvement.* Data from the Rio Bravo Basin illustrates

[33] TFP measures productivity growth not captured by the contributions of individual production factors. It thus explains the impact of technology improvements measured as the residual output growth after the effect of growth in all factors has been considered.

these facts (Table 2.23). Average water productivity varies greatly between the three main irrigated areas, from US$0.06/m^3 in Bajo San Juan to US$0.21/m^3 in Saltillo.

Table 2.23 Gross Water Productivity in the Rio Bravo Basin in 2003 (US$/m^3)

Irrigation Districts	Average	Maximum	Minimum
Juarez	0.08	0.17 Fruits	0.02 Sorghum for silage
Saltillo	0.21	1.60 Garlic	0.04 Corn
Bajo San Juan	0.06	0.71 Garlic	0.01 Sorghum for silage

Source: Economic value of water in the Rio Bravo Basin, 2005.

o In general, the variations in water productivities are mostly explained by differences in cropping patterns (i.e. low versus higher value crops) and differences in irrigation performance (i.e. water losses off and on farm and irrigation scheduling).

o *Despite a sharp increase in the value of agricultural exports, the agricultural trade balance has been deteriorating.* The agricultural trade balance with the USA (the main trading partner[34]), deteriorated from a deficit of US$211 million in 1992/93 to US$1.3 billion in 2001/03.

o Increases in exports favored mostly the irrigated areas and commercial farms growing fruits and vegetables, as well as processed food and beverage (mostly beer). Increases in imports concerned mostly cereals (maize, sorghum, wheat), maize accounting for 37 per cent of agricultural imports.

o *Despite sharp increases in imports, the national production of cereals, maize and sorghum in particular, did not fall.* The strong increase in the national demand for maize and sorghum, mostly for meat production, was met by increasing imports, while the national production was maintained. Wheat production, however, used almost exclusively for human consumption, has been decreasing steadily since the mid-80's as imports increased. The resilience of maize and sorghum productions can be explained by several factors: (a) the sharp increase in the national demand for animal feed, as Mexicans meat consumption increased; (b) indirect price protection through marketing subsidies; (c) the resilience of these productions in rainfed areas due to tradition, risk factors, shortage of alternatives and subsistence consumption and in the irrigation districts due to infrastructure and management constraints; and (d) the segmentation of Mexican maize markets due to differences in varieties associated with taste.

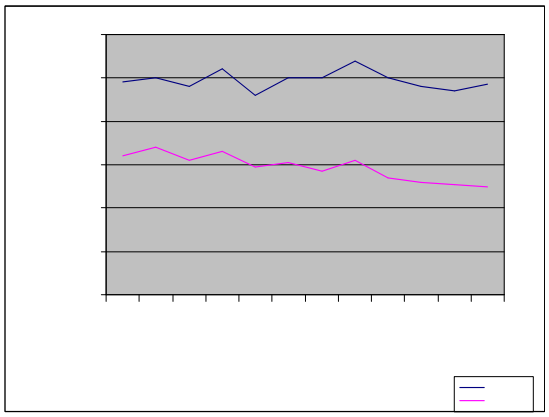
o *The total value of irrigated agriculture production has been stagnant in real terms since the 80's.* It hovered between 25 and 35 billions (1993 MxP) per year between 1980 and 2001. This is explained by: (a) a stagnant cultivated irrigated area of

[34] The USA absorbs 85 per cent of Mexico's food and agricultural exports and is the source of --- per cent of food and agricultural imports. Attempts to diversify exports to non US markets proved difficult, despite the signature of 12 free trade agreements (FTA) after 1994. The EU is the second importer with 4 per cent of the agricultural and food exports.

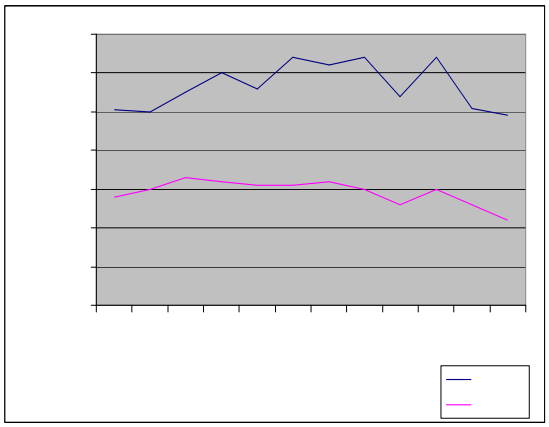
about 5 million ha and (b) a stagnant value of agricultural production per ha in real terms, despite substantial increases in land productivity (i.e. yields and crop mixed), explained by a sharp deterioration of the crop price in real terms.

Graph 2.1 Cultivated area under irrigation, 1980 – 2001
and
Graph 2.2 Value of agricultural production in irrigated areas, 1980-2001

Graph 2.1. Cultivated area under irrigation, 1980 – 2001



Graph 2.2. Value of agricultural production in irrigated areas, 1980-2001



- The development of IUs and private irrigation from groundwater is responsible for a large part of the over-exploitation of groundwater. The lack of water metering and the high number of farms concerned make control of water abstraction difficult, thereby facilitating groundwater over-exploitation. Moreover, it is in the IUs, that the over-concession of water rights is the most prevalent. Finally, the lack of water use fees for irrigation coupled with a large energy subsidy, have facilitated the increase in groundwater irrigation, further contributing to the over-exploitation of groundwater.

- *In the irrigated areas, there are important constraints to diversification to higher value crops*. One difficulty is that higher value crops need higher capital investment; another difficulty is that IDs and IUs with surface water have irrigation schedules adapted to cereal requirements which deliver water to farmers at times not always suitable to vegetable, fruit tree and other high-value crops. Another constraint preventing a change to higher value crop is poor access to markets. Change in cropping pattern are easiest on farms with independent irrigation systems, i.e., on farms that use groundwater or directly pump in the river, such as private irrigation schemes.

- ***In conclusion***, the overall decrease in the value of agricultural production in the IDs is due to the following factors: decrease in the cultivated area, high share of the production dedicated to cereal crops for which competitiveness has eroded as a result of trade liberalization, difficulty to convert to higher value crops due to rigid irrigation infrastructure and scheduling and lower water reliability of surface water. On the other hand, private irrigation, and to a lesser extent, some of the IUs, have better taken advantage of increasing export opportunities in fruits and vegetables due to trade liberalization. These irrigators have a more diversified agricultural production and have a more flexible and secure groundwater supply that can be more readily used to grow fruits and horticulture crops. However, IUs and private irrigation rely on unsustainable water use, and are the primary cause of groundwater over-exploitation in the north and center of the country. In IUs, groundwater is still used primarily for low-value crops.

Water resources degradation, agricultural liberalization and policy interventions to support agriculture competitiveness

- Agriculture dynamism has been scarce in spite of a range of policy interventions to support the competitiveness of agricultural production introduced in the context of trade liberalization and high government spending in agriculture. Some of these policy interventions and investment programs have fostered the degradation of water resources. Conversely, the degradation of water resources puts at risk the competitiveness of the Mexican agriculture and of the rest of the economy. The situation has become particularly serious in the northern and central part of the country where the increasing water demand for irrigated agriculture is the primary cause of the over-exploitation of water resources. Most of the high-value crops produced for exports, which provided most of the dynamism in crop production, rely on unsustainable groundwater abstraction. The high water demand of the agricultural sector in the northern part of the country puts pressure on the expansion of the industry and service sectors which provide 26.6 per cent and 69.4 per cent of GDP respectively.

Trade policy

o *Liberalization policies embarked upon in the late 80's and carried out throughout the 90's tended to accelerate the degradation of water resources, especially groundwater resources in the northern and central part of the country*. Agricultural liberalization was stimulated by GATT, which Mexico joined in 1986, and a number of bilateral treaties in the 1990's (Japan, EU, some LAC countries and, of course, NAFTA in 1994). Most of the conversion of quantitative restrictions to tariffs and of tariff reduction was accomplished before NAFTA (see Box 2.6). Economic opening was accompanied by internal liberalization of agricultural prices, the elimination of most subsidies, the phasing out of the state marketing company and the introduction of compensatory programs like *Procampo* and *Aserca* price and marketing supports, and a farm modernization program, *Alianza para el Campo*.

Box 2.6 What has been the effect of NAFTA on the agricultural sector?

Before the mid-1980s, Mexico had highly protectionist and interventionist agricultural policies. In the mid-1980s, it reduced average tariff levels in agriculture to between 10 to 20 per cent and, following the signature of NAFTA in 1994, tariff on most agricultural products were eliminated between Mexico, the USA and Canada. Only a few sensitive products were allowed tariff rate quotas (TRQ). Mexico has currently TRQ rights for the importation of dry beans, maize and powder milk, while the USA established seasonal tariffs and TRQ for certain fresh fruits, vegetables and sugar. All remaining agricultural tariffs will be eliminated in 2008. It is important to mention, however, that Mexico has continuously exceeded the import quotas established for most of the agricultural commodities under NAFTA, effectively accelerating the agreed transition period to less than three years.

The effects of NAFTA on the agriculture sector can be summarized as follows:

- There was a large expansion of agricultural trade with a deterioration of the agricultural trade balance. Imports, particularly those of feed grains, increased much, from US$3.4 billion in 1994 to 5.9 billion in 2003. In turn, exports rose from US$2.7 billion in 1994 to 4.7 billion in 2003, particularly non traditional exports of fruits and vegetables.
- Agricultural prices fell markedly in real terms, following rather closely in nominal terms the evolution of the international prices.
- Production of wheat, soybeans and rice fell, but not that of maize or sorghum.
- Overall production and yields of food crops increased. Most of the increase took place in irrigated agriculture, commercial farms, richer regions and export-oriented crops, while most of the increase in land area occurred in rainfed areas.
- Agricultural employment decreased, from 8.1 million in 1993 to 6.8 million in 2002, without sign of factor price convergence with NAFTA partners, particularly in wages.

Source: Mexico, Income Generation and Social Protection for the Poor, World Bank, 2005

o As mentioned earlier, in part due to trade liberalization, the production of fruit and vegetables for export increased, thanks to (a) an expansion of the irrigated area with groundwater; (b) replacement of lower value crops by fruit and vegetable production and (c) modest increases in crop yields. Most of the increase in production took place in

commercial farms, in the northern region, in other words, in areas irrigated with scarce groundwater resources, exacerbating groundwater over-exploitation.

- The outcomes of trade policy must however be examined in conjunction with what happened to other policies introduced to boost the competitiveness of agriculture in the context of trade liberalization. The unsustainable use of groundwater is fostered by direct and indirect subsidies (such as the electricity tariff) to the irrigation sector.

Policy interventions to support agriculture competitiveness

- *Government spending in agriculture is high compared to regional competitors*. Between 1996 and 2000, the proportion between the share of agriculture in public expenditure and its share in GDP "agriculture orientation index" was 1.8 in Mexico, by far the greatest in the LAC region. In comparison, it is 0.4 in Chile, 0.2 in Brazil and less than 0.1 in Argentina and Colombia. Over the same period, federal spending in agriculture averaged 8 per cent of total public spending. Public expenditure in agriculture per agricultural worker is the second highest in the region after Chile.

- From 2000 to 2005, CONAGUA invested MxP 13,747 million in the irrigation sub-sector, or about 40 per cent of overall CONAGUA investments. CONAGUA has two categories of programs to support irrigated agriculture in Mexico: (a) programs directly implemented by CONAGUA; (b) and programs implemented through Aliance with Rural Areas - *Alianza para el Campo (PAC)*.

    - Programs directly implemented by CONAGUA include activities and investment projects: (i) to expand existing or create new IDs and IUs; (ii) in flood control and drainage works in rainfed agriculture areas; (iii) to rehabilitate, modernize operate and maintain irrigation and drainage systems in IDs that have not yet been transferred to WUAs; (iv) for new dams, and for rehabilitation, O&M of dams, headworks and other principal structures that will not be transferred to WUAs.
    - PAC is an overall program that includes activities implemented by SAGARPA and CONAGUA in accordance with a 1997 agreement with the objective to support, develop and establish agriculture incentives in all aspects. PAC includes additional objectives to: (i) transfer modern technology; (ii) promote investments; and (ii) support integrated development in rural communities. In regard to irrigated agriculture, PAC includes the following programs: (i) rehabilitation and modernization of IDs; (ii) on-farm irrigation development; (iii) efficient use of water and energy; and (iv) optimal use of irrigation infrastructure.

- *Input subsidies and price support mechanisms have had different impact on water use efficiency in agriculture.* Currently, farmers may receive five different types of subsidies for agriculture:

    1. *Electricity tariff for irrigation*. As mentioned earlier, this subsidy is particularly harmful to the sustainable use of groundwater resources. It

benefits primarily farmers who rely on water pumping (mostly groundwater irrigation) for agricultural production. This subsidy, by lowering the production cost of water, has boosted water demand and is one of the main factors explaining groundwater over-exploitation.

- *The Programa de Apoyos Directos al Campo* (PROCAMPO) is a direct subsidy granted by the federal government through SAGARPA to support the income of rural producers. It is a cash-transfer program launched in 1994 to compensate grain farmers from income losses due to increased competition brought about by NAFTA. The subsidy is based, for each farm, on the area planted with certain crops before 1993.[35] The subsidy varies between MxP 935/ha and MxP 120/ha, depending on how the farmer is categorized. The impact of this subsidy on water resources over-exploitation is limited. However, by boosting overall farm profitability, it does support irrigation in areas or on crops that would not be profitable otherwise.

- Aserca Price and marketing support. *Programa de Apoyos Directos al Productor por Excedentes de Comercialización para Reconversión Productiva, Integración de Cadenas Alimentarías y Atención a Factores Críticos*. This program is divided into 9 subprograms, one of which, *Apoyo Directo al Ingreso Objetivo* guarantees a minimum price for 10 crops (maize, wheat, sorghum, safflower, canola, cotton, rice, soybean, triticale and wheat for forage). Introduced in 1991, this program allow Mexican commercial producers of import-competing grains to compete in better terms, and compensate somewhat for price reducing practices from trade partners. This subsidy mainly supports traditional low-value crops. It fosters the over-exploitation of water resources by discouraging diversification to higher value crops and, by boosting overall farm profitability, it does support irrigation in areas or on crops that would not be profitable otherwise. On the other hand, it promotes some crops with low water requirements.

- *Alianza para el Campo* is a demand-driven investment support program aimed at farm modernization introduced in 1996 and operating on a matching grant basis. Among other things, the program encourages on-farm irrigation technology improvement which saves substantial volume of water and is frequently used for shifting to higher value crops.

Conclusion and Recommendations

- While the level of financial self-sufficiency has substantially increased in irrigation since the 90's through the transfer of most O&M responsibilities to farmers and the introduction of cost-sharing arrangements for investments, irrigation still falls short of generating sufficient revenues to cover full costs. **It is recommended to increase cost-recovery level to at least recover fully O&M costs requirements in the IDs**. This will

[35] There was a widening in crop eligibility over the years. The crops currently eligible are maize, rice, wheat, barley, sorghum, beans, soybeans, cardamom and cotton.

require revising water tariff taking into account (a) appropriate maintenance needs and (b) generalizing volumetric pricing through the installation of water measurement devices at the tertiary levels. It could also be advisable to increase tariffs to levels that will pay for the replacement of systems as they wear out, but this may not be very realistic in irrigation as farmers may not be able to pay the real costs.

- The price of water is one of the many policies that the government controls to cope with the problem of water scarcity. However, **inadequate water pricing has not promoted water use efficiency**, but rather boosted water demand and fostered the over-exploitation of water resources. **It is recommended to : (a) eliminate or decouple the energy subsidy to the use of electricity; (b) introduce a water use fee for irrigation, starting in the IDs that suffer the most from water resources scarcity and (c) generalize volumetric pricing in the IDs.** However, before charging a water use fee to farmers, they should at least pay the full cost of O&M (presently 72 per cent) in IDs. To encourage bulk water payments and the possible future payment of a small water use fee, mechanisms (similar to PRODDER) could be established to ensure that the amounts paid are returned to the irrigation areas where they are collected in the form of investment subsidies.

- **I&D investments and programs need to be directed towards supporting both agriculture productivity, poverty reduction and the sustainable utilization of water resources**. As mentioned in Chapter 1, CONAGUA and some IDs have achieved significant success in reducing water consumption towards sustainable levels (e.g. ID 066, Santo Domingo, Baja California Sur).

- **As discussed later in the paper, irrigation and drainage, and agricultural support should not be implemented through centrally managed programs, but instead should be planned within the context of Integrated Water Resources Management (IWRM) Plans carried out at the river basin or aquifer level** with the participation of states, municipalities, water users and the private sector.

- There is sufficient water to meet all of the domestic and industrial/commercial demands, to increase production of high-value crops, and still have some water available for low-value crop production in most areas in the northern and central part of Mexico.

- As discussed later in regard to IWRM planning, for each aquifer, basin or sub-basin, the starting point needs to be a good water balance analysis. After taking into account environmental water needs, it will then be important to estimate the demands (considering efficient water usage) for domestic water and industrial/commercial and the water demands for high-value crop production, taking into account the amount of these crops that the national and international markets could absorb. The remaining water would be available for low-value crop production.

- Large existing surface water irrigation systems, such as those of the IDs, have considerable sunk costs and low O&M costs, which make them the most likely to be able to continue to compete in the production of low-value crops after 2008. Some low-

cost modernization investments may also be justified in these areas. Because of the high social costs and other risks that could result from the abandonment of these large irrigation areas due to non-competitiveness of low-value crop production after 2008, there is an urgent need for CONAGUA and SAGARPA to carefully analyze how costs can be minimized and yields maximized in these areas. A careful analysis of permissible subsidies that could be directed towards sustaining these irrigation systems and agricultural production in these areas is also urgently needed.

- Because of the higher operating costs (energy, pumps, etc.) it is highly unlikely that groundwater irrigation of low-value cereal crops could be similarly supported and made competitive. This is especially true in the case of groundwater resources that are presently being overexploited, because of the added costs associated with depletion of the resource. Given that many poor farmers in IUs are currently irrigating low-value crops with groundwater, a major effort is needed to support conversion to high-value crops in reduced areas, and to assist farmers in making the transition from irrigation to rainfed agriculture or to other ways of earning a living.

- **In irrigated areas where water resources, in particular groundwater, are presently overexploited, net extraction (evapotranspiration) needs to be the basis for decision-making.** In the critical water scarce areas, evapotranspiration will need to be reduced to sustainable levels and this will often require reductions in the irrigated areas. Improving the efficiency of existing irrigation systems on existing lands will not by itself solve the systemic problem of water scarcity, because these local efficiency improvements eliminate infiltration and operational "losses" that replenish water resources of the area. Rather than saving water, efficiency improvements in this way can increase water consumption. Efficiency improvements should still be undertaken, but they should take into account the need to reduce the **net** extraction of water, if resources are already overexploited.

- Hence, when considering future investment programs for I&D, a focus should be on **conversion to higher value crops** that can be competitive within the NAFTA area, particularly in water scarce groundwater irrigated areas. The export market potential for fruits, vegetables, sugar and other similar crops is quite large, but the commercialization is difficult and the market risks are high. Large investments in irrigation drip systems, plasticulture, green houses and post harvest processing and transport will be needed and these will also normally result in high economic returns. Experience indicates that changing technology like this takes time; investment and capacity building, compared to just changing crops, so the reorientation plans and programs need to take account of this.

- **Mexico has significant potential to increase grain and forage crop production through non-irrigated rainfed agriculture in parts of the country where rainfall is adequate for this purpose.** Here usually drainage, flood zoning and in some cases flood control infrastructure is required (e.g. PRODERITH). An important strategy to partially deal with the overexploitation and economic issues discussed above would be to greatly increase support and programs for rainfed agriculture. This would also benefit the poor because many of them are located in these more humid rural areas. Existing

subsidy and investment programs do not adequately support such a strategy, however, and often have the negative effect of perpetuating uneconomic activities that negatively impact the environment (e.g. overexploitation of aquifers).

3. Options for reforming water sector institutions

- Mexico's legal framework for water seeks to: (a) develop deconcentrated/decentralized WRM at the basin and aquifer levels with the direct participation of federal agencies, states, municipalities, water users and other stakeholders; (b) improve federal government water administration mechanisms and allow state governments to gradually participate in such tasks; (c) establish a Water Financing System (*Sistema Financiero del Agua*) supporting the principle "*water pays for water*" by improving fiscal revenues from water use fees and water service tariffs; and (d) determine incentives as well as sanctions to improve law enforcement approaches.

- The ability of the law to reach these objectives depends on how it is regulated and implemented. The law calls for the Basin Agencies (*Organismos de Cuenca*) under CONAGUA with broad autonomous responsibility for carrying out WRM at the river basin level. Such Basin Agencies are deemed to replace and substantially improve the existing Regional Offices (*Gerencias Regionales*) of CONAGUA. The law also supports the establishment and strengthening of the River Basin Councils (*Consejos de Cuenca*) that were included in the previous law – though not well implemented. How these two key entities are regulated and how they carry out their duties in accordance with the law together with increased state and municipal government involvement in water resources planning and management, will determine whether WRM has been effectively deconcentrated/decentralized or not. This Water Public Expenditure Review is expected to contribute to achieving a more comprehensive and successful implementation of deconcentrated/decentralized WRM at the basin and state levels through several recommendations that incorporate public expenditure mechanisms, processes and tools within the current legal framework.

- Presently, CONAGUA defines and manages a series of programs in the areas of irrigation and drainage, flood control, water supply and sanitation, water rights administration, hydrometeorology and surface and groundwater monitoring and assessment from its central offices. Although these programs do include a degree of water user, state and municipal government participation, the fact that the programs are basically defined and managed at the central level, greatly limits the ability of deconcentrated/decentralized (river basin, aquifer level and other) entities to carry out integrated WRM and participatory planning. The 2004 revision to the NWL tried to address this issue by giving the Basin Agencies autonomy and placing them directly under CONAGUA's Director General instead of under the direction of the various central departments responsible for the individual area programs.

- In order for this arrangement to be successful, it will be necessary to change the financing mechanisms. Presently, to a large extent, funding comes from annual budgets approved by Congress and through SHCP to each of the area investment programs. Details are then defined and funds transferred to the lower levels as a result of specific decisions adopted by the respective areas of CONAGUA for program implementation. The law mandates the development and establishment of a new Water

Financing System, which presumably should support deconcentrated/decentralized integrated water resources management (IWRM) whereby activities are defined from the 'bottom-up' and financial flows are aligned. However, if existing financing mechanisms are maintained intact, IWRM will not occur and little will change in the sector.

STAGES OF INSTITUTIONAL REFORM

- The recent legal reforms indicate that there is considerable consensus that Mexico's water management needs to be changed. Some water institutions analysts propose that the process of change within water management may be divided into four stages. Dinar and Saleth call this the stage-based approach.[36] They identify four stages of the water institutional change process:

  - Mentality change, the initial phase in which an idea of the reform direction is developed;
  - Political articulation, where political consensus about the need for change is reached;
  - Institutional change, which is the actual implementation stage;
  - Actual impact, when the results of the reform can be measured.

- Given that changes to the law have already been made, it would appear that Mexico has already passed the political articulation stage and would be ready to embark upon the third stage to implement the institutional changes. However, given some perceived deficiencies in the 2004 revision to the NWL and the water sector political economy, there are some stakeholders which are not in full agreement with the law. The proposals for implementation of the law should therefore assign some more space and time for building political consensus.

- While working on building consensus, some moves may be made in the direction of the reforms, like introducing performance measures in the existing water programs; designing and implementing improvements in established water public expenditure mechanisms, processes and tools; delegating more responsibilities to the Regional Offices of CONAGUA (some or all of which will become Basin Agencies); and improving existing consultative processes with the basin stakeholders through the Basin Councils. In addition, a more complete deconcentrated/decentralized WRM and financing mechanisms could be implemented on a pilot basis in selected hydrographic regions.

- Once consensus is broad enough, the 2004 revised NWL could be implemented unless there are deep and justified elements suggesting further amendments and agreement on paying the political costs incurred from such a decision.

[36] Dinar, Ariel and R. Maria Saleth. (2004). *The Institutional Economics of Water*. Washington DC: The World Bank.

- In order to implement some of the reformed water law's intentions, the WaPER proposes both a deconcentration of functions and an administrative decentralization. The options for institutional arrangements presented are in line with the 2004 revised NWL but in some cases may require regulatory changes from the regulations presently in effect and based on the 1992 NWL.

- Deconcentration would entail moving some of central CONAGUA's functions out to the Basin Agencies. The Basin Agencies supported by the Basin Councils would plan their own infrastructure development and generate budget proposals with stakeholders' participation (including State and Municipal Governments as well as water users). Past experiences from other basin entities and some experiences of successful COPLADEs provide a template for a consensus building process.

- Simultaneously, an administrative deconcentration/decentralization would maintain the overall federal organization, mostly in terms of policy making and implementation, strategic national water planning and centrally administering certain programs whose nature requires such an approach, but also expand the role of State and Municipal Governments in the planning and budgeting process, as well as in investment and operation.

- Both deconcentration and decentralization could include a participatory process (again, taking advantage of Basin Councils, COTAS, COPLADES and FOFAES experiences) to prioritize actions and a well-negotiated budget proposal.

Central CONAGUA's Roles

- Under this proposal, CONAGUA and SEMARNAT at the central level would articulate the national water policy and management vision. CONAGUA at the central level would be smaller with some functions and personnel transferred to the Basin Agencies. It would set water policy[37], define standards and norms, sector guidelines, criteria for water charges, tariffs and subsidies, conduct aspects of water administration, broad sector regulation, monitoring and evaluation and management of the national water sector information system.

Basin Agencies and Basin Council Roles

- The Basin Agencies could have several broad areas of actions: (a) carry out some of the water authority responsibilities of CONAGUA, i.e. water rights administration, discharge control, water use fee and pollution penalty charge collection; (b) carry out water quality assessments, water balance analyses and modeling; (c) with the support of Basin Councils and their auxiliary institutions including Aquifer Committees (*COTAS*), carry out basin and aquifer IWRM planning; (d) support the

[37] The 2004 NWL specifies that the head of SEMARNAT will propose the national water policy to the President of the Republic for his approval. The Draft is prepared by CONAGUA.

implementation of actions agreed-upon within the Basin Councils; and (e) consolidate the plans and budget proposals agreed upon by the Basin Councils for submission to central CONAGUA. The Consultative Councils of the Basin Agencies would ensure coordination and support of the Basin Agencies activities by different government entities at different levels (federal, state, and municipal).

o In accordance with the 2004 legal reforms, the Basin Councils would function as consensus builders among stakeholders providing advice to the Basin Agencies. Municipal, State and other stakeholder proposals and needs could be submitted to the Basin Council, which in turn, would analyze, consolidate and approve stakeholders' proposals. This approach has at least partially worked in the Lerma Chapala basin in which many programs and projects implemented with regional relevance (including water allocation schemes) during the past 17 years were analyzed, debated and approved within its Basin Council. See Box 3.1 on the Lerma Basin Council experience. The stakeholders, in terms of the 2004 revision to the NWL, include government (federal, state and municipal interests), utilities, commercial water users, industrial water users, agricultural water users (irrigation districts as well as other irrigated areas), basin committees and commissions, COTAS, environmental or any other pertinent interest groups. The Basin Councils should basically have the same government representatives as the Consultative Councils, but also include water users and other non-governmental stakeholders.

OVERALL PLANNING AND BUDGETING IN THE WATER SECTOR[38]

o The water sector in Mexico went through significant changes during the last decades, particularly in regard to decentralization, but the policy and planning functions have not completely adapted to the new circumstances. To a large extent, planning has focused on determining an overall public investment program. Other functions such as analyzing constraints for its implementation, increasing private financing and monitoring outcomes are more incipient and still need to be scaled up. In an overall context of tight constraints for central budget funding and scarce water resources, resources in the water sector are not allocated based on objective criteria such as need or efficiency.

Planning and budgeting in the water sector

Planning

o *Multi-year investment plans at the different tiers of government are often not consistent with each other*. Mexico does national-level planning, but it is often not sufficiently well linked with planning by governments and agencies at the sub-national

[38] The budget cycle starts ideally with the planning process, assessing the needs of society and the funding that will be available. The plan usually focuses on investment needs, but it should also consider the associated requirements for current spending and the availability of current revenue to pay for them. Next, the spending must be budgeted, annually in Mexico, to carry out a year of the plan. Then, the budget must be executed and monitoring and evaluation should report on the quality and efficiency of the spending, and the evaluation should guide decisions in the next round of planning and budgeting. (source: IPER, 2005)

levels, which implement a significant portion of the water infrastructure. In addition, there are insufficient incentives and help for good sub-national planning, which is critical in the sector.

o The formal planning process by federal and state governments is done once every six years, at the start of each new presidential and gubernatorial terms. These multi-sectoral National Development Plan (PND) and State Development Plans set objectives and investment programs for all sectors including the water sector. CONAGUA produces a National Water Plan (PNH) that coincides with the six-year presidential term and feeds into the federal PND formulated by the Presidency. Similarly, State Water Commissions, where established, participate in state water investment planning, usually through the formulation of State Water Plans. The multi-sectoral development plans at the state level coincide with the six year gubernorial term and thus not necessarily with the PNH and PND.

o At the local level, plans are prepared for different water sub-sectors. They are poorly coordinated among themselves and loosely linked to state and national plans.

- In the WSS sector, there is little planning at the local level. There are multi-sector Municipal Urban Development Plans that usually cover 20 years. Some of the better utilities have established WSS Master Plans, including investment plans covering 5 to 15 years. Most water utilities and municipalities do not engage in formal long-term planning for their WSS systems, which expand ad hoc, following the pattern of urbanization and in response to the fluctuating availability of funds from federal programs. All investment projects need to be approved by the municipal council, which usually does not have a long-term perspective and favors piecemeal system expansion and emergency repairs for which federal grants are available instead of preventive maintenance.

- In the irrigation sector, there is some planning at the local level: CONAGUA is responsible for investment planning in the irrigation districts and units. Under the Irrigated Agriculture Modernization Project (PMIR) master plans are being developed for most of the irrigation districts and some irrigation units with a good deal of participation by water users in the development of the plans. To date, however, these plans need a stronger link to the investment programs, although these linkages increases as the plans are finalized. In the future, these irrigation master plans could be adjusted to conform to Integrated Water Resources Management (IWRM) Plans at the basin or aquifer level that will include allocation of available water between sectors (see paras. 2.64 to 2.69).

- In water resources management, Regional Water Plans (RWP) have recently been prepared for all of the hydrographic regions in the country. However, centrally managed sectoral programs are only loosely linked to the Regional Water Plans and this linkage becomes less as time elapses after completion of the plans.

Budgeting

- *Despite some links, annual budget allocations are detached from Government's plans.* The plans usually make statements of intent, unaccompanied by financing plans, indicative budget allocations, or effective prioritization. Hence, in the absence of a revenue boom, parts of the plans are immediately found unachievable financially. The annual budget formulation process makes some reference to the development plans, but the links become more tenuous over time. Rather, the federal budget emerges from an interaction among sector ministries, with not necessarily the same priorities.

Federal allocation for various water investment programs is determined year by year among CONAGUA, SHCP and Congress. SHCP focuses basically on the fiscal ceilings. States and municipalities through their respective executive and legislative branches do have some influence on investment decisions, but it seems to be secondary to the influence of CONAGUA and the federal Congress. In practice, CONAGUA has considerable authority and thus has substantial discretion in determining its budget.

- The general process of annual budget allocation is as follows.

  1. Preparation of the annual budget

  - From February to August the government defines the basic structure and requirements for the upcoming budgeting process.
  - From June to August a preliminary budget is prepared: for CONAGUA, regional and state offices indicate their needs for financial resources for current and capital expenditures for the upcoming year to CONAGUA central. The CONAGUA General Sudirectorates incorporate and adjust the regional and state petitions into the national programs.
  - From July to August preliminary expenditure needs are determined.
  - From August to October financing caps for expenditures are established for each program, Project and office: CONAGUA's Planning General Subdirectorate consolidates the budget requests into an overall CONAGUA budget; which is then submitted to SHCP for analysis, modification and presentation to Congress.
  - From September to October the overall federal budget is developed for presentation to Congress on the 15th of November.
  - SHCP is also responsable for preparing the annual operating budgets for all federal agencies including for the legislative and judicial branches of government.

  2. Approval of the annual budget;

  - Beginning the 15th of November both houses of Congress review and approve the annual revenue law and only the House of Deputies reviews and approves the federal budget.

- By mid-December Congress should send to the executive branch approval and authorization to expend the annual budget.

③ Budget execution of the budget process

- During the first three months of the year (normally in March), SHCP will send to the implementing agencies, in this case CONAGUA, Official Authorization for Expenditures along with which the detailed budget resources are assigned for the programs, projects and offices. After receipt of these Authorizations the different offices in CONAGUA can begin to commit the budget resources.
- CONAGUA's Planning General Subdirectorate after having received the Authorization from SHCP sends specific Authorization for Expenditures to each CONAGUA office (usually in April) and it is from that point that they may begin to expend funds.
- The 31st of December all federal agencies return to SHCP the amounts of the budget that they have not expended..

Budget execution

o There are often significant differences between the investments foreseen in the development plans, and what is executed on the ground. The main limitations related to the execution of annual budget in the water sector are the following:

- First, the amount available each year for investments is determined as a residual after funds are allocated for salaries, debt service and other current spending. These resources are usually smaller than what has been foreseen in the various plans. In addition, they fluctuate significantly from year to year. In the case of CONAGUA, the budget caps are set between August and October after the budget requests have been consolidated between June and August. Thus, there is a disconnect between budget planning and budget limit setting

- Second, in the absence of any medium-term expenditure framework, larger projects get fragmented into pieces that can get finished in a year or less—but at higher total cost.[39]

- Third, at the federal level resources for investment programs do not begin to be applied until around June of each year, which means investments are often rushed in order for expenditures to be made by the end of the year, leading to an unproductive annual stop-and-go cycle of investments. Those delays can prevent the realization of the investments originally planned leading to under-spending of the investment budget or sometimes affect the quality of the work as it must be rushed. This dysfunctionality at the federal level reverberates through the entire water sector, because practically all investments are co-funded by federal programs which all

[39] Exceptions from this rule are programs which provide a multi-year expenditure framework. SHCP does grant multi-year contracting authority on a case-by-case basis, and getting this authority has become easier in recent years.

require state and local counterpart contributions which tie up almost all state and local resources. In the case of CONAGUA, authorizations for expenditures are sent to the offices of CONAGUA in April results in a minimum 3-month delay in initiating expenditures. However, preparation of terms of reference, technical specifications and other contract documents for procurement of goods, civil works and studies is often not initiated by the offices until the Authorizations have been received. This is because there is always some uncertainty before the authorizations are in hand. This often results in contracts being signed and initiated in July or later, sometimes as late as December. These processes and conventions result in incomplete expenditure of authorized amounts (which are often characterized as "savings" when in fact they are inefficiencies in implementation) and can produce inadequate goods, poor quality studies and unsatisfactory works.

o The combined effect of these factors makes it difficult to reach the targets of the development plans, and to implement multi-annual single projects.

o The delays in the availability of federal funds sometimes also result from the difficulty to comply with the administrative norms. The administrative norms for public investment projects at various levels of government are so complex that they delay investments and are often ignored. Moreover, the complexity of the norms discriminates against funding for states and municipalities – usually the poorer ones – that do not have the capacity to comply with all the norms. These norms could most probably be streamlined without impairing economic efficiency, environmental sustainability and transparency of investments for which they have been designed.

Monitoring and evaluation

o Fragmented information systems and decisions about resource allocation have led to sector outcomes of different quality without the ability to determine to what extent a particular program contributed to achieve certain development outcomes. As stated above, the involvement of all three levels of government presents a particular challenge in the water sector.

o The present system authorizes individual projects and budget envelopes annually on the basis of notional, largely historical unit costs and ex-ante cost-benefit studies. There is little systematic information on whether results are good or bad, and such information rarely has budgetary consequences. Existing information systems monitor inputs such as investment by program separately from outputs such as an increase in irrigated area or water and sanitation coverage, without trying to link the two in order to assess the unit costs and the efficiency in various regions and programs. In addition there is no mechanism for analyzing up front and monitoring and evaluating post anti the effects of the investments on the water resource base.

o Currently, SHCP does not receive timely, objective information on whether funds were provided to the executing unit as planned, whether they were used for the purposes intended, whether their application translated into improved services, and at what cost. And, without such information, it is difficult to determine what could

have been done better. There is no regular reporting by sub-national governments on the use of federal transfers, especially unconditional transfers such as Ramo 33-FAIS, which are a growing source of finance for water supply and sanitation; nor is there standardized reporting on performance of WSS companies (organismos operadores - OOs), irrigation districts and irrigation units. The Law of Ramo 33 requires the states to report the destination of these resources, but there are no standards for this or sanctions for not doing it at all. This hinders both accountability to the local clientele and planning at the state and national level.

The need for Integrated Water Resources Management Plans

- The objectives enshrined in the National Water Program 2001-2006 are largely appropriate. Considering the seriousness of the water problems and the transcendence of water resources in the welfare and development of the country, the principal vision of the Mexican National Water Program 2001-2006 is to transform the existing situation to "a nation with secure water resources to sustain development, that utilizes them in an efficient manner, that recognizes their strategic and economic value, and that protects water bodies and preserves environmental resources for future generations". This vision takes into account: (a) the importance of water resources for social welfare; (b) water's key strategic role in the development of different productive activities (agriculture, industry, energy generation, fisheries, navigation, tourism); (c) the rights of future generations to adequate water resources for their welfare and development; and (d) the recognition that the environment is an important valid and essential water user.

- Realizing this vision is undermined by poor coordination among the various policies and programs of the different government entities and administrative levels. This is further compounded by a basic lack of awareness among some government, private sector and water users as to the urgency with which sustainable integrated water resources management (IWRM) is required and what needs to be done to achieve it.

- Water resources planning and management needs to be carried out at the basin or aquifer level because all uses within a basin or aquifer need to share the same often limited water resources. The Regional Water Plans (RWP) that have recently been prepared for all of the hydrographic regions are an improvement over past water resources planning in Mexico because: (a) they were developed for river basins or groups of river basin in line with hydrographic boundaries; (b) and they included participation of local stakeholders in the planning process. The RWP provide good insights and analysis and an adequate starting point for developing more detailed integrated water resources management plans (IWRM Plans). IWRM Plans should be the basis for the investment planning and budgeting processes.

- The 2004 NWL calls for the development of IWRM Plans in basins and aquifers with serious overexploitation of water resources problems. Traditional water resources planning makes a projection of water demands into the future based on existing trends and then comes up with investment plans to increase the supply of water to meet

the projected demands. In overexploited basins and aquifers all of the water resources are presently being utilized and so it is very difficult to come up with investment options that will increase the water supply. Importing water from other basins can be an option, but is often too expensive. In Mexico, the entire central and northern part of the country is water scarce and there is very little water available for transfer projects.

o The starting point for IWRM Plans is a determination of the amount and quality of water that is required to meet environmental sustainability needs and then determine the amount and quality of water that is available for consumptive uses of water (irrigation, municipal use, industrial use) giving priority to domestic use. In areas where there is presently overexploitation of water resources and poor quality water this will require reducing net extractions of water (i.e. evapotranspiration) for these uses to sustainable levels and improving water quality as determined through the water balance and water quality analyses.

o In addition to the objective of eliminating overexploitation of water resources, improving water quality to acceptable levels, and achieving sustainable water resources management, the IWRM Plans need to: (a) support economic development ensuring adequate water resources for high-value growth needs; and (b) ensure that benefits are equitably shared and in particular that the poor benefit and are not negatively impacted.

Box 3.1 Elements of an IWRM Plan

An IWRM plan should include the following elements:

- A survey and analysis of the history, problems and needs in the basin or aquifer.
- A water balance and water quality analysis and water resources models that are utilized to: (a) evaluate the present situation; (b) evaluate scenarios of actions and future conditions to support the selection of priority structural and non structural actions; and (c) monitor and evaluate implementation of the selected action plan.
- A selected IWRM Plan including both structural and non-structural actions that will achieve the sustainable WRM objectives confirmed through the water balance, water quality and modeling analyses and also meet economic development and social objectives. The process of arriving at the selected plan should include a prioritization of potential actions based on economic, social and environmental objectives and the selection of the optimum plan within the envelope of available financial resources
- A financing plan that includes the sources and uses of funds and funding mechanisms necessary to successfully implement the IWRM Plan. The financing plan should include the establishment of mechanisms (such as trust funds and water banks) with transparent regulations to facilitate implementation of the plans.
- A draft regulation for the basin or aquifer that reduces water rights to sustainable utilization levels.
- An institutional plan for implementation of the IWRM Plan.
- Acts issued by the Basin Councils, COTAS, state governments, municipal government federal government agencies and private sector entities adopting the IWRM Plan and committing to its implementation.

o The IWRM Plans need to be prepared with the participation of federal, state and municipal governments, water users and other local stakeholders. The Basin

Councils and COTAS need to play a central role in the planning process supporting the Basin Agencies, which should be responsible for preparing the agreed plans.

o In the future, these more detailed and comprehensive IWRM Plans can replace the Regional Water Plans, and State Water Programs should be derived directly from the IWRM Plans. Eventually the National Water Plan and the National and State Development Plans should include a bottom-up aggregation of the IWRM Plans.

o While decentralization and deconcentration of CONAGUA will entail greater autonomy in investment planning, execution, and financing for Basin Agencies, States and Municipalities, effective accountability should accompany autonomy. Indeed, without reliable, verifiable information on actual performance, it is risky to respond unconditionally to demands for more autonomy. Rather, increments to autonomy should depend on improvements in accountability.

o CONAGUA central needs to play an important role in overseeing and ensuring good decentralized and deconcentrated planning, programming, implementation, operation and maintenance and monitoring and evaluation. This role should include: (a) development and issuing of policies, strategies, regulations, guidelines, norms and standards; (b) technical assistance and training; and (c) oversight supervision and monitoring and evaluation. Better performance tracking and information disclosure will require measures like the following: regular reporting by subnational governments on the use of federal transfers, e.g. Ramo 33/FAIS and standardized reporting on performance of water companies, irrigation districts and irrigation units through an expansion of CONAGUA's *sistema de información nacional* (national information system). Such measures do not require large sums of money, yet they do require building institutional capacities among the concerned sectoral agencies and subnational governments, and sustained political commitment to transparency.

OPTIONS FOR IMPLEMENTING THE NEW WATER FINANCING SYSTEM

o Each Basin Agency[40], with support from the Basin Council, based on stakeholder inputs and in accordance with clear rules previously established by CONAGUA central (with SHCP support), would develop an annual plan, including investment and management actions along with financing sources and requirements, timeframes and responsibilities. Once dependable IWRM basin or aquifer planning processes are in place[41], this annual plan would be based on a 10-year rolling IWRM plan at river basin-level or aquifer-level that is also agreed upon within the Basin Councils. The annual plan should cover all federal, state, municipal and private sector programs and actions that relate to WRM, and be agreed upon by all stakeholders (including CONAGUA activities, which in turn, will incorporate Regional Office-*Gerencia Regional* activities). Existing programs of all of the different players would need to be

[40] *Gerencias Regionales* will temporarily participate while *Organismos de Cuenca* are being implemented.

[41] It is expected that already existing regional strategic plans will continue, as well as specific action, master basin or regional plans that contain details on projects and actions, both including infrastructure as well as other non-structurally related tasks that need to be addressed to contribute to IWRM within a specific basin, aquifer or region (i.e. a set of two or more contiguous basins).

adjusted to conform to each basin's agreed-upon IWRM plan and to any specific IWRM policies.

- In turn, it would be advisable that Basin Agencies eventually only be able to obtain funding with a 10-year rolling IWRM plan in place and consensus among stakeholders. Consensus would not require unanimity in voting, but it should imply a high level of agreement among stakeholders.42 Through its Basin Agencies, the federal government (supported by clear rules from CONAGUA) could manage conflicts between differing interests and provide room for (a) isolated cases where agreements may need to be reinforced as well as for (b) specific reorientations needed whenever a specific portion of national policy is endangered or must prevail on grounds of national interest. Annex 1 presents an analysis of international and Mexican experiences in the use of consensus for river basin management that will be useful in implementing the proposed changes.

- The Basin Agencies would submit their proposed annual plan to CONAGUA central, clearly specifying those parts of the plans that would be included within CONAGUA's budget. CONAGUA central would consolidate and incorporate them into the budget approval process. It is expected that only minor adjustments would ordinarily occur in the process of consolidation resulting in a final annual national water sector plan.[43] At this stage, CONAGUA central would also include in the consolidated annual plan specific investment and management actions, along with their budget requirements, that it directly implements. Such actions include: water policy setting, defining norms and standards, aspects of water administration, regulation, monitoring and evaluation. These actions would not commonly be subject to stakeholders' approval (although some information could be provided to them, to contribute to overall water resources governance).

- To match goals with actual results, and to rationalize disbursements in a coherent fashion with needs and proposals, it would be necessary to establish a follow-up control assessment (monitoring and evaluation) system closely linked to the afore-mentioned rolling plans to ensure matching objectives, strategies and specific goals with achievements on an annual basis.

[42] Past experience is quite clear: no voting has been necessary on most decisions adopted by Consejos de Cuenca. This, in turn, has facilitated obtaining support for programs, projects and actions and has proven of paramount importance for successful implementation of investments as well as other types of disbursements.

[43] 2004 NWL regulations (yet to be approved and enacted) provide for CONAGUA's Subdirectores Generales to participate in reviewing and pre-approving proposals from Organismos de Cuenca related to their corresponding spheres of action.

Box 3.2 Lerma-Chapala Basin

As the largest lake in Mexico, Lake Chapala, located in Lerma's basin, is a point of pride for many in Jalisco as well as Mexico as a whole. It supplies Guadalajara's drinking water needs and generates significant revenue from important activities such as fishing and tourism. By late 1988, Lake Chapala was ailing with very low water levels and rising levels of pollution during a severe regional drought. Guadalajara found it difficult to extract water and fish population levels dropped. Likewise, reservoirs and aquifers were at low levels. Simultaneously, more water was allocated than was actually available. It was quite clear that maintaining the status quo was unacceptable. The Federal Government was the only entity entitled to solve or mitigate the same problems that had evolved under its watch.

There were clear and harsh social reactions to the situation. Federal, State and local authorities were all under pressure and being criticized. Politicians, even the President, received many complaints and demands for concrete action. Social organizations, including public and private actors and water users, began to seek solutions and take action. State Governments were also crucial in initiating change.

In April of 1989, the Federal Government and the five states in the basin signed an agreement to distribute water according to a new allocation policy, improve the water quality through residential and industrial effluent treatment, increase water-use efficiency and protect and conserve the river basin system. On September 1, 1989 a consultative council made up of federal and state government officials formed to follow-up on and evaluate the goals and tasks on the water agenda. Members of the Council included the following: President of the Republic as an honorary member; the Ministers of Agriculture, Fisheries, Urban and Social Development, Environment, Health and the Federal Comptroller; the CEOs of decentralized energy institutions (CFE and Pemex); and the five Governors of the States in the basin. CONAGUA's Director General was the Council Secretary responsible for its agenda. The Council met about once a year.

The Council created a Technical Work Group (TWG) which proved key in maintaining interest and regularly producing practical work. The TWG, composed of about 20 high level federal and state public servants, met regularly every 3 or 4 months and had decision-making capabilities. This group negotiated resources, coordinated efforts, forged consensus, created projects per legal instruments to support decisions, programs and actions. Specifically they defined a wastewater treatment plant program, designed surface runoff water allocation policy and used various approaches to enhance water efficiency and to mitigate or reverse negative environmental impacts. CONAGUA's Regional Manager for the Lerma and Balsas Basins chaired all TWG meetings which allowed for communication with and access to CONAGUA resources, technical capacity and Authority for decision-making. Soon the TWG grew to 60 high level representatives and became very influential.

Both the Consultative Council and the TWG met in large cities, small towns and rural areas throughout the basin and so locals from all five basin States participated in the meetings raising their awareness and moderated their criticism. There were also critics and resistance from CONAGUA and State Governments. Within the TWG there were of course conflicts between differing interests, but consensus was adopted as the manner to solve disputes and so differences were always settled either in group work sessions or through lobbying. When discussions stalemated, the sessions were suspended and bilateral and multilateral negotiations started with much success. The TWG created the Permanent Work Group (PWG) for extreme cases where consensus was difficult to attain. Made up of selected high-level TWG members, the PWG met daily on particularly thorny issues until they were resolved.

The Lerma-Chapala Basin approach was sufficiently successful that it was considered as a model for water management to be encouraged throughout Mexico. As a result, the TWG worked on revising various National Water Law drafts which led to the National Water Law of 1992 supporting the creation of river Basin Councils that would have both governmental and non-governmental participants. In turn, as per the National Water Law of 1992, the Consultative Council became the Lerma-Chapala River Basin Council on January 28, 1993, the very first Basin Council in Mexico's history.

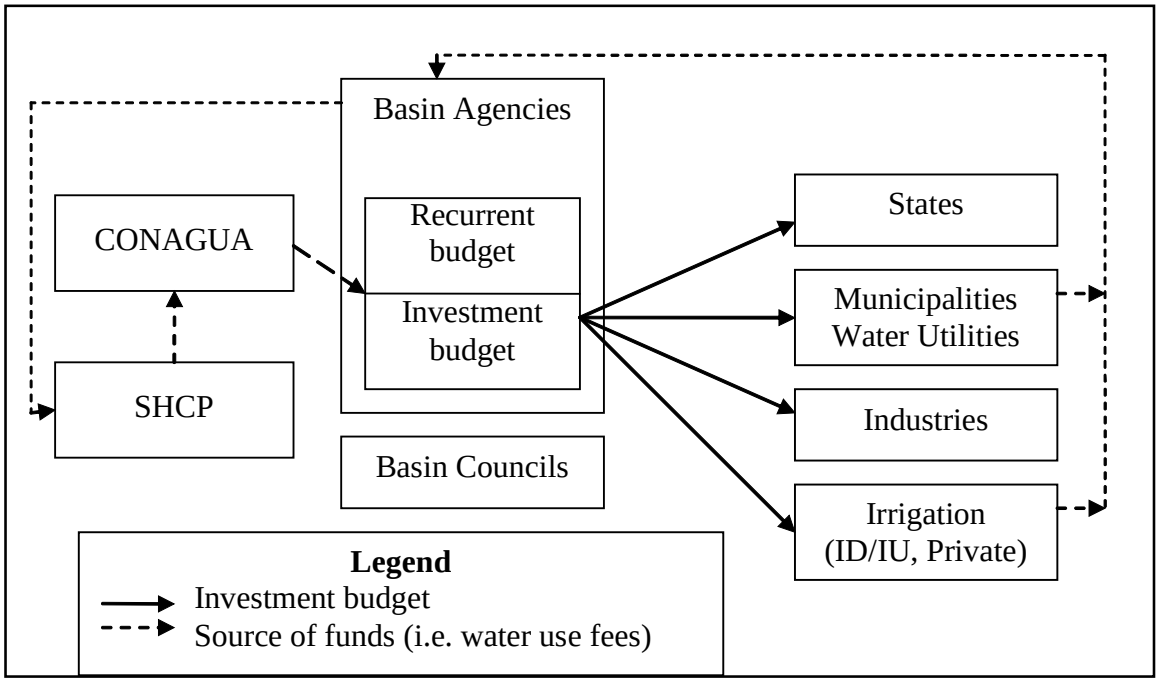
Flow of funds

o In support of the deconcentration/decentralization agenda, and in accordance with a deepening of past practices, most of the federal funding for investments would be assigned for transfer to States, Municipalities, and Irrigation Districts and Units, who would then be responsible for implementation of the investments.

o These federal transfers could be channeled and administered through the basin agencies budgets or through basin-level Trust Funds (*fideicomisos*), which have a strong history as effective institutional arrangements in Mexico.

o Under the first option, the budget of every basin agency would include resources to cover the basin agency current and capital expenditures as well as the federal investment subsidies transferred to states, municipalities, irrigation districts and irrigation units within the basin, for activities that they would be responsible for implementing in accordance with the annual basin action plan. The annual budget of the basin agency would be based on the annual action plan that would be derived from the 10-year rolling IWRM plans for the basin. Figure 3.1 depicts the proposed arrangements to channel and administer the federal resources transferred through CONAGUA to support the implementation of the IWRM plans.

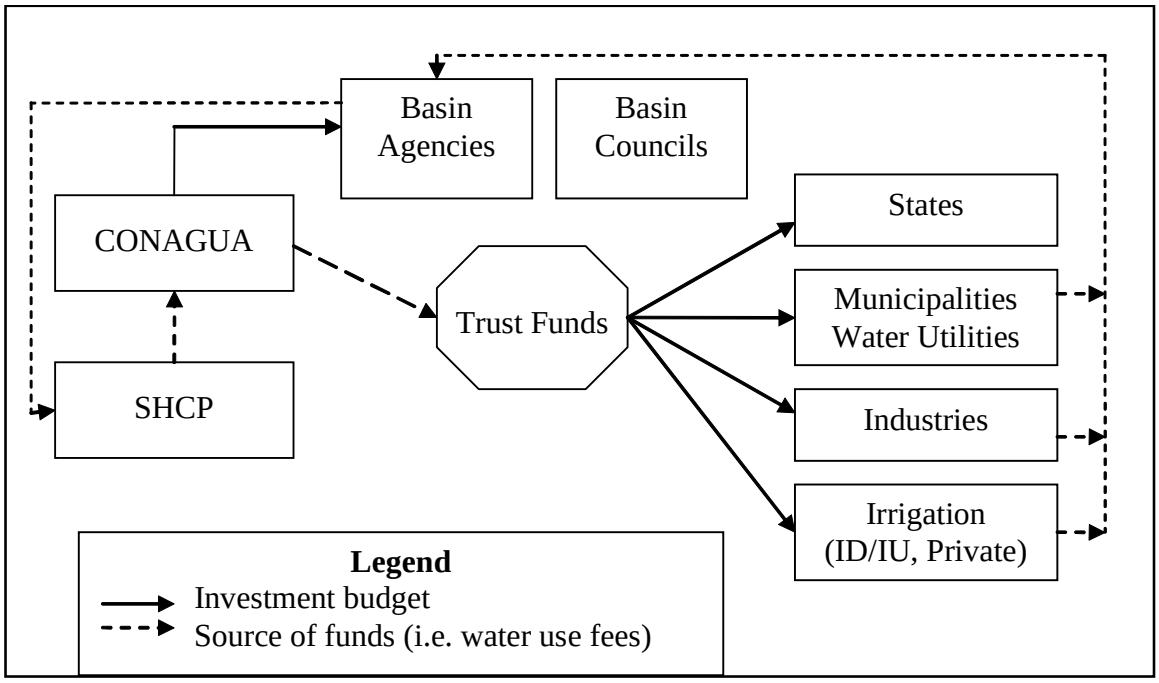
Figure 3.1 Proposed flows of investment funds – Basin agency budget option



o Under the second option, a Water Valuation Trust Fund (*Fidecomisos de Valoración del Agua* - FIVAGUA) would be set-up in each basin to channel and

administer the financial resources from the federal budget and, possibly other sources, to support the implementation of the investments foreseen in the basin/aquifer IWRM plans. CONAGUA would thus channel funding for IWRM-based investment programs and actions to basin-level trust funds which would then send funds to Municipalities, States, and Irrigation Districts and Units. Trust Funds would not cover current expenditures. CONAGUA would still transfer directly (i.e. not through Trust Funds) to each Basin agency financial resources to cover expenses related to its daily operational purposes and small investment expenditures for which BAs are responsible. Figure 3.2 depicts the proposed arrangements to channel and administer the investment resources from the various sources to support the implementation of the IWRM plans.

Figure 3.2 Proposed flows of investment funds – Trust Fund option



o Under the Trust Fund option, federal deposits in the Trust Funds could be a one-time annual event (perhaps in July). Once financial resources are deposited into the Trust Funds, they should not be returned to the Federal Treasury except in cases of fraud, abuse or corruption. This could allow for continuous programs and actions in the hydrographic region, not subject to the annual budget cycle where financial resources become especially scarce during the first semester of every fiscal year. The fact that funds are not available until about July of each year in the present annual budgeting process hampers many programs/projects from being fully effective and efficient.

o In addition to financing investments, each Trust Fund could support water market and establish a water bank (a locus permitting regulated water rights transfers between suppliers and demanders) to facilitate reallocation of water rights to higher-value

uses and environmental purposes. As mentioned in Chapter 1, water market could promote reductions in overexploitation and improve overall water-use efficiency as well as raising water productivity. The Trust Fund could operate through a decentralized framework and the flow of funds could be worked out between federal and state governments, with private sector and water user participation.

o Trust funds could constitute a powerful transparent financial and administrative mechanism for ensuring that various governmental and private sector actions positively impact WRM and do not conflict or contradict each other but instead complement each other and systematically contribute to sustainable IWRM. Both Basin Agencies and Councils could each play a consultative role; Basin Agencies may also adopt the role of investment plan regulators. The basin's trust funds would be managed through a technical committee that would have representation from the Basin Agency, states and others. A trustee would be responsible for the administration of the Trust (as required by law in Mexico). Banks appointed through public bidding could be trustees; the entities responsible for executing programs and actions listed in IWRM Plans would be the beneficiaries. Beneficiaries would normally be members of the Basin Council.

o Past experience in Mexico has shown that Trust Funds can have strict and transparent rules and procedures for the use of funds that avoid corruption and promote financial efficiency. Since revenues from water use fees and water pollution penalty charges are federal fiscal funds (as well as any reoriented electricity subsidies), the federal government (through the Basin Agencies, as deconcentrated arms of CONAGUA) would be in a strong position to oversee and audit the management and use of funds from the trust funds.[44] The trust funds could focus on financing the implementation of IWRM plans (more specifically, the annual investment/action plans) through contracts, procurement programs, other types of investments run directly or indirectly by entitled executors and other such activities which in Treasury's terms may be eligible as investments or other allowed disbursements. Trust funds will not pay salaries (which CONAGUA, state and municipal governments could take care of, each in their corresponding area of responsibility) as well as some other recurrent costs, many of which are usually programmed costs already fully covered by other lines of budget.

Financing the IWRM plans

o Most federal funding for investment in the water sector would be recovered from water users and polluters, through the bulk water charges, the water use fees and the water pollution charges.

o Eventually, water investments within a hydrographic region should be funded exclusively from the revenue generated by the bulk water charges, the water use fees and the water pollution penalty charges in the region, except in the case of some poor southern basins that could continue to receive subsidies from the general treasury funds. This would greatly increase the incentives for setting fee/charge rates that cover

[44] It is mandatory to establish a clear distinction between the federal government's roles in (i) auditing trust fund's operations vis a vis (ii) following-up and assessing investment plans.

costs; and improving collection, payment and record keeping thus resulting in increased revenues.

o Recognizing the success of PRODDER in greatly increasing water use fee collections from water supply utilities because of the direct return of funds for investments, financing of the basin-level IWRM plans could maintain similar mechanisms for water utilities, and eventually extend it to the irrigation districts and units if they are charged a water use fee in the future. Although the purpose of the bulk water charge is to cover the costs of operating and maintaining the bulk water supply systems, similar mechanisms for direct return of bulk water payments from irrigation districts could also be envisaged as an incentive to encourage payments. The concept could also be extended to the water pollution penalty charge in order to improve collection from utilities and industries and encourage much needed investments towards decreasing wastewater pollution load. By far, the largest payer of water use fees is industries and they do not receive any subsidy back. However, the fact that these resources would be used to support water-related investments within the basins where the industries are located should increase their willingness to pay the fees.

o Hence, federal funding to the hydrographic region should be equal to the revenues from water use fees and water pollution charges collected during the previous year (except for some poor southern basins) and would be based on the annual IWRM plan that would in turn be based on the hydrographic region's 10-year rolling IWRM plan.

o Another potentially substantial source of funding for the hydrographic region would be a reorientation of the electricity subsidy monies in irrigated agriculture. Indeed, even if the subsidy is maintained (which would not be advisable but may be politically expedient), the Federal Government could recognize the savings in the electrical subsidy from reduced pumping that would result from implementation of the IWRM Plans, and provide an equal amount of funds into the basins to support implementation of the Plans (see para 3.42).

Scenarios to finance IWRM plans

o As mentioned above, it is proposed that fiscal revenues from water use fees, bulk water charges and water penalty charges collected in a hydrographic region, should remain in that hydrographic region to finance programs and actions as defined by the hydrographic region's IWRM plans. Table 3.1 shows the average budget for each of the Basin Agencies during the 2003-2005 period. Most of the water programs are part of the capital expenditures, and most of the current expenditures are used to pay personnel payroll. Fee collections in about half of the hydrographic regions are sufficient to cover capital expenditures.

Table 3.1 CONAGUA's average budget in the 2003-2005 period

Current Situation
Averages of 2003-2005

		Expenditures			Revenues	Non-fee	
	(2004 MxP million)	Current Exp.	Capital Exp.	Total	Fees & Bulk Water*	Transf. Fed. Gov.	Total
I	Península de Baja California	57.9	530.9	588.9	153.8		
II	Noroeste	39.7	357.8	397.5	228.0		
III	Pacífico Norte	62.3	663.4	725.7	156.1		
IV	Balsas	47.0	335.2	382.2	484.3		
V	Pacífico Sur	38.2	330.0	368.3	139.7		
VI	Río Bravo	51.3	701.4	752.8	957.9		
VII	Cuencas Centrales del Norte	54.4	252.1	306.5	517.8		
VIII	Lerma-Santiago-Pacífico	72.0	661.4	733.4	1,425.2		
IX	Golfo Norte	47.4	484.7	532.0	322.2		
X	Golfo Centro	44.2	190.0	234.2	455.6		
XI	Frontera Sur	41.3	539.8	581.0	282.1		
XII	Península de Yucatán	36.9	213.9	250.8	121.8		
XIII	Aguas del Valle de México y Sistema Cutzamala	1,942.1	1,009.6	2,951.8	2,382.6		
	Total	**2,534.8**	**6,270.3**	**8,805.1**	**7,626.9**	**1,178.1**	**8,805.1**

	CONAGUA Central Administration					
	Expenditures			Revenues		
	Current Exp.	Capital Exp.	Total	Other Collections	Trasnf. Fed. Gov.	Total
Transfers to basins			1,178.1			
Other	4,263.9	2,258.7	6,522.6			
Total	4,263.9	2,258.7	7,700.7	719.0	6,981.7	7,700.7

Total CONAGUA Central Expenditures	6,522.6
Total add. CONAGUA Central Expenditures	0.0
Total Fee Collections	7,626.9
Total Additional Fee Collections	0.0
Total Basin Expenditures	8,805.1
Total Additional Basin Transfers	0.0
Total CONAGUA Expenditures	15,327.7
Total Additional Resources from Treasury	0.0
Total Add. Res. from Treas. Not covered by fees	0.0

* For the revenue calculations it was assumed that:
(i) all of the urban bulk water charges were for Valle de México;
(ii) the irrigation bulk water charges were proportional to the total collections for operation and maintenance in the irrigation districts; and (iii) the pollution penalty charges were already included within the water use fee collection estimates.

o Many different scenarios could be developed and considered. The two presented here are mainly to demonstrate the potential budgeting approaches that could: (1) return all fees to the hydrographic regions and thereby provide incentives for increasing collections and rationalizing collections with expenditures; (2) adjust CONAGUA central budget and provide more resources to the hydrographic regions to support deconcentration and decentralization; (3) exploring increases in water use fee rates to provide incentives for water conservation and increase financial resources for WRM and investments; and (4) reduce reliance on non-fee resources for financing in the sector.

o Tables 3.2 and 3.3 show two scenarios. The first reflecting a relatively short-term approach that could be implemented without major changes in existing revenue and expenditure patterns and processes; and the second, a longer-term approach that would reflect the objective that the hydrographic regions should be financially self-sustaining.

- Table 3.2 – Scenario 1 assumes that 90 per cent of all fee (estimated as the historical average) would be returned to the hydrographic regions where they were collected. The balance, 10 per cent of the fees, would be distributed, as cross-subsidies, to the regions that had insufficient fee collections to cover expenditures. Additional non-fee

resources would be provided to those hydrographic regions (Baja California, Noroeste, Pacífico Norte, Pacíifico Sur, Golfo Norte, Frontera Sur, Península de Yucatan, Valle de México) where the fees do not cover the historical average current and capital expenditures. These non-fee resources would be provided such that expenditures would equal historical average expenditures in the hydrographic regions where fees would be insufficient. This would result in increased resources to the regions of about MxP 1,014 million. This increase would be offset by a decrease in CONAGUA Central current expenditures by 10 per cent and capital expenditures by 28 per cent. The scenario 1 is therefore revenue neutral. It should be noted that some hydrographic regions (Balsas, Río Bravo, Cuencas Centrales del Norte, Lerma-Santiago-Pacífico, Golfo Centro) would have resources from fees in excess of their historical average expenditures because 90 per cent of their fees exceed these historic amounts.

- Table 3.3 – Scenario 2 assumes that all hydrographic regions would retain 100 per cent of their fee collections and, with the exception of Pacífico Sur, Frontera Sur and Península de Yucatan, the 3 poorest southern regions, would become self-financing. The scenario also assumes that CONAGUA central current expenditures would be reduced by 20% and capital expenditures by 50%. Scenario 2 is based on the following additional assumptions:

  (a) For Baja California, Noroeste, Pacífico Norte, Golfo Norte and Valle de México, it will be a big challenge to increase fee collections to the point that they would be able to sustain expenditures at historical average levels. Because these regions are the most water scarce in the country, it would follow that prices (water user fee rates) should be the highest.

    (i) In the case of Baja California, Noroeste, Pacífico Norte, Golfo Norte, the introduction of a MxP 0.10 per cubic meter fee for agriculture water[45], coupled with a 20 per cent increase in collections from industrial and municipal users (through improved enforcement and possible higher rates) would generate sufficient resources for these regions to be self-sustaining financially and approximately be able to maintain expenditures at historical levels.

    (ii) In the case of Valle de México, a 24 per cent increase in collections from industrial and municipal users would generate sufficient resources to meet this goal.

  (b) Those basins with fee collections already higher than their historical expenditures (Río Bravo, Cuencas Centrales del Norte, Lerma-Santiago-Pacífico, Balsas, Golfo Centro) would also increase fee collections from industrial and municipal users by 20 per cent through improved enforcement

[45] As a comparison, in 2006, the French Water Agency Seine-Normandie charged €0.9/m^3 (about MxP 11/m^3) for a water consumption estimated from the energy bill; €0.5/m^3 (about MxP 6/m^3) for a water consumption estimated from a water meter and about €20,000/ha (about MxP 240,000/ha) otherwise; the French Water Agency Adour-Garonne charged €4,45/1,000 m^3 (about MxP 0.05/m^3)

and possibly increases in fee rates. This would allow them to significantly increase expenditures over historical levels.

(c) Pacífico Sur, Frontera Sur and Península de Yucatan would also increase fee collections from industrial and municipal users by 20 per cent. However, additional non-fee resources would still be needed for these regions in order for their expenditures to reach historical levels. Continued provision of non-fee resources to these regions would be justified because of their wide-spread poverty.

o Figure 3.2 shows the baseline case and the effects of the 2 scenarios on three hydrographic regions: (a) Lerma-Santiago-Pacífico where existing fee collections greatly exceed expenditures; (b) Balsas where existing fee collections are relatively close to expenditures; and (c) Pacífico Norte where fee collections are far below expenditures. It is interesting to note that setting an agriculture water use rate in Pacífico Norte at MxP 0.10 per cubic meter would generate about MxP 850 million, whereas only MxP 600 million of additional resources would be necessary to bring fees into line with expenditures. This is because Pacífico Norte has large amounts of irrigated agriculture. Figure 3.3 present a summary of the scenarios. Scenario 0 is the baseline case from Table 3.1.

Table 3.2 and Table 3.3 Scenarios

Table 3.2

Scenario 1 90% of all fees collected are returned to the basins where collected. The reminaing 10% pooled resources are distrbuted to the basins with deficits.
Additional resources are provided to the basins to cover the amounts of current expenditures and capital expenditures not covered by the fees.
CONAGUA's central budget is reduced by % 16%.

0.9000

		BASINS						
		Expenditures			Revenues			
	(2004 MxP million)	Current Exp.	Capital Exp.	Total	Fee Collection	Transf. Curr. Exp.	Trasnf. Cap. Exp.	Total
I	Península de Baja California	57.9	530.9	588.9	153.8	57.9	392.5	588.9
II	Noroeste	39.7	357.8	397.5	228.0	39.7	152.6	397.5
III	Pacífico Norte	62.3	663.4	725.7	156.1	62.3	522.9	725.7
IV	Balsas	47.0	388.9	435.8	484.3			435.8
V	Pacífico Sur	38.2	330.0	368.3	139.7	38.2	204.4	368.3
VI	Río Bravo	51.3	810.7	862.1	957.9			862.1
VII	Cuencas Centrales del Norte	54.4	411.6	466.0	517.8			466.0
VIII	Lerma-Santiago-Pacífico	72.0	1,210.7	1,282.7	1,425.2			1,282.7
IX	Golfo Norte	47.4	484.7	532.0	322.2	47.4	194.7	532.0
X	Golfo Centro	44.2	365.8	410.0	455.6			410.0
XI	Frontera Sur	41.3	539.8	581.0	282.1	41.3	285.8	581.0
XII	Península de Yucatán	36.9	213.9	250.8	121.8	36.9	104.3	250.8
XIII	Aguas del Valle de México y Sistema Cutzamala	1,942.1	1,009.6	2,951.8	2,382.6	807.4		2,951.8
	Total	2,534.8	7,317.8	9,852.6	7,626.9	1,131.1	1,857.3	9,852.6

	CONAGUA Central Administration					
	Expenditures			Revenues		
	Current Exp.	Capital Exp.	Total	Other Collections	Trasnf. Fed. Gov.	Total
Transfers to basins	1,131.1	1,857.3	2,988.4			
Other	3,837.5	1,637.5	5,475.0			
Total	4,968.6	3,494.8	8,463.4	719.0	6,982	7,701

Total CONAGUA Central Expenditures	5,475.0	CONAGUA central budget reduced by 10% of current expenditures and 28% of capital expenditures
Total add. CONAGUA Central Expenditures	-1,047.6	
Total Fee Collections	7,626.9	Fee Collections unchanged
Total Additional Fee Collections	0.0	
Total Basin Expenditures	9,852.6	Expenditures increased in basins with surplus fee cols. 10% of cols. redistributed to basins with insufficient cols.
Total Additional Basin Transfers	1,047.6	Add. resources provided to basins to cover amounts of current & capital exps. not covered by fees.
Total CONAGUA Expenditures	15,327.7	
Total Additional Resources from Treasury	0.0	
Total Add. Res. from Treas. Not covered by fees	0.0	

Table 3.3

Scenario 2 All fees collected in the Basins are returned to the basins.
Additional resources are provided to the basins to cover the amounts of current expenditures and capital expenditures not covered by the fees.
Irrigation water use fee $0.2/cubic meter
CONAGUA's central budget is reduced by 50%.

		BASINS						
		Expenditures			Revenues			
	(2004 MxP million)	Current Exp.	Capital Exp.	Total	Fee Collection	Increased Fee Collection	Transf. Curr. Exp.	Trasnf. Cap. Exp.	Total
I	Península de Baja California	57.9	530.9	588.9	153.8	435.0			588.9
II	Noroeste	39.7	357.8	397.5	228.0	169.5			397.5
III	Pacífico Norte	62.3	663.4	725.7	156.1	569.6			725.7
IV	Balsas	47.0	534.1	581.1	484.3	96.9			581.1
V	Pacífico Sur	38.2	330.0	368.3	139.7	27.9		200.7	368.3
VI	Río Bravo	51.3	1,098.1	1,149.4	957.9	191.6			1149.4
VII	Cuencas Centrales del Norte	54.4	567.0	621.4	517.8	103.6			621.4
VIII	Lerma-Santiago-Pacífico	72.0	1,638.2	1,710.2	1,425.2	285.0			1710.2
IX	Golfo Norte	47.4	484.7	532.0	322.2	209.9			532.0
X	Golfo Centro	44.2	502.5	546.7	455.6	91.1			546.7
XI	Frontera Sur	41.3	539.8	581.0	282.1	56.4		242.5	581.0
XII	Península de Yucatán	36.9	213.9	250.8	121.8	24.4		104.7	250.8
XIII	Aguas del Valle de México y Sistema Cutzamala	1,942.1	1,009.6	2,951.8	2,382.6	569.2			2951.8
	Total	2,534.8	8,470.1	11,004.8	7,626.9	2,830.0		547.9	11004.8

	CONAGUA Central Administration					
	Expenditures			Revenues		
	Current Exp.	Capital Exp.	Total	Other Collections	Trasnf. Fed. Gov.	Total
Transfers to basins	0.0	547.9	547.9			
Other	3,411.1	1,129.4	4,540.5			
Total	3,411.1	1,677.3	5,088.4	719.0	4,369.4	5,088.4

Total CONAGUA Central Expenditures	4,540.5	CONAGUA central budget reduced by 20% of current expenditures and 50% of capital expenditures
Total add. CONAGUA Central Expenditures	-1,982.1	
Total Fee Collections	10,456.9	Fee Collections increased to cover expenditure needs except for regions V, XI & XII
Total Additional Fee Collections	2,830.0	
Total Basin Expenditures	11,004.8	Basin Expenditures increased in basins with surplus fee collections
Total Additional Basin Transfers	-630.2	Add. resources provided to regions V, Xi & XII to cover amounts of current & capital exps. not covered by fees.
Total CONAGUA Expenditures	15,545.3	
Total Additional Resources from Treasury	217.7	
Total Add. Res. from Treas. Not covered by fees	-2,612.3	Although total expenditures increase, the non-fee resources decrease.

Figure 3.3 Relationship Between Fee Collection and Expenditures for Lerma-Santiago Pacífico, Balsas and Pacífico Norte for the 2 scenarios and the baseline

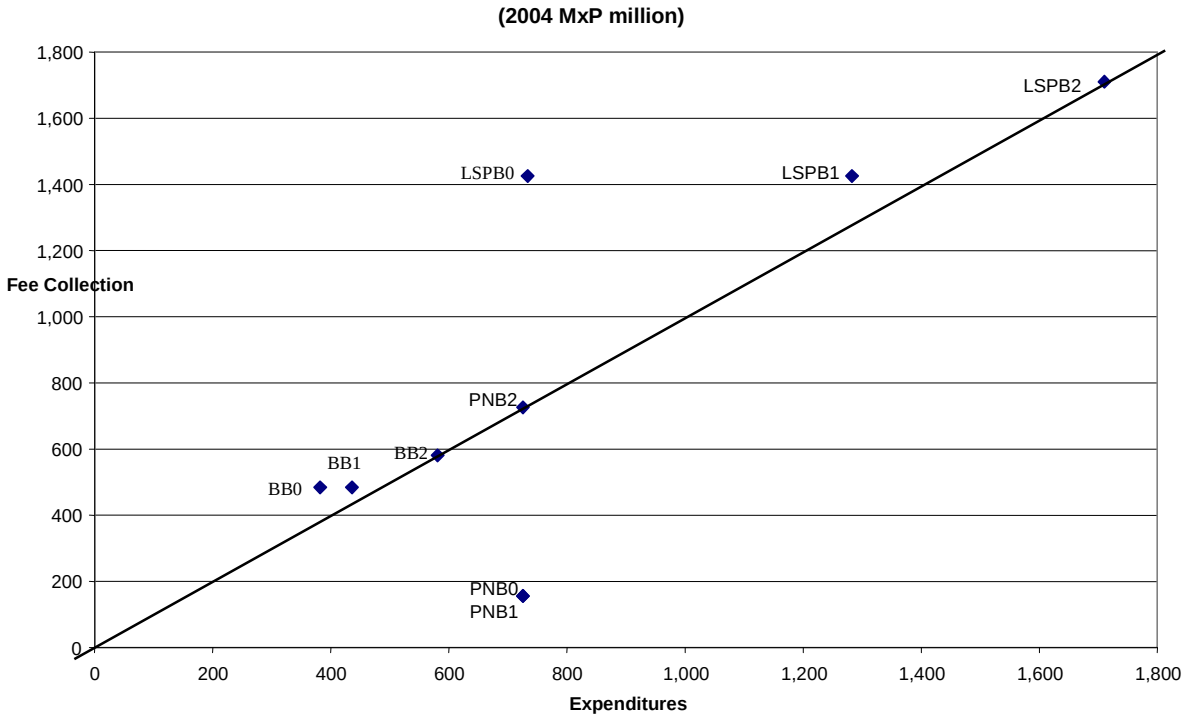
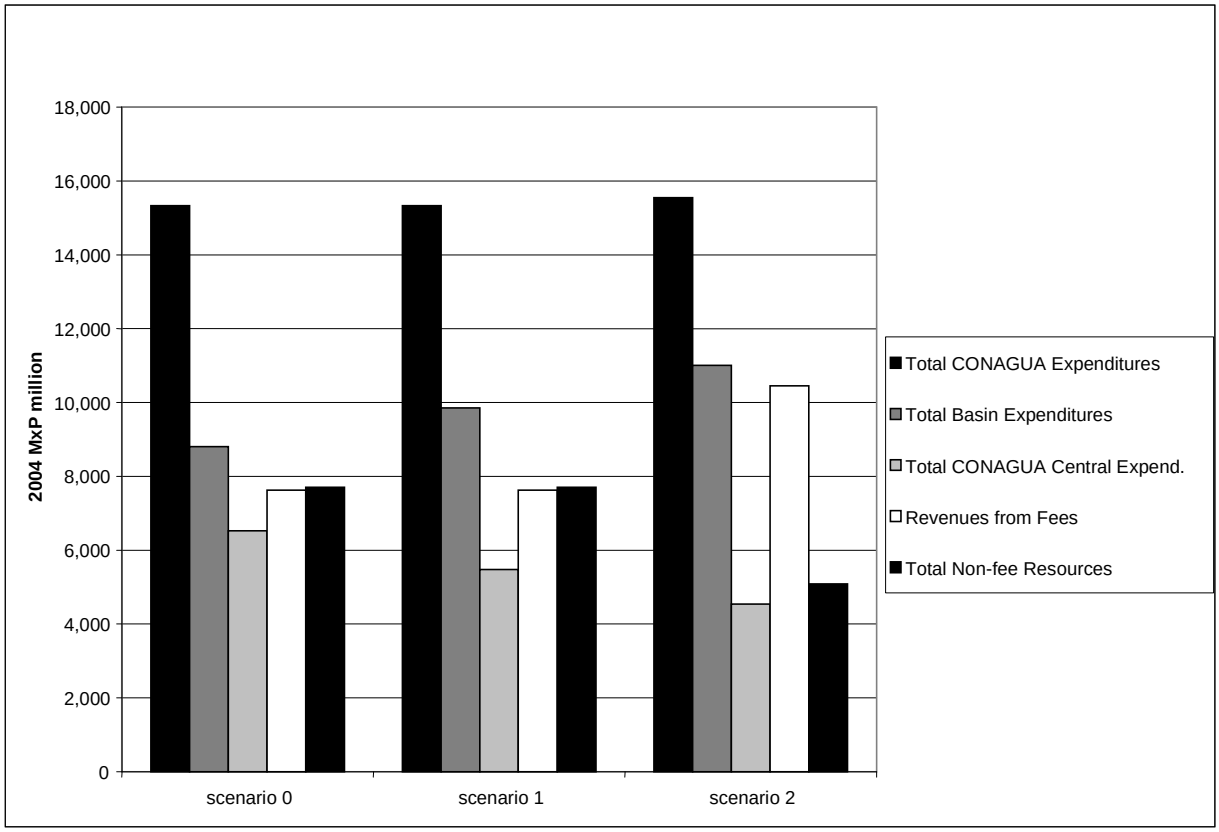


Figure 3.4 Summary of Scenarios



o As previously stated, *returning all fees to the hydrographic regions where they are collected is an important policy objective*. This could lead to visible changes in WRM which could reduce some of the complaints (especially from industrial users) about paying high fiscal water user fees since such users will see that their fees are being used to solve their own basin's water resource management problems. On a related note, increased enforcement for delinquent water fees could also promote payments and, in turn, increase revenues.

o *Transfer of responsibility for setting fee rates and fee collection to the hydrographic regions* would also be an important step because it would allow the hydrographic regions to determine their resource requirements and set the fee rates to meet their needs as determined through the IWRM planning process. Water users will be encouraged to directly participate in proposing action plans and priorities for the basin through the Basin Council's consensus building IWRM planning process, and they would also participate in defining the fee rates. When considering fee rates, the BAs and BCs should evaluate all sectors (industry and commerce, municipal, agriculture, aquaculture, etc), as well as charges for polluted discharges. Currently there is a notorious difference between the levels of water use fees for industries which are high, municipalities (for drinking water and final discharge of urban effluents) which are much lower and irrigated

agriculture, which is exempt.[46] Each sector's fee levels could be reviewed and perhaps adjusted to better reflect the economic value of the water (taking into account opportunity costs and marginal sectoral costs). This evaluation should be carried out within the Basin Council with the participation of representatives of the different water uses.

- For both Scenario 1 and 2, *it will be important to establish policies and criteria for these non-fee transfers* that are based on *inter alia*: need for investments, ability to generate resources through fees, and poverty alleviation needs. Some hydrographic regions (e.g. Baja California, Noroeste, Pacífico Norte, Golfo Norte) have low fee collections and high historical expenditure rates, but also are relative rich in terms of per capita income. There may be potential to reduce expenditures or increase fee rates in these hydrographic regions. Other hydrographic regions (e.g. Pacífico Sur, Frontera Sur, Peninsula de Yucatan) have low fee collections and relatively high expenditure rates, but these hydrographic regions are relatively poor and increased non-fee transfers may be justified. It is important to note that non-fee federal resources decrease by MXP 2,612 million from scenario 0 to scenario 2. This is a significant fiscal savings.

- The scenarios only address CONAGUA funding. Another significant source of financing could come from reorientation of the agriculture electricity tariff subsidy, the vast majority of which is used for pumping irrigation water. Agricultural users pay about 35 per cent of the cost of electricity that they use. The other 65 per cent can be considered a government subsidy that is estimated to be about 6,000 Million Pesos per year. This is a large amount of money and when coupled with the fact that agricultural users are exempt from paying a water user fee, amounts to a large government financial incentive to use irrigation water (often in water scarce areas with serious overexploitation problems). Much of the electricity subsidy supports the production of low-value crops in uneconomic farming operations whose net incomes are often considerably less than the amount of the subsidy. The 2006 World Bank Report: Economic Assessment of Policy Interventions in the Water Sector suggests that the subsidy could be decoupled from electricity/water usage. The electricity rate would be set at the commercial rate, and the farmers would receive the subsidy through direct payments or other compensation. (This reoriented subsidy could be given only to poor water users.) This would significantly reduce the incentive to overuse scarce water resources. The program would need to be well designed to ensure fair transparent mechanisms for determining the amount and kind of compensation and for dispensing the financial resources. The Basin Councils and FIVAGUA Trust Funds (if established) could play an important role in this subsidy reorientation program, which should be designed and managed within the IWRM Planning process.

- Finally, after the implementation stage it may be advisable to have an independent third party (perhaps SHCP using performance indicators), evaluate CONAGUA and Basin Agencies' performances thus completing Dinar and Saleth's

[46]Given that irrigation is the most important consumptive use in Mexico, representing about 80% of all consumptive water uses, the fact that farmers pay nothing for the rights to extract may need to be reconsidered.

stage-based analytical framework with the fourth and final stage of performance evaluation.

PHASED APPROACH AND ROADMAP TO WATER SECTOR REFORM IN MEXICO

o The Roadmat to water sector reform in Mexico should include a schedule for transition and steps to help implement the reformed water law through changes in the water sector in terms of technical and physical aspects as well as financial aspects at the national, state and municipal levels. Reorienting financial resources, decision making, qualified professionals, etc. from the center to the local level will take some years.

o Deconcentration and Decentralization could be implemented in a phased approach. This could allow time to test basin-level management and to work on the re-allocation of resources. Within the Dinar and Saleth analysis, this could allow more time for consensus to develop among the stakeholders affected by the water law changes and perhaps smooth implementation.

- A first step might include a design stage to conduct an institutional feasibility assessment and a stakeholder impact assessment. SCHP, CONAGUA and some stakeholders could participate in these assessments. In this first stage, all required procedures could be drafted (including for example, necessary amendments to operating rules for centrally managed programs, new operating rules for basin-level programs and possible transfers of functions and staff from some areas within CONAGUA central to the Regional offices/Basin Agencies). The design stage and outcome could be influenced by the following issues:

  - What is CONAGUA's capacity and willingness for implementation at both central and regional levels? What are the strengths and weaknesses of Regional Offices to become Basin Agencies?

  - What are the anticipated impacts on water users and stakeholders and how willing and able are they to participate? There may be negative reactions from parties (municipalities, irrigation users, water abstractors and effluent dischargers) that previously did not pay water use fees and pollution penalty charge. Are there any regional differences in terms of willingness or capacities of water users and stakeholders to pay?

  - What capacity building programs should be designed and implemented both for private and public organizations? Which possible existing institutions might be the most suitable to carry out these crucial activities?

  - How could the institutional framework be designed to create financial and behavioral incentives? Is there a need to modify or introduce specific policies and programs, as well as to adapt or reform existing structures and functions? Is it necessary to modify existing legal

instruments (codes, regulations, operating rules)? What are the most necessary reforms in CONAGUA and SHCP?

- What legal and implementation impediments can be anticipated? Should deconcentration via Basin Agencies and decentralization via state governments be gradually implemented or could attendant challenges be overcome through regulation in the short term? Does the NWL need to be amended again to facilitate processes (perhaps by relaxing some relatively stiff provisions)?

- Additionally, expected roles for Basin Agencies, Basin Councils and state governments could be designed and made explicit beyond the provisions in the 2004 revision to the NWL and its drafted regulations.

3. A second step could be to implement these changes in 1 or 2 pilot hydrographic regions:

- Four possible hydrographic regions that could be considered are: (a) Lerma-Santiago-Pacífico; (b) Balsas; (c) Cuencas Centrales del Norte; and (d) Noroeste. Each has serious water scarcity, overexploitation and contamination issues. The first three have fee collections in excess of expenditures and Noroeste has expenditures in excess of fee collections.

- This study proposes the following criteria for pilot selection:

  3. States willing to participate
  3. A State SWOT (*strengths, weaknesses, opportunities and threats*) analysis that demonstrates acceptable success possibilities
  3. A Basin Agency/Basin Council SWOT (*strengths, weaknesses,* opportunities *and threats*) analysis that portraits acceptable success possibilities.
  3. A relatively strong CONAGUA *Regional Office*, with capable staff and proven negotiating capacities with states, municipalities and water users and other stakeholders
  3. The hydrographic region must already have a reasonable amount of information regarding water availability, water users and revenue collection.
  3. A good historical record on water tariffs, willingness to pay, water user fee revenues, etc.

- Some experience in IWRM planning / programming / budgeting
- Willingness to try a new well-negotiated (among institutions including federal, state, municipal levels as well as water users and stakeholders) scheme where budgets originate from basin proposals,
- Capabilities (at State and regional office levels) to manage budgets allocated on a hydrographic region basis
- Good existing capacity in public water expenditure and overall executive capacity to use financial resources in a timely, transparent and efficient fashion

CONCLUSIONS

- Sustainable IWRM depends on a holistic integrated approach that deals with irrigation and drainage, water supply and sanitation, land and water productivity and the environment. These need to be planned and managed at the basin or aquifer level with the direct participation of water users and other stakeholders. Irrigation and water supply and sanitation development activities could be more comprehensive in considering water resources availability and management parameters. The amount and quality of water that can be consumptively used in a basin or aquifer as well as meet environmental needs should form the basis or centerpiece for project planning and investment. Irrigation and drainage and water supply and sanitation draw from water sources, consume water and return water with reduced quality to water systems, as well as impact flow regimes and ecological systems. The environment is a special "water using sector" and most environmental concerns are typically the responsibility of environmental rather than water management agencies. But environmental service activities are important to overall IWRM, particularly in regard to the provision of ecological flows.

- In addition to ensuring the availability and quality of the resources, IWRM explores ways to maximize the economic and social benefits derived from the utilization of the limited water resources. This will mean that in water scarce areas, much higher economic returns and job creation will need to result from the use of less water on less land. There is great potential for increasing water productivity in irrigated agriculture through the conversion to higher-value crops and other measures. Water supply and sanitation needs to focus more on improving service quality, including wastewater treatment and meeting the basic needs of the poor.

- Improving water governance will be important to achieve the nation's objectives of economic development and social justice. If there is no change in the strategy of water management, Mexico may expect worsening problems with over-exploitation of water, waste and pollution, which will endanger the availability of water for future generations and the poorest members of the country. The deconcentration/decentralization reforms in public policies and financing for water,

would help deal with the problems of inefficiency, lack of transparency, higher costs, low credibility, weak public involvement.

- Decentralized and deconcentrated IWRM will require intensive cooperative planning in the areas of the basins and aquifers with the direct participation of water users, local stakeholders and government at all levels. This effort should result in consensus-driven IWRM plans that would include actions by all of these entities. Programs could be defined at the local and basin level and harmonized with national and regional policy. The water financing system should be designed to support implementation of these locally and regionally proposed IWRM plans, at the same time strengthening information systems and accountability measures. The process of decentralization/deconcentration has gained some momentum, and would now benefit from additional activities, such as improving the regulations and procedures in support of the NWL, and continuing to build capacities.

- The basic principles for the scenarios presented for budgeting and expenditures are that : (1) all water use fees should be returned to the hydrographic regions and thereby provide incentives for increasing collections and rationalizing collections with expenditures; (2) CONAGUA central's budget should be reduced and more resources should be provided to the hydrographic regions to support deconcentration and decentralization; (3) the responsibility for setting water use fees and for planning investment and management programs (developing and agreeing upon IWRM Plans) should be transferred to the Basin Agencies/Basin Councils, who should in turn explore increases in water user fee rates in order to provide sufficient resources for the planned water resources management and investments actions; and (4) for relatively rich regions their should eventually be no non-fee resources for financing in the sector; non-fee resources should be directed towards poor regions with large investment needs and small potential for increasing fee collections.

- The scenarios only address CONAGUA funding. Another significant source of financing could come from reorientation of the agriculture electricity tariff subsidy (Tarifa 09), the vast majority of which is used for pumping irrigation water. The subsidy could be decoupled from electricity/water usage. The electricity rate would be set at the commercial rate, and the farmers would receive the subsidy through direct payments or other compensation. This would significant reduce the incentive to overuse scarce water resources.

- Much progress has been made in Mexico, and the country is at the vanguard of developing countries in many aspects of water resources management and it is important to continue down the path laid out in the 2004 modification to the NWL. The first years of the next administration would be critical to ensure that. The current water law demands that some action be taken to decentralize and deconcentrate water resource decision-making and funding. Following Dinar and Saleth's stage-based analytical framework, the next steps could be to implement these changes and finally to evaluate the performance of the new systems. The design stage and pilot hydrographic regions should allow for learning (and time for consensus building among the key players) to make the implementation process smooth.

ANNEX 1 – RIVER BASIN MANAGEMENT - INTERNATIONAL EXPERIENCE

INTRODUCTION

In deciding how to implement the amendments to the National Water Law especially concerning the functioning of the basin entities and the Water Financial System, it is useful to examine how other countries have decentralized water planning and management and their associated funding. Case studies from river basin management in Canada, Australia, Spain and France are presented here. France, Spain and Australia have a long history of river basin management. Canada, though comparatively more recent, presents an interesting case of nongovernmental organizations engaged in river basin management.

CASE STUDIES

Fraser River Basin, Canada

A locally initiated, non-governmental river basin organization that has pursued a broad set of objectives related to a concept of basin "sustainability", which includes social and economic as well as environmental aspects.

The Fraser River Basin

The Fraser River drains 238,000 km^2 of British Columbia, an area about the size of the United Kingdom. The river basin is rich and diverse in natural resources. The Fraser Basin supports a population of more than 2.7 million residents, and an economy that includes forestry and pulp and paper production, ranching and agriculture, fishing, mining, recreation and tourism and other industries. Seventy-eight per cent of the basin's population lives in the lower Fraser River valley and estuary region where the Vancouver metropolitan area is located. The basin has been home to aboriginal peoples, or First Nations, for thousands of years. The current population of indigenous residents is estimated to be 50,000.

The River is 1,399 km long, originating in the Rocky Mountains and emptying into the Strait of Georgia and the Pacific Ocean after flowing through the Vancouver Metropolitan area. There are 13 principal watersheds or sub-basins of the Fraser Basin and three main hydrologic regions – the coastal mountains, the interior plateau, and the eastern mountains. The interior plateau is the driest, the coastal mountains the wettest. Flooding has been a significant problem in the basin, especially in the lower Fraser sub-basin. Even in the non flood periods, the amount of precipitation and stream flow concentrated in the lower Fraser River Valley has contributed to drainage problems. Millions of dollars of dyke works have been constructed and maintained, with financial assistance from the federal and provincial governments, to keep streams in the lower river

area within their banks and to preserve agricultural lands and building foundations from seepage. The interior portion of the basin is drier, and even subject to occasional drought. There, farming and ranching, along with extractive industries such as timber and mining, sometimes compete for relatively scarce surface water supplies, particularly towards the late summer and fall. In addition to flood hazards and emerging scarcity concerns in portions of the basin, the principal water management issue is water pollution. Seventeen aquifers are classified as having substantial water quality or quantity problems. In the lower Fraser Valley, groundwater has been contaminated by manure, fertilizers and pesticides. Although toxic discharges from industries have declined, concentration of toxic materials has accumulated in estuarine fish and sediments and biota of poorly flushed streams and in areas adjacent to outfalls.

Although there are serious WRM problems in the Fraser Basin, there are also favorable situations. There remain undeveloped headwaters with pristine water quality. The main stem of the Fraser River has never been damned, and will not be due to its designation as a Heritage River. The large size of the river basin, the large volume of flow on the main stem in normal years, and the fact that urban development has been concentrated mainly near the river mouth have reduced the negative impacts on the basin as a whole.

History of the Fraser Basin Council and Society

The Fraser River Basin has a pair of non-governmental organizations (NGO) as its principal governance and management institutions-the Fraser Basin Society and the Fraser Basin Council. The society is a Canadian non-profit organization governed by a board of directors and able to receive funding from public and private sources. The Fraser Basin Council is a multi-organizational, multi-interest planning body composed of 36 representatives drawn from diverse geographical and sectoral communities within the basin as well as all four levels of Canadian government-federal, provincial, local/regional, and First Nations. The council is the body that truly addresses, discusses and decides upon basin planning and management priorities and activities.

The society and council grew out of the Fraser Basin Management Board, which existed from 1992 through 1997. Efforts to focus on developing a plan for improving the conditions of the entire Fraser River began with the creation of the Fraser Basin Start-Up Committee, the Fraser Basin Action Plan, and the Fraser Basin Management Program in 1990-91. At the same time, the idea emerged of a basin management board responsible for planning and executing projects with input and funding from governmental agencies and with the participation of First Nations and nongovernmental bodies. In May 1992, the principal federal agencies and the provincial government agreed to initiate a five-year Fraser Basin Management Program (FBMP) to be administered by the Fraser Basin Management Board (FBMB). The FBMB was to be a multi-organizational, multi-interest committee designed to encourage, and itself employ, consensus-based decision making about basin activities. In1997, at the end of this five-year period, the FBMB drew up a quasi-constitutional document for the Fraser River basin, called the ‘Charter for

Sustainability.' The FBMB's successor, the Fraser Basin Council, published the charter in 1997. The most striking aspect of the charter is the tremendous breadth that it gives to the concept of basin sustainability and the effect that this has had on the council's organization and indeed its mandate.

Salient Features of the Basin Organization

The council is composed of 36 members. Council seats are deliberately distributed in such a way that no sector of basin interests or level of government has a majority of members and non-water as well as water-related basin interests are represented. Principal stakeholder groups include: hydropower, First Nations, port authorities and harbor commissions, mining, timber/forestry, pulp and paper manufacturing, other industries, agriculture, commercial fishing, recreation and tourism, environmental organizations, and federal and provincial agencies. The Fraser Basin Council has continued the FBMB practice of employing consensus-based decision making and of maintaining regional coordinators in addition to its staff in Vancouver. The council has divided the Fraser basin into five regions based primarily on sub-basin groupings but also reflecting some jurisdictional boundaries (particularly regional districts). These are the basis not only for the assignment of regional coordinators but for the designation of regional representatives on the council.

Unlike its predecessor organization, the Fraser Basin Council has moved beyond total reliance on funding support from government agencies and added "project funding," i.e., funding that comes from public and private organizations that contract with the council to perform a study, organize an event or program, administer a project, etc. The council still relies on core funding support from federal, provincial, and local government annual contributions, but that funding has declined, in percentage terms, from 95 per cent of the council's revenue in 1998 to 51 per cent of its revenue in 2003, while project funding has grown from 4 per cent of council revenue in 1998 to 36 per cent in 2003. The council's revenue has roughly doubled since 1998 due primarily to increased project funding.

Outcomes

Contextual factors and initial conditions. Canada generally, and the Fraser Basin in particular, are prosperous enough that policy makers and stakeholders have resources to devote to research, institution building, meetings, environmental improvement projects, and monitoring and assessment. The initial distribution of resources among basin stakeholders is also conducive to successful river basin management. As a matter of economic policy, the vast majority of land and water resources in the Fraser Basin are held by the province of British Columbia, and used by private individuals under lease arrangements with the government. This situation has allowed institutional arrangements to develop in the basin under conditions where no one interest or sector of basin users had legal immunity for their claims or titles to resource use.

The decentralization process. The construction of basin-scale institutional arrangements in the Fraser Basin is a matter of integrating already decentralized

organizations and jurisdictions rather than decentralizing previously centralized ones. The extent of central government recognition of local-level basin governance has been extraordinarily positive. Not only did the Canadian national and British Columbia provincial governments join in the predecessor organizations in the basin (the estuary steering committee, the basin management board) and fund the Fraser River Action Plan from 1992 through 1998, but they have been original and consistent members of the Fraser Basin Council and have supported it financially through changes of government and administration at both the provincial and federal levels.

Central-local relationship and capacity. The financial resources and the financial autonomy of the council are relatively strong. The council members have, through the Fraser Basin Society and the council's own by-laws, the demonstrated ability to create and modify the institutional arrangements with which they work. The water rights system, on the other hand, is something of a mixed bag. The arrangements governing rights to water and land use allow for considerable management flexibility, however, the control of groundwater resources is particularly weak and represents a current and future vulnerability in terms of WRM within the overall basin sustainability effort.

Basin-level institutional arrangements. The strongest features in this regard are: the availability of a basin level governance body (the council), the recognition of sub-basin communities of interest through the composition of the council with regional representatives and through its employment of regional coordinators, and the institutionalization of regular monitoring of basin conditions by means that are trusted by resource users. The council was designed quite deliberately to share information and promote communication among basin stakeholders, to provide means for basin stakeholders to enter into agreements to take actions for improvement of basin conditions, and to resolve conflicts. While the council has emerged as the paramount deliberative body in the basin, in its capacity as a NGO funded through a nonprofit society, the council has limits in terms of its ability to implement projects. It often must hand off projects to other entities for implementation, and at times even the council members are not entirely clear what actions are within the council's scope.

Conclusion

The NGO model reduces some of the bureaucratic "turf battles" that one would expect to be associated with placing basin management responsibility in an existing agency, or creating an agency that would have authority and responsibilities that were transferred from, or overlapped with, existing agencies. The NGO approach also fits well with a federal system such as Canada's, since it provides a means of crossing jurisdictional boundaries among levels of government in a context where a constitution divides authority and one level of government is not entirely superior or subordinate to another. It is also suited to a common-law cultural context where private organizations are free to do anything that is not expressly forbidden by law, and to take actions (including the raising and distribution of funds) up to the limits of public authority. Furthermore, the NGO approach in the Fraser basin has allowed for the integration of First Nations communities and private stakeholders in ways that more traditional inter-governmental

programs have often found difficult if not impossible. It has provided a good forum for information generation and sharing. A NGO has the boundary flexibility to cover the whole basin (which no local government can do) but not more than the basin (as would be the case for a provincial or federal agency). A NGO of the Fraser Basin Council type also provides good political cover for agencies, who can justify actions that might otherwise be unpopular with a particular constituency. The NGO approach epitomized by the Fraser Basin Council also has its weaknesses. The council is generally unable to implement the plans and programs it agrees upon, and must hand them off to others—usually governmental agencies— for implementation. Other vulnerabilities include the fact that the council's consensus decision making approach, though helpful in a number of respects, can at times be inefficient. Also, as an NGO reliant upon contributions and funded projects, the council is vulnerable to "mission creep," the temptation to move beyond its primary concerns and interests to follow the money. On balance, the approach represented by the Fraser Basin Council has worked well as a means of bridging fragmented public authorities and integrating indigenous and other private stakeholders. It has succeeded in preserving a reputation for objectivity and in building a more diverse financial base. One key to this success has been the ability of the council to promote the concept of interdependency among various stakeholders.

Murray Darling Basin, Australia

River basin governance and management in an industrialized country where water resources are scarce and extremely variable and where the evolution of basin management institutions has been as much a matter of integration as decentralization.

The River Basin

The Murray-Darling Basin is an interior basin defined by the catchment areas of the Murray and Darling Rivers and their many tributaries. The Basin extends across much of southeastern Australia, with the mouth of the Murray River on the southern coast of Australia near Adelaide. It includes over 1 million km^2, and about one-seventh of the land area of Australia. The Basin contains more than 20 major rivers as well as important groundwater systems.

The rivers of the Murray-Darling Basin are characterized by highly variable flows and limited runoff. Total runoff is the lowest of any of the world's major basins, 24 million m^3 of which around half is lost to natural processes, and average annual flow to the sea is a mere 400 m^3 per second. Much of the basin is semi-arid and some 86 per cent of the area contributes no runoff. There are about 30,000 wetlands in the basin, with 11 being listed for their internationally significant values. They are major considerations in environmental management of rivers.

The water resources of the basin are now highly developed for domestic consumption, agricultural production and industry. Annual diversions from the river system are 11.43 million m^3, 96 per cent of which is for irrigation. Total water storage capacity in the basin is 34.7 million m3, which supports some 1,470,000 hectares of irrigated crops and

pastures (representing 71 per cent of Australia's total irrigated area). Around 40 percent of Australia's gross value of agricultural production originates from the basin. In 1996, the basin was home to nearly 2 million people and another one million people outside the basin were heavily dependent on its water resources.

The dominant water management issues in the basin are: (1) water scarcity, over-allocation of supplies and drought exposure; (2) irrigated-related salinity and "dryland salinity", following land clearing for agriculture development; and (3) overall degradation of water quality in the Basin leading to a decline in "river health" and associated wetlands, lakes and forests of substantial natural and ecological significance. As a result, there is a major focus of debate in Australia concerning the need to recover a proportion of water now allocated to agriculture and re-assign it to the maintenance of river health. "The new competition for water is river health versus extraction of water for economics gain".

Institutional Framework

The institutional arrangements in the Murray-Darling Basin have evolved through three major stages: (1) an intergovernmental agreement allocating water flows of the Murray River and providing for the construction and operation of infrastructure on the River, benefiting three states (South Australia, New South Wales, and Victoria); (2) the extension of the scope and structure of the intergovernmental arrangements to the Darling River, as disputes among the States over river flows and water quality escalated, and unilateral state actions were implemented to restructure irrigation schemes and to limit water uses, and; (3) the emergence of IWRM in the Basin with new organizational structures and relationships at the sub-basin and basin levels, and with leadership and financial support from both the national and State governments.

Today, the National Government (Commonwealth) does not manage either interstate or intrastate water uses or regulate water quality – these are functions of the States. In partnership with the States, the Commonwealth, exercises some policy and coordination functions through the Council of Australian Government (COAG), and this has included setting a national water policy reform agenda (1994) and a National Water Initiative (2004). Commonwealth is an essential source of funding for the States which cannot impose customs or exercise duties or income taxes. It provides funding that support the national interest in terms of NRM and provides funds to sub-state water management entities, such as catchment management boards or authorities. The Commonwealth is a party to the Murray-Darling Basin Agreement, participates in the Murray-Darling Basin Ministerial Council and the Murray-Darling Basin Commission, and provides a significant share of the funding for the Commission and its activities in the Basin. The State governments have full sovereign powers over land, water and other natural resources. The control and use of water, including the administration of the water rights, is usually the responsibility of a state Ministry. States build, own and operate major dams on rivers. Initially built and operated irrigation schemes, although with the exception of the State of Victoria, these are now all privatized. Oversees and to some degree finances, WSS functions of local governments. The local governments (urban and

rural) are established and authorized by State legislation. They provide and operate WSS infrastructure and flood protection, often with State government financial support and in adherence to state standards for flood protection works. The Murray-Darling Basin Ministerial Council (MDBMC) composed of ministers from the State and Commonwealth Governments, is the policy making body for the MDB. The council takes a consensus approach in order to achieve unanimous agreement on actions. The Murray-Darling Basin Commission (MDBC) is the executing body for implementing Council's decisions on Basin policy and management. It also advises the Council on Basin conditions and concerns. It consists of representatives from each Basin government and is supported by staff and operations are funded under the cooperative agreement among the participating governments. The Murray-Darling Basin Community Advisory Committee (CAC) advises the Council, representing the interests and concerns of local communities and stakeholder groups throughout the Basin. On major policy issues, the Council receives two reports – one from the Commission and one from the CAC. The catchment management boards/authorities are mostly coordinating and advisory sub-basin and sub-state bodies with responsibility for protecting water quality and riparian and floodplain conditions through efforts to improve landstewardship, riverbank protection projects and tree-planting. Water management committees are community-based advisory committees composed primarily of water users; in some instances they are component of catchment management entities. They advise on water allocation, environmental flows, flood protection, river facility operations and water pricing. Rural water authorities (Victoria only) are governmental, corporatized water suppliers managing all aspects of bulk water provision for municipalities and operating irrigation schemes. They are virtually self-sufficient financially and set-up their own water prices. Irrigation companies are fully privatized bodies operating in all states but Victoria to which previously governmental irrigation infrastructure assets and operations have been transferred.

Four contextual elements are important in understanding these arrangements more fully: (1) Federalism and the sovereign role of the states. The Australian constitution devolves nearly all domestic policy matters to the States. This is essential to understand that management organizations and functions have never been unified on the river basin scale or uniform across states. Water use and wastewater discharges are granted by the state, not MDBC. The same is true for the creation and authorization of all forms of sub-basin organizations, so that each state in the basin contains a different combination of WM organizations. The policy making body for the Basin – the council – operates with a unanimity rule such as each state can block basin policy. (2) Restructuring of sub-basin organizations and State and national ministries. The states prompted by substantial fiscal problems, reorganized water provision and water management operations in the 1980s. The essence of the reorganizations was this: publicly provided services for which fees could be collected should be either corporatized (financially self-sufficient governmental bodies) or fully privatized. States and territories were offered financial incentives for the adoption of measures consistent with the National Competition Policy intended to improve public-sector efficiency in Australia. These changes facilitated a round of other changes: once the construction, operation and maintenance of infrastructure and the provision of services have been moved from state or Commonwealth departments of

water resources, a next step was to combine water resources department with other natural resources or environment departments. This has facilitated the policy shift towards integrated resource management, taking into account the interactive effects between land use, water quality, riverine species and habitat; and made it easier to enact changes such as capping water diversions for the sake of protecting environmental values. (3) Emergence on national leadership on water policy, with State consent. The Commonwealth's superior financial position has allowed accumulating some leverage with the States, by offering financial incentives to states to conform with policy directions approved by the Commonwealth (i.e. the National Competition Policy mentioned above and the National Water Initiative-NWI). Another instrument of strengthened national-level policy making is the COAG. Its influence in the MDB has been profound, as the council adopted the National Water Policy Reform Initiative, revised in 2004 and labeled the NWI. (4) Renegotiation of the River Murray Agreement and its expansion into the Murray-Darling Basin Initiative. In 1988 the Murray-Darling Basin Commission (MDBC) was formed under a new Murray-Darling Basin Agreement (MDBA) and took over the transboundary water management role plus took on a new responsibility for coordinating integrated catchment management across the whole Basin.

As of 2004, the institutional arrangements for governing and managing the Murray-Darling Basin have been modified in substantial ways. Water management has evolved from a focus on managing rivers for water quantity and security of supply (to "drought proof agriculture development") to integrated catchment management. The state governments and the Murray-Darling Basin organizations have been supplemented at the sub-basin level with catchment management bodies that are still developing their own role in land, water and natural resources management. States have however balked at giving these bodies too much authorities – in particular the power to raise their own funds. At the national level, COAG and the Commonwealth government have become intensively involved in the development of national water policy reforms and initiatives that in some respects lead and in other respects follow the IWRM direction taken during the 1990s by the MDBMC.

Outcomes

Contextual Factors and Initial Conditions. Initial conditions and contextual factors in the MDB were in most respects quite favorable to IWRM. Overall, the basin was quite favorable social and economic terrain for the development of Basin management institutions: its semi-arid climate makes water issues significant enough to stimulate action, and the relative wealth and homogeneity of its population present few barriers to such action. The initial distribution of resources among basin stakeholders clearly has favored irrigators in the basin, who account for more than 90 per cent of water diversions. This has slowed the pace of reforms such as licensing restrictions and cost-recovery pricing, with the latter driven more by national economic policy reforms than by internal basin-scale reform efforts. Indeed, national reform efforts have provided leverage to policy actors within the basin trying to enact restrictions on water diversions and the reduction of agricultural water subsidies. Current reform efforts oriented toward implementation of the "Living Murray initiative", particularly the real reductions in water

licensing and diversions for environmental protection, have entailed several concessions toward irrigation interests, such as more flexibility in the form of expanded water trading, permanent water entitlement, financial support for water-use efficiency and the perpetuation of some subsidies for water deliveries. Thus, "irrigators'position" has affected the shape and speed of institutional reform in the MDB.

The decentralization process. The construction of basin management institutions and policies has been more a matter of integration than decentralization. Primary decision making authority predominantly and initially rested at the sub-basin level with the state governments. Over time, and with the cooperation and consent of the national government, the states have constructed intergovernmental arrangements to control and operate Murray River flows and then to address other issues. The process has been as much a matter of integration as decentralization. Central-level recognition of basin governance and management has been complete and consistent. The Commonwealth government not only recognizes, but participates in and helps fund, basin-scale organizations such as the Ministerial Council and the Commission. Through financial incentives offered to the states and to sub-state catchment management authorities, and through establishment of and participation in bodies such as the COAG, the national government has actively encouraged the development of IWRM in the basin. These commitments from the national government have remained consistent across elections and changes in party control.

Central local relationship and capacity. One hindrance to basin-level IWRM is the system of water rights. Entitlements to the use of water are not issued by a basin-scale entity, but by each state which rules governing water entitlements differs (i.e duration, security, and transferability). Each state has arguably over-allocated water licenses as it responded to economic development pressures, and this now represents on of the major basin WRM challenge. Groundwater still has uncertain status in the States water licensing arrangements and has not been fully integrated into the licensing system. Overall, reforms will be needed if measures such as water trading and the protection of environmental flows are to be fully implemented. A second hindrance is that the organizations in the basin most directly associated with integrated resource management (eg., the sub-basin catchment management authorities) have virtually no financial resources of their own and are dependent on funding from state and Commonwealth governments. Otherwise, central-local relationships and capacities are favorable to IWRM. Indeed, the basin management participants have the ability to create and modify institutional arrangements: the States and the Commonwealth governments have amended and replaced the agreements for the Murray River and the Murray-Darling Basin during their existence resulting in their current structure of Ministerial Council, Commission, and Community Advisory Committee. In addition, there is considerable experience at the local and state levels with self-governance and service provision. With the existence of local government councils, irrigation trusts and districts, and rural water authorities (in Victoria), one finds that participatory catchment management has been introduced into a situation already rich with social and organizational capital.

Basin-level institutional arrangements. Basin-level institutions are conducive to IWRM at the basin level. There are basin-level governance organizations and sub-basin organizations, each with firm recognition and considerable support from the state and commonwealth governments. The states themselves are recognized as communities of interest within the river basin, as are a number of stakeholder communities represented on the Community Advisory Committee. Basin users and policy makers have an array of means by which to negotiate and enter into agreement for committing and combining resources for projects and programs to improve basin conditions. Monitoring of basin conditions is performed regularly and then consolidated by the Commission staff. Two basin-level institutional arrangements have led to limited uncertainty. First, the clarity of institutional boundaries has been somewhat reduced by the introduction of the relatively new catchment management bodies. Local governments are not certain how the land and water management activities of these bodies will overlap with their own traditional land use regulatory authority. Second, though mechanisms for conflict resolution exist to address conflicts between water users and states, it is less clear how conflicts between sub-state and sub-basin entities such as a local government and a catchment management body, or between catchment management bodies etc. would be addressed.

Conclusion

MDB water resource management's successes in gaining intergovernmental cooperation and commitment, instituting mechanisms for stakeholder participation, and generating trusted data are considerable. In terms of devolution of authority, stakeholder participation, and financial self-sufficiency, the arrangements have been generally successful: (1) WRM is still driven by policy elites and audit groups in each state, but all actual management is carried out at regional levels in local offices with almost complete authority for policy implementation (including water sharing). Management and operation of dams and irrigation schemes has been transferred to entities designed for completely localized day-to-day management and financial sustainability. In all states but Victoria, this has included the privatization of irrigation schemes and their assets into the hands of the irrigators. Urban water and floodplain management have always been local responsibilities; this has continued and intensified in both technical and financial terms. (2) All levels of water management are now supported by stakeholder advisory groups. Public consultation is now the norm. (3) The national water reform agenda articulated in 1994 emphasized financial sustainability. Economic elements of water reform policy required removal of cross-subsidies, consumption-based water pricing, new investments only if they were economically viable and ecologically sustainable, better specification of water entitlements, and the encouragement of water trading. These reforms were accompanied by institutional reforms that separated regulatory roles from service provision, required greater local-level responsibilities for management, and encouraged public education and consultation. Generally, both urban and rural (irrigation) water supply infrastructure now gets no government funding for operations and maintenance and a very small and steadily decreasing amount of capital funding.

Today, the individuals and organizations in the MDB management structure are incorporating sub-basin catchment organizations into the framework for IWRM, while

leaving the basin-level organizations relatively unchanged. They are also attempting to achieve an ambitious portfolio of ecological restoration objectives in addition to their past focus on balancing water supply and demands for consumptive human uses. They undertake these efforts at a time when national-level bodies are becoming more actively involved in water policy, creating a national water policy framework into which the Murray-Darling will be expected to fit. These challenges will further test the robustness of the institutions for river basin governance and management in the basin which to this point have proved quite effective.

Guadalquivir Basin, Spain

How political transformation, the addition of EU policies and regulations, and the dispersion of responsibilities into overlapping agencies and levels of government have produced an uncertain transition and generated a mixed record of institutional performance in the seventy-five-year history of river basin governance.

The River Basin

The Guadalquivir river basin extends westerly across southern Spain, and nearly all (90.2%) of its 57,017 km2 area lies within the region (*Communidad Autonoma*-CA) of Andalucia. The entire 640-km main stem of the Guadalquivir River itself is located within the CA of Andalucia. The Guadalquivir basin has a relatively small share of the nation's water resources, despite having a substantial share of Spain's population.

Water users in the Guadalquivir basin have relied primarily upon surface water resources to supply their needs. There are 52 identified groundwater areas in the river basin, and groundwater overdrafting is an isolated problem in the basin. Precipitation is greatest in the mountains along the edges of the basin and lowest in the valley floor, where most of the population and irrigation are concentrated. Precipitation and stream flows are highly variable, exposing residents to risks of flooding as well as drought.

Water management issues include flood, drought, overall water deficit in the basin and substantial water quality problems. Flood control and drought protection are important to sustain the basin's substantial population and significant agricultural production. Irrigation is the dominant consumptive water use, with 80-85 per cent of water consumption. Irrigation areas, estimated at 665,000 ha in 1999 and concentrated along the Guadalquivir river stem, continue to grow. Crop types are gradually shifting to higher value produce such as fruits and vegetables, however 35,000 ha of rice paddies are still cultivated. Each category of water use is increasing. The region's population has been growing, especially in urban areas, and its economic base changing. The basin is home to 4 million people. Service industries, recreation and tourism are expanding. Even in an average year, overall water demands in the basin (3,578 Mm3/year) exceed supplies (3,357 Mm3/year). Water quality issues are substantial and stem from expanding agriculture, urban population and industries. Municipal and industrial pollution sources are covered by national and EU regulations requiring pre-discharge treatment, but compliance is lagging.

Institutional Framework

Created by the central government in 1927, the Guadalquivir River Basin Organization (CH) was, for much of its existence, a hydro-technical agency devoted to the construction of dams, reservoirs, and water conveyance facilities, while water law administration and management of water uses were handled by a separate agency. Since 1985, the CHs have had combined responsibilities for physical infrastructure and water use management in the basins, and thus are currently supposed to function as IWRM agencies at the river basin scale. CHs are not autonomous. They are under the direction of the central government or regional governments (CAs), depending on whether they cover an inter-regional river basin or an intra-regional one. The National Water Law adopted in 1985 recognizes 13 CHs.

The principal responsibilities of the CHs are established by the 1985 national water law and 1999 amendments to it, by the Guadalquivir Basin Plan and National Water Plan, and by EU regulations that are implemented at the river basin level: (1) construction, financing, and operation of dams and reservoirs for flow regulation and water storage. In the Guadalquivir basin, reservoir operations largely determine the surface water flows available to water users; (2) water planning including the development of basin plans; collection and analysis of data about physical conditions of the basin and water uses, designation of sub-basin management units, and conformity of basin plans to national and EU guidelines; (3) monitoring of water resource conditions such as river flows to anticipate and identify flooding or insufficiency, and water quality; (4) water licensing, including reviewing and approving applications for water concessions (licenses for use of water in the public domain). The CH is required by law to maintain a publicly accessible registry of authorized water users; (5) authority to approve transfers of water concessions between authorized and registered water users (since 1999); (6) enforcement of Spanish and EU water regulations.

Within their sphere of competence, the decisions of CHs are final. Challenges to a CH decision would have to be taken to court, based on a claim that the CH has exceeded its legal authority. CHs also have the authority to enforce their decisions through the imposition of sanctions such as fines. The CH president serves as head of the CH staff and chairs the advisory bodies. Thus, the president has a strong role in guiding the CH's activities. The president is appointed by the Council of Ministers and is effectively an official of the central government.

CH administration and operations are funded by a combination of revenues from the central government and revenues generated by the CH itself. By law, CHs must cover their own expenditures. CH Guadalquivir reported a 2001 annual budget of US$115,800,000, with 35% coming from the central government, 30% from basin water users, and 35% from other sources. An important income source is tariffs and taxes on water users and residents within the basin, which fall into the following categories: (1) tariffs on water users based on the volume of water used, approved each year by the president after a review and comment period, and intended to represent O&M expenses associated with hydraulic works in the basin, plus amortization of capital investments and indirect costs; (2) taxes on basin residents for benefits of CH services (e.g., flood

control, water storage); (3) fees on wastewater dischargers into the river; (4) severance taxes on sand and gravel, or other extractive, industries within the basin; and (5) tax on hydroelectric power generated in the basin. CH Guadalquivir reported the following tariff rates for 2001: irrigation users pay a tariff currently set at US$59.81 per hectare, industrial users pay a tariff of US$0.516 per cubic meter, domestic users pay a tariff of US$0.355 per cubic meter, and hydroelectric producers pay a tariff of US$0.76 per kwh.

CH Guadalquivir retains 100% of these locally-generated revenues for use in the basin; none are distributed back to the central government. CHs also receive an annual appropriation from the central government, which is included in the budget of the Ministry of the Environment. The rationale for central government funding is that the CHs incur costs implementing and enforcing national law and regulations, as well as costs that cannot be assigned to any particular group of users within the basin (e.g., planning, monitoring, and data collection). The national government also passes some EU "structural funds" through to the CHs. Structural funds are EU appropriations to assist in economic development of poorer member states.

Outcomes

Contextual factors and initial conditions. The economic development of the nation and of the region have had notable effects on the emergence and performance of the CH. The very establishment of the CHs, with an emphasis on the construction of water works to promote land development, emanated from national policies to bolster economic development by promoting first the expansion of agriculture and later the expansion of industry. The Guadalquivir basin was poorer and more rural than most of the rest of the country, and these conditions contributed to an emphasis on the expansion and protection of irrigated agriculture as the central element of the region's economic and social life. These contextual factors have shaped the perceptions of many Guadalquivir basin stakeholders and the CH staff about the principal purposes and appropriate focus of river basin management.

Decentralization process. The CHs were created by the central government for its own purposes—neither because of local-level demands for greater autonomy nor because of a central-government desire to shed water management responsibilities, but as an organizational device for executing central government policy one river basin at a time. The CHs nonetheless provide a means for stakeholder participation through representation on boards and commissions. The CHs are best thought of as central government agencies with representative components, with the balance between central control and user participation varying over time. The organization, responsibilities, and policy directions are established primarily from Madrid.

Central-local relationships and capacities. Basin level entities such as CH Guadalquivir develop basin level plans, but these plans must be submitted for national approval and be consistent with the national water plan. CHs collect and maintain revenue of their own for some of the services they provide but they also rely on central government funding for functions established and determined by central government officials. CHs have several advisory bodies composed of stakeholder representatives, but

several of those councils also have central government representatives and the CH president is still a central government designee. In addition, central government policy reforms since the 1970s have broadened the CHs' portfolio of IWRM responsibilities in ways that CH Guadalquivir staff have found difficult to sustain despite CH Guadalquivir having relatively good financial resources and autonomy. The central government's new water rights regime (begun in 1985 and modified somewhat in 1999) is certainly beneficial from an IWRM standpoint— bringing more users into the system (through the expanded definition of "public domain"), quantifying licenses, maintaining a registry of users, and creating opportunities for trading. The new regime's actual effects on IWRM will depend on its implementation and enforcement, which have been delegated to the CH. The central government has the authority to alter the governance structure or decision making processes of the CHs (and to appoint its leadership) with as much or as little stakeholder consultation as it chooses, but the basin stakeholders do not possess a comparable ability to tailor the institutions to their perceptions of needed or appropriate arrangements. This limits the flexibility and adaptiveness of the institutional arrangements to varying basin conditions and is translated, for example, by the failure to adjust the representation of basin stakeholders to reflect the rapid and substantial urbanization.

Basin-level institutional arrangements. Basin-level governance institutions correspond with the geographic boundaries of the river basin. From 1927 to the present the river basin authority was primarily a water works construction and operation agency. CH Guadalquivir did not function as a basin governance entity through much of its existence. Changes in the responsibilities and the structure of the CHs in 1985 and 1987 appear to have been intended to transform them into basin governance organizations. But while geographic boundaries fit well, institutional boundaries have become unclear. The allocation of authority to regional government in the 1970s leaves room for interpretation about who is responsible for what or who can do what, and the changes in the CHs' roles/responsibilities from the 1930s through the mid-1980s broadened (but did not necessarily sharpen) the understanding of what they may, must, or must not do. The potential for conflict between regional government policies and CH policies is heightened by social and political factors. For example, the CH's representation and governance structure gives disproportional weight to irrigation users. The basin-level institutional arrangements do recognize sub-watershed communities of interest within the basin. However, only irrigation user communities have formal recognition in both national law and the CH organizational structure. Basin-level institutional arrangements are structured to provide fora for information sharing and communication among basin stakeholders and between stakeholders and CH staff. The effectiveness of these structures varies. It appears that meetings of the Water Users' Assembly, for example, are few and rather far between. Operations boards and the CH governing board meet more regularly but their representation is not as broad. At the sub-basin level, users' assemblies in the irrigation user communities may draw greater rates of participation but this varies a great deal across the hundreds of communities in the basin. The irrigation communities have irrigation courts to resolve disagreements among water users, but no comparable forum exists on the river basin scale.

Conclusion.

The 1985 water law, 1999 amendments, and 2001 national water plan, combined with the EU Water Framework Directive, have moved Spanish water policy away from a sole emphasis on supply augmentation and toward the incorporation of additional goals of water quality improvement, water demand management, water use efficiency, and environmental protection. At a system-wide level, Spanish water policy in 2004 much more closely resembles an IWRM approach than it did 20 years ago. In the Guadalquivir basin, these changes have been accompanied by greater friction between urban and irrigation water constituencies (particularly during and after the 1992-95 drought), and the growing interest of the Andalusian regional government in providing an alternative forum for water policy making. Water policy reform has resulted mainly in the addition of new and different responsibilities to the CHs, and some involvement of regional and local governments in water policy and politics, but not a transformation of the organizational approach to river basin management. Even today, almost 20 years since the water works and management functions were re-combined in 1985, the water works function seems to be what CH Guadalquivir officials and staff are most interested in and comfortable with. The management functions—water licensing, demand management—have been performed with less vigor and with less positive results. The Guadalquivir basin "water deficit" has not been erased, and exposure to droughts remains a principal problem. The effectiveness of the structural approach to addressing supply-demand imbalances is now being called into question. Flooding remains an occasional problem, despite the number of facilities that have been built. Indeed, urban and agricultural development has encroached into floodplain areas, making the population and economic activities more vulnerable. Thus far, no systematic efforts to reduce non-point pollution such as that coming from runoff have been implemented in the basin. Many problems have emerged in implementing the 1985 law's integration of groundwater pumping into the water licensing system, and integration remains a work in progress. Agricultural water use remains comparatively inefficient: most irrigation users pay water tariffs based on their land surface rather than water use, so the tariff does not provide a financial incentive to conserve. Although stakeholder representation on the CH boards and councils was expanded in 1987 and 1989 central government decrees, the management structure and internal culture of CH Guadalquivir has been slow to change. Formal decision-making authority remains concentrated in the hands of the CH president and board. The current conflicts concerning water management appear to be taking place outside the CHs rather than finding expression within them. CH Guadalquivir may still be perceived as a relatively closed agency serving irrigators' interests, and is not yet the forum within which a broader range of basin stakeholders express their views and determine basin policy direction. CH Guadalquivir was established as an agency of the central government and remains so today. The transformation of the Spanish political system, the addition of EU policies and regulations, and the dispersion of responsibilities into overlapping agencies and levels of government have made for an uncertain transition in the Guadalquivir basin and generated a mixed record of institutional performance.