



Water Rights Arrangements in Australia and Overseas

Annex K *Mexico*

The views expressed in this annex are those of the staff involved and do not necessarily reflect those of the Productivity Commission.

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Abbreviations

CNA	<i>Comisión Nacional del Agua</i> , National Water Commission
LEEPA 1988	<i>Ley General del Equilibrio Ecológico y la Protección al Ambiente</i> , General Law of Ecological Balance and Environment Protection 1988
LAN 1992	<i>Ley de Aguas Nacionales</i> , National Waters Law 1992
PNH	<i>Programa Nacional Hidráulico</i> , National Water Program
PC	Productivity Commission (Australia)
PND	<i>Plan Nacional de Desarrollo: 2001–2006</i> , National Development Plan
PNMA	<i>Programa Nacional del Medio Ambiente y Recursos Naturales: 2001–2006</i> , National Environmental and Natural Resources Program
RELAN 1994	<i>Reglamento de la Ley de Aguas Nacionales</i> , National Waters Law Regulations 1994
SEMARNAT	<i>Secretaría del Medio Ambiente y Recursos Naturales</i> , Secretariat (Ministry) of Environment and Natural Resources
SLL	<i>Sociedad de Responsabilidad Limitada e Interés Público</i> , Society of Limited Liability
WUA	<i>Asociación Civil</i> , Water user association

Preface

Water Rights Arrangements in Australia and Overseas is a study that forms part of the Commission's program of benchmarking the performance of economic infrastructure industries. It continues previous work undertaken into the arrangements for setting drinking water quality standards. The study compares the legal, organisational and regulatory arrangements for managing water rights, against accepted best practice principles.

This annex is one of twelve case studies prepared to assist readers understand the complex legal, organisational and management arrangements of the jurisdictions studied. Case studies were prepared for the Murray–Darling Basin, NSW, Victoria, Queensland, South Australia, the ACT, the Colorado River Basin, California, Colorado, Chile, Mexico and South Africa.

Research for the study and each of the annexes was undertaken by the Economic Infrastructure Branch, with Dr Neil Byron as mentoring Commissioner.

The views in this annex do not necessarily represent those of the jurisdiction or any of its organisations. Further feedback from readers would also be welcome.

1 The water sector

Mexico is located in central America and shares its borders with Belize, Guatemala and the United States. It shares three major rivers with the US — the Colorado, Tijuana and Rio Grande.

Inter-jurisdictional arrangements governing the Colorado River are discussed in Productivity Commission (2003a). Information on the arrangements governing the Tijuana and Rio Grande rivers is not presented because the two US jurisdictions included in this study — California and Colorado — do not lie within the watersheds of these two rivers (see PC 2003b and 2003c).

Mexico has mountain ranges on both its eastern and western coasts in between which lies a desert plateau. This topography creates three main watersheds: the Western (or Pacific) Watershed, the Eastern (or Atlantic) Watershed and the Inland Watershed. The National Water Commission (CNA) operates regional offices in each of the thirteen administrative regions of Mexico. These regional offices are responsible for coordinating the activities of 26 river basin councils (see figure 1.1).

Mexico's climate reflects its topography. Most of Mexico experiences high temperatures and an average rainfall of 777mm per year (Aguilar undated). The majority of rainfall occurs between June and October in the far south of the country. The northern and central areas of the central plateau receive little rainfall, averaging less than 500 mm a year compared with over 1000 mm in the south (CNA 2001a).

Rainfall is also highly variable on an annual basis, particularly in the north of the country. Evaporation rates are high (around 1400 mm per year), and the El Niño and La Niña effects result in frequent droughts and flooding (CNA 2001a).

The mean annual run-off is approximately 410 cubic kilometres per year, and just over 62 cubic kilometres of renewable groundwater (Aguilar undated). Most of Mexico's run-off occurs in the western and eastern watersheds. There are around 100 rivers in the Western Watershed, the largest of which are the Balsas, Lerma-Santiago and Verde. Another 46 rivers flow in the Eastern Watershed. The Usumacinta, Grijalva, Papaloapán, Coatzacoalcos and Pánuco rivers alone account for 52 per cent of Mexico's average annual volume of surface water. The Inland

Watershed is a closed basin — its five rivers do not flow to the sea (Aguilar undated).

Figure 1.1 River basins, by administrative region, 2003



Source: CNA (2001a).

Total consumption of groundwater was over 24 cubic kilometres (24 000 GL). Surface water consumption was almost 50 cubic kilometres (Aguilar undated). In the arid and semi-arid regions in the north of the country, reliance upon groundwater is much higher (Aguilar undated).

The CNA reported that the main consumptive uses for surface water were: agriculture (78 per cent); household and other urban (12 per cent); industry (6 per cent); and fisheries and aquaculture (2 per cent) (CNA 2001a). Groundwater was used mostly for irrigation (contributing to the irrigation of 1.6 million hectares). Industry and households were also important users of groundwater (CNA 2001a).

Electricity generation was the most important non-consumptive use of water and accounted for 143 cubic kilometres of water. Other important non-consumptive uses include tourism, fishing, and navigation (CNA 2001a).

Approximately 640 large dams have been built to accommodate the variability of rainfall. Just 59 dams account for 95 per cent of the total storage capacity. Total storage capacity was used for: irrigation (42 per cent); power generation (39 per cent); and flood control activities (10 per cent) (Aguilar undated).

There are a number of major challenges for water resource management. In some areas, such as the Lerma–Chapala Basin (which accounts for approximately one-eighth of the total land in Mexico under irrigation), the major problems faced by water users include: increasing water scarcity because of over-extraction of water resources; pollution of water sources; inefficient water use; and environmental degradation (Mestre undated).

The over-exploitation of groundwater sources is a particularly important issue. In 1975, there were 32 aquifers that were suffering from over-exploitation. By 2000, 96 aquifers were over-exploited (CNA 2001a). The consequences of over-exploitation included declining groundwater levels and increased extraction costs, irreversible ecological impacts, disappearance of lakes and wetlands, and the reduction of surface water flows. In 17 aquifers (including South Baja California, Baja California, Sonant, Veracruz and Colima) salt-water intrusion is a problem (CNA 2001a).

Contamination of surface water is an important policy issue. The CNA reported that of all surface water bodies, 24 per cent of surface water was contaminated or toxic, and a further 49 per cent were on the borderline of being contaminated (CNA 2001a).

2 Legal framework

2.1 Evolution of water law

Mexican water law dates from the period of Spanish colonial rule (1521 to 1821), when water was vested with the Crown and a royal grant was needed for its use (CNA undated). When the United Mexican States were formed in 1817, the property of the Spanish Crown and state were ceded to Mexico.

The 1917 Constitution of Mexico formed the basis of water resource management. Under the Constitution, the state had the authority to regulate the exploitation and use of national (public) waters. Private waters — waters that flow through a single privately owned property or lie entirely beneath a property — could not be regulated (see box 2.1). In practice, groundwater extraction was unregulated.

Box 2.1 Key points of Article 27 of the Constitution of Mexico

- The Nation is the original owner of land and water within the Mexican territory.
- The Nation has had and has the right to transfer the domain of land and water in order to constitute private property.
- All surface and groundwater, except that which flows through a single property or lies only beneath it, belongs to the Nation.
- All groundwater whose use has not been prohibited, ruled or reserved by the Federal Executive, can be used without a concession.
- The domain of the Nation upon water is inalienable and imprescriptible.
- National waters can only be used with a concession granted by the Federal Executive.
- The Federal Executive has the power to prohibit the use of national waters.
- All water concessions granted from 1876 to 1917 which violated the rights of communities are null.
- All contracts signed from 1876 to 1917 which monopolised water are subject to revision.

Source: CNA (undated).

The first legislation governing water allocation was the *Federal Irrigation Law 1926*. The law established the Nation Irrigation Commission, which was responsible for constructing and operating irrigation infrastructure as part of a wider regional development program. In 1947, the commission was replaced by the Secretariat for Water Resources,¹ a ministry whose purpose was to construct and operate irrigation schemes, manage rivers and provide potable water and wastewater services to municipalities. Between 1947 and 1960, the secretariat created a number of river basin executive commissions — government-managed entities responsible for managing water resources in each of the major river basins.

The first comprehensive water legislation governing water access was the *Federal Water Law 1972*. It provided for the licensing of water — although this was limited to agricultural and domestic purposes. The legislation failed to provide any guide to reduce over-pumping of groundwater or to resolve conflicts between surface water users (Mestre undated). In 1976, the Secretariat for Water Resources was replaced by the Secretariat for Water Resources and Agriculture² which continued to manage water resources and agricultural development.

2.2 Current legislative framework

Mexico began to liberalise its centrally planned economy to a more market-oriented one following the economic crisis of the 1980s (Rosegrant and Gazmuri 1994; Gorriz, Subramanian and Simas 1995). The liberalisation process was accelerated following Mexico's entry into the General Agreement on Tariffs and Trade and the North American Free Trade Agreement. This involved removing state support for agriculture and amending the Constitution to strengthen land and water rights that had earlier been communalised (Rosegrant and Gazmuri 1994; Aguilar undated). The objective of the reforms was to give greater independence to farmers to manage their affairs.

In addition, the government also amended the Constitution to provide for greater environmental protection by:

- conferring on every person a right to an environment that is conducive for their development and well-being (Article 4);
- requiring that sustainability be a central principle of the National Development Plan (PND)³ (Article 26); and

¹ *Secretaría de Recursos Hidráulicos*.

² *Secretaría de Agricultura y Recursos Hidráulicos*

³ *Plan Nacional de Desarrollo*.

-
- requiring that the regulation, use, development, distribution and control of national waters, in terms of quantity and quality, be based on the principles of integrated and sustainable resource development (Article 27).

Finally, the government sought to increase transparency and improve public participation in the preparation of the PND and its subordinate plans. It did so by amending the Constitution to require that the PND be prepared democratically so that it recognises the aspirations and demands of society (Article 26).

The key legislative instruments responsible for implementing the Constitutional reforms relating to water include the:

- *Planning Law 1983*⁴ — the legislation that gives effect to the preparation of the PND and its subordinate plans and programs;
- *General Law of Ecological Balance and Environmental Protection 1988* (LEEPA 1988)⁵ — the main legislation governing the protection of the environment; and
- *National Waters Law 1992* (LAN 1992)⁶ — the main legislation governing the management of national waters, including the processes of resource planning and defining entitlements to water.

Planning Law 1983

The Planning Law 1983 provides the framework for the preparation of the PND. The PND describes the vision, principles, objectives and broad strategies to:

- be adopted by federal government secretariats and agencies; and
- guide the preparation of national development plans, including the National Water Program (PNH)⁷ and the National Environmental and Natural Resources Program (PNMA)⁸ (President of Mexico 2001).

A key principle of the PND is that of integrated and sustainable development.

⁴ *Ley de Planeación.*

⁵ *Ley General del Equilibrio Ecológico y la Protección al Ambiente.*

⁶ *Ley de Aguas Nacionales.*

⁷ *Programa Nacional Hidráulico.*

⁸ *Programa Nacional del Medio Ambiente y Recursos Naturales.*

General Law of Ecological Balance and Environmental Protection 1988

The LEEPA 1988 is the main legislation that implements the environmental and ecological objectives in the Constitution of Mexico. In relation to water, some of the provisions of the LEEPA 1988 include:

- defining the role of the federal, state and municipal governments in environmental protection;
- setting out the requirement and the principles for the preparation of environmental programs by federal, state and municipal government bodies;
- requiring environmental programs to be consistent with the PND;
- requiring EIAs to be prepared for certain activities and authorisations that might harm the environment; and
- creating natural reserves, parks and protected areas.

EIAs are required for any work or undertaking that might cause ‘ecological imbalances’ or exceed the limits and conditions set forth under relevant environmental laws or Official Mexican Standards. In the case of water, EIAs can be required for the:

- construction of channels to convey water; and
- agricultural use of water that endangers one or more species or cause damage to an ecosystem (LEEPA 1988, Art. 28).

The LEEPA 1988 sets out four criteria for the sustainable exploitation of water and aquatic ecosystems (see box 2.2).

These resource development criteria must be considered in the:

- development of the PNH;
- granting of concessions, permits and any kind of authorisations for the exploitation of natural resources or execution of activities affecting the water cycle;
- granting of authorisations for the deviation, extraction or diversion of national waters;
- regulating water use, and establishing restricted areas and reserves;
- suspensions or revocations of concessions, permits or authorisations where the works or activities are damaging national water resources or affecting the ecological balance; and

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- policies and programs for the protection of aquatic species, endemic species, threatened, endangered by extinction or subject to special protection (LEEPA 1988, Art. 89).

Box 2.2 Selected criteria from the *General Law of Ecological Balance and Environment Protection 1988*

The *General Law of Ecological Balance and Environment Protection 1988* lists a number of criteria that must be considered when undertaking or authorising water-related activities. Where water is to be extracted:

1. it is the responsibility of the State and society to protect aquatic ecosystems and the balance of natural elements participating in the water cycle;
2. the sustainable exploitation of natural resources involving aquatic ecosystems shall be carried out in a manner that does not affect their ecological balance.
3. to maintain the integrity and balance of natural elements involved in the water cycle, it shall be necessary to consider the protection of soil and wooded and forest areas and maintain basic levels of water currents, and the recharge capacity of aquifer layers; and
4. the preservation and sustainable exploitation of water and aquatic ecosystems falls within the responsibility of users, as well as individuals carrying out works or activities affecting such resources.

In the case of discharging waste water:

1. the prevention and control of water pollution is essential to maintain water availability and protect the ecosystems of the country;
2. it is the responsibility of the State and society to avoid pollution in rivers, basins, oceans and other deposits and water currents, including subsoil waters;
3. the exploitation of water in productive activities that may cause water pollution, entails the responsibility to treat the discharges in order to return water in appropriate conditions so the same can be used in other activities and the balance of ecosystems be maintained;
4. urban waste water shall undergo treatment before being discharged into rivers, basins, vessels, oceans and other deposits or water currents, including subsoil water; and
5. the participation and joint responsibility of society is essential to avoid water pollution.

Source: General Law of Ecological Balance and Environment Protection (1988, Arts. 88 and 117)

Similarly, the criteria to prevent and control pollution shall be considered in:

- regulating water use, and establishing restricted areas and reserves under the LAN 1992;

-
- granting of concessions, permits or other kinds of authorisations for the discharge of waste water into lands or water bodies other than the sewage systems of the cities or towns; and
 - organising, managing and regulating water works in basins, streams and beds of national waters, either surface or underground (LEEPA 1988, Art. 118).

National Environmental and Natural Resources Program: 2001–2006

The National Environmental and Natural Resources Program: 2001–2006 (PNMA)⁹ is the over-arching national program for implementing the LEEPA 1988.

The broad objective of the PNMA is:

... to satisfy the people's expectations of change, creating a new environmental state policy for Mexico (SEMARNAT 2001, p. ii).

The PNMA describes the state of Mexico's environmental health, identifies the causes and outlines how provisions in the LEEPA 1988 are to be implemented. Under the PNMA, sectoral programs (such as the water, forestry, environmental justice, and the protected areas) must comply with the PNMA's policy objectives of:

1. *Integrated resource management* — Natural resources should be managed at the basin-level and take into account the relationship between water, air, soil, forestry resources and biological diversity.
2. *Sustainable development* — Federal government agencies must promote sustainable development in their activities and programs and their performance may be measured regularly.
3. *Devolved and incentive-based environmental management* — Promote a new cooperative federalism and encourage the use of clear, efficient and up-to-date regulations and incentives for efficient environmental performance;
4. *Assessment of natural resources* — Encourage users to recognise the economic and social values of natural resources and environmental services.
5. *Observance of the law* — Enforce the law with diligence and without exception.
6. *Social involvement and accountability* — Provide information to the public on the state of the environment and on the government's performance in environmental management against established performance indicators (SEMARNAT 2001).

⁹ *Programa Nacional del Medio Ambiente y Recursos Naturales: 2001–2006*

The PNMA provides the performance indicators with which to measure the progress with which each of the sectoral programs, such as the PNH, are implemented by their agency. In the case of the CNA, these include (but are not limited to):

- the number of river basin advisory councils and technical committees established in a given year;
- proportion of water users that have been verified as complying with their concessions and discharge permits; and
- proportion of the rural population receiving clean drinking water, and the proportion with from reticulated wastewater services (SEMARNAT 2001).

National Waters Law 1992

The LAN 1992 establishes the legal and regulatory framework for water resource management. The objective of the LAN 1992 is:

... to regulate the exploitation, use or development of [national] waters, their distribution and control, as well as the protection of their quantity and quality with a view to their comprehensive and sustainable development (Art. 1)

The LAN 1992 provides for:

- the creation of the National Water Commission (CNA),¹⁰ river basin advisory councils, and water user associations (WUAs)¹¹ (Title 2);
- water resource planning to be undertaken at national and subnational levels (Title 3);
- the definition of the nation's water right and the administration of concessions to users (Title 4);
- the CNA to regulate water use, create restricted areas or to reserve water, if it is in the public interest (Title 5);
- the CNA to control wastewater discharges through the specification of water quality standards and the issue of discharge permits (Title 7);
- the investment construction, operation and maintenance of federally-financed water infrastructure (Title 8); and
- offences and penalties, and establishes grounds and procedures for appeal (Title 10).

¹⁰ *Comisión Nacional del Agua.*

¹¹ *Asociación Civil.*

The LAN 1992 is complemented by the National Waters Law Regulations 1994 (RELAN 1994)¹² and the Official Mexican Standards (NOMs).

Water resource planning

Under the LAN 1992, the federal government is responsible for coordinating the planning of water resources. In the first instance this involves:

- establishing and maintaining an inventory of water resources, the use of water and relevant water infrastructure; and
- classifying water bodies in terms of their use, quantity of water and quality, for each basin and region (LAN 1992, Art. 15).

Water resource planning also involves preparing:

- the National Water Program (PNH); and
- subordinate water resource plans to implement the PNH (LAN 1992, Art. 15).

Water resource plans can be prepared for a variety of areas or water bodies such as regions (comprising more than one river basin), river basins, catchments, rivers and aquifers.

The objectives of the PND and the PNMA contribute to the objectives of the PNH.

Entitlements to use water

The LAN 1992 creates two broad categories of private entitlements to water — rights for stock and domestic use and concessions.

Stock and domestic rights entitle landholders to take and use surface water for residential or stock-raising purposes without the approval of the CNA. Stock and domestic rights must not cause a change in the quality or a significant decrease in the quantity of water left in the surface water source (LAN 1992, Art. 17). Water users may freely extract national groundwater, except when the CNA regulates the extraction or establishes restricted areas, or reserves water for other uses (LAN 1992, Art. 18).

Otherwise, individuals wishing to take and use water must first acquire a concession from the CNA. Decentralised federal, state and municipal departments or agencies must obtain a grant from the CNA to use water (LAN 1992, Art. 20).¹³

¹² *Reglamento de la Ley de Aguas Nacionales.*

Concession holders are entitled to:

- exploit, use or develop the national waters in accordance with the LAN 1992;
- carry out works necessary for exercising concessions and obtain legal rights-of-way for the construction of such works;
- assign their rights to others, for example to members of a WUA;
- surrender or renew their concession;
- seek administrative corrections to or copies of their authorisations;
- carry out any other activities permitted by the Act (LAN 1992, Art. 28).

The LAN 1992 also obligates concession holders to:

- carry out the works necessary for the exercise of their concession, provided that their implementation does not adversely affect third parties or the water resource;
- make any payments required under current tax legislation and other applicable provisions;
- comply with general provisions and standards in regard to water safety, ecological balance and environmental protection;
- operate, maintain and protect the works needed for the stability and safety of dams, control of floods and other phenomena;
- allow CNA personnel to inspect water works and permit the reading and verification of the accuracy of metres as well as other activities necessary to provide compliance;
- provide any information or documentation requested by the CNA;
- satisfy the requirements for efficient use of water and ensure its reuse in accordance with official standards and specific conditions set; and
- comply with any other obligations established by the Act (LAN 1992, Art. 29).

Concessions can be granted to individuals or to WUAs. In the case of irrigation, there appears to be a strong preference for concessions to be granted to WUAs. WUAs would be responsible for passing on to their members concessions or some other form of right to their own members. The internal processes for administering these instruments are authorised by the CNA (Rosegrant and Gazmuri 1994).

¹³ Grants are governed by the same obligations and entitlements that apply to concessions and a grantee is considered a concession holder for the purposes of the LAN 1992. In the interests of keeping the discussion simple, grants are not discussed separately.

3 Organisations

3.1 Secretariat of Environment and Natural Resources

The Secretariat (Ministry) of Environment and Natural Resources (SEMARNAT)¹⁴ is responsible for administering the LEEPA 1988 and preparing the PNMA (SEMARNAT undated).

SEMARNAT's mission is:

To strive for including in all levels of society and public duty, criteria and instruments assuring the optimal protection, conservation and exploitation of our natural resources thereby creating a comprehensive and inclusive environmental policy within the sustainable development framework (SEMARNAT undated).

To meet this mission, SEMARNAT is responsible for:

- preparing, implementing and assessing the PNMA;
- issuing the Official Mexican Standards and verifying compliance to those standards;
- regulating the discharge of waste that can impact on the environment or human health;
- establishing, regulating and managing federal natural protected areas;
- regulating the use of natural resources, such as national waters, forests, biodiversity, flora and fauna, and minerals;
- assessing the environmental impact caused by works or activities and to authorise those works or activities; and
- oversee compliance with legislation on the environment and natural resources, and promote voluntary mechanisms for compliance (LEEPA 1988, Art. 5).

¹⁴ *Secretaría del Medio Ambiente y Recursos Naturales.*

3.2 National Water Commission

The CNA is an independent agency within SEMARNAT. It was created by Presidential Decree in 1989 and its director is appointed by the Federal Executive. It reports to the Technical Council.

Some of the CNA's major objectives include:

- encouraging the efficient use, pricing and conservation of water;
- achieving a sustainable use of water, both in terms of quantity and quality;
- decentralising water resource management programs and functions to regional, state and municipal government agencies and to water users;
- strengthening the participation of users and corporations in the administration of water; and
- encouraging greater participation among users and the private sector in the construction, operation and financing of water infrastructure projects (CNA 2001b).

To meet these objectives, the CNA's activities include:

- Institution building — establishing and monitoring river basin advisory councils,¹⁵ sub-basin commissions,¹⁶ river committees,¹⁷ groundwater technical committees¹⁸ and water user associations, and transferring the operation and maintenance of water infrastructure to water users;
- Planning — preparing, implementing and monitoring the PNH, assisting the preparation of water resource plans and water resource protection programs for basins, watersheds and aquifers;
- Administering water rights — approving the grants and transfers of concessions, monitoring and enforcing concessions to use water, including the regularisation of traditional (unlicensed) uses of water;
- Infrastructure services — operating headworks and distribution networks to supply bulk water to users, and operating infrastructure to preserve, conserve and maintain water quality in watersheds and aquifers;

¹⁵ *Consejo de Cuenca.*

¹⁶ *Comisión de Cuenca.*

¹⁷ *Comité de Cuenca.*

¹⁸ *Comité Técnico de Aguas Subterráneas.*

-
- Technical support — providing technical and other assistance to water users to promote efficient water use, to water user associations in the transfer of water infrastructure management roles; and
 - Monitoring — monitoring water resources and wastewater discharges, including the water cycle, quality of water, and monitoring and enforcing the construction and operation of dams (in terms of safety and flood control) and the construction and operation of potable and sanitation works undertaken by municipal, state and federal governments (Aguilar undated; Palacios 1999; CNA 2001a and 2001b).

Regional offices

In addition to the above functions, the CNA is establishing a regional office for each of the 13 regions in Mexico.¹⁹ It is expected that over time, the regional offices will be granted power, responsibilities, resources, technical capacity and authority (Mestre undated).

Technical Council

The Technical Council²⁰ is the steering committee that oversees the CNA's programs and performance. It is chaired by the Secretary for the Environment and Natural Resources and comprises the Secretaries of Finance and Public Credit; Agriculture; Fisheries; Health; Energy, Mines and Quasi-Public Industry; and the Federal Comptroller (LAN 1992, Art. 10).

The Technical Council has the power to:

- establish policies and measures that facilitate the coordination of programs and actions undertaken by federal agencies that have responsibilities in regard to water resources;
- decide what issues come before it for its consideration;
- review the programs and budget of the CNA, oversee its implementation and review the report submitted by the Director general;
- propose the terms under which any funds that are borrowed by the CNA are to be negotiated and concluded;
- approve the establishment of basin councils; and

¹⁹ *Gerencias Regionales*.

²⁰ *Consejo Técnico*.

-
- carry out any other function required by Mexican law or regulation or fulfilment of the Council's objective (LAN 1992, Art. 11).

3.3 Consultative bodies

There are a number of mechanisms established to facilitate community consultation in the development of water resource plans.

Consultative Council on Water

The Consultative Council on Water is an independent non-government body established to provide independent advice to the CNA. It is also responsible for consulting with water users and other non-government bodies. It has been responsible for providing advice on the preparation of the PNH (CNA 2001a).

River basin advisory councils

Under the LAN 1992, river basin advisory councils are constituted by the CNA and comprise representatives from the CNA, federal, state and municipal government agencies, users and interested groups. River basin advisory councils are responsible for advising the CNA on the development and management of water resources in a river basin, and for coordinating the implementation of water resource plans (Aguilar undated; Paredes undated; LAN 1992, Art. 13).

For example, the four main objectives of the Lerma–Chapala River Basin Advisory Council are to:

- distribute water among users according to a new water allocation policy;
- improve water quality by treating municipal and industrial raw effluents;
- increase water-use efficiency; and
- conserve the river basin system (Mestre undated).

Each council, as far as practicable, takes responsibility for a defined river basin. There are currently 24 river basin advisory councils (CNA 2001a).

Other consultative bodies

A number of other consultative bodies have been constituted to assist the preparation of local water resource plans. These bodies comprise government

representatives and water users, and are responsible for developing and implementing local programs to conserve the water resources and protect the environment. They are:

- catchment commissions — which are responsible for sub-river basins;
- river committees — which are responsible for micro-river basins; and
- groundwater technical committees — which are responsible for an aquifer.

As at September 2001, there were 6 catchment commissions, 4 river committees and 47 groundwater technical committees (CNA 2001a).

3.4 Water user associations

A WUA is a cooperative not-for-profit association of water users. The purpose of a WUA is to construct, operate and maintain infrastructure, as well as undertake a range of activities, for the mutual benefit of its members.

Under the LAN 1992, the CNA is required to devolve the control of irrigation infrastructure to local users. For this purpose, and to improve governance arrangements among water users, the CNA has constituted WUAs from existing irrigation districts,²¹ irrigation units and modules.²²

A WUA is managed by a board of directors elected by an assembly of its members. The board comprises, at a minimum, a president, secretary and a treasurer.

The responsibilities of WUAs include:

- holding concessions on behalf of their members.
- assigning concessions or entitlements to use water to its members.
- operating and managing water infrastructure and recovering the costs of operating and maintenance of infrastructure.
- establishing rules for the transfer of concessions between its members; and
- resolving disputes between members and users (LAN 1992, Art. 51).

WUAs carry out their activities in accordance with a Memorandum of Understanding entered into with the CNA.

²¹ *La grande irrigación.*

²² A *módulus* is a subdivision of an irrigation district. It is similar in function and size to an irrigation unit and, for the purpose of this discussion, not distinguished separately.

Irrigation districts

Traditionally, irrigation in Mexico was organised into government-owned irrigation districts and privately operated irrigation units. There are 82 irrigation districts covering a total land area of approximately 3.2 million hectares. As noted, the CNA has been devolving the operation of irrigation districts to newly formed WUAs since 1989.

Irrigation districts are associations of free-hold farmers, irrigation units and *ejidos*. They are governed and operate as per WUAs, except that concessions to use water are held by the land-holders themselves (LAN 1992, Arts. 66–67).

Irrigation units

Irrigation units were created during the Mexican Revolution in the early 1900s when land was redistributed to peasant farmers (Kloezen 1998). Irrigation units are comparatively small — between 50 and 200 hectares each but account for a total land area of approximately 2.5 million hectares (Palacios 1999).

Irrigation units are bodies corporate of free-hold farmers established to:

- build, own and operate irrigation infrastructure on behalf of its members;
- build irrigation works with assistance from federal, state or municipal funds; and
- apply for concessions to the CNA to operate, conserve, maintain and rehabilitate federal public infrastructure (LAN 1992, Art. 59).

Irrigation units are organised as WUAs, and have the same powers and obligations to operate water infrastructure as WUAs, subject to the terms and conditions of their concessions. Irrigation units may associate to form irrigation districts (LAN 1992, Art. 62–63).

Ejidos

Irrigation districts and units contain *ejidos*, communal land whose title was formerly held by the state. In the early 1990s, approximately 55 per cent of all district and unit land were *ejido*. As part of the process of devolution, the title to *ejido* land has been transferred to their farmers (*ejidatarios*) (Palacios 1999).

The title to a concession is normally held by the WUA (on behalf of an *ejido*) or an *ejido* (in cases that an *ejido* is not attached to an irrigation district or unit). If an *ejido*'s general assembly decides that its members can hold full title to their land,

the concession passes to its members in accordance with water they had used in the past (LAN 1992, Art. 56).

Societies of Limited Liability

Societies of Limited Liability (SLLs)²³ are federations of WUAs created for the management of major infrastructure (canals and drainage networks) and maintaining equipment and machinery used by more than one WUA. Federations are constituted as societies of limited responsibility (Palacios 1999).

SLLs do not have any decision-making powers. Rather they have been established to take advantage of economies of scale in the use of maintenance machinery and equipment. This reduces the cost of maintenance and operation for all farmers because only one set of machinery and equipment is required (Gorriz, Subramanian and Simas 1995).

²³ *Sociedad de Responsabilidad Limitada e Interes Publico.*

4 Definition of water rights

As noted, the main entitlements to water are:

- rights to take water from national surface waters for domestic use or watering stock;
- rights to take groundwater for any use, unless it is in a restricted or protected area;
- concessions granted to individuals or WUAs for the taking of surface or groundwater (in the case of restricted areas); and
- grants to government agencies for the taking and use of water.

WUAs must be registered with the CNA and any concessions granted by the CNA are attached to the WUA's title.

4.1 Coverage

A universal system of water rights exists when the entire resource is encompassed by the rights to its use. Water right arrangements should take in all identifiable water sources to ensure rights of access are protected and to allow for the sustainable management of the resource.

Currently, groundwater extraction is unregulated except where the CNA has declared, for reasons of public interest, an aquifer to be a restricted area (LAN 1992, Art. 18). In this case, users must apply to the CNA for a concession before being able to take and use groundwater.

In determining whether a groundwater source should be restricted, the CNA must have regard for the criteria described in box 2.2.

Land use change and forestry activities are not described in the LAN 1992. Forestry issues are addressed in the National Forestry Program, one of the sectoral programs prepared under the PNMA. In addition, in preparing strategies to protect water quality (water protection programs), the CNA is required to take into account land use patterns (LAN 1992, Art. 86).

4.2 Specification

The specification of an entitlement in terms of priority, volume (or share), purposes, and conditions are important for assisting the predictability of quantity available to the water user. Predictability of quantity (and quality) is achieved when users have a reasonable expectation of the quantity of water that they can extract from a source at any point in time.

Surface water concessions are specified as an average annual volume rather than a share of the stream flow (LAN 1992, Art. 21). Each season the CNA determines the volume of water to be allocated to each concession holder in accordance with the PNH and the relevant water resource plan. In many cases WUAs hold the concessions on behalf of their members, and members receive a share of the seasonal allocation (Rosegrant and Gazmuri 1994).

However, there have been concerns that the volumetric entitlements of WUAs' concessions are not adequately defined. The Memorandum of Understanding between the WUA and the CNA that establishes a WUA, states that the CNA will supply the WUA with a proportion of the expected run-off, stored water or canal flow — relative to the normal allocation each season (Aguilar undated). However, neither 'expected' or 'normal' are adequately defined. It is not clear whether the concession constitutes a water right or a water allocation (Palacios 1999).

Concessions to groundwater in restricted areas are also specified as a volume. When a concession to groundwater is granted, the annual volume is based on the average taken during the two years immediately preceding the aquifer being declared a restricted area (LAN 1992, Art. 42).

Generally, the LAN 1992 does not specify the priorities to access water except when addressing major water shortages or droughts. The CNA has the authority to determine by regulation the priorities of water use — although there has been some confusion as to the priority of access that is to be accorded to human, domestic, and urban uses relative to irrigation in some WUAs (Palacios 1999; Aguilar undated).

4.3 Record of title

The CNA must maintain a Public Registry of Water Rights²⁴ to record the title to concessions. Given that concession holders may assign their concessions to others, such as to members of a WUA, the registry also records any extensions, suspensions, terminations and acts and contracts relating to the total or partial

²⁴ *Registro Publico de Derechos de Agua.*

assignment of the concession (LAN 1992, Art. 30). Anyone may consult the registry and pay for certified copies of the entries and documents giving rise the entries (LAN 1992, Art. 31).

The records of the registry are sufficient to prove the existence and status of a concession. Once a concession is registered, it is legally binding on the CNA and other parties (LAN 1992, Art. 31).

However, the registry may be amended or rectified if requested by an interested party provided the omission or error is verified, the rights of third parties are not prejudiced and there is a documented consensus between the concession holder and other parties. Claims of falsehood or injury to third parties from any amendment or correction must be resolved by the CNA in accordance with the regulations (LAN 1992, Art. 31).

Any extension, suspension, termination, amendment or correction made to a concession by the CNA must be automatically entered into the registry (LAN 1992, Art. 30).

The CNA is also responsible for preparing a list of water users (and their use) in each irrigation district. Irrigation districts are required to maintain their list in accordance with their by-laws. The list of an irrigation district may be included in the Public Registry of Water Rights (LAN 1992, Art. 67).

Finally, a record of groundwater extraction works and groundwater use must also be included in the registry. This is to assist the CNA to determine the current state of aquifers and, if appropriate, regulate the future use of the aquifer. The CNA can request information on groundwater works and use from property owners and property owners must supply this information regardless of whether their property is within a restricted groundwater area (LAN 1992, Art. 32).

4.4 Duration

The duration of a right — the length of time a right holder possesses the title to a right — affects the certainty that right holders have over their ability to take water in the future.

Statutory rights for stock and domestic purposes are ongoing until the use changes or the use is subject to regulation by the CNA. Groundwater rights are also ongoing, subject to the CNA declaring the aquifer a restricted area.

Concessions and grants are issued for periods of between 5 and 50 years. The duration of a concession may be extended if such a request is made to the CNA five years before the concession's expiry date and the concession holder has not exercised the causes for which a concession may be terminated (LAN 1992, Art. 24).

Concessions are subject to a 'use-it or lose-it' requirement. A concession or part of a concession is forfeited if its holder has not performed the authorised works necessary to use the water and to control for its quality, or if the concession (or part of the concession) has not been used consecutively for three years (LAN 1992, Art. 27).

Concessions may also be cancelled if it is in the public interest. However, compensation must be made to the concession holder in accordance with the General Act Governing National Assets (LAN 1992, Art. 27).

As part of its enforcement activities, the CNA can suspend a concession, until such time as the situation is remedied, if the concession holder does not:

- make the payments required by law for the exploitation, use or development of water or for the services involved in its supply;
- allow for the inspection, measurement or verification of water and water infrastructure that has been ceded or granted; or
- comply with the terms of the concession (LAN 1992, Art. 26).

Similarly, the CNA may terminate or not renew a concession if the concession holder has:

- used water in greater volumes than authorised and a suspension of the concession has not remedied the situation;
- failed to make the payments required by law for the exploitation, use or development of water or for the services involved in its supply and suspension of the concession has not remedied the situation;
- assigned rights in violation of the concession; or
- repeatedly breached a provision of the Act for which a sanction has previously been applied (LAN 1992, Art. 27).

Finally, the CNA can suspend, terminate or not renew a concession if its holder:

- extracts or uses water in a way that adversely affects third parties or the water resource;

-
- does not operate, maintain and protect water works needed for the stability and safety of dams and control of floods; or
 - does not comply with general provisions for maintaining water safety, maintaining ecological balance and protecting the environment (LAN 1992, Art. 29).

The CNA must have regard to the criteria listed in box 2.2 when implementing any of these provisions.

4.5 Exclusivity

Water rights are exclusive if, at the margin, the benefits and costs of using water accrue to the right holder. Some third-party effects include:

- storage effects — that result from the storage and regulation of the flow of water;
- extraction effects — that result from the extraction of water from an ecosystem; and
- return flows — that result from the discharge of wastewater (whether from point or non-point source).

Third-party effects can be beneficial or harmful to human health, the environment and other aspects of water use.

Storage effects

Dams increase the benefits that accrue from holding a water right. They are used to change the natural flow patterns of rivers to more closely match demand patterns for water and thus increase the productive value of water. However, the alteration of natural river flow patterns by storing and releasing water can degrade the ecological health of river systems. Most of these costs are borne by the community as whole rather than the water right holder alone.

Under the LAN 1992, a concession also provides the authorisation to construct the necessary works to extract and use the water, and if necessary, disturb the water body and its flow regime (LAN 1992, Arts. 21, 23 and 97).

The CNA can require the water user to gain its authorisation to construct and operate a water work that affects the hydrological characteristics of the water source, if the authorisation is in the public interest. Public interest is defined to include the protection or restoration of an ecosystem, preservation of sources of

potable water, and the preservation of water quality (LAN 1992, Art. 38). The CNA can require the applicant to comply with the CNA's standards for maintaining safety, ecological equilibrium and environmental protection (LAN 1992, Art. 29 and 98).

Extraction effects

The removal of water from a watercourse can have detrimental consequences on the aquatic ecosystem and on other native fauna and flora.

The LAN 1992 provides for the allocation of water to the environment. This is achieved by requiring water resource plans to be prepared for each water source that describe how water is to be managed in that source. As part of this planning process, the CNA:

- must base the allocations on the natural water replenishment of the resource;
- can reserve water for any purpose, including the environment;
- regulate water use if it is in the public interest, such as to address the over-exploitation of an aquifer, to protect an ecosystem or water quality (LAN 1992, Arts. 15, 38 and 41).

A minimum stream flow is determined for each river but explicit reservations have not been provided (Rosegrant and Gazmuri 1994).

Return flows

Return flows are the point- and non-point return of water to a water source, whether contaminated or unused by the user. The LAN 1992 provides several methods for addressing return flows. First, non-agricultural users must obtain discharge permits prior to applying for a concession to use water.²⁵ A condition of exercising a concession is for the holder to comply with the requirements of the discharge permit (LAN 1992, Arts. 21 and 88; Rosegrant and Gazmuri 1994).

The discharge permit will, as a minimum, specify 'the location of discharge, the volume and type [of discharge], the procedures that are to be followed to prevent or control pollution, and the duration of the permit' (LAN 1992, Art. 90).

²⁵ Discharge permits can be obtained from the CNA (Gorriz, Subramanian and Simas 1995). They are not required for settlements of 2500 inhabitants or less or companies that do not use heavy metals, and certain pesticides and herbicides, and their discharge is no more than 300 cubic metres (0.3 ML) in any one day (RELAN 1994, Art. 137).

In contrast, agricultural users (irrigation districts and units) are required to maintain their return flows within the Mexican National Standards. The CNA must develop rules to make land use compatible with water use (LAN 1992, Art. 96).

Second, unused water from irrigation can also be used by downstream users. Concessions cannot be constituted on the basis of return flows. WUAs and irrigation districts are free to capture and re-use their return flows (Rosegrant and Gazmuri 1994).

Finally, the CNA with the authority to restrict water use in the event of damage to ecosystems, over-exploitation of aquifers, and other environmental impacts (LAN 1992, Art. 38). The CNA will have the authority to regulated extraction and discharge volumes

4.6 Detached from land title and use restrictions

A water user's ability to transfer or dispose of a water right, along with all the privileges and obligations that the right imposes, contributes to the efficient allocation of water. Consequently, water rights should be separate or free of any requirements to hold land or any restrictions on how the right can be exercised.

Concessions are detached from land title and in discharge requirements. As concessions are defined in terms the use to which water will be put, a transfer of a water right requires the authorisation of the CNA. However, the CNA will approve the proposed transfer if the new use will not change the total water use (LAN 1992, Art. 25).

4.7 Divisibility and transferability

An efficient allocation of water rights can be achieved through market trading. Water rights need to be divisible and transferable. Water rights are divisible if right holders can sub-divide their entitlement into parts and sell either all or part of their right.

Concessions are fully divisible and transferable. Requests for transfers must be made to the CNA within 15 business days of the transfer contract date and transfer agreements are published in the Official Diary of the Federation²⁶ (LAN 1992, Arts. 33 and 34). Transfers made in violation of these requirements are null and void (LAN 1992, Art. 37). Transfers between and within WUAs are also subject to

²⁶ *Diario Oficial de la Federación.*

the rules and regulations of WUAs. In some cases, restrictions may be imposed on the transfer of these concessions.

5 Government involvement in water allocation

5.1 Allocation mechanisms

As noted, the CNA has the power to reserve water for specific purposes, such as the environment. The CNA also has the power to expropriate, fully or partially occupy an asset or to limit the ownership of a water right if it is in the public interest (LAN 1992, Arts. 6 and 7; see box 5.1).

Box 5.1 Areas of public interest under the *National Waters Law 1992*

The following is declared to be in the public interest:

- I. the acquisition or utilisation of fixed assets required for the construction, operation, maintenance, conservation, rehabilitation, improvement or development of public works and related services, and the acquisition and use of facilities, fixed assets and communication channels required therefore;
- II. the protection, improvement and conservation of basins, aquifers, river beds, enclosed bodies of water and nationally-owned deposits, as well as the infiltration of water to resupply water-bearing strata and the diversion of waters from one basin or water region towards others;
- III. the use of national waters to generate electricity to be used in the provision of public services;
- IV. restore the hydrological balance of national surface and underground waters, including extraction limits, restrictions, reserves and change the use of water so that it is suitable for residential use;
- V. the opening of wastewater treatment plants and implementation to reuse such water, as well as the construction of works for the prevention and control of water pollution;
- VI. the establishment in accordance herewith of irrigation districts or drainage units, and the acquisition of the land and other fixed assets necessary for establishing the irrigation or drainage zone;
- VII. the prevention of and response to the effects of extraordinary weather phenomenon that endanger people or installations; and
- VIII. the installation of the necessary devices for measuring the quantity and quality of national water.

Source: National Waters Law 1992.

However, once constituted, concessions are the property of individuals and any expropriation must be compensated (Constitution of Mexico 1917, Art. 27). That said, the CNA can regulate the extraction and use of water to ensure compliance with the ‘general provisions and standards as regards water safety, ecological equilibrium and environmental protection’ (LAN 1992, Art. 29).

The LAN 1992 provides for water rights to be traded. Generally, there are few legislative restrictions on the trading of water rights apart from the requirement to protect other users, the water source and the environment (LAN 1992, Art. 33).

5.2 Resource programming

As indicated, the CNA is required to prepare the PNH. The PNH is prepared in accordance with the provisions of the Planning Law 1983 and in conjunction with the river basin advisory councils (or if they are not constituted, public participation where possible). The PNH is a strategic plan that identifies problems, objectives, management principles and strategies to manage the water resources in each of the CNA’s 13 administrative regions (CNA 2001a).

The CNA can constitute a consultative body to prepare a water resource plan for each river basin, catchment and aquifer in a region (CNA 2001a). The consultative body has the authority to implement ‘programs and actions to improve water administration, a development of water infrastructure and the respective services, and the preservation of basin resources’ (LAN 1992, Art. 13).

Objectives

The PND sets a long-term vision to 2025 for the democratic and sustainable development of Mexico (CNA 2001a). Though the current PNH is for the period 2001–2006, its vision to 2025 is for a nation that ‘efficiently uses water, recognises the strategic and economic value of water, and protects water bodies and the environment for future generations’ (CNA 2001a, p. 46).

The objectives of the PNH are to:

1. encourage the efficient use of water in agricultural production;
2. encourage expansion in the coverage and quality of the drinking water, sewage and drainage systems services;
3. achieve integrated and sustainable management of water in basins and aquifers;
4. promote technical, administrative and financial development of the water sector;

-
5. consolidate the participation of users and the organised society in the water administration and promote the culture for its correct use; and
 6. decrease risks and pay attention to the floods and drought effects (CNA 2001a).

The development of the PNH was guided by the four criteria for the sustainable exploitation of water and aquatic ecosystems set out in the LEEPA 1988 (see box 2.2).

As noted, the PNH also summarises the key objectives and strategies to be implemented by water resource plans. The objectives of the water resource plans reflect the objectives of the PNH as well as the individual concerns of the region (CNA 2001a). For example, the main objective of the Querétaro Valley Groundwater Technical Committee was to stabilise groundwater levels in the aquifer by:

- developing an appropriate groundwater use culture;
- managing the demand for groundwater water;
- reducing existing extraction levels;
- finding alternative and efficient sources of water; and
- encouraging recharging of the aquifer (CNA 2002a).

Resource assessment

The PNH provided a preliminary assessment of the water resources, both nationally and for each of the thirteen administrative regions (CNA 2001a). In Region I (Baja California), the assessment identified a number of problems including the:

- over-exploitation of groundwater sources;
- declining surface water quality — for example due to rising salinity and deficient wastewater treatment in urban areas; and
- poor water-use efficiency in urban areas and in irrigation (CNA 2001a).

More detailed resources assessments are to be undertaken for each of the water resource plans. For example, assessments were undertaken of the quantity and quality of the water available, the level of water use type of water use, and the sustainability of water use in the aquifers in the Ojocaliente–Aguascalientes–Encarnación area and the Querétaro valley (CNA 2002a and 2002b).

Impact assessment

The CNA is required to ensure that the exploitation of water resources and aquatic ecosystems are sustainable when preparing the PNH (LEEPA 1988, Arts. 88 and 89). For each of the thirteen administrative regions, the CNA undertook preliminary assessments of the:

- causes of the region's water resource problems;
- scenarios to the year 2025 of the region's water requirements; and
- alternative solutions (CNA 2001a).

Each cause and solution was assessed in terms of its technical, economic, social and environmental impacts (CNA 2001a).

Similarly, in preparing a water resource plan, the CNA is required to assess the sustainability of the plan's options, if the plan establishes a restricted area or reserves water for particular uses (LEEPA 1998, Arts. 88 and 89).

Consultation

Consultation is provided through several mechanisms. First, as part of the preparation of the PNH, the CNA received public submissions on the draft PNH. Second, a number of consultative bodies were engaged to advise the CNA (such as river basin advisory bodies, catchment commissions, river committees, groundwater technical committees, as well as expert consultants and public forums) (CNA 2001a).

Third, the consultative bodies also consulted with key representatives of water users and other agencies when preparing water resource plans. For example, groundwater technical committees undertook a public consultative forum when determining appropriate responses to manage over-extraction of groundwater from key aquifers in the Querétaro Valley and Ojocaliente, Aguascalientes, Encarnación areas (CNA 2002a and 2002b).

Review and flexibility

As noted, the PND provides a vision for Mexico to 2025. The goals of the PNH and each water resource plan reflect the vision of the PND. Though the current PNH is only for the period 2001–2006, its progress will be reviewed against the vision of the PND.

6 Administering water rights

The LAN 1992 outlines the administrative procedures for granting, renewing, terminating and transferring concessions. The administration of water rights within WUAs and irrigation districts takes place within those areas and are subject to the rules the association or district (LAN 1992, Art. 34).

6.1 Application

To obtain a concession from the CNA, the applicant must provide:

- their name and address;
- the basin, region and locality to which the application refers;
- the site from which water will be extracted;
- the volume required;
- the initial use to which the water will be put;
- the point of discharge, and quality and quantity conditions on that discharge;
- the works that will be carried out and the features of existing works; and
- the period for which the concession is sought (LAN 1992, Art. 21).

The CNA will also ask the applicant to provide evidence that they possess an appropriate discharge permit (except in the case of irrigation), permit of the water works necessary to use the water and any permit required to the extraction of water in channels operated by the CNA (RELAN 1994, Art. 30).

Under the LEEPA 1988, the CNA has the authority to request the applicant to prepare an EIA where the agricultural use of water might endanger one or more species or cause damage to an ecosystem (LEEPA 1988, Art. 28).

The CNA is required to respond to applicants within 90 business days from the date of the application (LAN 1992, Art. 22).

6.2 Consultation

The CNA must make public information on the availability of water for allocation to users (LAN 1992, Art. 22). If the CNA anticipates various competing interests for the water, it may request bids or tenders from the public (LAN 1992, Art. 22).

If the CNA is request bids or tenders, it must advertise the availability of the water in the Official Diary of the Federation, in major national newspapers and local newspapers where relevant. The notice will indicate the volume of water, the selection criteria, the time to implement the use of water, and any requirements to satisfy the needs of interested parties (RELAN 1994, Art. 40).

The LAN 1992 does not provide for any other formal consultation between applicants and third parties during the granting or transfer of a concession.

6.3 Assessment

The granting and transfers of a concession is subject to the provisions of the LAN 1992, the RELAN 1994, the LEEPA 1988, and the requirements of the appropriate water resource plan (LAN 1992, Art. 22; RELAN 1994, Art. 38). For example, the CNA must consider the four criteria for the sustainable exploitation of water and aquatic ecosystems established under the LEEPA 1988 (see box 2.2).

Granting concessions

If the CNA requested bids or tenders for a concession, the concession will be awarded to the applicant who best met the requirements of the tender brief. The tender brief will reflect the PNH's requirement that the proposed water use is the most rational and which provides for the greatest economic and social benefit (RELAN 1994, Art. 38).

The CNA will not grant a concession if the return flows from the grant will injure a third party, or fail to meet the water quality or ecological standards of the Official Mexican Standards (RELAN 1994, Art. 42).

The applicant will have three years to construct the necessary infrastructure to extract the water and use it. If after that time, any part of the concession has not been used, it will have been forfeited — except in cases the applicant had reserved the use of that water (RELAN 1994, Art. 47).

The CNA may impose conditions relating to levels of extraction or discharge, the means of extraction, limits on the rights of concession holders, and other special provisions if it is in the public interest. These conditions are intended to protect third-party water users, potable water supplies, ecosystems and water quality (LAN 1992, Art. 39).

Transferring concessions

If an application to transfer a concession for surface water involves changing only the name of the title holder (for example, the water use is unchanged and takes place within the same WUA), the CNA will effect the transfer by entering the change of details in the Public Registry of Water Rights. Similarly, if there is a proposed transfer of groundwater concession in a restricted or regulated groundwater area is limited to the transfer of ownership, then this requires the joint agreement of the parties (RELAN 1994, Art. 64).

Some transfers can affect third parties, the hydrological or ecological conditions of the pertinent basin or aquifer. In these instances, the CNA assesses applications to transfer, and consider:

- the PNH and any local water resource plans;
- the establishment of any reserves; and
- whether third parties, water sources or the environment are likely to be injured.

The CNA may either grant, deny or set out the terms and conditions under which it will grant the transfer. Once approved, the transfer takes effect from when the transfer details have been entered into the Public Registry of Water Rights (LAN 1992, Arts. 33 and 34).

6.4 Decision notification, appeals and registration

The CNA must make public all concessions granted. In the case of concessions forfeited because of non-use, the CNA must also inform the applicant of its decision. The applicant may appeal the decision under the Federal Code of Civil Procedures (RELAN 1994, Art. 49).

7 Distribution management

Water distribution involves the collection, storage, release and transportation of water to users.

7.1 Water accounting

At the beginning of each cropping season, the CNA estimates the quantity of water that is available for each irrigation district, including carry over storage and estimates of available surface water. This information is disseminated to the WUAs in each irrigation district (Gorriz, Subramaniam and Simas 1995).

At the same time, farmers in each module submit their cropping plan to the staff of the WUA. The staff tabulate these requests by farm inlet and ditch, and present the information to the WUA. The WUA then sort the requests by major inlet and canal, and calculate the total requirement for each module. These requirements include allowances for conveyancy losses (Gorriz, Subramaniam and Simas 1995).

The WUAs submit their plans to the CNA for approval. The CNA estimates the releases that must be made from storages to meet the delivery schedule specified in the approved plan. These estimates take into account any conveyancy losses that may be incurred in transporting water through the main canal (Gorriz, Subramaniam and Simas 1995).

Changes to the delivery schedule can be made but the approval of the CNA is required (Gorriz, Subramaniam and Simas 1995).

7.2 Distributing water

The WUA delivers water to the user at the farm intake. Beyond the farm intake, water management and use is the responsibility of the farmer. To have water delivered, the user must comply with the bylaws of the WUA, which specifies that users must:

- present a planting permit and an irrigation permit for the crop or crops to be planted;

-
- be current in their payment of water fees;
 - keep on-farm irrigation systems in good condition;
 - prepare land to be irrigated for irrigation; and
 - be ready to receive water at the designated day and time (Gorriz, Subramaniam and Simas 1995).

Once the user has complied with these requirements and obligations, the canal operator delivers the water requested by the user. Water is measured by the canal operator using measurement structures at parcel intakes (where they exist) or by supplying water by surface area and crop. The canal operator maintains records of water deliveries and issues daily reports to the manager of the WUA (Gorriz, Subramaniam and Simas 1995).

8 Pricing

A key feature of recent reforms to the management of water infrastructure has been to increase the private sector's contribution towards the financing and operation of water infrastructure. In addition, the reforms have focussed on introducing levies for the levels of water use and wastewater discharge (Aguilar undated).

The LAN 1992 requires that users pay for the use of water, including the use of groundwater sources in non-restricted areas. The amounts that must be paid are established under the Federal Payments Act (LAN 1992, Art. 112). Under the LAN 1992, users must also pay for the operation, maintenance and administration of irrigation system.

8.1 Pricing the scarcity value of water

Under marginal cost pricing, the opportunity cost of water (the value of water in its next best use) is equal to the opportunity cost of service delivery (the cost of infrastructure necessary to impound, divert and deliver water). In Mexico, water users have resisted the government pricing for the opportunity cost or long-term marginal cost of water (Aguilar undated). Trades in water rights are the main mechanism by which the value of the scarcity value of water is realised — the difference between opportunity cost of water and the opportunity cost of infrastructure is the scarcity value of water.

8.2 Pricing infrastructure services

The price of infrastructure services includes the costs associated with constructing and operating the storage and delivery infrastructure.

Historically, the farmers' contribution to the operating and maintenance costs of infrastructure declined from 85 per cent in the 1950s to less than 20 per cent in the early 1980s. The differences was made up from deferral of maintenance activities and government subsidies (Aguilar undated).

The government's current policy is to ensure that water users are self-sufficient in the provision of water delivery services — at least to fully recover operating and maintenance costs (Aguilar undated). Throughout 1990s, the contribution of water users to the operating and maintenance costs rose substantially. In 1996, water users contributed 72 per cent, government (15 per cent), and deficit (13 per cent) (Aguilar undated).

Cost recovery — bulk water

Bulk water fees are determined in a collaborative process between the CNA and the WUAs. The CNA's costs are equal to the operation, maintenance and administration costs of its storages, headworks, main channels, irrigation and drainage channels, and supervision.

This cost is then divided by the total volume of water available for distribution plus any conveyancy losses in the irrigation districts. The cost is then shared proportionally among the modules in the irrigation district as a function of surface area (Gorriz, Subramaniam and Simas 1995).

If an SLL exists in the irrigation district, the SLL calculates the costs of operating, maintaining and administering the main canal and main drainage and the cost of bulk water delivery from the CNA. Then this costs is distributed proportionately among the WUAs (Gorriz, Subramaniam and Simas 1995).

Cost recovery — retail

The WUAs in the irrigation district determine their costs for the coming year. A WUA's costs are equal to the operation, maintenance and administration costs of the local distribution and drainage network, roads and other infrastructure. The WUA's costs also take into account any improvements that the WUA may want to carry out that year and the cost of bulk water delivery from the CNA (Gorriz, Subramaniam and Simas 1995).

Price structure

Each WUA is required to charge its members according to the water supplied. The CNA's 'Instructions for Operation, Maintenance and Administration' that accompany the WUA's Title of Concession, recommends that the final costs be charged on a volumetric basis — by dividing the total costs by the volume of water supplied. In practice however, charges are often collected on a per hectare of land,

by type of crop and by cultivated area. Only in a few cases are fees charged on a per volume basis (Aguilar undated).

8.3 Other issues

Water resource management costs are those associated with maintaining the integrity of the water rights system, and include the costs of administering the water rights (monitoring water resources, enforcing breaches, approving water right grants and approvals). Currently, fees are collected by the CNA to recover some of the costs of processing applications. However, abstraction levies are not collected by the CNA to recover the costs of administering the water rights basin, apart by industrial water users and urban water utilities suppliers (Aguilar undated).

9 Monitoring and enforcement

The CNA is responsible for the detection of breaches of the law and the application of sanctions and penalties.

9.1 Monitoring procedures

The CNA has issued regulations under the LAN 1992 that provide a mechanism to monitor user compliance with the conditions of their concessions and the payment of the correct charges. The regulations provide mandatory sampling and monitoring procedures and are used for bringing administrative enforcement actions (CEC 2002). Records are kept for statistical and legal purposes (Garduño 2001).

Monitoring is also done by the users themselves under Art. 137 of the LAN 1992 regulations. Permit holders are required to install and maintain monitoring equipment, inform the CNA of any changes and cooperate with CNA inspections, conduct sampling as per the regulations and keep records for a minimum of three years (CEC 2002).

The CNA can check the results of self-monitoring against samples or averages. Some irrigations districts have different levels of autonomy and will attract different levels of scrutiny (Kloezen 1998).

The Sub-directorate General for Water Administration within the CNA visits state and regional areas to assess the consistency of the information system, check the correct application of guidelines and procedures and identify difficulties. After each visit both parties commit to deadlines to solve the detected problems (Garduño 2001).

Recording keeping and information are central to the CNA monitoring mechanisms. The CNA has initiated the use of four databases:

- User's Population — a learning model that estimates number of users and water use volumes through available hard data and indirect information and indices.
- Applications Follow Up — keeps track of all the steps of each concession application. All applications for concessions, including the relevant documents,

must be filed and safeguarded for future reference, regardless of the outcome of the application.

- Public Registry of Water Rights — keeps files of concessions, permits, and water rights, trades. This allows the CNA to monitor the concurrence between withdrawn volumes and concessional volumes. The Public Registry is available to the public on request.
- Water Tax Payers — keeps track of all water related charges (Garduño 2001).

9.2 Enforcement procedures

Offences

The LAN 1992 sets out a number of offences in regard to water rights. These include:

- using water in a larger volume than a user is entitled to;
- altering authorised infrastructure for the use of water or operating it without the permission of the CNA;
- failing to install devices to record or measure water quantity or altering such equipment without the permission of the CNA;
- using water without a concession;
- extracting and using groundwater in a restricted area without the permission of the CNA;
- obstructing visits, inspections or examinations by the CNA;
- failing to provide information requested by the CNA;
- failing to comply with the requirement of a concession;
- failing to register a concession in the Public Registry of Water Rights;
- squandering water; and
- any other violation of the LAN 1992 (LAN 1992, Art. 119).²⁷

²⁷ The LAN 1992 also specifies a number of violations relating to water quality and the dumping of contaminants. These have not been listed here because it is beyond the scope of the study.

Sanctions

The CNA has authority under the LAN 1992 (Art. 120) to sanction individuals who engage in offences against the Act. These sanctions take the form of fines equal to the general minimum daily wage in effect in the geographical area where the offence occurred and at the time it occurred times:

- 50 to 500 for failing to:
 - provide the CNA with requested information,
 - comply with the requirements of a concession, and
 - non-specified violations against the LAN 1992;
- 100 to 1000 for:
 - using water in a larger volume than a user is entitled to,
 - failing to install devices to record or measure water quantity or altering such equipment without the permission of the CNA,
 - obstructing visits, inspections or examinations by the CNA,
 - failing to register a concession in the Public Registry of Water Rights, and
 - squandering water; and
- 5000 to 10 000 for:
 - altering authorised infrastructure for the use of water or operating it without the permission of the CNA,
 - using water without a concession, and
 - extracting and using groundwater in a restricted area without the permission of the CNA.

The level of sanction applied must take into consideration the seriousness of the offence, the economic circumstances of the offender and whether it is a repetition of a previous offence (LAN 1992, Art. 121).

Where the deadline allowed by the CNA to remedy an offence expires without the offence ceasing, fines may be imposed for each day that passes without the order being obeyed. However, the total fine may not exceed the maximum permitted under Art. 120 of the LAN 1992. In the case of second offences, the original fine may be doubled, although it may not exceed the maximum permissible.

Where the offence committed includes using water without a concession, extracting and using groundwater in a restricted area without the permission of the CNA, or committing an offence twice, the CNA may order the partial or total, temporary or

permit closure of wells and works or intakes. The CNA may also order such an closure where an individual has:

- failed to obey an order suspending activities; or
- used infrastructure illegally to obtain water and sunken clandestine wells (LAN 1992, Art. 122).

To enforce a closure, the CNA may request the assistance of federal, state or municipal authorities, and call upon public security bodies to intervene within their sphere of authority. If the water source or property is occupied by the construction of any type of work or infrastructure without the necessary permit, the CNA can remove or demolish the work or infrastructure at the offender's expense (LAN 1992, Art. 122).

Employees of the CNA enforcing a closure must keep a detailed record of the proceedings. If the offender refuses to sign the record, the record is not invalidated but the circumstances must be recorded in the presence of two witnesses chosen by the interested party or if the party is absent or refuses to choose, two witnesses chosen by the CNA (LAN 1992, Art. 122).

Appeals

Actions or decisions made by the CNA may be appealed within 15 business days after the notice is issued. Interested parties also have the option of filing appeals for review (LAN 1992, Art. 124).

Appeals for a review of the CNA's administrative decision must be submitted in writing to the head of the CNA. The appeal must include the name and address of the appellant and the complaint(s), accompanied by any evidence and proof of the appellant's legal status (LAN 1992, Art. 124).

The CNA may revoke, amend or uphold its original decision. The revised decision must contain a description of the action under appeal, the legal grounds and the final determination (LAN 1992, Art. 124).

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