Statistics on Water in Mexico 2016 Edition

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The document Statistics on Water in Mexico, 2016 edition is part of the National information system on water quality, quantity, uses and conservation (Sina) and is an effort from the National Water Commission of Mexico (Conagua) to present an integral panorama of the water sector in our country.

With the aim of clearly presenting the data included in this publication, the tables and graphs generally speaking show the last ten years of information. For the reader interested in looking into the details, the original data for the tables and graphs conserve the whole period of annual statistics available. Throughout the text you may identify them by their first letter, the number of the chapter and a consecutive number: table 7.1, graph 4.9. You may also find maps and figures which may be identified in the same way: map 4.2 and figure 2.3.

An electronic version of this publication is available for download and can be viewed on the web page http://app.conagua.gob.mx/consultapublicaciones.aspx, where it is possible to have access to this original data and find the records on the theme of each chapter, in the Sina with the indication [Tablero: <Name of the theme in Spanish>], as well as the complementary tables, graphs and maps, with the indication [Adicional: <key>].

Thirteen hydrological-administrative regions (HARs) are the basis for the federal administration of water issues, hence their territorial division is presented in most of the maps in this document. Their characteristics are listed in the map on page 214.

The calculation of renewable water resources (RWR) is proposed as an important indicator for the sector. This edition presents the calculation of RWR with the latest available studies of catchments and aquifers.

With the intention of guiding the reader, there are notes identified with numbers ([1]) in the footnotes, as well as notes under the tables, graphs or maps. Annex F includes some brief methodological notes on relevant issues. The sources are identified by references within the text, such as Inegi (2015a), and a complete bibliography can be found in annex G.

CHAPTER

1

Geographical and socio-economic context

GEOGRAPHICAL AND SOCIO-ECONOMIC CONTEXT

Geographical and demographic aspects

Surface area
1.964
million km²

11.4 million people in extreme poverty

Political division

32 states

2 457
municipalities and delegations

57.0%

of the population is concentrated in metropolitan areas

59

metropolitan areas in Mexico in 2015

2015 projection
121.0
million inhabitants

2030 projection
137.5
million inhabitants

Hydrological-administrative regions

13

Regions for water management

North

Less available water
Greater population
Higher contribution to the GDP

South

Higher available water
Lower population
Lower contribution to the GDP

Economy 2015

Inflation	2.13%
Per capita GDP	$149 804 pesos
Total GDP	$18.127 trillion pesos

Composition of the GDP

	1950	2015
Primary Agriculture and livestock	19.2%	3.6%
Secondary Industry	26.5%	32.8%
Tertiary Services	54.3%	63.6%

1.1 Geographical and demographic aspects

[Tablero: Ubicación geográfica de México, Población]

The territorial extension of the United Mexican States includes 1.964 million km^2, of which 1.959 million km^2 correspond to the **continental surface** and the rest to the island area, as can be observed in table 1.1. The Exclusive Economic Zone (EEZ) should also be considered, defined as a strip up to 370 kilometers wide[1] measured from the coastal baseline,[2] the extension of which is estimated at approximately three million km^2.

There are different factors which determine Mexico's climate. As a result of its **geographical** location, the southern part of the country is in the inter-tropical area of the globe, whereas the northern part is located in the temperate area. Mexico is situated at the same latitude as the Saharan and Arabian deserts, as can be appreciated in map 1.1.

The second factor is the geographical accidents which characterize Mexico's relief, as illustrated in figure 1.1. The geographical location and the **relief** have a direct impact on the availability of water resources.

Mexico has a surface area of 1.964 million km^2

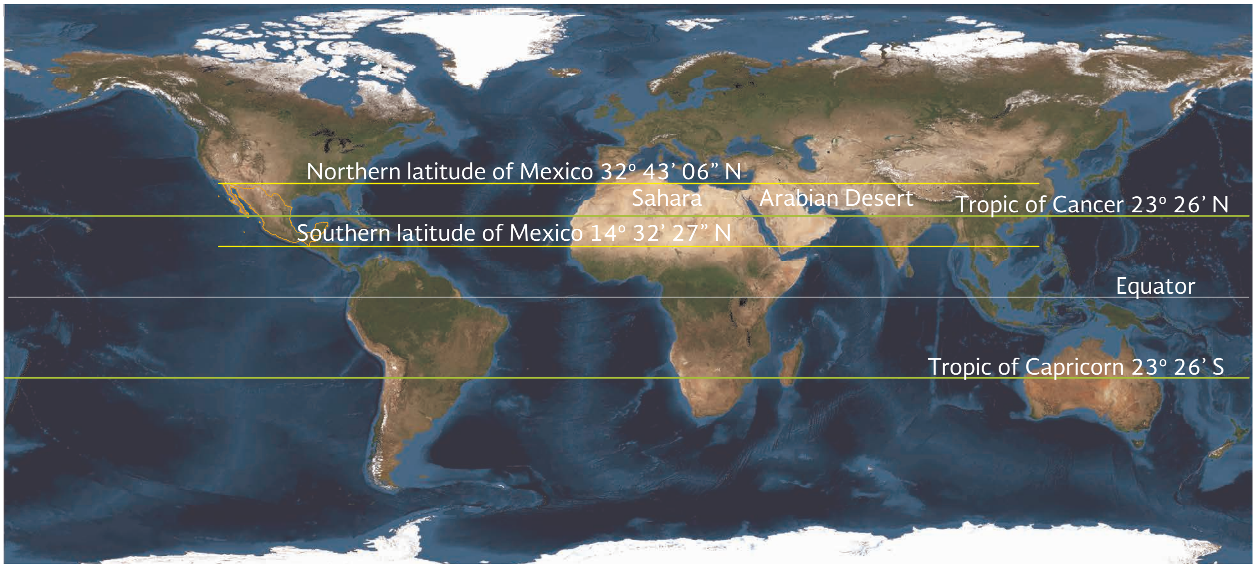
Table 1.1 Mexico's location and territorial extension

Territorial extension	
Territorial area	1 964 375 km^2
Mainland	*1 959 248 km^2*
Island-based	*5 127 km^2*
Coastline	
Total length	11 122 km
Pacific Ocean	*7 828 km*
Gulf of Mexico and Caribbean Sea	*3 294 km*
International borders of the mainland territory	
With the United States of America	3 152 km
With Guatemala	956 km
With Belize	193 km
Extreme geographical coordinates	
To the north: 32º 43´ 06" latitude north. Monument 206, on the border with the United States of America	
To the south: 14º 32´27" latitude north. At the mouth of the Suchiate river, at the border with Guatemala	
To the east: 86º 42´36" longitude west. Mujeres Island	
To the west: 118º 22´00" longitude west. Guadalupe Island	

Source: Inegi (2016a).

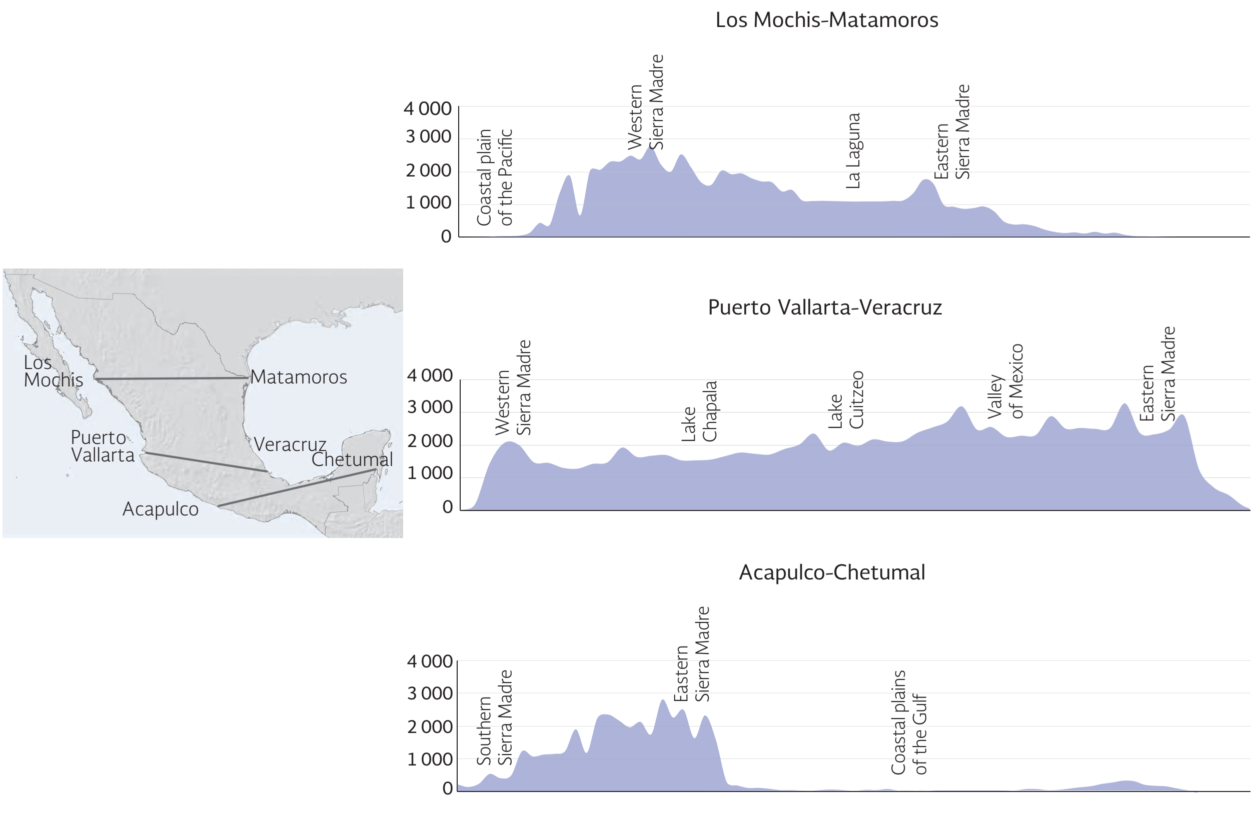
1 Internationally defined as 200 nautical miles (UN 1994). One nautical mile is the equivalent of 1.852 km.
2 Defined as the low tide line along the coast (UN 1994).

Map 1.1 Mexico's geographical location



Source: Produced based on NASA (2016).

Figure 1.1 Elevation profiles (MASL)



Source: Produced based on USGS (2015a).

Two thirds of the territory is considered **arid or semi-arid**, with annual precipitation lower than 500 mm, whereas the southeast is **humid** with annual precipitations of over 2 000 mm per year. In the majority of the territory, the rainfall is more intense in the summer, when it is mainly torrential.

As of December 31, 2015, Mexico was made up of 31 states and one Federal District (translator's note: Mexico City for the purpose of this publication), made up of 2 441 municipalities and 16 delegations respectively, giving a total of 2 457 municipalities and delegations.[3]

Mexico's population is estimated based on around-the-country data-listing and entry, known as **censuses** on population and housing (translator's note: known in Spanish as censos-carried out in years ending in 0, and conteos carried out in years ending in 5), carried out by the National Institute of Statistics and Geography (Inegi),[4] and through population **projections** carried out based on the National Population Council's (Conapo) censuses.[5]

Additionally, in 2015 Inegi, instead of a census (*conteo*) on population and housing, established the carrying out of a broad-ranging thematic survey, known as "2015 Intercensal Survey", which, based on a sample, would allow the total population of the country to be estimated by state, municipality and for the country's main cities, as well as the population's and housing's characteristics (Inegi 2016c). One of the objectives of the survey was to maintain the comparability with the national censuses, so it will be employed, when its results allow, to complement the census data up to 2015.

Since the mid-20th century, the population has shown a marked trend towards abandoning small rural localities and congregating in urban areas. From 1950 to 2015, the country's population more than quadrupled, and went from being predominantly rural to mainly **urban**, as can be observed in graph 1.1.

Mexico has 2 457 municipalities and delegations

Table 1.2 Distribution of the population by size of locality, 2010

Range	Number of localities	Population (millions of inhabitants)	Percentage of the population
500 000 or more	36	31.19	27.8
From 50 000 to 499 999	181	28.42	25.3
From 2 500 to 49 999	3 434	26.68	23.7
From 100 to 2 499	49 440	23.67	21.1
Less than 100	139 156	2.38	2.1
Total	**192 247**	**112.34**	**100.0**

Source: Inegi (2016e).

3 According to Inegi (2015b), up to that date there were 2 457 municipalities and delegations with geographical representation. It should be commented that on January 29, 2016, after the closing of this edition, the political reform of Mexico City was published in the Official Government Gazette.

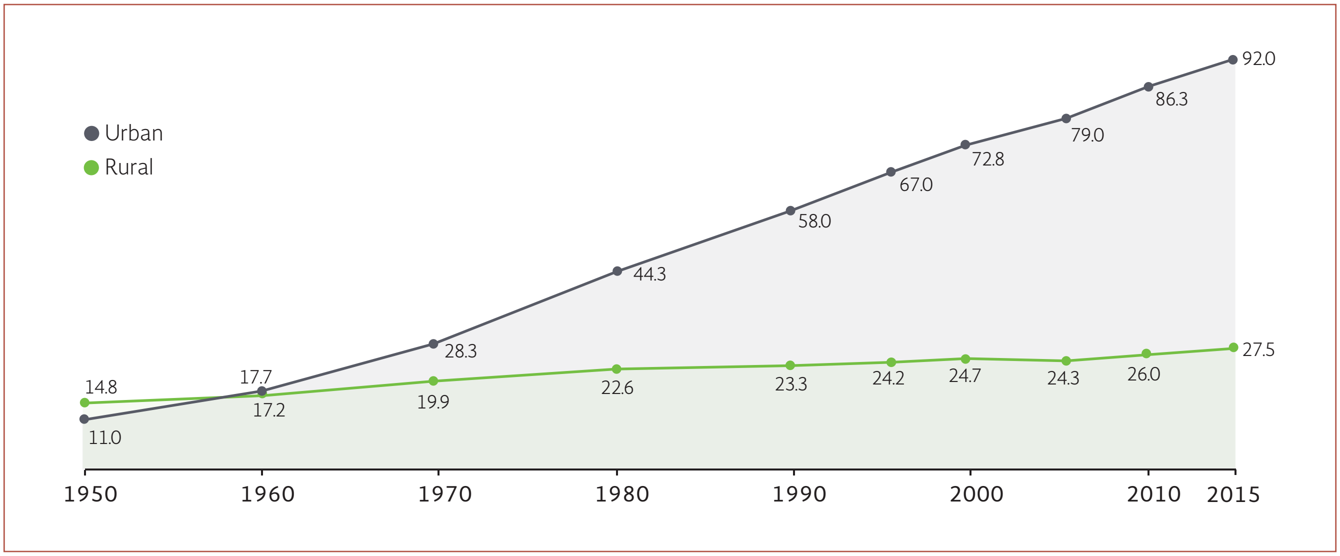
4 The last census (*conteo*) was in 2005. The last census (*censo*), known as the *Censo General de Población y Vivienda* 2010, found, at the time of its realization, a total population of 112.3 million inhabitants. It generated as a by-product the location of all of the country's localities.

5 For the calculation of the 2010-2050 population projects, Conapo (2012) carried out a 1990-2010 **demographic conciliation,** which allowed it to establish that the population at the midway point of 2010 was 114.3 million inhabitants. As of 2015, the population projection was 121.0 million inhabitants, and up to 2030 it was 137.5 million inhabitants.

According to the results of the *Censo General de Población y Vivienda 2010* (2010 Census on Population and Housing), in Mexico that year there were 192 247 inhabited localities, spread out according to their size as shown in table 1.2.

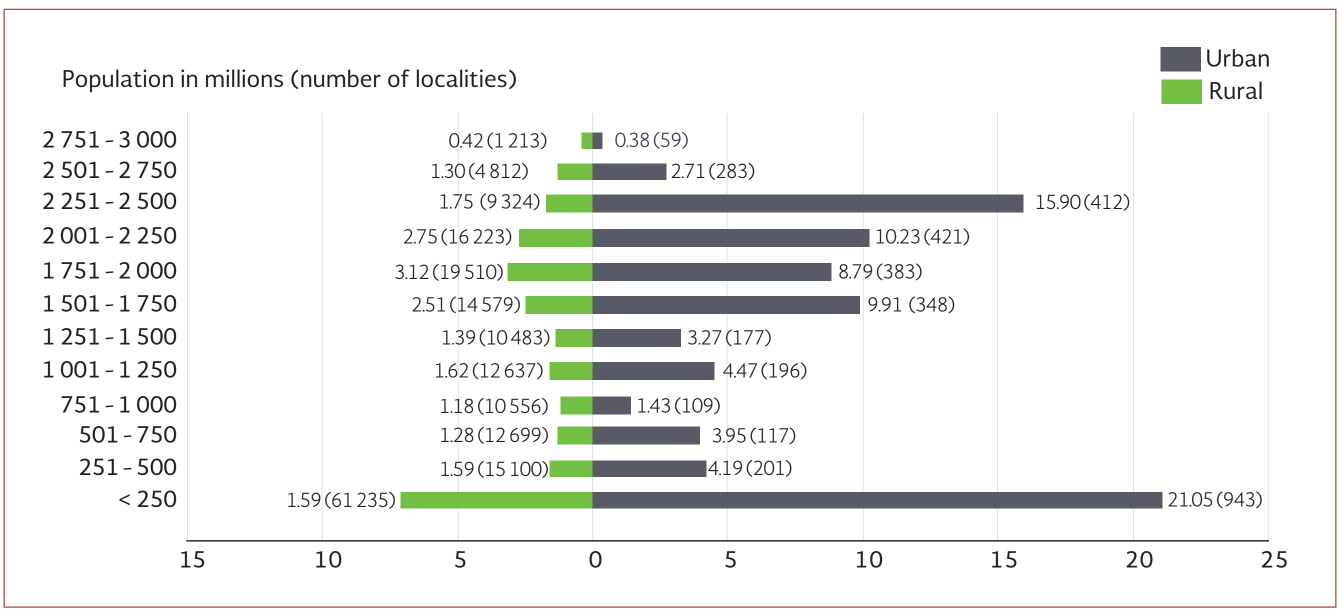
In 2010, 53.2% of the population of Mexico lived in areas over 1 500 meters above sea level, as can be observed in graph 1.2.

Graph 1.1 Evolution in the urban and rural population (millions of inhabitants)



Source: Produced based on Inegi (2016d), Inegi (2016c).

Graph 1.2 Distribution of the population and their localities by ranges of altitude, 2010



Note: Data as of the date of the Census (*Censo*). In 2010 there were 277 localities (225 rural and 2 urban ones) with a total of 57 821 inhabitants, situated at more than 3 000 meters above sea level. Rural localities are those of under 2 500 inhabitants.
Source: Inegi (2016e).

1.2 Population centers

[Tablero: Población]

Based on data from the *Censo General de Población y Vivienda 2010*, 59 Metropolitan Areas were defined,[6] for which the CONAPO estimated a population in 2015 at 68.9 million inhabitants, thus constituting 57% of the total population projected for that year. Up to the same date, additionally there were 36 localities of more than 100 000 inhabitants in localities that are not part of metropolitan areas, adding up to 8.5 million people and 7% of the national population.

Of these MAs, 32 have more than 500 000 inhabitants, which represents a total of 61.4 million people and 50.8% of the national population at that point. Three localities that are not part of an MA (Hermosillo, Victoria de Durango and Culiacan Rosales) had more than 500 000 inhabitants in 2015. Those population centers are shown In map 1.2.

The concentration and the accelerated growth of the population in urban localities have led to stronger **pressures** on the environment and on institutions, due to the increasing demand for services.

The CONAPO estimated that in 2015, in the fourteen MAs with a population of more than one million inhabitants, 39.3% of the total population of Mexico was concentrated, or 47.6 million inhabitants.

In 2015 there were 14 metropolitan areas with more than a million inhabitants

MAP 1.2 Main population centers, 2015

Note: Includes both MAs and localities outside MAs, with a population of more than 500 000 inhabitants.
Source: Produced based on CONAPO (2012), INEGI (2016E), SEDESOL et al. (2012).

6 An MA is defined as the sum of two or more municipalities in which a city of 50 000 or more inhabitants is located, and the urban area, functions and activities of which go beyond the limits of the municipality that it was originally part of, incorporating mainly urban neighboring municipalities as part of the municipality or of its area of direct influence, with which they maintain a high degree of socio-economic integration. That definition also includes those municipalities which, due to their particular characteristics, are relevant for urban planning and politics of the metropolitan areas in question (SEDESOL et al. 2012).

1.3 Economic indicators

[Tablero: Indicadores económicos]

In 2015, Mexico's GDP grew by 2.5 %

According to the Bank of Mexico,[7] 2015 presented a complicated scenario for the Mexican economy. The internal economic growth was moderate, supported by private consumption, which contrasted with a complicated international context. The rhythm of expansion of global activity was weak, characterized by recurring episodes of financial volatility and low oil prices, which led to adjustments that were absorbed by the peso-dollar exchange rate. The latter thus had a trend towards depreciation. Nevertheless, the objective of an annual inflation rate of less than three percent was met: annual inflation was 2.13% (Inegi 2016h). An annual growth in the Gross Domestic Product (GDP) of 2.5% was registered (Inegi 2016g).

The five-year **trend** in the main indicators can be observed in table 1.3. It is worth mentioning that, in the previous edition, constant 2008 prices were employed to keep consistency with Inegi (2016g); for this edition, the reference year is 2015.

Throughout the 20th century, the contribution of agriculture and livestock activities, silviculture and fishing to Mexico's GDP has progressively decreased, as opposed to industry and services which have increased, as can be observed in graph 1.3. This change is even more evident in the population occupied by economic sector,[8] with a significant reduction in the Mexicans occupied in the primary sector (from 58.3% to 13.4% in the 1950-2015 period), and the corresponding increase in those occupied in the tertiary sector (from 25.7% to 61.8% in the same period). The population occupied in Mexico up to the fourth trimester of 2015 was 50.3 million people.

Table 1.3 Main economic indicators in Mexico

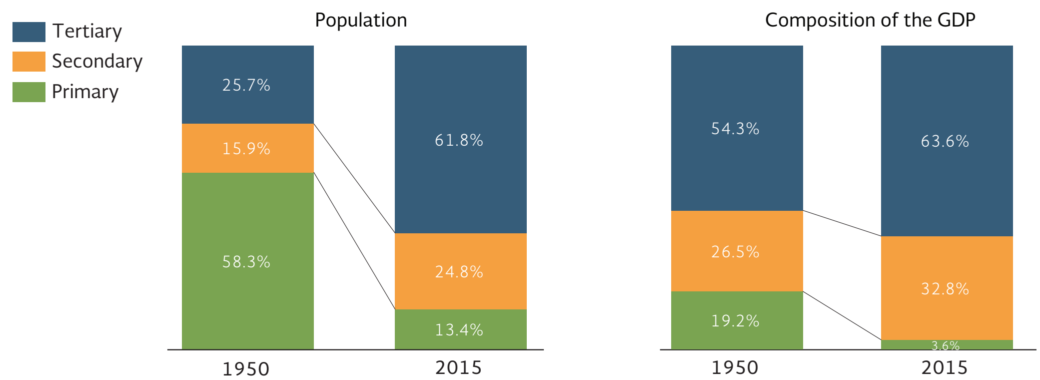
Year	Indicators		
	Gross Domestic Product (GDP) (billions of pesos, constant 2015 prices)	Per capita GDP (pesos, constant 2015 prices)	Annual inflation based on the National Consumer Price Index
1995	9 984.52	105 667.11	51.97
2000	12 191.95	120 837.03	8.96
2005	14 004.45	130 698.27	3.33
2010	15 860.20	138 813.37	4.40
2015	18 127.18	149 804.18	2.13

Source: Produced based on Conapo (2012), Inegi (2016f), Inegi (2016g).

7 Banxico (2016a)

8 The primary sector includes agriculture and livestock, silviculture and fishing activities. The secondary sector considers mining, the manufacturing industry, construction and electricity, gas and water. The tertiary sector includes trade, restaurants and hotels, transport, storage and communications, financial services, insurance, real estate and renting activities, community, social and personal services.

Graph 1.3 Composition of economic activity by sector, 1950 and 2015



Note: For illustrative purposes only, the calculation of the percentage of the population occupied by sector of economic activity does not consider the "Others" category, which represents 0.6% of the average population occupied in 2015. Along the same lines, the representation of the charges allocated for banking services was simplified, representing indirectly measured financial intermediation services, with a negative sign.
Source: Produced based on Inegi (2014a), Inegi (2016i), Inegi (2016g).

1.4 Socio-demographic conditions

[Tablero: Rezago social, Marginación social, Desarrollo humano]

According to the General Law of Social Development, it is the responsibility of the National Council for the Evaluation of Social Development Policies (Coneval) to establish the guidelines and criteria to define, identify and measure poverty in Mexico. The objective is to provide elements to improve public policies aiming to overcome this condition. The estimation both nationwide and by state is carried out every two years, the latest one being from 2014. At the municipal level it is carried out every five years, since it is calculated based on different national censuses.

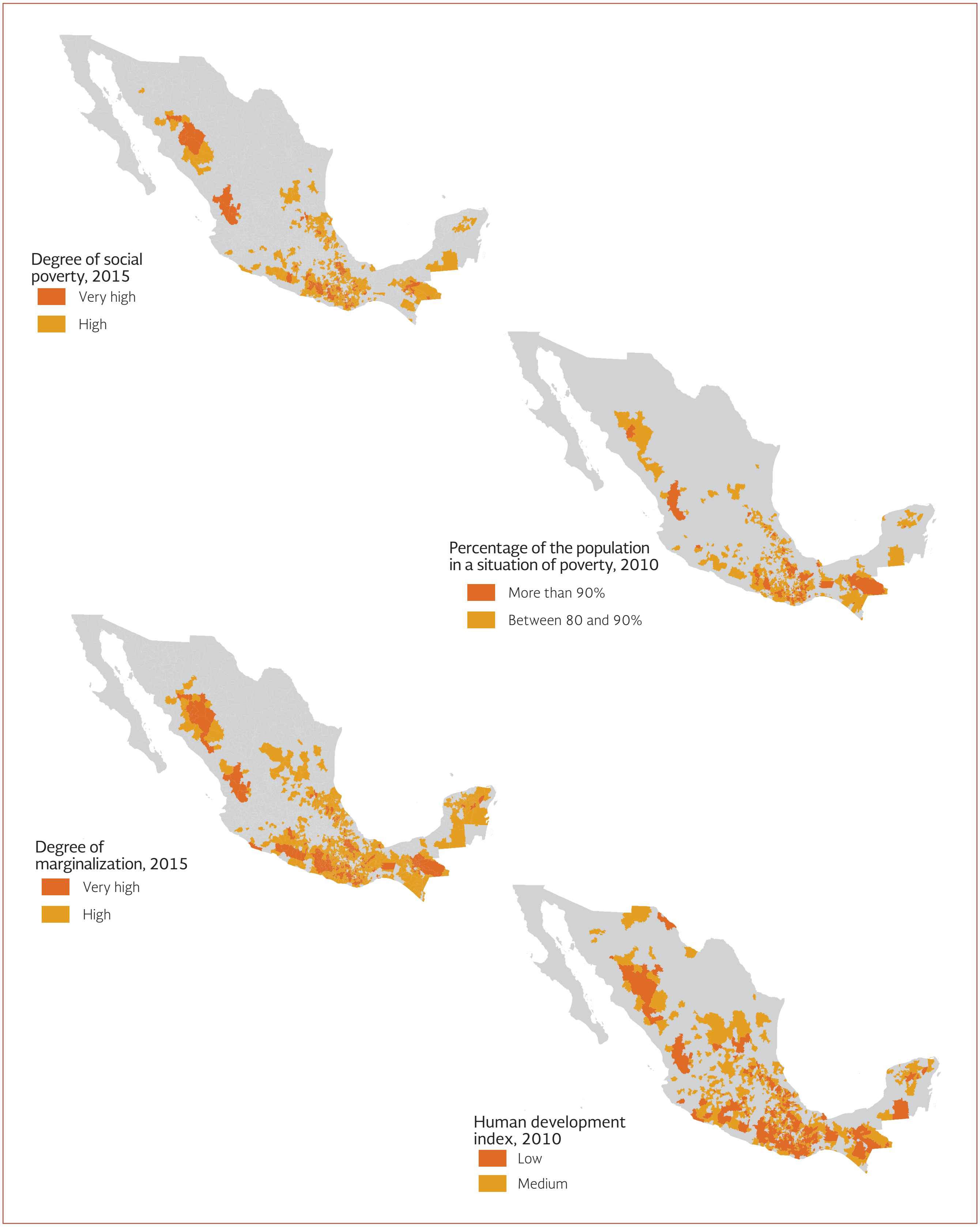
The measurement of **poverty** includes the indicators of income, educational lag, access to health services and social security, living quality and spaces, access to food and degree of social cohesion, since poverty is considered a multi-dimensional manifestation of shortages. In 2014 nationwide, it is estimated that 46.2% of the population (55.3 million people) are in a state of poverty. Of these, 11.4 million are in a state of extreme poverty.

In 2014 55.3 million people were under some degree of poverty

A complementary measurement is the index of **social poverty**, also produced by the Coneval [Adicional: Table 1.A]. This measurement includes indicators of education, assets in the home and quality and services in the house. Also complementary are the indexes of marginalization, produced by Conapo, which considers aspects of education, housing, income from work and distribution of the population. These two indices were updated to 2015 based on the Inter-Censal Survey. Another reference is the human development index, based on standard of living, education and life expectancy at birth.

Figure 1.2 presents these four indicators at the municipal level, highlighting the municipalities in unfavorable socio-demographic conditions. The concentration of municipalities in these conditions in the south and along the Western Sierra Madre stands out.

Figure 1.2 Municipalities with adverse socio-demographic conditions



Source: Produced based on Coneval (2011b), Coneval (2016), Conapo (2016), UNDP (2014).

1.5 Hydrological-administrative regions (HARs) for water management

[Tablero: División hidrológico-administrativa]

For the purpose of the management and preservation of Mexico's water resources, since 1997 the country has been divided into thirteen HARs, which are made up by grouping together watersheds, considered the basic units for water resources management. The limits of the HARs respect municipal divisions, so as to facilitate the integration of socio-economic information.

The National Water Commission of Mexico (Conagua), an administrative, standard-bearing, technical and consultative agency in charge of water management in the country, carries out its functions through 13 thirteen basin organizations, the scope of competence of which are the HARs (see the map on page 214).

The Conagua has 13 river basin organization

The characteristics of the HARs are shown in the following table. It should be mentioned that the calculation of the contribution to the national GDP is based on the GDP by state, the latest data on which is from 2014.

The municipalities that make up each one of these HARs are indicated in the Territorial Constituency Agreement for River Basin Organizations, published in the Official Government Gazette on April 1, 2010.

Additionally, the Conagua has twenty local offices in the states in which no river basin organization has its headquarters.

Table 1.4 Characteristics of the HARs

HAR number	Mainland surface (km²)	2015 renewable water resources (hm³/year)	Population at mid-2015 (millions of inhabitants)	Population density (inhabitants/km²)	2015 per capita renewable water resources (m³/inhabitant/year)	Contribution to the 2014 national GDP (%)	Municipalities or delegations of Mexico City (number)
I	154 279	4 958	4.45	28.8	1 115	3.61	11
II	196 326	8 273	2.84	14.5	2 912	2.86	78
III	152 007	25 596	4.51	29.7	5 676	2.88	51
IV	116 439	21 678	11.81	101.4	1 836	6.14	420
V	82 775	30 565	5.06	61.1	6 041	2.29	378
VI	390 440	12 352	12.30	31.5	1 004	14.29	144
VII	187 621	7 905	4.56	24.3	1 733	4.19	78
VIII	192 722	35 080	24.17	125.4	1 451	19.08	332
IX	127 064	28 124	5.28	41.6	5 326	2.24	148
X	102 354	95 022	10.57	103.2	8 993	5.62	432
XI	99 094	144 459	7.66	77.3	18 852	4.93	137
XII	139 897	29 324	4.60	32.9	6 373	7.38	127
XIII	18 229	3 442	23.19	1 272.2	148	24.49	121
Total	**1 959 248**	**446 777**	**121.01**	**61.8**	**3 692**	**100.00**	**2 457**

Source: Produced based on Conapo (2012), Inegi (2008), Inegi (2016j), Conagua (2016b).

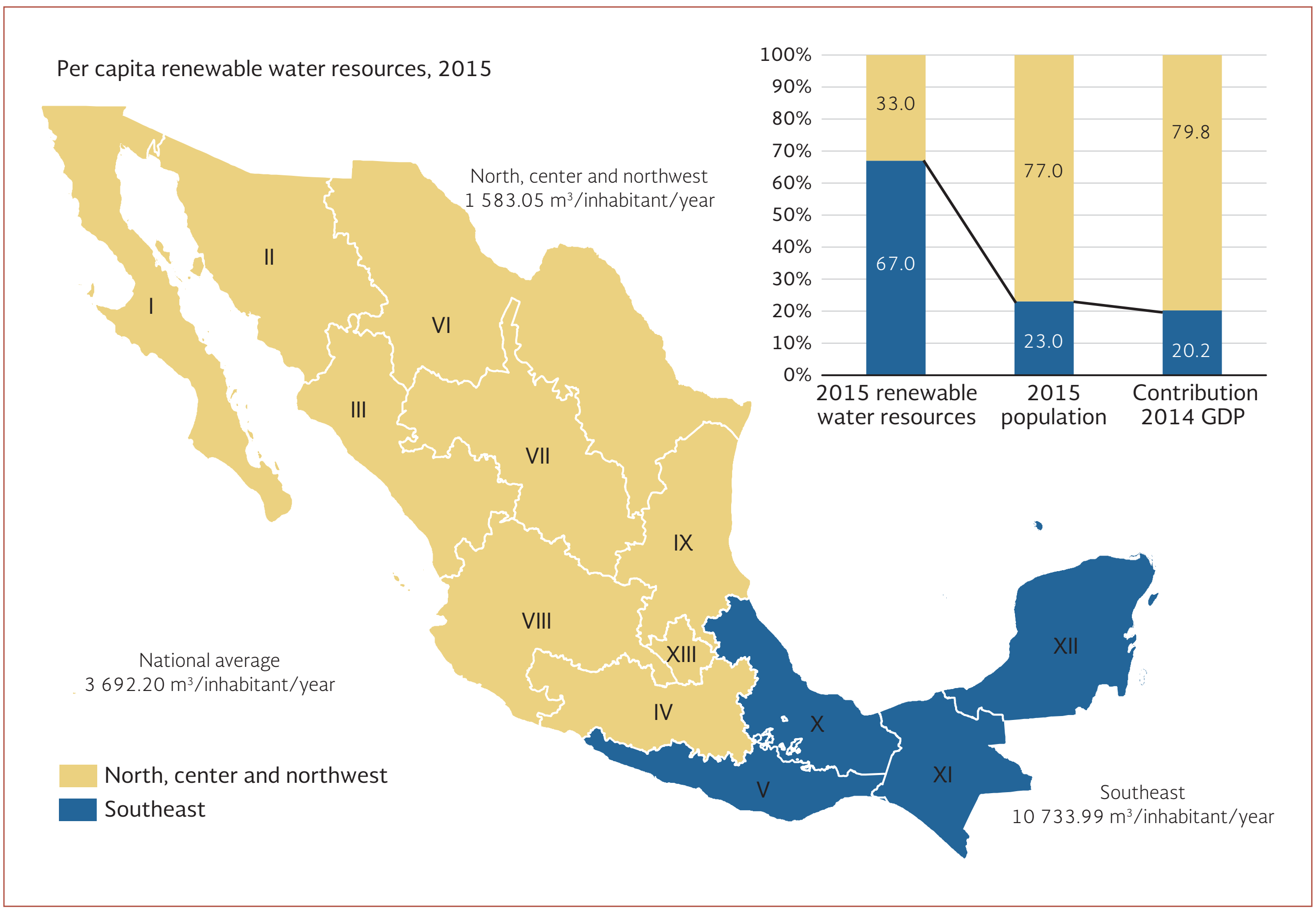
1.6 Regional contrast between development and renewable water resources (RWR)

[Tablero: División hidrológico-administrativa, Agua renovable]

The aggregate national values, such as population, renewable water resources (RWR) or GDP, conceal the great regional diversity in Mexico.

There are significant **variations between** regional characteristics. If the hydrological-administrative regions V, X, XI and XII are grouped together, in the south-east of the country, they can be contrasted with the remaining regions. The regions in the south-east present two thirds of the country's renewable water resources, with one fifth of the population which contributes one fifth of the national GDP. The regions in the north, center and northwest have one third of the country's renewable water resources, four fifths of the population and of the regional contribution to the national GDP. Considering the per capita renewable water resources, the value available in the regions of the south-east is seven times higher than that available in the rest of Mexico's hydrological-administrative regions.

FIGURE 1.3 Regional contrast between renewable water resources and development



Source: Produced based on CONAPO (2012), INEGI (2008), INEGI (2016j), CONAGUA (2016b).

1.7 Summary of data by state

[Tablero: División hidrológico-administrativa]

The main demographic and socio-economic data and on renewable water resources (RWR) by state are presented in the following table.

Table 1.5 Geographical and socio-economic data by state

Code	State	Mainland surface area (km²)	2015 renewable water resources (hm³/year)	Population at mid-2015 (m³/inhabitant/year)	2015 per capita renewable water resources (m³/inhabitant/year)	Contribution to the 2014 national GDP (%)	Municipalities or delegations of Mexico City (number)
01	Aguascalientes	5 618	514	1.29	399	1.21	11
02	Baja California	71 446	2 989	3.48	858	2.79	5
03	Baja California Sur	73 922	1 264	0.76	1 654	0.74	5
04	Campeche	57 924	14 274	0.91	15 723	4.24	11
05	Coahuila de Zaragoza	151 563	3 151	2.96	1 064	3.40	38
06	Colima	5 625	2 136	0.72	2 952	0.60	10
07	Chiapas	73 289	112 929	5.25	21 499	1.79	118
08	Chihuahua	247 455	11 888	3.71	3 204	2.84	67
09	Federal District (Mexico City)	1 486	478	8.85	54	16.52	16
10	Durango	123 451	13 370	1.76	7 576	1.23	39
11	Guanajuato	30 608	3 856	5.82	663	4.18	46
12	Guerrero	63 621	21 097	3.57	5 913	1.51	81
13	Hidalgo	20 846	7 256	2.88	2 521	1.70	84
14	Jalisco	78 599	15 654	7.93	1 974	6.54	125
15	Mexico	22 357	5 190	16.87	308	9.30	125
16	Michoacan de Ocampo	58 643	12 547	4.60	2 730	2.43	113
17	Morelos	4 893	1 797	1.92	936	1.16	33
18	Nayarit	27 815	6 392	1.22	5 223	0.67	20
19	Nuevo Leon	64 220	4 285	5.09	843	7.29	51
20	Oaxaca	93 793	55 362	4.01	13 798	1.61	570

Code	State	Mainland surface area (km²)	2015 renewable water resources (hm³/year)	Population at mid-2015 (m³/inhabitant/year)	2015 per capita renewable water resources (m³/inhabitant/year)	Contribution to the 2014 national GDP (%)	Municipalities or delegations of Mexico City (number)
21	Puebla	34 290	11 478	6.19	1 853	3.16	217
22	Queretaro	11 684	2 032	2.00	1 014	2.17	18
23	Quintana Roo	42 361	7 993	1.57	5 076	1.62	10
24	San Luis Potosi	60 983	10 597	2.75	3 848	1.92	58
25	Sinaloa	57 377	8 682	2.98	2 909	2.09	18
26	Sonora	179 503	7 018	2.93	2 393	2.91	72
27	Tabasco	24 738	31 040	2.38	13 021	3.14	17
28	Tamaulipas	80 175	8 928	3.54	2 520	3.04	43
29	Tlaxcala	3 991	908	1.28	711	0.56	60
30	Veracruz de Ignacio de la Llave	71 820	50 880	8.05	6 323	5.09	212
31	Yucatan	39 612	6 924	2.12	3 268	1.52	106
32	Zacatecas	75 539	3 868	1.58	2 454	1.02	58
	Total	**1 959 248**	**446 777**	**121.01**	**3 692**	**100.00**	**2 457**

Source: Produced based on CONAPO (2012), INEGI (2008), INEGI (2016j), CONAGUA (2016b).

CHAPTER

2

State of water resources

STATE OF WATER RESOURCES

Renewable water resources

Water that may be feasibly and sustainably used in a region

Mexico in 2015:

446 777 hm^3

per year

Climate

Precipitation

Normal 1981-2010

740 mm

2015

872 mm

Hydro-meteorological phenomena

Hurricanes:

cyclones with a wind speed greater than 119 km/h

Droughts:

rainfall less than normal levels in any given region

Water quality

4 999

monitoring sites operated by the CONAGUA

BOD$_5$

Biochemical Oxygen Demand

Indicates biodegradable organic matter

Caused by municipal wastewater discharges

COD

Chemical Oxygen Demand

Indicates organic matter

Caused by wastewater discharges in general

TSS

Total Suspended Solids

Indicates the suspended solids and organic matter

Caused by wastewater discharges, agricultural waste and erosion

Groundwater

653 aquifers for groundwater management provide **38.9%** of the volume for offstream uses

- **105** in conditions of overdrafting
- **32** with presence of saline soils and brackish water
- **18** with saltwater intrusion

Surface water

731 watersheds for the management of surface water

8 transboundary watersheds

- **51** main rivers
  - **87%** of the runoff
  - **65%** of the territory is occupied by its watersheds

2.1 Mexico's catchments and aquifers

[Tablero: Regiones hidrológicas, Cuencas]

In the hydrological cycle, a significant proportion of precipitation returns to the atmosphere in the form of evapotranspiration, whereas the rest runs off into the country's streams and water bodies, following the conformation of the land, in the shape of surface water; or filters through to the subsoil as groundwater.

Watersheds are natural territorial units, defined by the existence of a continental divide of surface water as a result of the conformation of the relief. For the purpose of the management of the nation's water resources, especially the publication of availability,[1] the Conagua has defined 731 watersheds. Up to December 31, 2015, the availability of all 731 watersheds had been published, in conformity with the standard NOM-011-CONAGUA-2000, of which 627 were in a situation of availability.

The country's catchments have been organized into 37 hydrological regions which are shown in figure 2.1, and are in turn grouped into the 13 hydrological-administrative regions (HARs) mentioned in the first chapter.

As regards groundwater, the country is divided into 653 **aquifers**. The names of the aquifers were published in the Official Government Gazette (DOF) on December 5, 2001. In the 2003-2009 period their geographical limits were published (map 2.1), whereas the publication of their availabilities and their updates have been carried out between 2003 and the present.

The Conagua has 3 160 stations in operation to measure **climate variables**, including temperature, precipitation, evaporation, wind speed and direction. Of these, 88 are observatories, which transmit meteorological information in real time. **Stream gages** measure the flow of water in rivers, as well as the extraction of water through dam intakes. In Mexico there are 861 stream gages, including some automatic ones. On the other hand, hydro-climate stations measure climatic and hydrometric parameters. The measurement infrastructure allows the hydrological cycle to be measured (see table 2.1).

There are 37 hydrological regions in Mexico

Table 2.1 Number of climate stations and stream gages in Mexico, 2015

Number of stations	Type of station
Climate stations	3 160
Stream gages	861

Source: Conagua (2016b), Conagua (2016f).

1 Availability of surface water: the value obtained from the difference between the mean annual volume of runoff from a catchment downstream and the current annual volume committed downstream.

FIGURE 2.1 Hydrological regions

Number	Name
1	Baja California Northwest
2	Baja California Central-West
3	Baja California South-West
4	Baja California North-East
5	Baja California Central-East
6	Baja California South-East
7	Colorado River
8	Sonora North
9	Sonora South
10	Sinaloa
11	Presidio-San Pedro
12	Lerma-Santiago
13	Huicicila
14	Ameca River
15	Jalisco Coast
16	Armeria-Coahuayana
17	Michoacan Coast
18	Balsas
19	Greater Guerrero Coast

Number	Name
20	Lower Guerrero Coast
21	Oaxaca Coast
22	Tehuantepec
23	Chiapas Coast
24	Bravo-Conchos
25	San Fernando-Soto La Marina
26	Panuco
27	North of Veracruz (Tuxpan-Nautla)
28	Papaloapan
29	Coatzacoalcos
30	Grijalva-Usumacinta
31	Yucatan West
32	Yucatan North
33	Yucatan East
34	Closed Catchments of the North
35	Mapimi
36	Nazas-Aguanaval
37	El Salado

Source: CONAGUA (2016b).

Map 2.1 Outline of aquifers

Source: Conagua (2016b).

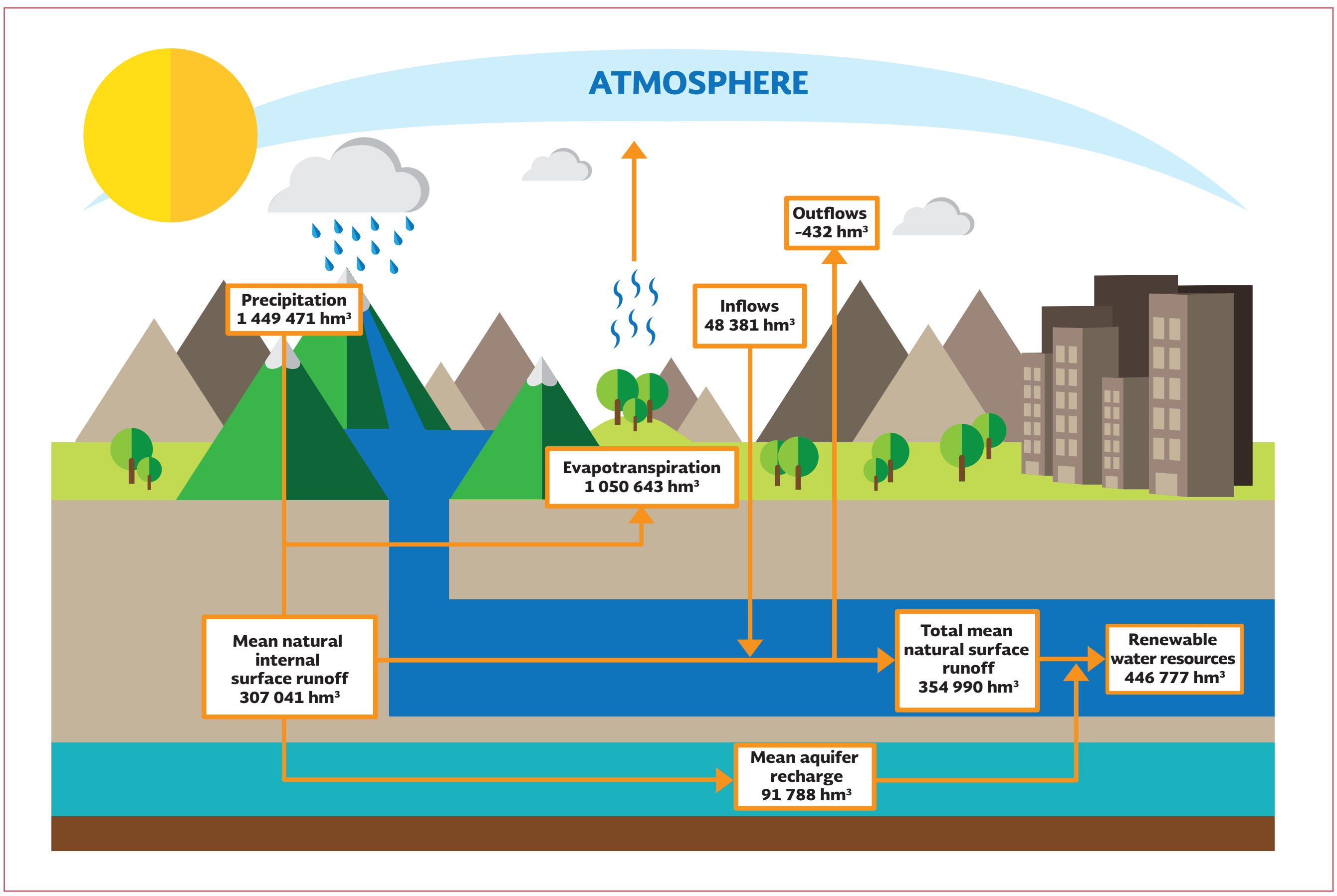
2.2 Renewable water resources[2]

[Tablero: Ciclo hidrológico, Agua renovable]

Every year, Mexico receives around 1 449 471 million cubic meters of water in the form of precipitation. Of this water, it is estimated that 72.5% evapotranspirates and returns to the atmosphere, 21.2% runs off into rivers and streams and the remaining 6.3% naturally filters through to the subsoil and recharges aquifers.[3] Taking into account the water outflows (exports) to and inflows (imports) from neighboring countries, every year the country has 446 777 million cubic meters of renewable freshwater resources.

Figure 2.2 shows the components and values that make up the calculation of **renewable** water resources.

Figure 2.2 Mean annual values of the components of the hydrological cycle in Mexico, 2015



Source: Conagua (2016b).

2 The maximum quantity of water that can feasibly be used in a region, meaning the quantity of water that is renewed by rainfall and the water that comes from other regions or countries (inflows). It is calculated as the mean natural annual internal surface runoff, plus the total annual aquifer recharge, plus the water inflows, minus the water outflows to other regions (Gleick 2002).

3 Some aquifers have renewal periods, understood as the rate of their estimated storage divided by their annual recharge, which are exceptionally long. These aquifers are thus known as non-renewable ones.

The inflows represent the volume of water which runs off to Mexico, generated in the transboundary watersheds that Mexico shares with its neighboring countries (United States of America, Guatemala and Belize). The outflows represent the volume of water that Mexico is bound to deliver to the United States of America under the 1944 "Water Treaty".[4]

Renewable water resources should be analyzed from three perspectives:

- Distribution over **time**: In Mexico there are significant variations in renewable water resources throughout the year. The majority of the rainfall occurs in the summer, and the rest of the year is relatively dry.
- Distribution in **space**: Some regions of the country have abundant precipitation and low population density, whereas in others exactly the opposite occurs.
- The **area** of analysis: Water problems and their resolution are predominantly local in scale. Indicators calculated at a large scale may hide some strong variations which exist throughout the country.

The per capita renewable water resources were estimated in 2015 at

3 692

m³/inhabitant/year

In some HARs, such as I Baja California Peninsula, VI Rio Bravo, VII Lerma-Santiago-Pacific and XIII Waters of the Valley of Mexico, the per capita renewable water resources are alarmingly low. In table 2.2 the mean values of renewable water resources in each of the regions of the country are shown.

Table 2.2 Per capita renewable water resources, 2015

HAR number	Renewable water resources (hm^3/year)	Population (millions of inhabitants)	Per capita renewable water resources (m^3/inhabitant/year)	Total mean natural surface runoff (hm^3/year)	Total mean aquifer recharge (hm^3/year)
I	4 958	4.45	1 115	3 300	1 658
II	8 273	2.84	2 912	5 066	3 207
III	25 596	4.51	5 676	22 519	3 076
IV	21 678	11.81	1 836	16 805	4 873
V	30 565	5.06	6 041	28 629	1 936
VI	12 352	12.30	1 004	6 416	5 935
VII	7 905	4.56	1 733	5 529	2 376
VIII	35 080	24.17	1 451	25 423	9 656
IX	28 124	5.28	5 326	24 016	4 108
X	95 022	10.57	8 993	90 424	4 599
XI	144 459	7.66	18 852	121 742	22 718
XII	29 324	4.60	6 373	4 008	25 316
XIII	3 442	23.19	148	1 112	2 330
Total	**446 777**	**121.01**	**3 692**	**354 990**	**91 788**

Note: for the HAR XIII, Mexico City's wastewater is considered.
Source: Produced based on Conagua (2016b), Conapo (2012).

4 "Treaty between the Government of the United Mexican States and the Government of the United States of America on the distribution of international water resources in the Colorado and Tijuana Rivers and the Rio Grande, from Fort Quitman, Texas, to the Gulf of Mexico".

Precipitation

[Tablero: Precipitación]

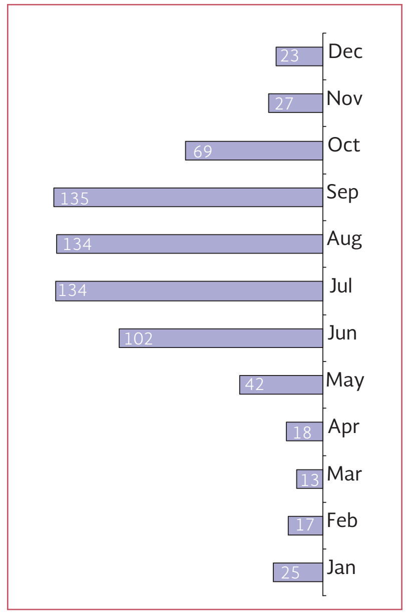
Mexico's **normal precipitation** in the period from 1981 to 2010 was 740 millimeters. According to the World Meteorological Organization (WMO), the normal values correspond to average measurements calculated for a uniform and relatively long period, which must include at least 30 years of data collection, considered as a minimum representative climate period. Furthermore, that period should start on January 1 of a year ending in one, and end on December 31 in a year ending in zero.

Table 2.3 presents the normal precipitation by HAR in the period from 1981 to 2010, (consult the data by state in [Adicional: Table 2.A]).

It is important to mention that the monthly distribution of precipitation accentuates the problems related with the availability of water resources, since 68% of the normal monthly precipitation falls between the months of June and September, as can be observed in graph 2.1.

In table 2.3, it may be observed, for example, that in the hydrological-administrative region XI Southern Border, which receives the greatest quantity of rain, the normal annual precipitation for 1981-2010 was 11 times higher than in the hydrological-administrative region I Baja California Peninsula, the driest one. This regional variation in the normal precipitation is highlighted in figure 2.3 and figure 2.4.

Graph 2.1 Normal monthly precipitation, 1981-2010 (mm)



Source: Conagua (2016f).

Table 2.3 Normal monthly precipitation, 1981-2010 (mm)

HAR number	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
I	20	19	14	4	1	1	10	26	32	11	10	20	168
II	24	21	12	6	4	19	108	103	58	25	17	31	428
III	31	16	8	6	9	66	194	188	142	52	26	29	765
IV	12	8	6	11	48	179	199	197	194	84	15	6	962
V	8	8	6	15	71	230	200	219	242	113	20	7	1 139
VI	19	11	11	17	28	40	63	61	64	32	12	15	372
VII	18	9	6	12	27	56	79	71	67	29	11	13	398
VIII	22	11	4	6	23	131	197	180	153	60	13	10	808
IX	26	20	19	38	67	120	137	119	166	89	30	23	855
X	51	40	30	43	84	222	261	264	293	179	97	64	1 626
XI	65	54	36	49	135	276	223	265	331	224	109	76	1 842
XII	45	35	31	39	90	167	153	173	208	147	72	49	1 207
XIII	11	11	12	28	51	109	126	115	110	57	13	6	649
National	**25**	**17**	**13**	**18**	**42**	**102**	**134**	**134**	**135**	**69**	**27**	**23**	**740**

Source: Conagua (2016f).

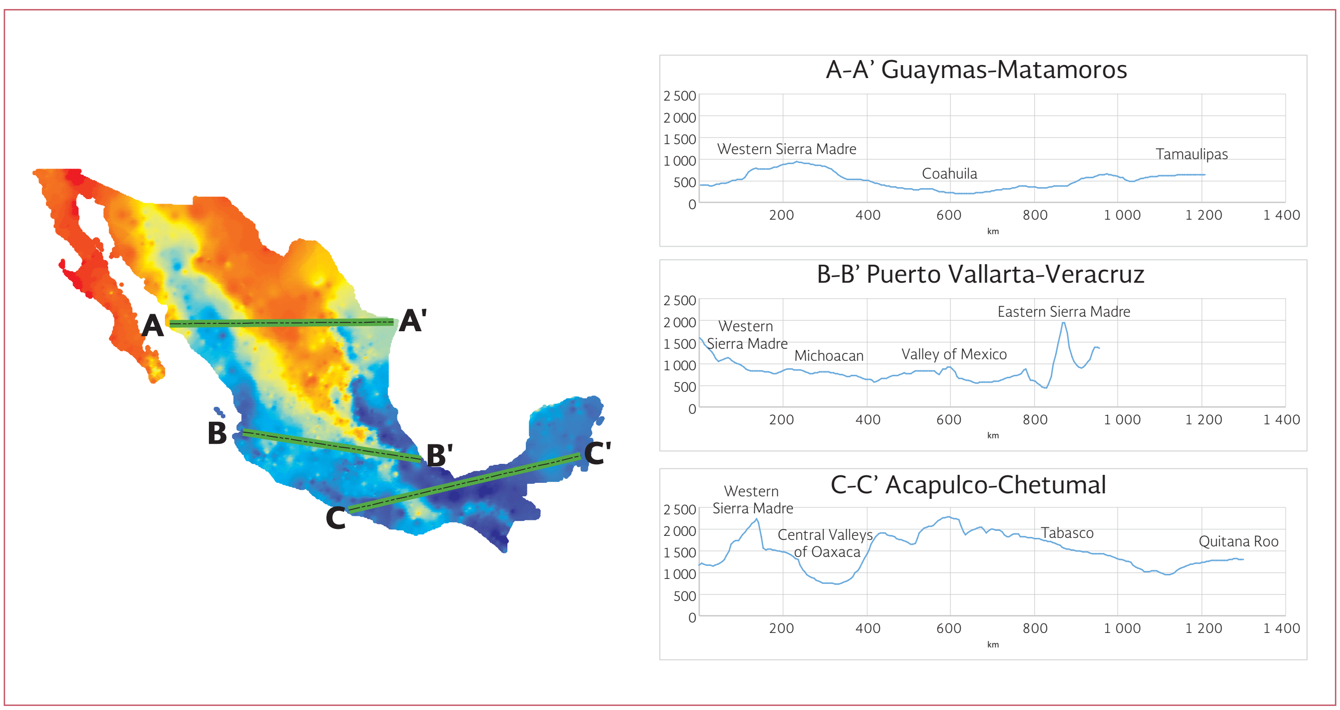
To illustrate the regional variation in rainfall, figure 2.3 shows three cross-sections that allow the normal precipitation profiles to be visualized in Guaymas-Matamoros (A-A'), Puerto Vallarta-Veracruz (B-B') and Acapulco-Chetumal (C-C'). The graphs show in blue the profile of the variation in the normal precipitation over the 1981-2010 period, throughout these cross-sections.

Figures 2.3 and 2.4 illustrate the characteristics of the distribution of precipitation in 2015 and its relation to the 1981-2010 normal precipitation. The 2015 precipitation may be compared with the 1981-2010 normal value. Map 2.2 shows the **anomaly**, meaning the difference between both precipitations. The colors scale goes from red, which means annual rain in 2015 that was lower than the 1981-2010 normal value, to blue in which the annual rainfall was higher than the normal one. As can be observed in the map, precipitation lower than the normal value occurred in general in the area that drains towards the Pacific, in the states of Guerrero, Oaxaca and Chiapas, with regional effects in the Yucatan Peninsula and parts of Veracruz and Tamaulipas. Precipitation higher than the normal value occurred mainly in Tabasco, the Papaloapan river basin between Oaxaca and Veracruz, and the Central Basins of the North.

Mexico had 872 mm of annual precipitation in 2015

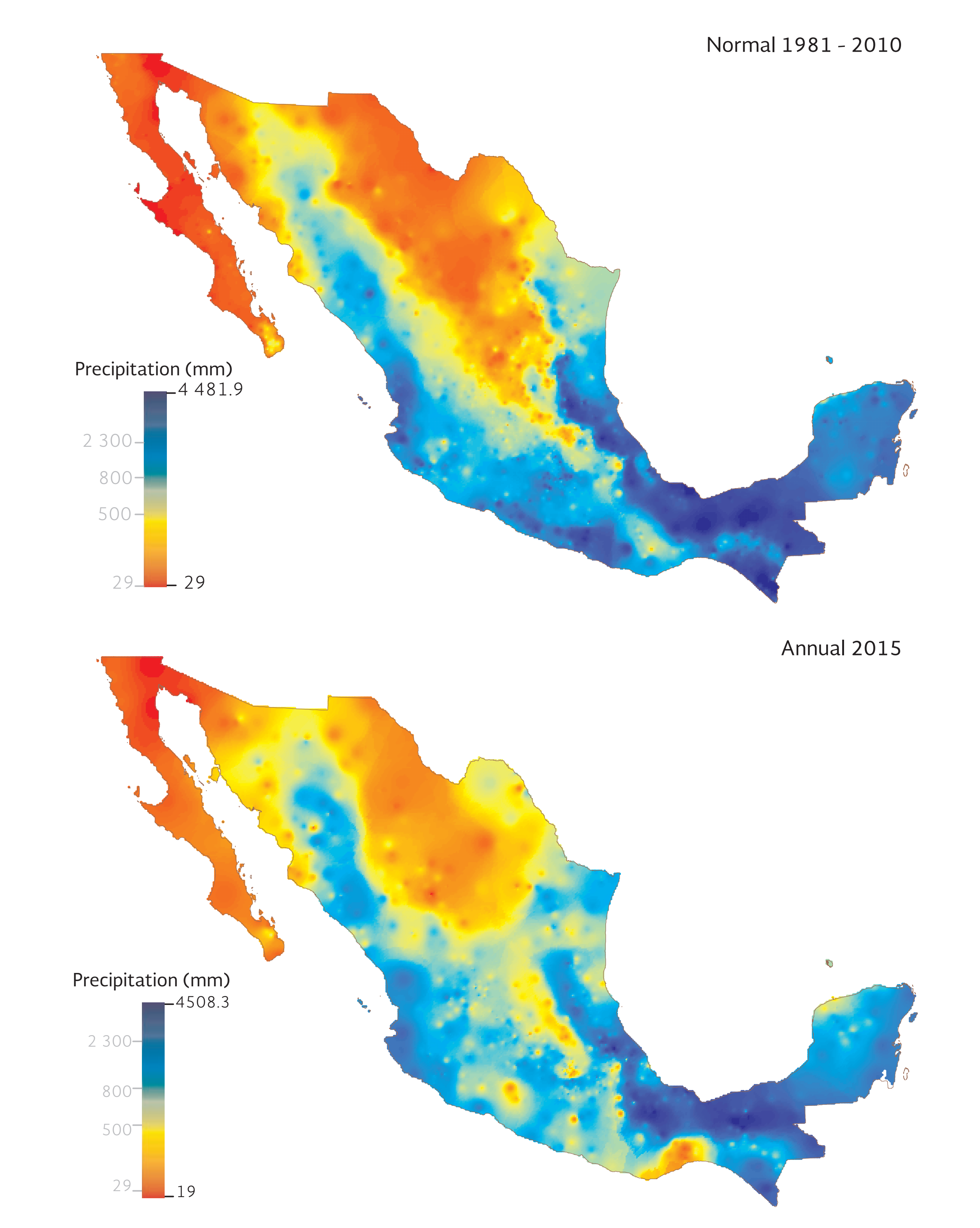
The accumulated precipitation in the Mexican Republic from January 1 to December 31, 2015, reached a sheet of 872 mm, which was 18% higher than the normal value for the 1981-2010 period (740 mm). The 2000-2015 annual series of accumulated precipitation is shown in graph 2.2.

FIGURE 2.3 Normal annual precipitation profiles 1981-2010 (mm)



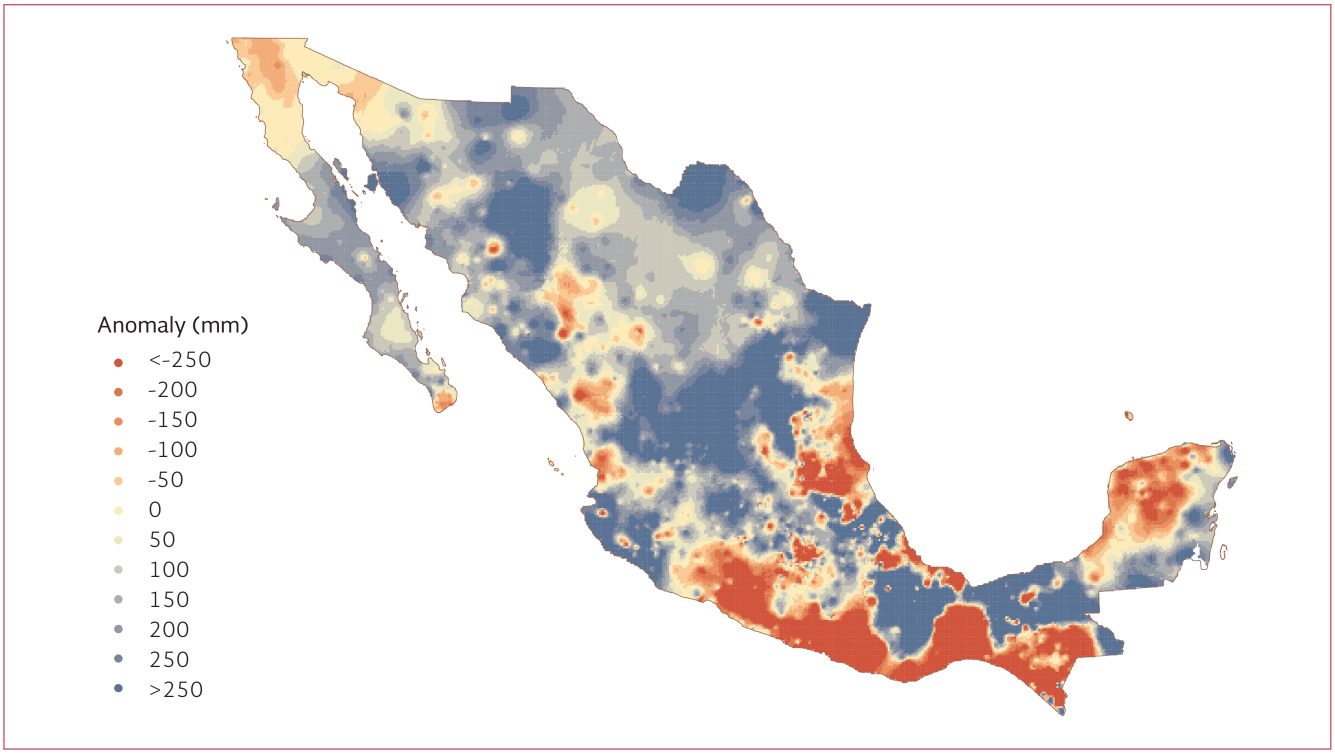
Source: Produced based on CONAGUA (2016f).

Figure 2.4 Distribution of the precipitation



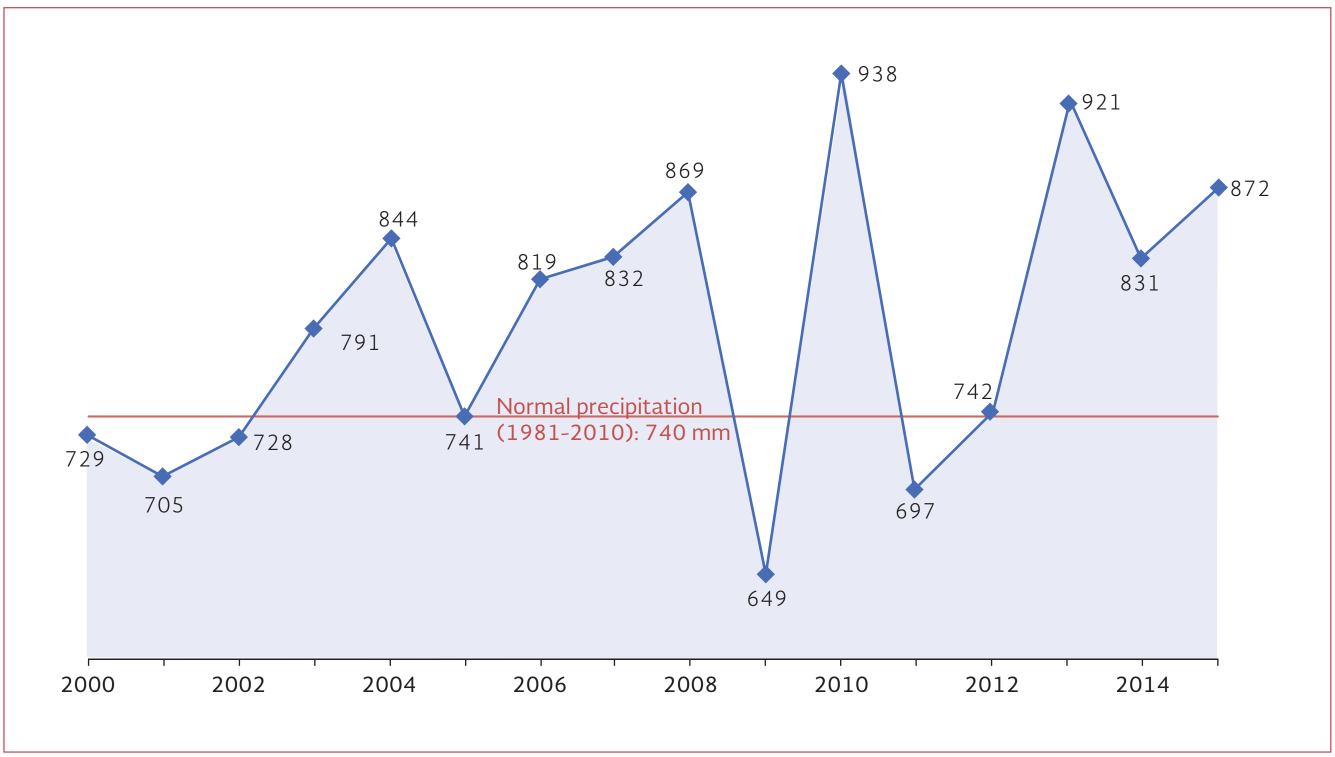
Source: Produced based on Conagua (2016f).

Map 2.2 Precipitation anomaly 2015



Source: Produced based on Conagua (2016f).

Graph 2.2 Annual precipitation, 2000-2015 (mm)



Source: Conagua (2016f).

2.3 Hydro-meteorological phenomena

Tropical cyclones

[Tablero: Ciclones tropicales]

Tropical cyclones are natural phenomena that generate most of the movement of sea humidity to the semi-arid zones of the country. In several regions of Mexico, cyclonic rains represent the majority of the annual precipitation.

Cyclones are classified according to the intensity of the maximum sustained winds. When the latter are lower than 62 km/h they are referred to as tropical depressions (TD), when they are between 63 km/h and 118 km/h, they are termed tropical storms (TS); and when they are stronger than 119 km/h, they are referred to as hurricanes (see table 2.4). In the latter case, the cloudy area covers an extension of between 500 and 900 km of diameter, producing intense rains. The eye of the hurricane normally reaches a diameter that varies between 24 and 40 km, however, it can be anything up to 100 km. Hurricanes are classified through the Saffir-Simpson scale.

Between 1970 and 2015, 224 tropical cyclones hit the coasts of Mexico. Table 2.5 presents their occurrence on the Atlantic and Pacific oceans, from which it can be observed that a greater number of cyclones have hit the Pacific coast.

In map 2.3 [Adicional: Table 2.B], the hurricanes that occurred in Mexico between 1970 and 2015 are shown. The intense hurricanes during this period (categories H3-H5) are identified with a label. In the 2015 hurricane season, the highest category that hit the Mexican coast was Patricia (H4), shown in bold.

224
tropical cyclones hit Mexico's coasts between 1970 and 2015

Table 2.4 Hurricanes and the Saffir-Simpson scale

Category	Maximum winds (km/h)	Storm tide that it normally generates (m)	Characteristics of the possible material damage and floods
H1	From 119 to 153	1.2 to 1.8	Small trees toppled; some flooding on the lowest-lying coastal highways.
H2	From 154 to 177	1.8 to 2.5	Additionally: Rooftops, doors and windows damaged; trees uprooted.
H3	From 178 to 208	2.5 to 4.0	Additionally: Cracks appear in small buildings; flooding in low-lying and flat grounds.
H4	From 209 to 251	4.0 to 5.5	Additionally: Household roofs come loose; significant erosion on beaches and river and stream channels. Imminent damage to drinking water and sanitation services.
H5	Greater than 252	Greater than 5.5	Additionally: Very severe and extensive damage to windows and doors. Total failure of roofs in many residences and industrial buildings.

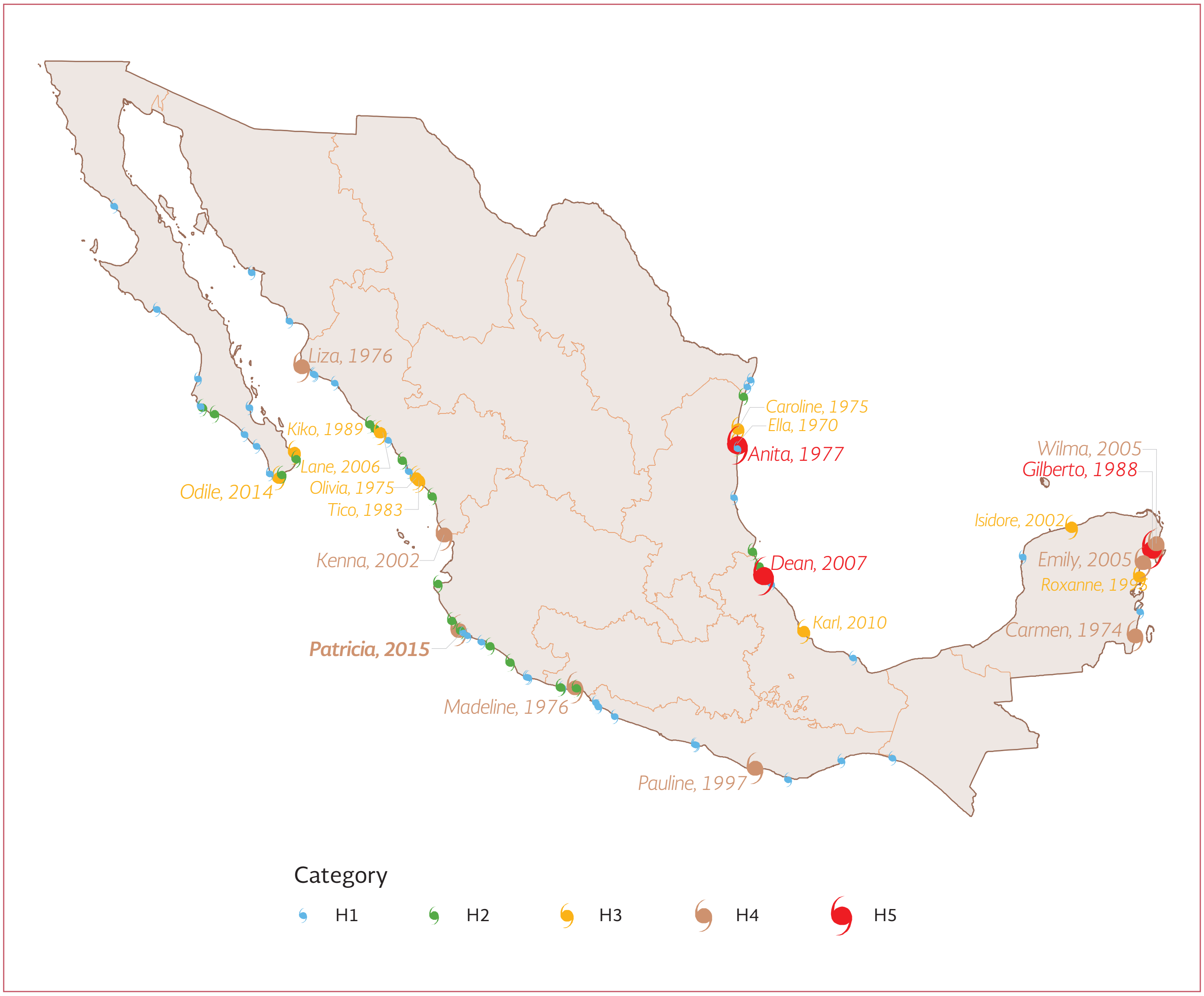
Source: Produced based on Conagua (2016a).

Table 2.5 Tropical cyclones that hit Mexico between 1970 and 2015

Ocean	Tropical depressions	Tropical storms	Moderate hurricanes (H1 and H2)	Intense hurricanes (H3-H5)	Total
Atlantic	27	31	14	12	84
Pacific	32	49	46	13	140
Total	59	80	60	25	224

Source: Produced based on Conagua (2016f).

Map 2.3 Hurricanes 1970-2015



Source: Produced based on Conagua (2016f).

Droughts

[Tablero: Sequías]

Drought is when rainfall is significantly lower than the levels normally registered, which causes serious hydrological imbalances that jeopardize agricultural production systems. When rainfall is scarce and infrequent and the temperature increases, it becomes more difficult for vegetation to develop. Droughts are the most costly natural disasters, since they affect more people than any other form of natural disaster.

In addition drought may be associated with phenomena of soil degradation and deforestation. In the drought season, the risk of forest fires increases (Inegi 2013b).

In partnership with the United States and Canada, Mexico takes part in the "North American Drought Monitor" (NADM), which analyzes climate conditions in order to continuously monitor drought at a large scale in North America. The types of droughts considered in the Monitor (Conagua 2016g) are:

- Abnormally dry (D0): This is a condition of dryness, but not a drought category. It occurs at the start or the end of a period of drought. At the start of a period of drought: due to the short-term dryness, it may lead to a delay in the sowing of annual crops, as well as a limited growth of crops or grazing areas, and there is a risk of fires. At the end of the drought period: there may continue to be a deficit of water, grazing areas or crops may not completely recover.
- Moderate drought (D1): Some damage to crops and grazing areas occurs; there is a high risk of fires, low levels in rivers, reservoirs, drinking troughs and wells, and voluntary restriction in the use of water is suggested.
- Severe drought (D2): Likely losses in crops and grazing areas, high risk of fires, water scarcity is common, restrictions should be imposed in the use of water.
- Extreme drought (D3): major losses to crops and grazing areas, the risk of forest fires is extreme, restrictions in the user of water are widespread due to its scarcity.
- Exceptional drought (D4): exceptional and widespread losses to crops and grazing areas, exceptional risk of fires, total scarcity of water in reservoirs, streams and wells, a situation of emergency is likely due to the absence of water.

The North American Drought Monitor considers

05

types of drought

Additionally, the Monitor identifies the types of the drought impact: short-term (S), typically less than six months, with possible alterations in agriculture and pastures, and long-term ones (L), typically longer than six months, with potential impacts on the regional hydrology and ecology. These impacts may be combined, meaning short- and long-term (S-L). The polygons that outline dominant impacts are also identified in the Monitor.

One moment of interest in the year is the month of May, when the dry season generally ends and the rainy season starts. In May 2015 (figure 2.5), the meteorological conditions caused important precipitations, resulting in this month being the ninth rainiest May since 1941. The rain was distributed over the northeast, centre and west of the country.

The drought occurred mainly in the northwest, with strips of D1 drought (moderate), D2 (severe) and D3 (extreme) in the state of Baja California and on the border with the United States. There were isolated areas in the southeast and south of the country classified as abnormally dry. The area affected by forest fires was 47 403 ha in the period between January and May 2015 (NADM 2016a).

Another interesting moment to review the evolution of drought is the month of November, when the rainy season generally finishes and the dry season starts. An improvement or disappearance is to be expected in the drought conditions that existed before the precipitation started.

In November 2015 (figure 2.5), above average precipitation occurred, making it the sixth wettest November since 1941. Compared to May, there was an improvement in the drought conditions in Baja California and in Yucatan. However, moderate (D1) and severe (D2) drought occurred along the country's southern coast. With lower intensity, in localized areas in Chiapas, Michoacan, the north of Hidalgo-south of Tamaulipas and in the Central Basins of the North abnormally dry (D0) and moderate (D1) drought situations occurred. The Conafor reported a surface affected by forest fires of 88 048 ha from January to November 2015 (NADM 2016b).

Area affected by forest fires
88 048
hectares, from January to November 2015

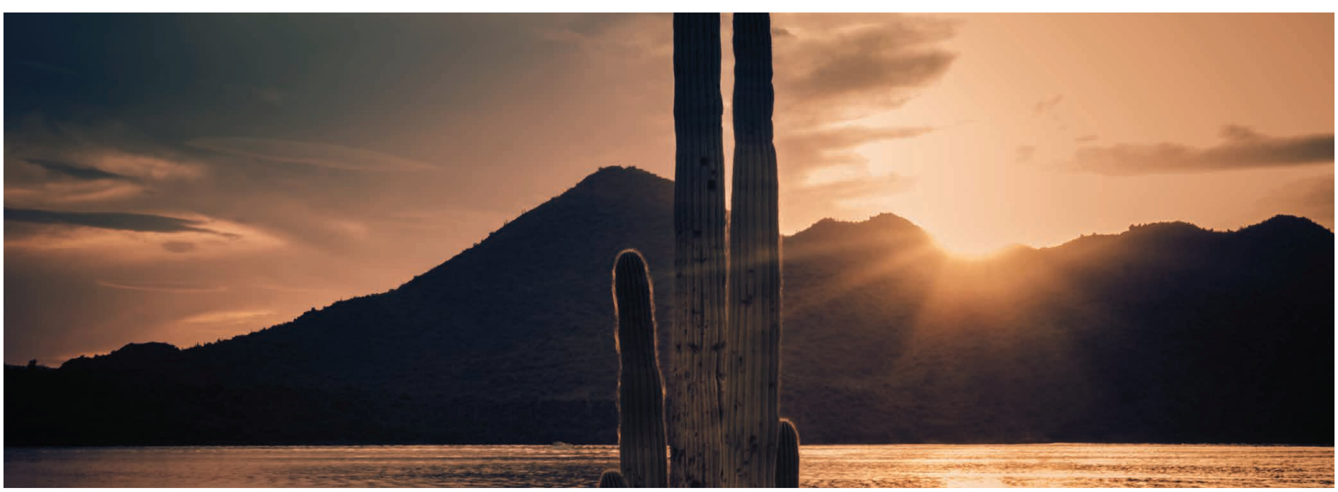
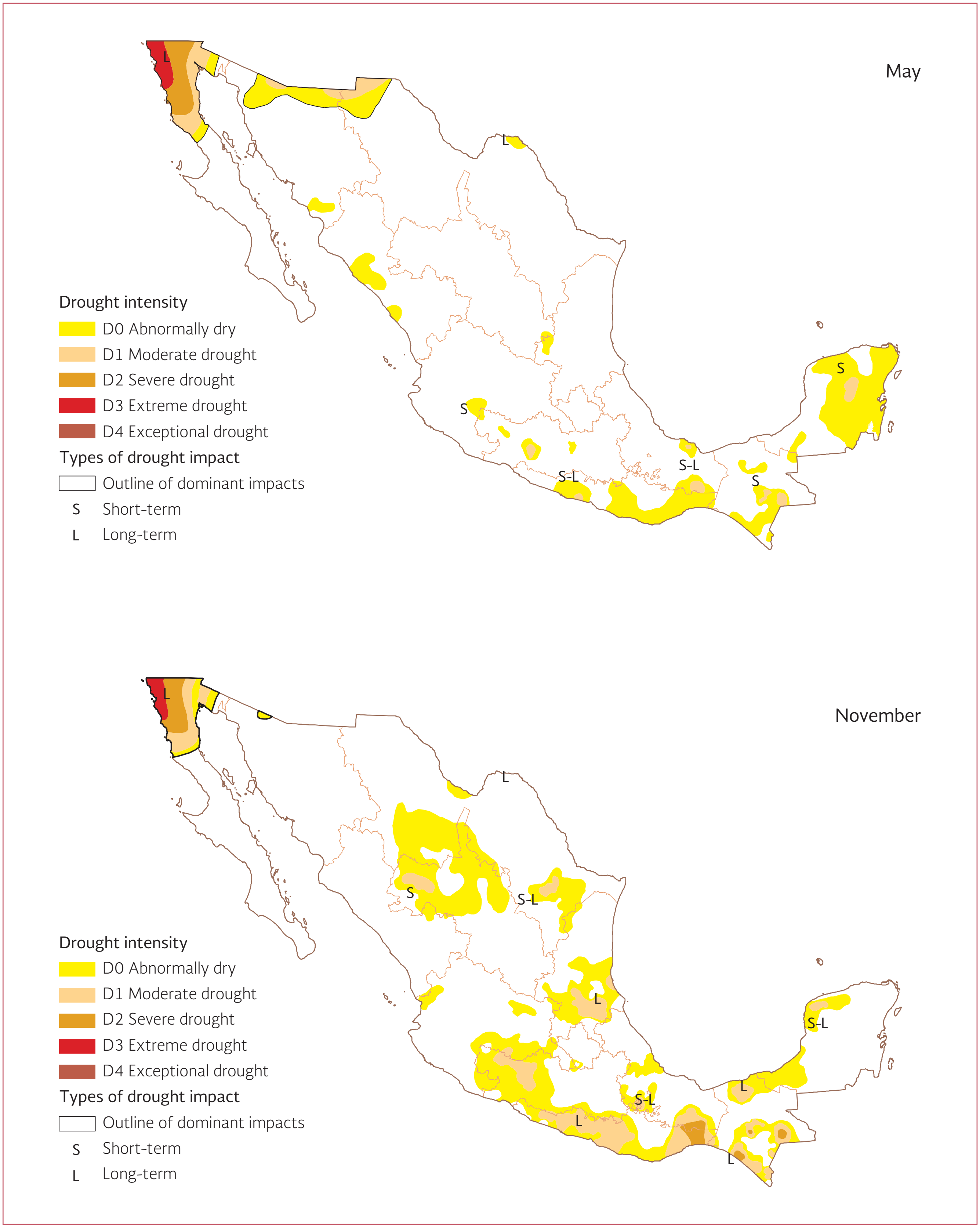


FIGURE 2.5 Drought conditions, 2015



Source: Produced based on CONAGUA (2016f), NADM (2016a), NADM (2016b).

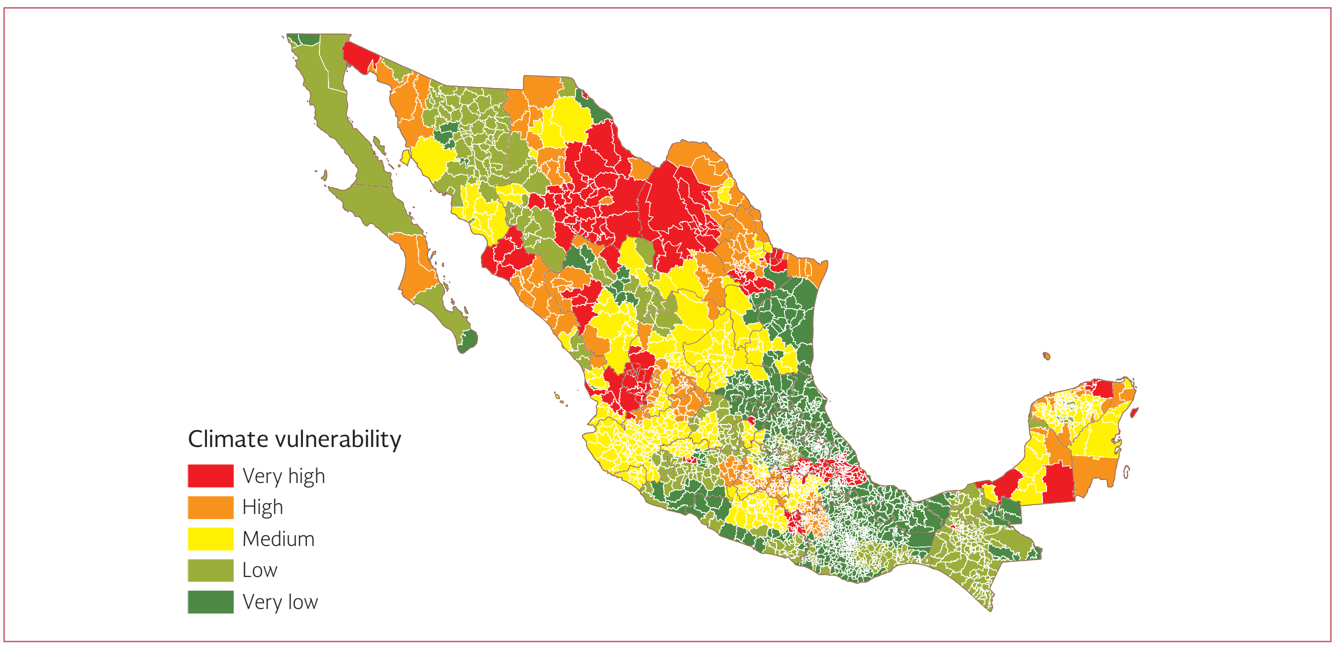
Effects of hydro-meteorological phenomena

Both drought and intense precipitation, in addition to factors such as topography, soil use and the status of vegetation cover, may cause impacts on society and economic activities.

Considering the effect of global phenomena such as “El Niño-Southern Oscillation”[5] and climate change, within the framework of the National Program against Drought (Pronacose), the Conagua analyzed overall climate vulnerability in 2012 at the level of planning cells (groups of municipalities belonging to a single state within the limits of a hydrological region). The **vulnerability** of each planning cell was estimated based on a three-component model: the degree of exposure (the quantification of the difficulty of a planning cell to meet demand in 2030), sensitivity (population in 2030, estimation of the impact in commercial and industrial economic activities, and the impact in agriculture) and adaptation capacity (degree of drafting of aquifers). Map 2.4 shows this estimation of vulnerability.

In Mexico there are procedures in place for the issuing of declarations[6] as a result of these phenomena of drought[7] or intense precipitation, in categories which describe their effects. Climate **contingencies** are affectations on productive activities, **emergencies** imply risks to life and public health, whereas **disasters** focus the state’s and society’s resources on the reconstruction of the affected areas.

Map 2.4 Climate vulnerability at the planning cell level, 2012



Source: Conagua (2016b).

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5 The term “El Niño” originally applied to the warming of the sea surface temperature (TSS) on the coasts of Peru and Ecuador, close to Christmas time. It has been observed that this warming affects an extensive region of the Pacific along the Equator, modifying global climate patterns. Now referred to as “El Niño-Southern Oscillation” (ENSO), it presents three phases: warm (El Niño), cold (La Niña) and neutral (Conagua 2015b).

6 The declarations make it possible to employ resources from public programs to attend these impacts.

7 It is worth mentioning that the drought reported in the NADM is established with a different methodology to the one used for the declarations.

2.4 Surface water

Rivers

[Tablero: Ríos principales]

Mexico's rivers and streams constitute a 633 000 kilometer long hydrographic network, in which fifty one main rivers stand out, through which 87% of the country's surface runoff flows, and whose catchments cover 65% of the country's mainland surface area (map 2.5).

For their **surface area**, the catchments of the Rio Grande and Balsas river stand out, as do the Rio Grande and Grijalva-Usumacinta river for their **length**. The Lerma and Nazas-Aguanaval are inland-flowing rivers. In tables 2.6, 2.7 and 2.8, the most relevant data on Mexico's main rivers is shown, according to the water body into which they flow. It should be mentioned that the mean natural surface runoff represents the mean annual value of its historical registry and the maximum stream order was determined according to the Strahler method. In the case of transboundary catchments, the area and length of the river correspond to the Mexican side of the watershed, strictly speaking the catchment itself.

Rivers and streams constitute a hydrographic network of

633 000 km

Map 2.5 Mexico's main rivers

Source: Conagua (2016d).

Table 2.6 describes the rivers which flow into the Pacific and Gulf of California. For the transboundary catchments (Colorado, Suchiate, Coatan and Tijuana) the mean natural surface runoff includes the inflows from other countries, with the exception of the Tijuana river, the runoff from which only corresponds to the Mexican share.

Table 2.6 Characteristics of the main rivers that flow into the Pacific and Gulf of California, ordered by their mean natural surface runoff, 2015

Number	River	HAR number	Mean natural surface runoff (hm³/year)	Catchment area (km²)	Length of the river (km)	Maximum order
1	Balsas	IV	16 279	117 406	770	7
2	Santiago	VIII	7 423	76 416	562	7
3	Verde	V	6 046	18 812	342	6
4	Ometepec	V	5 100	6 922	115	4
5	El Fuerte	III	5 024	33 590	540	6
6	Papagayo	V	4 288	7 410	140	6
7	San Pedro	III	3 347	26 480	255	6
8	Yaqui	II	3 179	72 540	410	6
9	Culiacan	III	3 122	15 731	875	5
10	Suchiate	XI	1 584	203	75	2
11	Ameca	VIII	2 205	12 214	205	5
12	Sinaloa	III	2 100	12 260	400	5
13	Armeria	VIII	1 805	9 795	240	5
14	Coahuayana	VIII	1 732	7 114	203	5
15	Colorado	I	1 928	3 840	160	6
16	Baluarte	III	1 830	5 094	142	5
17	San Lorenzo	III	1 665	8 919	315	5
18	Acaponeta	III	1 433	5 092	233	5
19	Piaxtla	III	1 406	11 473	220	5
20	Presidio	III	1 084	6 479	NA	4
21	Mayo	II	1 222	15 113	386	5
22	Tehuantepec	V	901	10 090	240	5
23	Coatan	XI	934	605	75	3
24	Tomatlan	VIII	1 166	2 118	NA	4
25	Marabasco	VIII	503	2 526	NA	5
26	San Nicolas	VIII	487	2 330	NA	5
27	Elota	III	463	2 324	NA	4
28	Sonora	II	412	27 740	421	5
29	Concepcion	II	113	25 808	335	2
30	Matape	II	89	6 606	205	4
31	Tijuana	I	95	3 231	186	4
32	Sonoyta	II	20	7 653	311	5
33	Huicicila	VIII	470	1 194	50	NA
	Total		**79 453**	**565 128**		

Note: The length of the Suchiate River belongs to the border between Mexico and Guatemala.
The runoff from the Colorado River considers the inflow as per the 1944 Water Treaty.
NA: Not Available.
Source: Conagua (2016b).

Table 2.7 describes the rivers that flow into the Gulf of Mexico and the Caribbean Sea. For the transboundary catchments (Grijalva-Usumacinta, Grande, Candelaria and Hondo), the mean natural surface runoff includes the inflows from other countries, with the exception of the Rio Grande and Hondo river, the runoff from which only corresponds to the Mexican share.

Table 2.8 describes the inland-flowing rivers. Lerma River, which flows out into Lake Chapala, is one of these rivers.

Table 2.7 Characteristics of the main rivers that flow into the Gulf of Mexico and Caribbean Sea, ordered by their mean natural runoff, 2015

Number	River	HAR number	Mean natural surface runoff (hm³/year)	Catchment area (km²)	Length of the river (km)	Maximum order
34	Grijalva-Usumacinta	XI	101 517	83 553	1 521	7
35	Papaloapan	X	42 887	46 517	354	6
36	Coatzacoalcos	X	28 679	17 369	325	5
37	Panuco	IX	19 673	84 956	510	7
38	Tecolutla	X	6 098	7 903	375	5
39	Bravo	VI	5 588	225 242	NA	7
40	Tonala	X	3 955	5 679	82	5
41	Nautla	X	2 218	2 785	124	4
42	La Antigua	X	2 145	2 827	139	5
43	Tuxpan	X	2 072	5 899	150	4
44	Jamapa	X	2 055	4 061	368	4
45	Soto La Marina	IX	1 999	21 183	416	6
46	Candelaria	XII	1 861	13 790	150	4
47	Cazones	X	1 712	2 688	145	4
48	San Fernando	X	1 573	17 744	400	5
49	Hondo	XII	576	7 614	115	4
	Total		**224 608**	**549 810**		

Note: The length reported for the Hondo River belongs to the border between Mexico and Belize.
NA: Not Available
Source: Conagua (2016b).

Table 2.8 Characteristics of the main inland-flowing rivers, ordered by the mean natural surface runoff, 2015

Number	River	HAR number	Mean natural surface runoff (hm³/year)	Catchment area (km²)	Length of the river (km)	Maximum order
50	Lerma	VIII	4 742	47 116	708	6
51	Nazas-Aguanaval	VII	2 085	89 239	1 081	7
	Total		**6 827**	**136 355**		

Source: Conagua (2016b).

Mexico's transboundary catchments

Mexico shares eight catchments with its neighboring countries: three with the United States of America (Grande, Colorado and Tijuana), four with Guatemala (Grijalva-Usumacinta, Suchiate, Coatan and Candelaria) and one with both Belize and Guatemala (Hondo river), the data on which is presented in figure 2.6 and table 2.9. The data on mean natural surface runoff and the catchment area in table 2.9 was obtained from available hydrological studies

The waters of the Colorado and Tijuana rivers and the Rio Grande are shared between Mexico and the United States of America according to the indications of the "Water Treaty" signed in Washington, D.C. on February 3, 1944.

In the case of the **Colorado** river, the treaty specifies that the United States of America should deliver 1 850.2 million cubic meters (1.5 million acre feet) every year to Mexico. The annual series of this delivery from 1945 to 2015 is shown in graph 2.3.

United States of America should deliver

1 850.2

hm³ in the Colorado river every year

FIGURE 2.6 Transboundary catchments

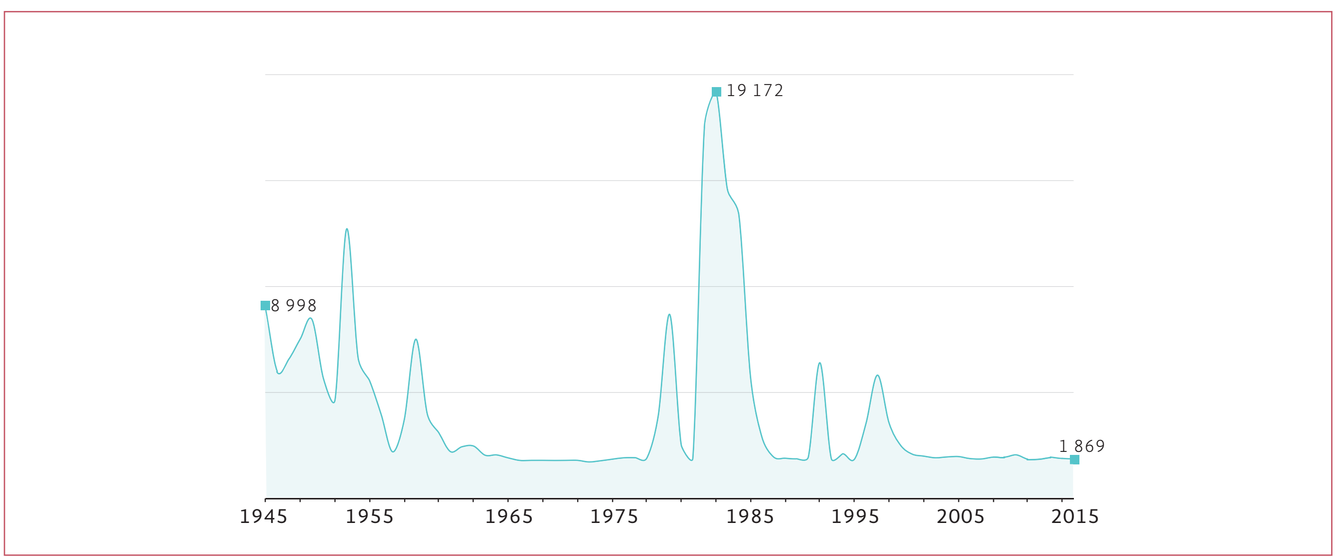
Source: Produced based on CEC (2016), USGS (2016a), USGS (2016b), VITO (2014).

TABLE 2.9 Characteristics of the main rivers with transboundary catchments, 2015

Number	River	HAR number	HAR	Country	Mean natural surface runoff (hm³/year)		Catchment area (km²)	Length of the river (km)	
1	Suchiate	XI	XI Southern Border	Mexico	291		203	75	a
				Guatemala	1 294		1 048	60	
2	Colorado	I	I Baja California Peninsula	Mexico	78		3 840	160	
				USA	1 850	*	626 943	2 140	
				Bi-national	NA		NA	37	
3	Coatan	XI	XI Southern Border	Mexico	642		605	75	
				Guatemala	292		280	12	
4	Tijuana	I	I Baja California Peninsula	Mexico	78		3 231	186	
				USA	17		1 221	9	
5	Grijalva-Usumacinta	XI	XI Southern Border	Mexico	57 697		83 553	1 521	
				Guatemala	43 820		44 837	390	
6	Bravo	VI	VI Rio Bravo	Mexico	5 588		225 242	-	
				USA	74	*	241 697	1 074	
				Bi-national	NA		NA	2 034	
7	Candelaria	XII	XII Yucatan Peninsula	Mexico	1 600		13 790	150	
				Guatemala	261		1 558	8	
8	Hondo	XII	XII Yucatan Peninsula	Mexico	576		7 614	115	b
				Guatemala	-		2 873	45	
				Belize	-		2 978	16	

Note: [a] The 75 km belong to the border between Mexico and Guatemala. [b] The 115 km belong to the border between Mexico and Belize.
* Volumes delivered to Mexico. NA: Not Applicable.
Source: CONAGUA (2016b).

GRAPH 2.3 Volume delivered from the Colorado river (hm³)



Source: CONAGUA (2016b).

For the Tijuana River, the treaty only establishes that both countries, through the International Boundary and Water Commission (IBWC), will make recommendations for the equitable sharing of its waters; will draw up projects for storage infrastructure and flood control; and estimate the costs and build the infrastructure that is agreed upon, sharing the construction and operation costs equitably.

As regards the Rio Grande (called the Río Bravo in Mexico), table 2.10 describes the distribution of its waters as defined in the treaty.

Three considerations are established regarding the six Mexican channels previously mentioned in table 2.10, which should be highlighted:

1. The volume that Mexico should provide to the United States of America, as part of the third of the volume in the six aforementioned Mexican channels, shall not be less on the whole, as an average amount and in cycles of five consecutive years, than 431.72 million cubic meters (350 000 acre feet) per year, or the equivalent of supplying a minimum volume of 2 158.6 million cubic meters (1 750 000 acre feet) in each cycle.
2. In the event of extraordinary drought or serious accident in the hydraulic systems on the measured Mexican tributaries, making it difficult for Mexico to make available the run-off of 431.72 million cubic meters annually, any shortfall existing at the end of the aforesaid five-year cycle shall be made up in the following five-year cycle with water from the aforementioned tributaries.
3. If the capacity assigned to the United States of America in the international reservoirs shared by both countries (La Amistad and Falcon) is filled with waters belonging to the United States, the five-year cycle shall be considered as terminated and all volumes pending delivery fully covered, whereupon a new five-year cycle shall commence.

In terms of the capacities in these reservoirs, the allocations by country are shown in table 2.11.

Table 2.11 Capacities assigned in the international reservoirs (hm^3)

Country	La Amistad	Falcon
Mexico	1 770	1 352
United States of America	2 271	1 913

Source: Conagua (2016b).

Table 2.10 Distribution of the waters in the Rio Grande according to the 1944 Treaty

The United Mexican States' share	The United States of America's share
All of the runoff from the Alamo and San Juan rivers	All of the runoff from the Pecos and Devils rivers, Goodenough spring and Alamito, Terlingua, San Felipe and Pinto streams.
Two thirds of the water that flows into the main channel of the Rio Grande from the following six Mexican channels: the Conchos, San Diego, San Rodrigo, Escondido and Salado rivers and the Las Vacas stream.	One third of the water that flows into the main channel of the Rio Grande from the following six Mexican channels: the Conchos, San Diego, San Rodrigo, Escondido and Salado rivers, and the Las Vacas stream.
One half of all unassigned flows in the Treaty that reach the main channel, between Quitman and Falcon.	One half of all unassigned flows in the Treaty that reach the main channel, between Quitman and Falcon.
One half of the runoff from the Rio Grande watershed, downstream from Falcon.	One half of all unassigned flows in the Treaty that reach the main channel, between Quitman and Falcon.

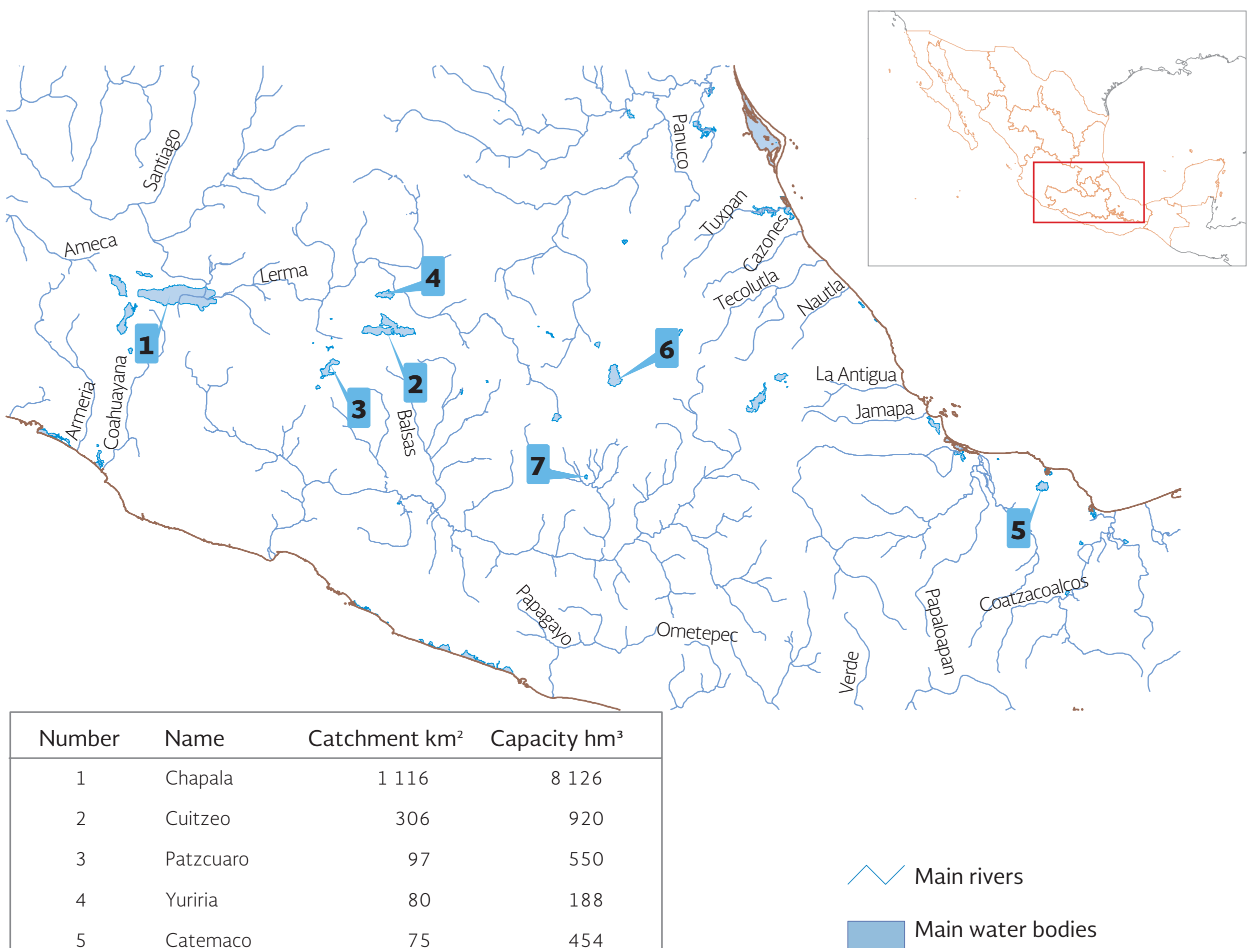
Source: IBWC (2016).

Mexico’s main lakes

[Tablero: Lagos principales]

Figure 2.7 shows some of Mexico’s main lakes in the central area of the country, due to the extension of their own catchment [Adicional: Table 2.C]. The data presented corresponds to the available hydrological studies and the catchment area corresponds to the water bodies’ own catchment. Lake Chapala is the biggest inland lake in Mexico, with a depth that varies between four and six meters. Its importance lies in the fact that it constitutes one of the main sources of supply for the Metropolitan Area of Guadalajara. The behavior of its volumes stored per year is shown in graph 2.4.

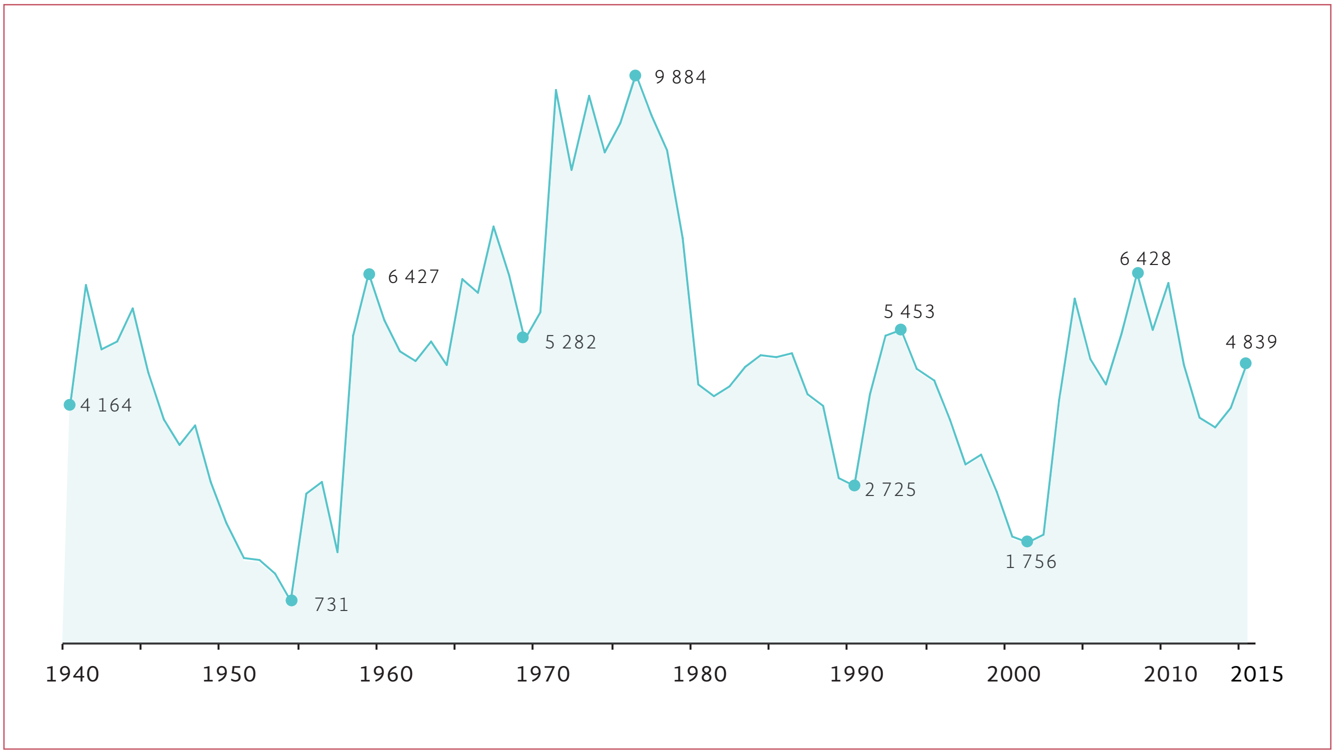
FIGURE 2.7 Main lakes in the central area



Number	Name	Catchment km²	Capacity hm³
1	Chapala	1 116	8 126
2	Cuitzeo	306	920
3	Patzcuaro	97	550
4	Yuriria	80	188
5	Catemaco	75	454
6	Dr. Nabor Carrillo	10	12
7	Tequesquitengo	8	160

Source: CONAGUA (2016b).

Graph 2.4 Volume stored in Lake Chapala (hm³)



Note: The values indicated are as of December 31 of every year.
Source: Conagua (2016b).

2.5 Groundwater

[Tablero: Acuíferos]

Groundwater plays an increasingly important role in the country's socio-economic growth, due to its physical characteristics which allow it to be used for a number of different purposes, since it works as a storage dam and distribution network, it being possible to extract water at any point of the year from practically any point of the surface above the aquifer. It also works as a purifying filter, preserving water quality.

The importance of groundwater is manifest due to the magnitude of the volume employed by the main users. 38.9% of the total volume allocated for offstream uses (33 311 hm^3 per year in 2015) comes from groundwater sources. As already mentioned, for the purpose of groundwater management, the country has been divided into 653 aquifers, the official names of which were published in the Official Government Gazette (DOF) on December 5, 2001.

From that point onwards a process of outlining and studying the aquifers commenced, in order to officially make their mean natural availability public, following the official Mexican standard NOM-011-CONAGUA-2000. As of December 31, 2015, the availability of groundwater in all 653 aquifers had been published in the DOF.[8] It is worth highlighting the publication on December 20, 2013 of the updated calculation of availability of all the nation's aquifers.

Availability is a basic indicator for the preservation of the resource through the management of the nation's water resources, by means of the instruments of concession or allocation of rights for the use of the nation's water resources, as well as regulatory measures for the use of aquifers, such as the suspension of free extraction (meaning a suspension of the free extraction of the nation's groundwater) prohibition zones, regulations, regulated zones and reserve zones (figure 2.8 and section 5.2 Legal framework for the use of water in Mexico). 448 aquifers in Mexico have a condition of availability.

There are
653
aquifers in Mexico

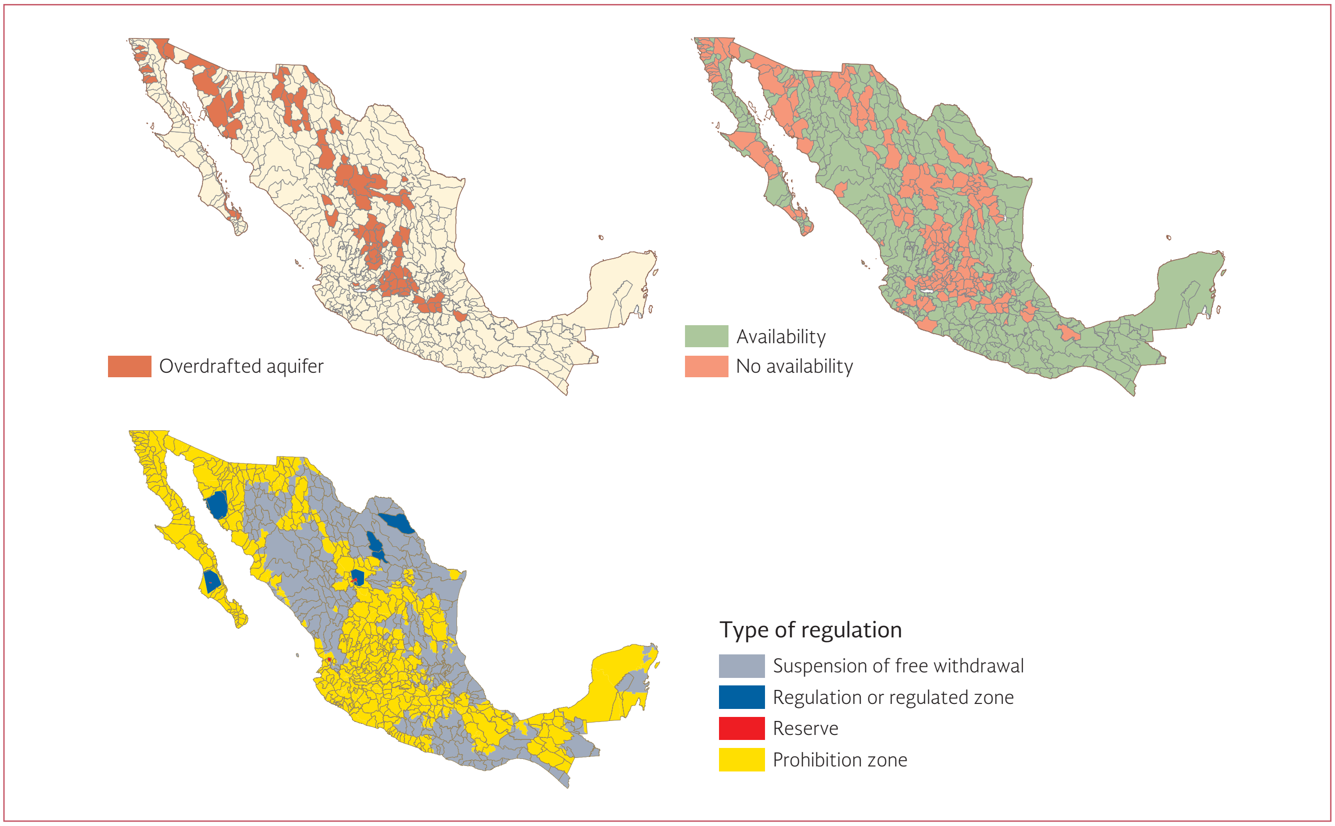
Overdrafting of aquifers

Based on the process of identification, outlining, studying and calculation of availability, which started in 2001, the number of overdrafted aquifers has varied every year from 100 to 106. As of December 31, 2015, it was reported that there were 105 overdrafted aquifers (figure 2.8). According to the results of recent studies, it is defined whether aquifers are considered overdrafted or cease to be so, based on the extraction/recharge ratio.

The statistics on aquifers are presented in table 2.12.

8 Availability of groundwater: The mean annual volume of groundwater that can be withdrawn from a hydrogeological unit for different uses, in addition to the extractions already allocated and the natural discharge committed, without jeopardizing the balance of ecosystems.

Figure 2.8 Aquifers, 2015



Source: Conagua (2016b).

Table 2.12 Mexico's aquifers, 2015

HAR number	Number of aquifers				Mean recharge (hm^3)
	Total	Overdrafted	With saltwater intrusion	Under the phenomena of soil salinization and brackish groundwater	
I	88	14	11	5	1 658
II	62	10	5		3 207
III	24	2			3 076
IV	45	1			4 873
V	36				1 936
VI	102	18		8	5 935
VII	65	23		18	2 376
VIII	128	32			9 656
IX	40	1			4 108
X	22				4 599
XI	23				22 718
XII	4		2	1	25 316
XIII	14	4			2 330
Total	**653**	**105**	**18**	**32**	**91 788**

Source: Conagua (2016b).

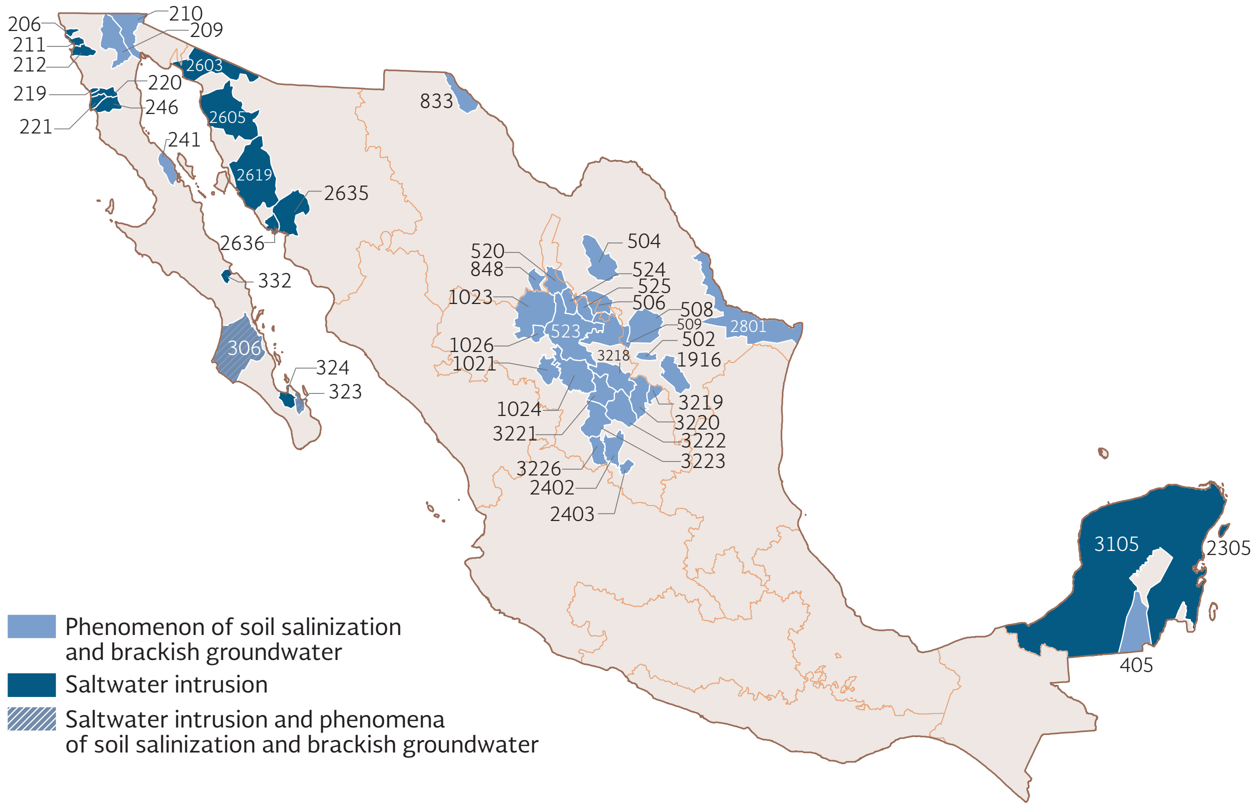
Aquifers with saltwater intrusion and/or suffering from the phenomena of soil salinization and brackish groundwater

Soil salinization and the presence of brackish groundwater occur as a result of high indices of evaporation in areas with shallow groundwater levels, the dissolution of evaporite minerals and the presence of high-salinity connate water. Brackish water occurs specifically in those aquifers located in geological provinces characterized by sedimentary formations that are ancient, shallow, of marine origin and evaporite, in which the interaction of groundwater with the geological material produces the higher salt content.

Up to the end of 2015, 32 aquifers with the presence of saline soils and brackish water had been identified, mainly located in the Baja California Peninsula and in the Mexican Plateau, which combine conditions of limited precipitation, high indices of solar radiation and thus evaporation, as well as the presence of connate water and easily-dissolved evaporite minerals.

In the same year, saltwater intrusion had occurred in 18 coastal aquifers nationwide, as shown in figure 2.9.

Figure 2.9 Aquifers with saltwater intrusion and/or soil salinization and brackish groundwater, 2015



Code	Aquifer
206	La Mision
209	Salada Lagoon
210	Mexicali Valley
211	Ensenada
212	Maneadero
219	Camalu
220	Colonia Vicente Guerrero
221	San Quintin
241	Agua Amarga
246	San Simon
306	Santo Domingo
323	Los Planes
324	La Paz
332	Mulege
405	Xpujil
502	Cañon del Derramadero

Code	Aquifer
504	Cuatrocienegas-Ocampo
506	El Hundido
508	Paredon
509	La Paila
520	Laguna del Rey-Sierra Mojada
523	Principal-Region Lagunera
524	Acatita
525	Las Delicias
833	Juarez Valley
848	Palomas Lagoon
1021	Pedriceña - Velardeña
1023	Ceballos
1024	Oriente Aguanaval
1026	Vicente Suarez
1916	Navidad-Potosi-Raices
2305	Isla de Cozumel

Code	Aquifer
2402	El Barril
2403	Salinas de Hidalgo
2603	Sonoyta - Puerto Peñasco
2605	Caborca
2619	Hermosillo Coast
2635	Guaymas Valley
2636	San Jose de Guaymas
2801	Lower Rio Grande
3105	Yucatan Peninsula
3218	Cedros
3219	El Salvador
3220	Guadalupe Garzaron
3221	Camacho
3222	El Cardito
3223	Guadalupe de las Corrientes
3226	Chupaderos

Source: Produced based on Conagua (2016b).

2.6 Water quality

[Tablero: Calidad del agua, Playas limpias]

Water quality is determined through the physical and chemical characterization of water samples and their comparison with quality standards. In this way, it can be determined if the water is ideal for the quality requirements associated with a given use, for example for human consumption or the environment, and the possible treatment processes required to remove undesirable or risky elements (UN 2016). The deterioration in water quality occurs as a result of both natural and anthropogenic processes.

Monitoring of water quality

In 2015, the National Monitoring Network had 4 999 sites, distributed throughout the country, as described in table 2.13.

In addition to the physical-chemical and microbiological parameters monitored by the Network, biological monitoring has been carried out since 2005 in some regions of the country, which allows water quality to be evaluated, using simple low-cost methods, such as the benthic organism diversity index. The results of these activities as of 2015 are shown in table 2.14.

The water quality monitoring network had

4 999

sites in 2015

Table 2.13 Sites in the National Monitoring Network, 2015

Network	Area	Sites (number)
Surface water	Surface water bodies	2 706
Groundwater	Groundwater bodies	1 065
Special studies	Surface water bodies	32
Coastal	Coastal zones	920
Surface water discharges		267
Groundwater discharges		9
Total		**4 999**

Source: Conagua (2016b).

Table 2.14 Samples for biological monitoring, 2015

	HAR	Number of samples
IV	Balsas	66
VI	Rio Bravo	39
VII	Central Basins of the North	10
VIII	Lerma-Santiago-Pacific	9
IX	Northern Gulf	3
X	Central Gulf	5
Total		**132**

Source: Conagua (2016b).

Evaluation of water quality

The evaluation of water quality is carried out by using three indicators: five-day Biochemical Oxygen Demand (BOD_5), Chemical Oxygen Demand (COD) and Total Suspended Solids (TSS).

BOD_5 and COD are used to determine the quantity of organic matter present in water bodies, mainly from municipal and non-municipal wastewater discharges.

BOD_5 determines the quantity of biodegradable organic matter, whereas COD measures the total quantity of organic matter. The increase in the concentration of these parameters has an impact on the decrease of the dissolved oxygen content in water bodies with the consequent affectation of aquatic ecosystems.

Additionally, the increase in COD indicates the presence of substances coming from non-municipal discharges containing non-biodegradable organic matter.

TSS measure the quantity of sedimentable solids, solids and organic matter that are in suspension and/or colloidal. They originate in wastewater and soil erosion. The increase in the levels of TSS results in the water body losing its capacity to support the diversity of aquatic life. These parameters allow gradients to be recognized that range from a relatively normal condition or with no influence of human activity, to water that shows significant signs or manifestations of municipal and non-municipal wastewater discharges, as well as areas with severe deforestation.

It should be mentioned that the water quality monitoring sites are situated in areas with a high anthropogenic influence. The water quality classification scale is shown in [Adicional: Table 2.D].

The evaluation for 2015 of the water quality indicators was carried out according to the terms established in table 2.15, with the results recorded in the following maps and tables (maps 2.6, 2.7 and 2.8; tables 2.16, 2.17 and 2.18).

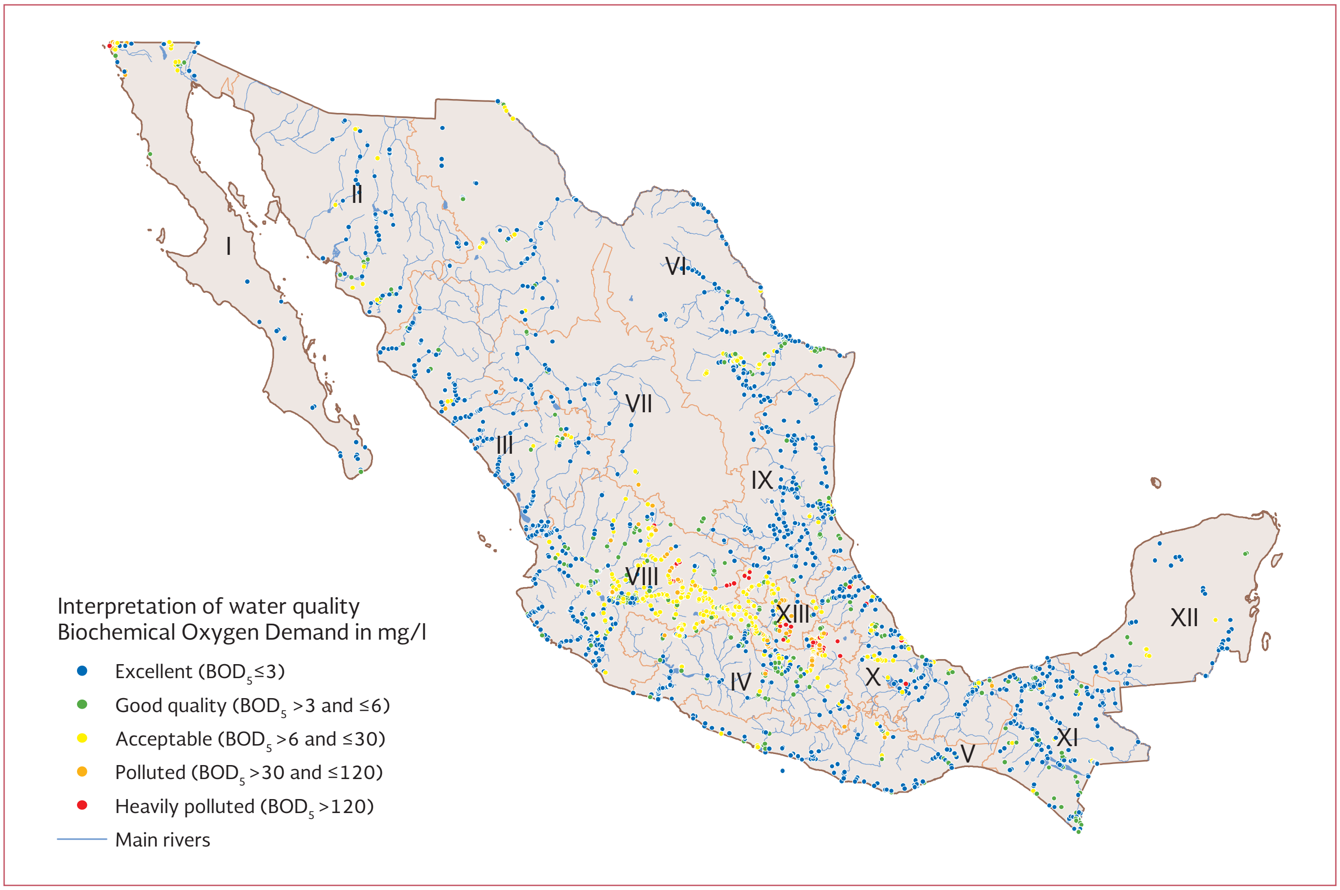
55.9% of the sites monitored for BOD_5 had **excellent** quality in 2015

Table 2.15 Number of monitoring sites with data for each water quality indicator, 2015

Water quality indicator	Number of monitoring sites
Biochemical Oxygen Demand (BOD_5)	2 766
Chemical Oxygen Demand (COD)	2 766
Total Suspended Solids (TSS)	3 766

Source: Conagua (2016b).

Map 2.6 Water quality: Biochemical Oxygen Demand (BOD_5), 2015



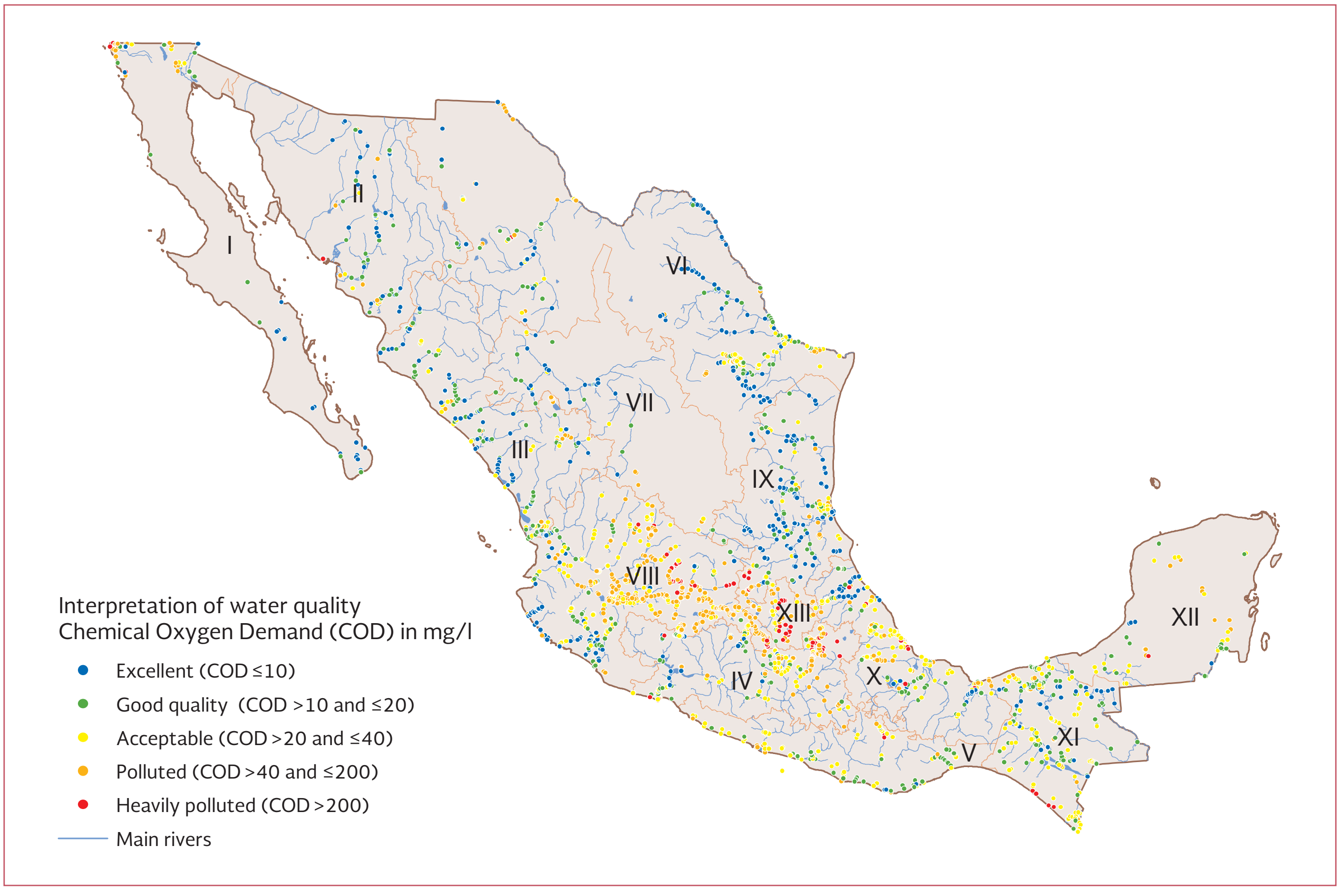
Source: Conagua (2016b).

Table 2.16 Percentage distribution of monitoring sites in surface water bodies by hydrological-administrative region, according to the BOD_5 indicator, 2015

HAR number	Excellent	Good quality	Acceptable	Polluted	Heavily polluted
I	48.8	9.5	31.0	9.5	1.2
II	73.8	13.1	11.9	0.0	1.2
III	86.0	8.4	4.7	0.9	0.0
IV	40.1	18.8	19.6	14.2	7.4
V	76.8	13.4	6.3	3.5	0.0
VI	68.0	15.1	15.5	1.4	0.0
VII	75.5	18.4	2.0	4.1	0.0
VIII	32.3	15.1	41.7	8.3	2.6
IX	73.0	9.9	12.7	1.2	3.2
X	55.0	17.2	19.8	5.0	3.1
XI	72.0	21.5	4.2	2.3	0.0
XII	81.1	7.5	11.3	0.0	0.0
XIII	13.3	17.3	36.0	24.0	9.3
National	**55.9**	**15.0**	**20.6**	**6.0**	**2.5**

Source: Conagua (2016b).

Map 2.7 Water quality: Chemical Oxygen Demand (COD), 2015



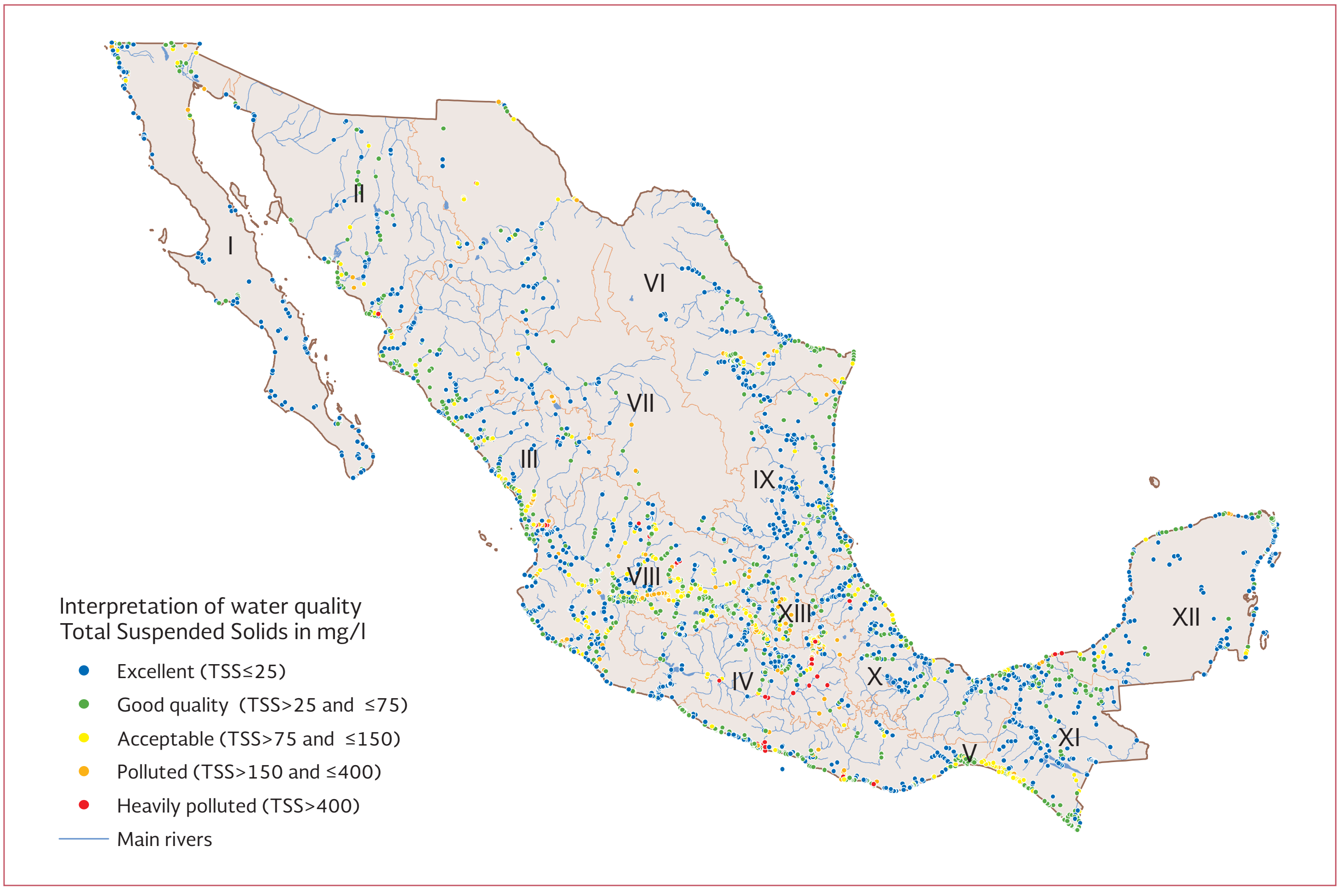
Source: Conagua (2016b).

Table 2.17 Percentage distribution of monitoring sites in surface water bodies by hydrological-administrative region, according to the COD indicator, 2015

HAR number	Excellent	Good quality	Acceptable	Polluted	Heavily polluted
I	28.6	19.0	8.3	38.1	6.0
II	42.9	35.7	9.5	9.5	2.4
III	33.2	37.4	18.2	11.2	0.0
IV	12.5	16.1	28.3	30.9	12.2
V	4.2	33.1	48.6	11.3	2.8
VI	33.8	26.1	23.9	15.5	0.7
VII	38.8	24.5	24.5	10.2	2.0
VIII	10.9	9.2	22.5	50.5	7.0
IX	46.6	18.3	14.3	16.7	4.0
X	13.4	16.8	40.5	24.4	5.0
XI	16.5	37.2	34.9	9.2	2.3
XII	7.5	35.8	35.8	18.9	1.9
XIII	1.3	2.7	22.7	37.3	36.0
National	**20.5**	**21.1**	**26.0**	**26.6**	**5.8**

Source: Conagua (2016b).

MAP 2.8 Water quality: Total Suspended Solids (TSS), 2015



Source: CONAGUA (2016b).

TABLE 2.18 Percentage distribution of monitoring sites in surface water bodies by hydrological-administrative region, according to the TSS indicator, 2015

HAR number	Excellent	Good quality	Acceptable	Polluted	Heavily polluted
I	70.8	17.1	7.9	4.2	0.0
II	46.4	39.3	7.9	5.0	1.4
III	46.6	33.4	11.3	7.4	1.3
IV	55.8	19.5	10.7	9.9	4.1
V	33.6	50.3	8.2	4.9	3.0
VI	58.5	26.2	10.5	4.4	0.3
VII	65.3	24.5	2.0	4.1	4.1
VIII	41.4	31.1	17.4	9.4	0.7
IX	65.4	28.2	4.2	2.3	0.0
X	60.3	34.2	4.9	0.3	0.3
XI	46.5	38.4	13.2	1.7	0.3
XII	72.8	22.3	3.5	1.0	0.5
XIII	36.0	40.0	8.0	16.0	0.0
National	**51.6**	**31.5**	**10.2**	**5.5**	**1.1**

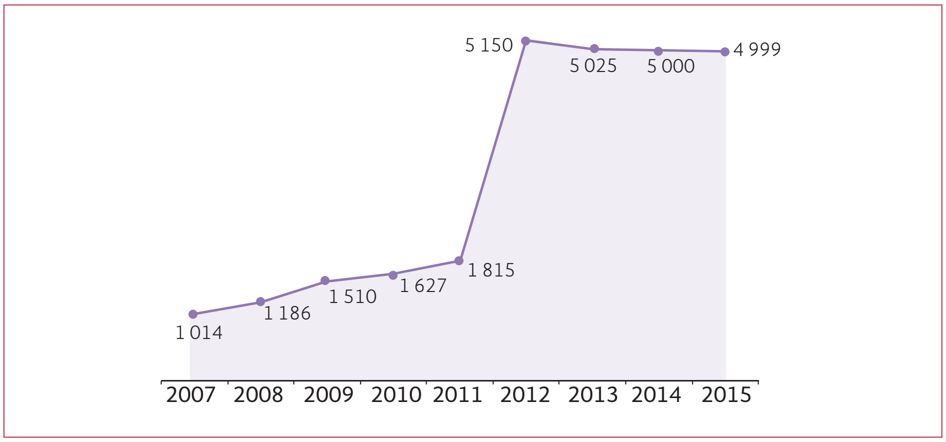
Source: CONAGUA (2016b).

Summary of water quality

Up to 2015 there were 4 999 water quality monitoring sites, the result of an increasing trend in recent years in this measurement, as can be observed in graph 2.5.

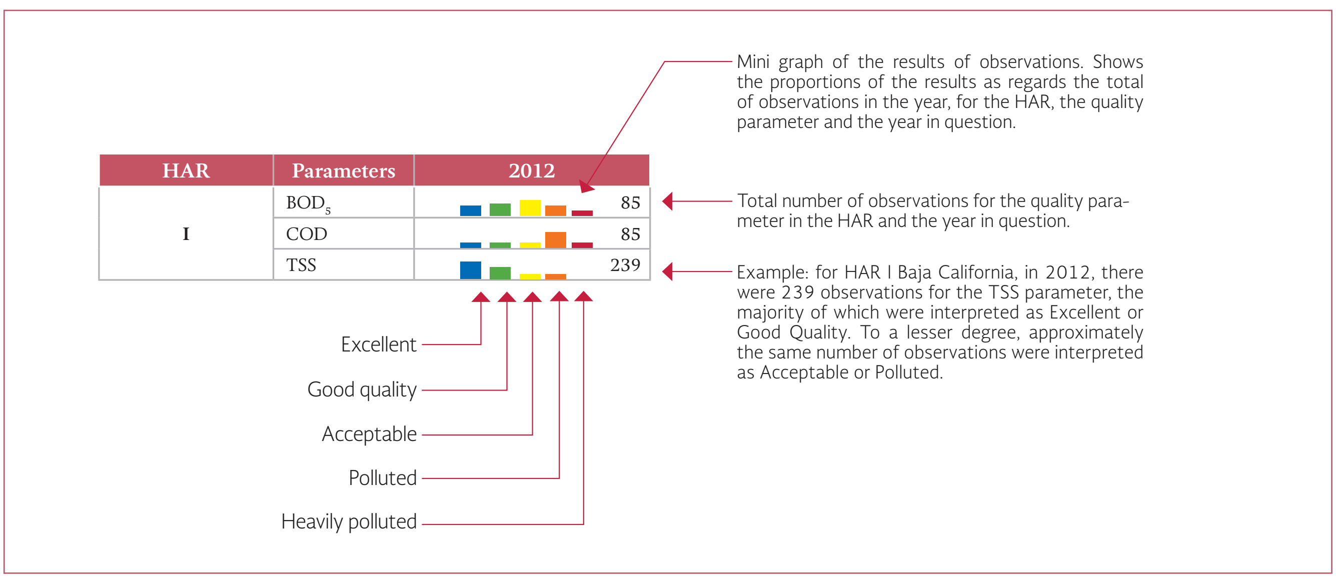
For the 2011-2015 period, the water quality results are presented regionally, summarized in table 2.19, which indicates, for each hydrological-administrative region, parameter (BOD_5, COD or TSS), and year, the observations with the interpretation of water quality (excellent, good quality, acceptable, polluted and heavily polluted) through a mini graph, as well as the total number of observations with data. Figure 2.10 has an example of the interpretation of the data in table 2.19.

Graph 2.5 Stations of the National Monitoring Network, 2007-2015



Source: Conagua (2016b).

Figure 2.10 Key to interpret table 2.19



Source: Conagua (2016d).

Table 2.19 Summary of water quality 2011-2015

HAR number	Parameter	2012	2013	2014	2015
I	BOD_5	85	84	76	84
	COD	85	84	76	84
	TSS	239	210	202	216
II	BOD_5	71	76	73	84
	COD	71	76	73	84
	TSS	116	128	126	140
III	BOD_5	195	215	206	214
	COD	184	215	206	214
	TSS	269	303	307	311
IV	BOD_5	337	312	310	352
	COD	338	312	310	353
	TSS	349	325	319	364
V	BOD_5	116	122	142	142
	COD	142	122	142	142
	TSS	373	361	358	366
VI	BOD_5	221	286	244	284
	COD	222	287	244	284
	TSS	233	293	255	294
VII	BOD_5	43	46	46	49
	COD	43	46	46	49
	TSS	44	46	46	49
VIII	BOD_5	672	639	647	654
	COD	671	641	647	654
	TSS	773	733	743	758
IX	BOD_5	235	242	242	252
	COD	235	243	241	251
	TSS	306	292	295	309
X	BOD_5	238	249	247	262
	COD	232	249	247	262
	TSS	285	306	307	325
XI	BOD_5	253	256	252	261
	COD	256	256	252	261
	TSS	350	353	349	357
XII	BOD_5	67	53	53	53
	COD	67	53	53	53
	TSS	225	199	202	202
XIII	BOD_5	55	67	98	75
	COD	55	67	98	75
	TSS	55	67	98	75
National	BOD_5	2 588	2 647	2 636	2 766
	COD	2 601	2 651	2 635	2 766
	TSS	3 617	3 616	3 607	3 766

Source: Produced based on Conagua (2016b).

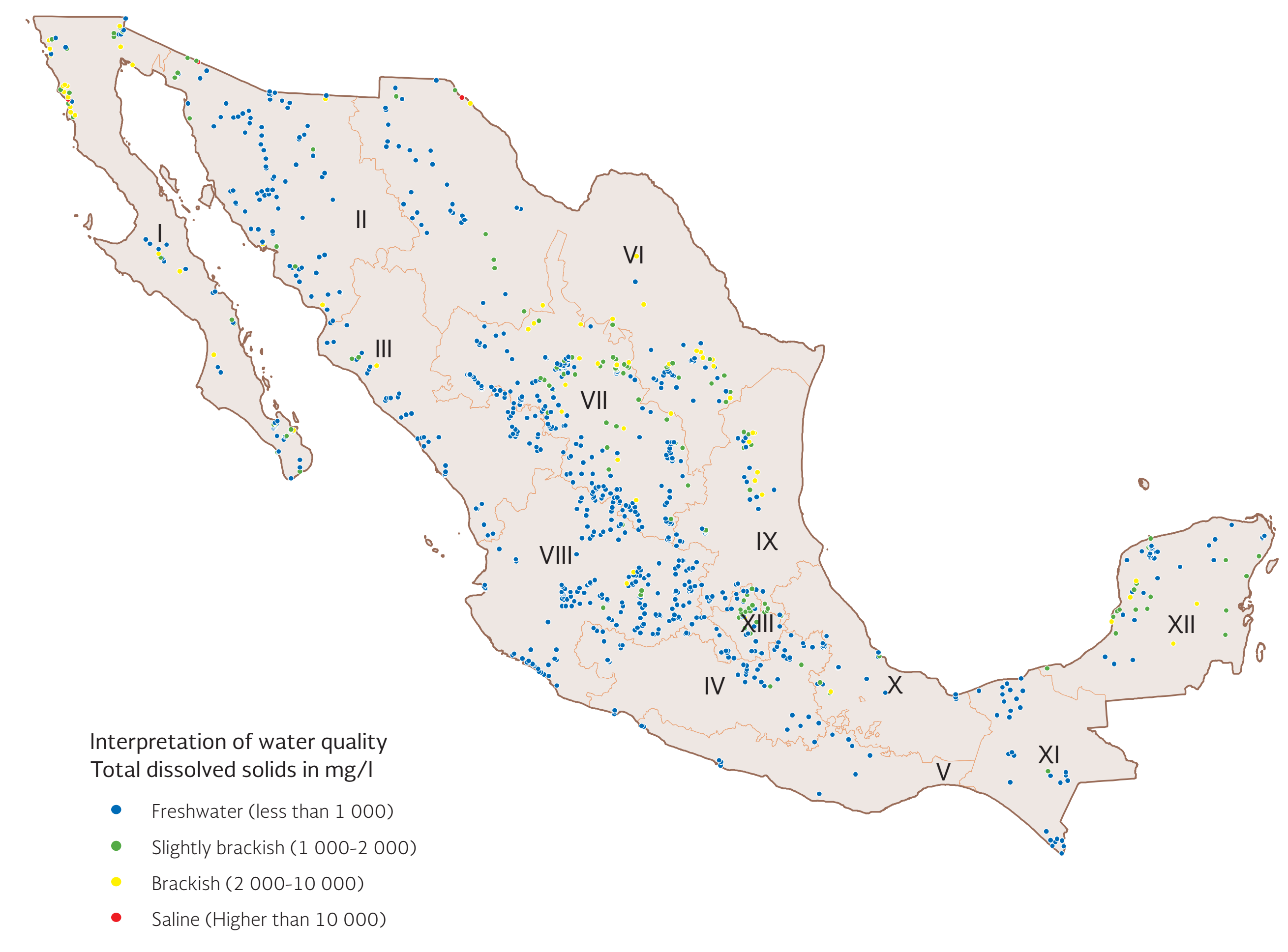
Groundwater quality

One of the parameters that allows groundwater salinization to be evaluated is the total solids. According to their concentration, groundwater is classified as fresh (<1 000 mg/l), slightly brackish (1 000-2 000 mg/l), brackish (2 000-10 000 mg/l) and saline (higher than10 000 mg/l).

The limit between freshwater and slightly brackish water coincides with the maximum concentration indicated by the modification of the Official Mexican Standard NOM-127-SSA1-1994, which "establishes the maximum permissible limits that water should comply with for human consumption and treatment as regards water quality for human consumption".

The annual monitoring of groundwater quality is shown in map 2.9

Map 2.9 Groundwater quality: Total Dissolved Solids, 2015



Source: Conagua (2016b).

Water quality on beaches

Through the Clean Beach Program, since 2003 the cleaning up of beaches and their associated catchments and aquifers has been promoted. The finality of the program is to prevent and redress the pollution of Mexico's beaches, respecting biodiversity, making them competitive for national and international tourism, as well as raising the quality and standard of living of the local population.

For the development of the program, clean beach committees have been set up, auxiliary bodies of the River Basin Councils (see chapter 5), which are chaired by the President of the municipality and have the active presence of representatives of SERMARNAT, PROFEPA, SEMAR, SECTUR, COFEPRIS and the CONAGUA, as well as representatives of associations and the private sector.

In order to evaluate water quality on beaches for first-contact recreational use, the bacteriological indicator of enterococcus faecalis is used. In 2003, the Ministry of Health set the maximum limit for recreational use at 500 MLN[9]/100 ml. As of 2010, in conformity with studies carried out by the World Health Organization (WHO), it was reduced to 200 MLN/100 ml).

Water quality classification criteria on beaches:

- 0-200 MLN/100 ml, the beach is considered SUITABLE for recreational use.
- Higher than 200 MLN/100 ml, the beach is considered UNSUITABLE for recreational use.

According to the findings in the National Information System on Water Quality on Mexican Beaches, the bacteriological monitoring shows that from 2006 to 2015, water quality on beaches tended to improve, as shown in graph 2.6.

The tourist destinations monitored in 2015 are shown in map 2.10. That year, all sites monitored were found to be appropriate for recreational use.

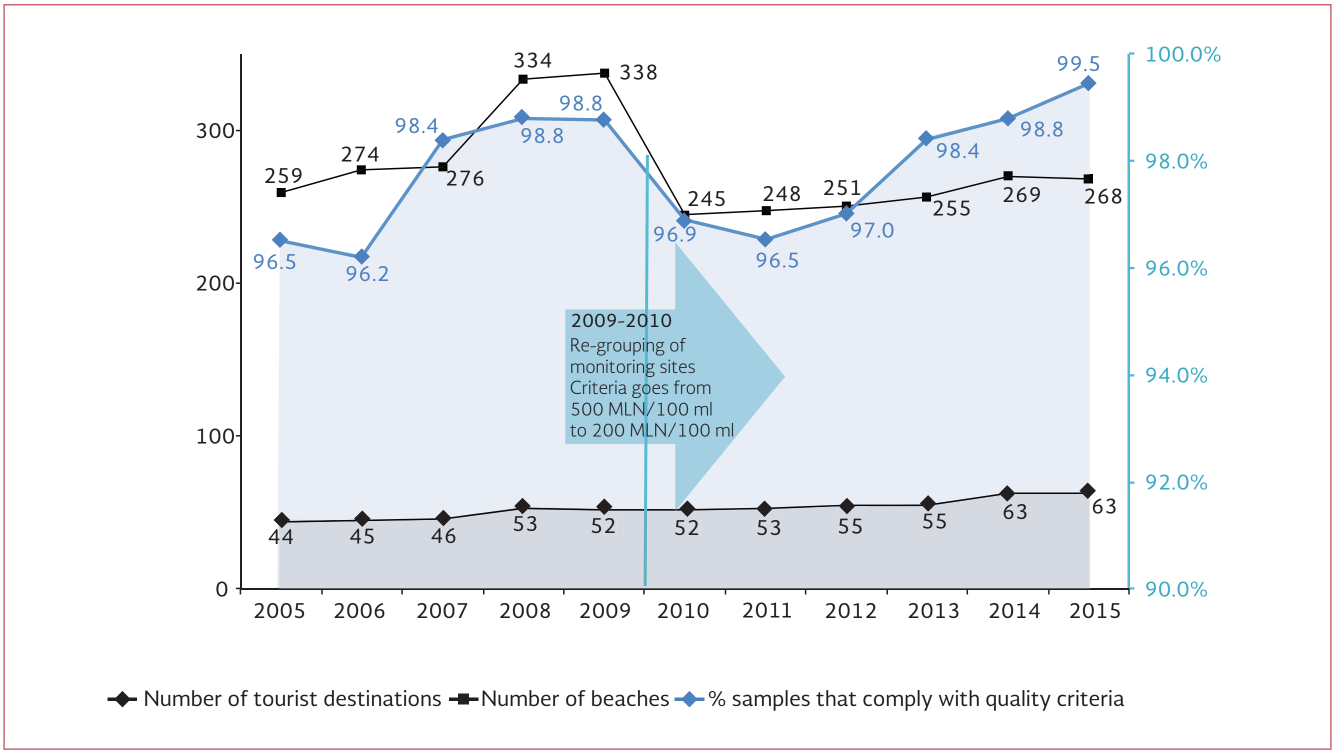
Similarly, the SEMARNAT published the Mexican standard NMX-AA-120-SCFI-2006 (voluntarily observed), which establishes the sustainable beach quality requirements and specifications for the modalities of recreational uses and priority for conservation. In order to be able to be certified with this standard, the maximum limit of enterococos is even lower than the Clean Beach Program, with 100 MLN/100 ml. The certification has a two-year validity. As of 2015, 35 beaches had this certification.

Another certification that Mexican beaches can aspire to is the Blue Flag, which rewards coastal resorts with excellence in environmental management, safe and hygienic installations, educational activities and environmental information. and water quality. As of 2015, 20 beaches and one marine had this certification.

The beaches with certifications are shown in figure 2.11.

9 MLN (most likely number)

Graph 2.6 Results of the monitoring program for water quality on beaches, 2005-2015



Source: Produced based on Semarnat et al. (2016).

Map 2.10 Tourist destinations monitored, 2015

Source: Produced based on Semarnat et al. (2016).

FIGURE 2.11 Certified beaches, 2015

Certified under NMX-AA-120-SCFI-2006

Certified under the Blue Flag

Source: Produced based on CONAGUA (2016b).

CHAPTER

3

Uses of water

USES OF WATER

Uses in Mexico

Variation between regions

15 723.7 hm³ highest volume allocated: **VIII** Lerma-Santiago-Pacific

1 555.1 hm³ lowest volume allocated: **V** Southern Pacific

Classification

Offstream
Difference between the volume extracted and the discharge once an activity has been completed

Instream
The activity does not modify the volume

Offstream water sources

Surface water:	Groundwater:
61.1% of offstream uses	**38.9%** of offstream uses

Grouped offstream uses

Public supply **14.6%**

Agriculture **76.3%**

Energy generation excluding hydropower **4.8%**

Self-supplying industry **4.3%**

Virtual water

- Quantity of water employed in the productive process of a good or service
- Virtual water exchanges due to product trade
- Mexico: Net importer of virtual water **23 033 hm³** in 2015

Water and the economy

Environmental and economic accounting

Relates the environment with the economy

Facilitates comparisons and decision making

Degree of water stress

Sources of offstream uses

Regions

Higher than

40 %

is considered high or very high water stress

Mexico

19.2%

(low)

Highest stress

XIII Waters of the Valley of Mexico

138.7%

(Very high)

Lowest stress

XI Southern Border

1.7 %

(no stress)

3.1 Classification of the uses of water

[Tablero: Registro Público de Derechos de Agua (REPDA) / Volúmenes Inscritos]

Water is used in different ways in all human activities, be it to meet basic needs or to produce and exchange goods and services.

The volumes allocated or assigned[1] to the users of the nation's water are recorded in the Public Registry of Water Duties (REPDA). The REPDA has the uses of water classified in different categories. In this chapter, the term **grouped use** will be used, with the categorization shown in table 3.1, which also distinguishes between offstream and instream uses.[2] It should be mentioned that in 2014, a new instream use was added: ecological conservation, with a volume allocated of 9.46 hm^3/year.

Throughout this chapter, the data on volumes allocated for 2015 are as of December 31, 2015. It should be mentioned that the regionalization of volumes was carried out based on the location of the use as registered in the REPDA, rather than the jurisdictional area of the respective deeds.

In 2015 266 559 hm³ were allocated

FIGURE 3.1 Grouping of uses in the REPDA classification

Code	Category of the REPDA classification	Volume allocated (hm³)
A	Agriculture (registered+pending)	58 450
B	Agro-industry	4
C	Domestic	39
D	Aquaculture	1 136
E	Services	1 474
F	Industry	6 347
F1	*Industry excluding thermoelectrics*	*2 198*
F2	*Thermoelectrics*	*4 149*
G	Livestock	207
H	Public urban	12 441
I	Multiple	5 566
K	Trade	0.1
L	Others	0.5
	Subtotal offstream	**85 664**
J	Hydropower	180 895
	Subtotal instream	**180 895**
	Total	**266 559**

Grouped offstream uses	Definition	Volume allocated (hm³)
Agriculture	A+D+G+I+L	65 359
Public supply	C+H	12 480
Self-supplying industry	B+E+*F1*+K	3 676
Energy generation excluding hydropower	*F2*	4 149
	Subtotal offstream	**85 664**
Hydropower	J	180 895
	Subtotal instream	**180 895**
	Total	**266 559**

Note: The F1 and F2 arbitrary codes were added as components in the REPDA code F Industry. These two arbitrary codes allow the offstream generation of electricity (in thermoelectric plants) to be distinguished from instream generation (hydropower).
Source: Produced based on CONAGUA (2016c).

1 In the case of volumes destined for public urban or domestic use.

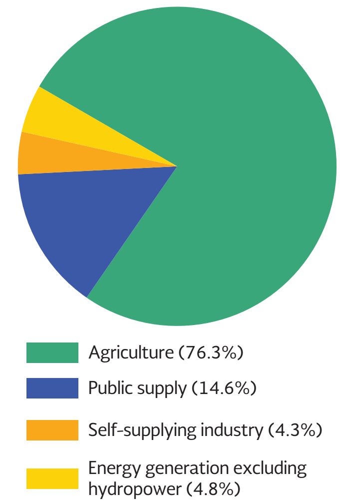
2 Offstream use: The volume of water of a given quality that is consumed during the implementation of a specific activity, which is determined as the difference between the volume of a given quality that is extracted, minus the volume of a given quality that is discharged, and which is shown in the respective deed (National Water Law).

Graph 3.1 shows the evolution in the volume allocated for offstream uses, in the period from 2006 to 2015. As may be appreciated, 61.1% of the water used for offstream uses comes from surface water sources (rivers, streams and lakes), whereas the remaining 38.9% corresponds to groundwater sources (aquifers). There are both increases and decreases in the volumes allocated throughout time. Compared to 2006, the first year in the graphic, in 2015 the volume of surface water allocated was 6.9% higher, whereas the groundwater allocated was 17.5% higher.

The greatest volume allocated for offstream uses is for the grouped use for agriculture, mainly for irrigation, as can be observed in table 3.1 and graph 3.2. It is also worth mentioning that Mexico is one of the countries with the most substantial irrigation infrastructures in the world (see chapters 4 and 8).

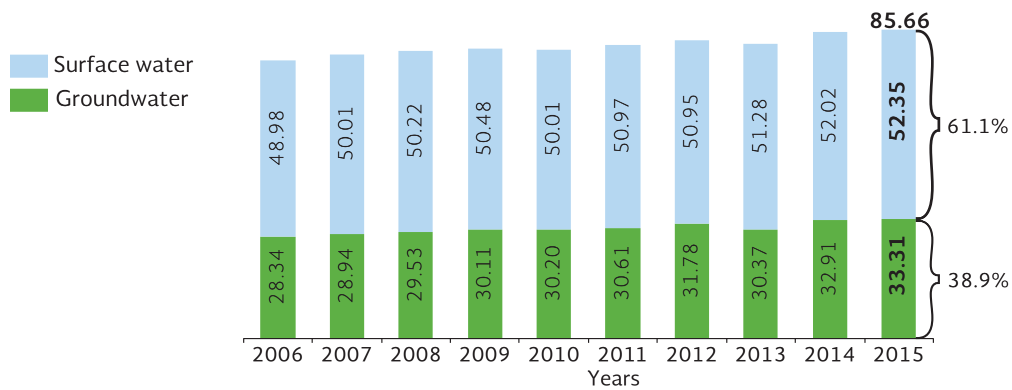
As regards hydropower, which represent an instream use of water resources, 138.7 billion cubic meters of water were used nationwide in 2015. It should be pointed out that, for this use, the same water is used several times, in all the country's plants.

Graph 3.2 Distribution of volumes allocated for grouped offstream uses, 2015



Source: Conagua (2016c).

Graph 3.1 Volume allocated for offstream uses by type of source, 2006-2015 (thousands of hm³)



Source: Produced based on Conagua (2016c).

Table 3.1 Grouped offstream uses by type of source, 2015

Grouped use	Origin: Surface water (thousands of hm³)	Origin: Groundwater (thousands of hm³)	Total volume (thousands of hm³)	Percentage of extraction
Agriculture	41.89	23.47	65.36	76.3
Public supply	5.16	7.32	12.48	14.6
Self-supplying industry	1.61	2.07	3.68	4.3
Energy generation excluding hydropower	3.70	0.45	4.15	4.8
Total	**52.35**	**33.31**	**85.66**	**100.0**

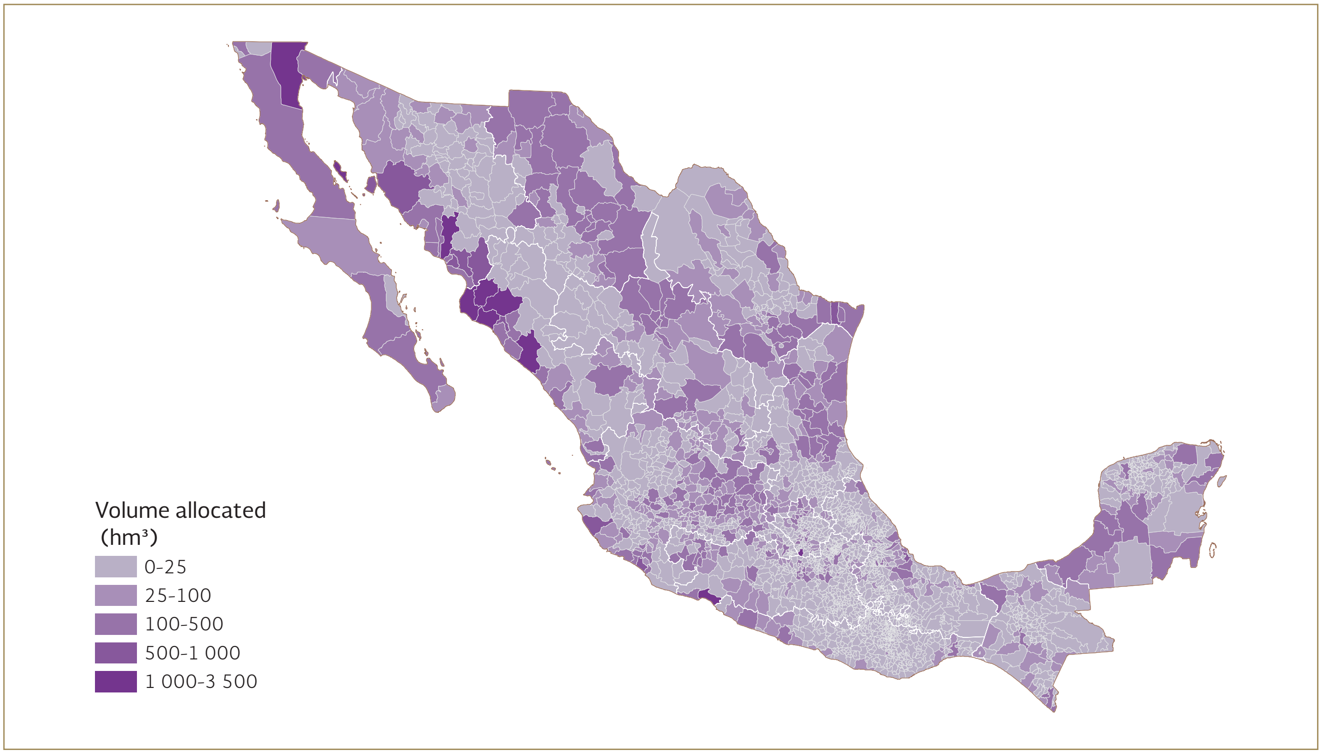
Source: Conagua (2016c).

3.2 Distribution of uses throughout Mexico

[Tablero: Registro Público de Derechos de Agua (REPDA) / Volúmenes Inscritos]

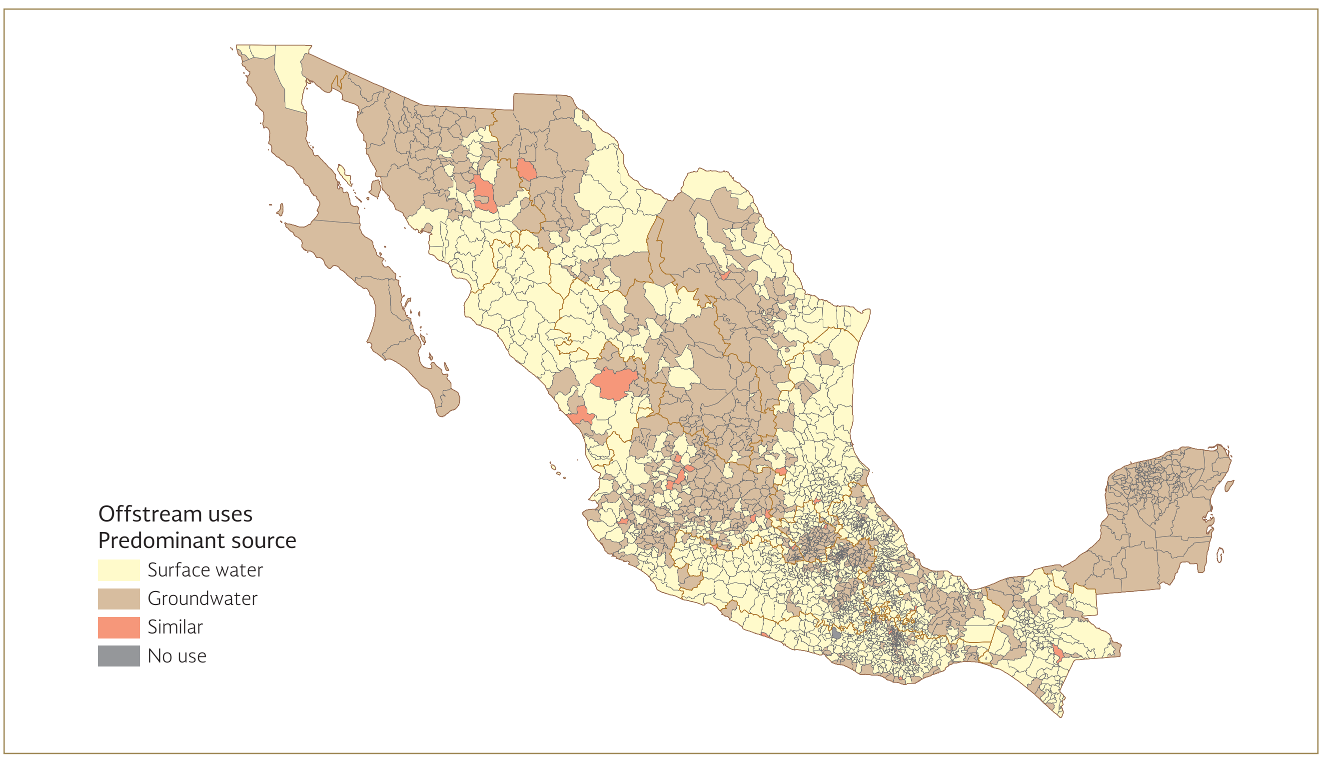
Map 3.1 shows the volume allocated for offstream uses in 2015 by municipality, and map 3.2 shows the predominant or main source for the volumes allocated in each municipality, be it surface or groundwater. When there is a difference of less than 5% between surface and groundwater sources, it is considered that there is no predominant source, and they are referred to as similar sources.

Map 3.1 Intensity of offstream uses by municipality, 2015



Source: Produced based on Conagua (2016c).

Map 3.2 Predominant source for offstream uses by municipality, 2015



Source: Produced based on Conagua (2016c).

The grouped uses in agriculture and public supply represented 90.9% of the volume allocated nationwide in 2015. Their distribution is shown in figure 3.2.

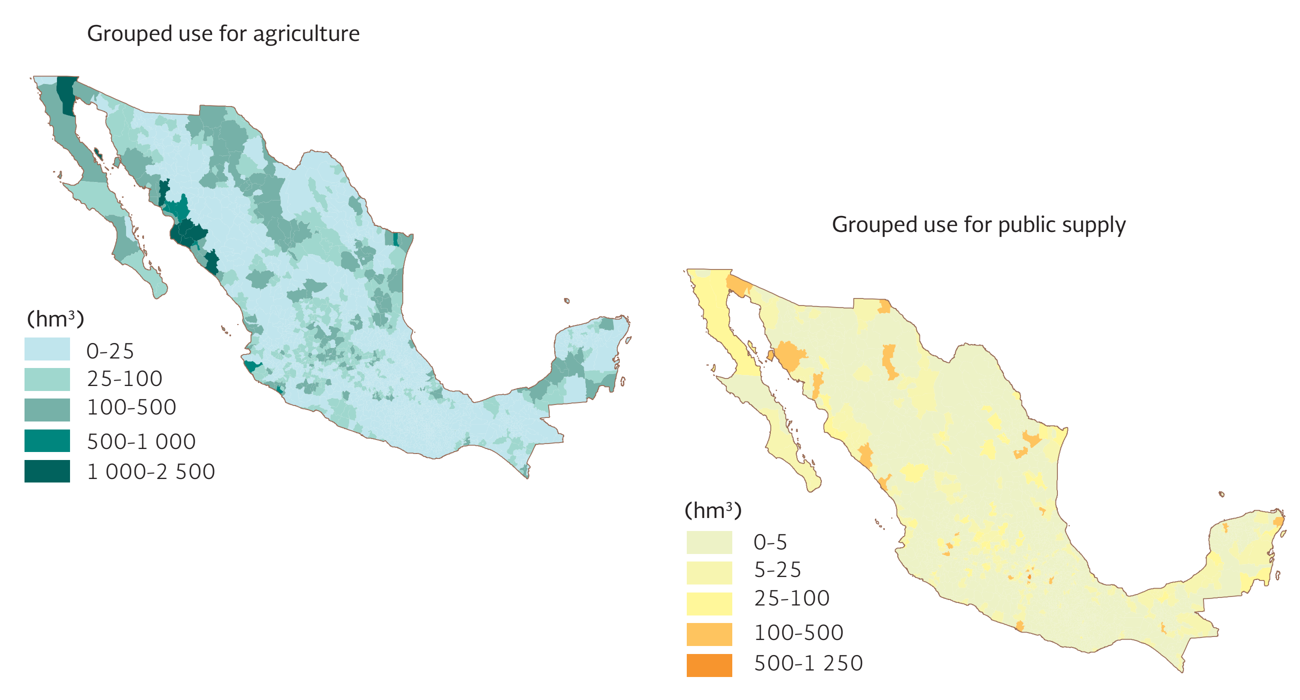
The distribution of uses can also be visualized over time according to the evolution of volumes allocated. Map 3.3 compares the volume allocated or assigned by municipality in 2015 compared to the volume in 2005, in order to indicate if it increased or decreased.

Graph 3.3 [Adicional: Table 3.A] shows how volumes of water have been allocated for grouped offstream uses throughout the country. The hydrological-administrative regions (HARs) with the greatest allocations of water are: VIII Lerma-Santiago-Pacific, IV Balsas, III Northern Pacific and VI Rio Bravo. It is worth noting that agriculture accounts for over 80% of the total allocations in those HARs, with the exception of IV Balsas, where the Petacalco thermoelectric plant, located near the estuary of the Balsas river, uses a significant volume of water.

Table 3.2 [Adicional: Graph 3.A] shows the information on the volumes of water allocated by state, among which Sinaloa and Sonora stand out, due to their large areas under irrigation.

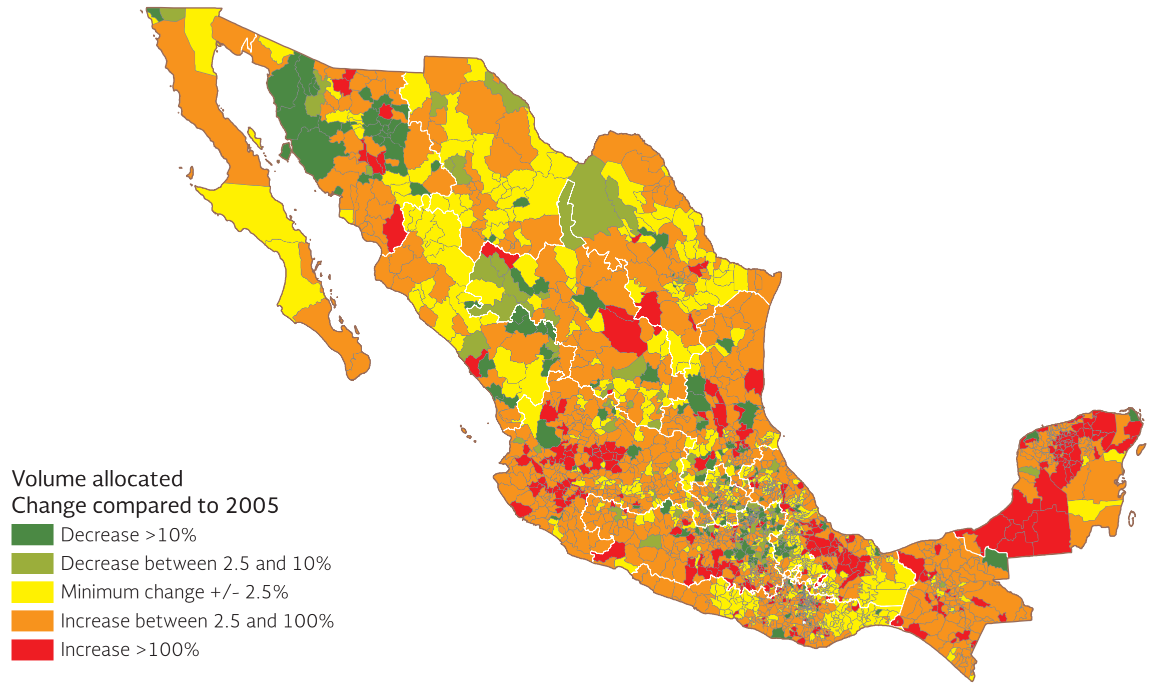
90.9%
of the volume allocated nationwide is made up of the grouped uses for agriculture and public supply

FIGURE 3.2 Main grouped offstream uses, 2015



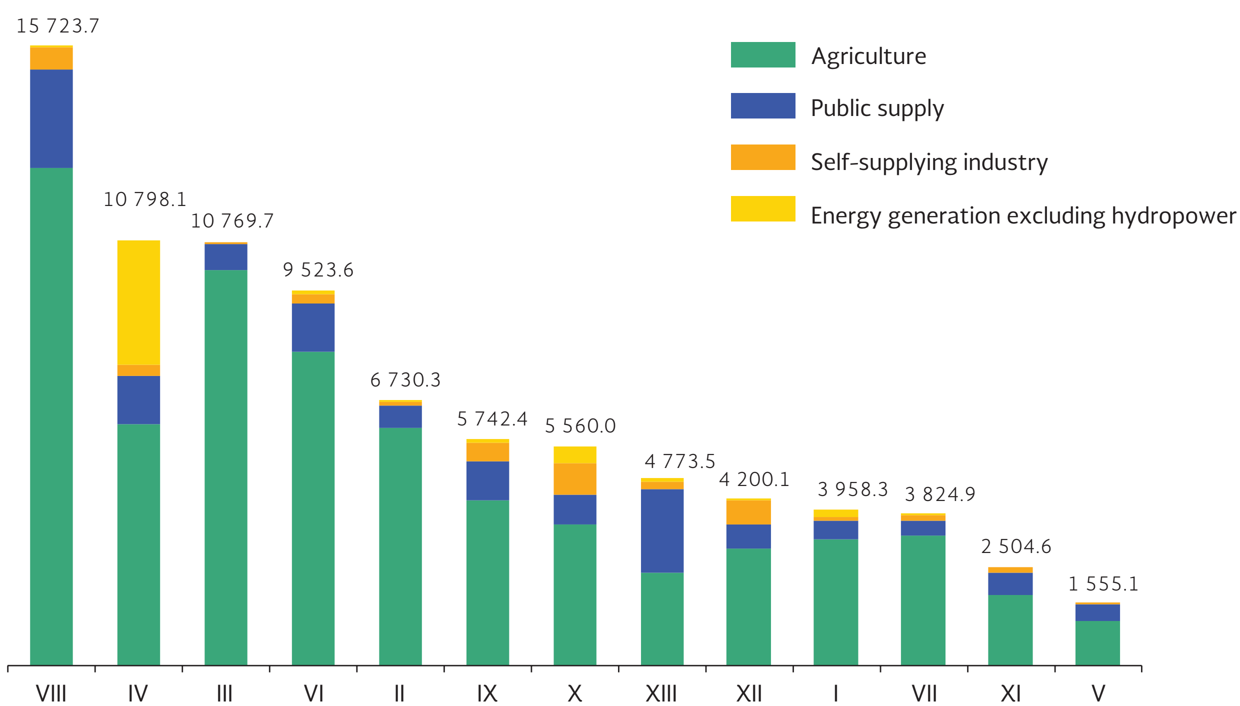
Source: Produced based on CONAGUA (2016c).

Map 3.3 Evolution in offstream uses by municipality, 2005-2015 comparison



Source: Produced based on Conagua (2016c).

Graph 3.3 Volumes allocated by grouped offstream uses, 2015



Source: Produced based on Conagua (2016c).

Table 3.2 Volumes allocated for grouped offstream uses, 2015 (hm^3)

Code	State	Volume allocated	Agriculture	Public supply	Self-suppl-ying industry	Energy generation excluding hydropower
1	Aguascalientes	622.3	479.5	127.1	15.7	0.0
2	Baja California	3 049.2	2 587.5	187.5	82.8	191.5
3	Baja California Sur	422.3	339.3	64.8	13.9	4.3
4	Campeche	1 201.9	1 030.4	143.9	23.9	3.6
5	Coahuila de Zaragoza	2 038.9	1 648.4	239.7	75.9	74.9
6	Colima	1 792.6	1 668.6	97.3	26.7	0.0
7	Chiapas	1 970.7	1 541.4	389.0	40.3	0.0
8	Chihuahua	5 159.8	4 588.8	489.8	53.7	27.5
9	Federal District (Mexico City)	1 122.6	1.2	1 089.6	31.8	0.0
10	Durango	1 565.3	1 366.5	170.5	16.8	11.5
11	Guanajuato	4 094.6	3 454.2	547.2	72.6	20.5
12	Guerrero	4 428.7	900.5	384.2	21.9	3 122.1
13	Hidalgo	2 370.8	2 093.2	162.9	32.1	82.6
14	Jalisco	4 985.2	3 712.0	1 061.8	211.3	0.1
15	Mexico	2 744.1	1 173.3	1 358.4	181.8	30.6
16	Michoacan de Ocampo	5 436.8	4 792.1	373.1	223.6	47.9
17	Morelos	1 313.5	986.2	279.3	48.0	0.0
18	Nayarit	1 332.8	1 110.8	115.8	106.2	0.0
19	Nuevo Leon	2 068.9	1 473.3	511.9	83.5	0.2
20	Oaxaca	1 322.4	1 021.3	266.3	34.9	0.0
21	Puebla	2 122.8	1 614.2	428.2	73.9	6.5
22	Queretaro	1 010.2	640.4	304.9	59.1	5.7
23	Quintana Roo	1 014.9	277.1	212.4	525.3	0.0
24	San Luis Potosi	2 058.8	1 337.9	655.1	34.7	31.0
25	Sinaloa	9 542.1	8 989.9	509.2	43.0	0.0
26	Sonora	7 027.1	6 130.6	770.3	109.7	16.5
27	Tabasco	496.2	224.6	183.8	87.8	0.0
28	Tamaulipas	4 215.1	3 710.0	334.9	114.9	55.5
29	Tlaxcala	269.5	162.8	89.5	17.1	0.0
30	Veracruz de Ignacio de la Llave	5 287.0	3 232.8	551.3	1 095.2	407.8
31	Yucatan	1 983.4	1 673.2	255.8	45.3	9.1
32	Zacatecas	1 593.6	1 397.3	124.3	72.0	0.0
Total		**85 664.2**	**65 359.5**	**12 480.0**	**3 675.5**	**4 149.3**

Source: Conagua (2016c).

3.3 Grouped use for agriculture

[Tablero: Registro Público de Derechos de Agua (REPDA) / Volúmenes Inscritos]

The largest use of water in Mexico is in agriculture. According to the VII Agricultural, Livestock and Forest Census from 2007 (the latest one available nationwide), the surface area in agricultural production units was 30.2 million hectares, of which 18% was for irrigation and the remainder was rainfed.

The area sown every year (considering the agricultural year and perennial crops, under both irrigated and rainfed regimes) has varied between 21.8 and 22.2 million hectares during the 2008-2014 period (SIAP 2013, SIAP 2015).

Every year the area harvested in this same period (considering the agricultural year and perennial crops, under both irrigated and rainfed regimes) varied between 18.1 and 20.5 million hectares per year (SIAP 2013). At constant prices, the contribution of the agriculture, livestock, forest use, fishing and hunting sector to the Gross Domestic Product (GDP) was 3.6% in 2015 (INEGI 2016g).

According to the National Inquiry of Occupation and Employment (ENOE in Spanish), the population occupied in this sector of primary activities (agriculture, livestock, forest use, fishing and hunting) up to the fourth trimester of 2015 was 6.9 million people, which represents 13.4% of the active population at that point (Inegi 2016i).

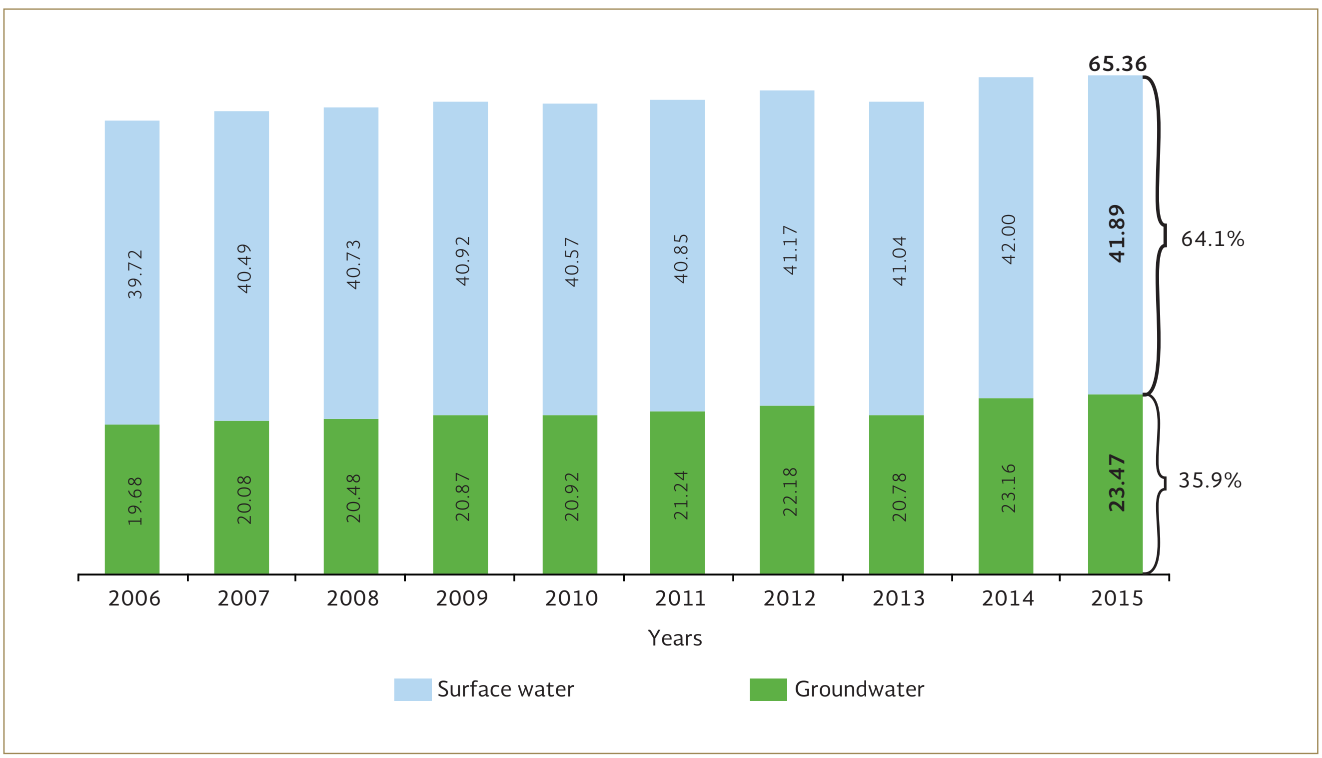
Mexico has more than 40 000 irrigation units

The yield in tons per hectare of irrigation agriculture is 2.2 to 3.3 times higher than in areas under a rainfed regime (see chapter 4).

Mexico is in seventh place worldwide in terms of the area with irrigation infrastructure, with 6.5 million hectares, of which just over half corresponds to 86 irrigation districts and the remainder to more than 40 000 irrigation units (see glossary).

35.9% of the water allocated for the grouped use for agriculture is of groundwater origin, as can be observed in graph 3.4. Taking into account that there are annual variations, the volume of groundwater allocated for this grouped use is 19.3% higher than in 2006, the first year in the graph.

Graph 3.4 Evolution in the volume allocated for grouped use for agriculture by type of source, 2006-2015 (thousands of hm^3)



Source: Produced based on Conagua (2016c).

3.4 Grouped use for public supply

[Tablero: Registro Público de Derechos de Agua (Repda) / Volúmenes Inscritos]

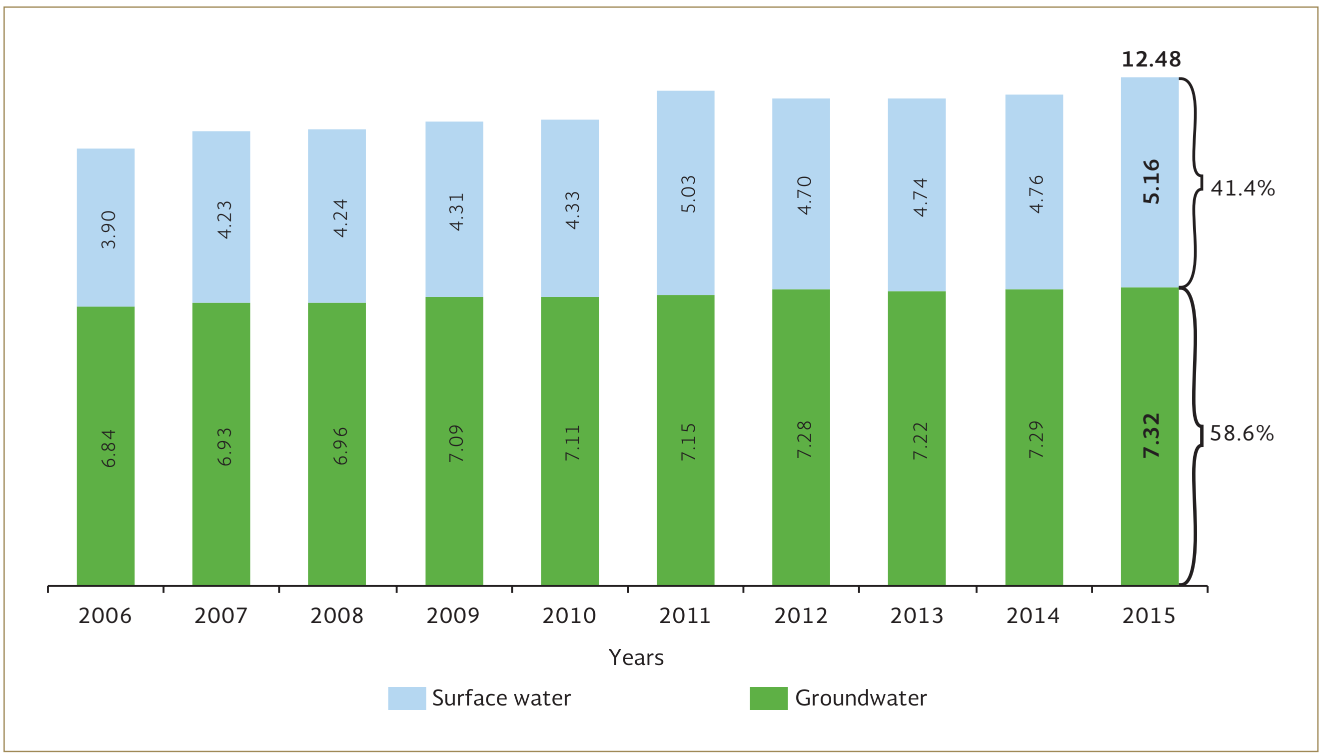
The grouped use for public supply consists of the water delivered through drinking water networks, which supply domestic users (homes), as well as different industries and services.

Having access to water of sufficient quantity and quality for human consumption is one of the basic needs of the population, since it has a direct influence on their health and general wellbeing. This characteristic is recognized by the guiding tools for national planning: the 2013-2018 National Development Plan and the 2014-2018 National Water Program.

In the grouped use for public supply, the predominant source is groundwater, with 58.6% of the volume, as shown in graph 3.5. It is worth noting that between 2006 and 2015, the surface water assigned for this use increased by 32.3%.

In Mexico, drinking water services, sanitation, sewerage, wastewater treatment and disposal are under the responsibility of municipalities, generally speaking through water utilities.

Graph 3.5 Evolution in the volume allocated for grouped use for public supply by type of source, 2006-2015 (thousands of hm³)



Source: Produced based on Conagua (2016c).

3.5 Grouped use for self-supplying industry

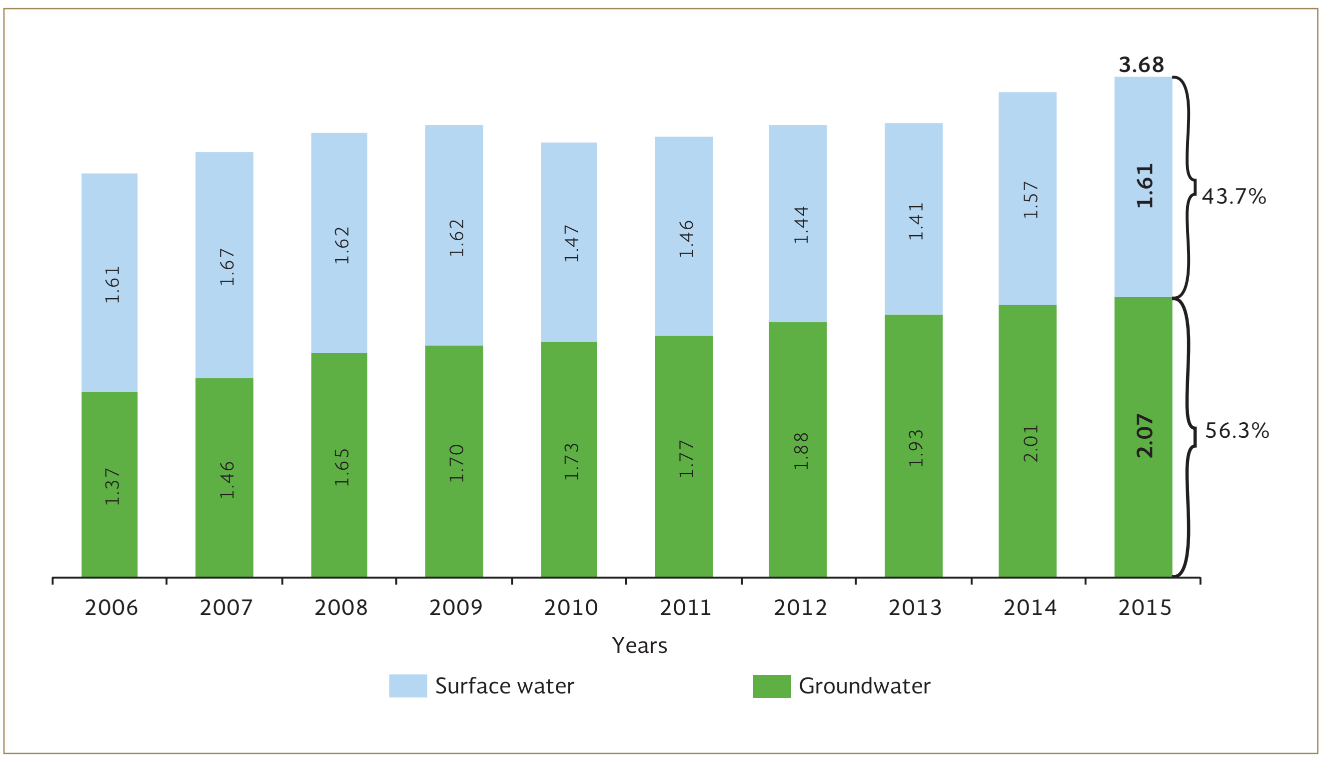
[Tablero: Registro Público de Derechos de Agua (REPDA) / Volúmenes Inscritos]

This grouped use includes the industry that takes its water directly from the country's rivers, streams, lakes or aquifers.

According to the North American Industrial Classification System (NAICS), secondary activities, known as **industry**, are made up of the sectors of mining, electricity, water and piped gas supply to end users, as well as the construction and manufacturing industries (INEGI 2013f). It should be added that the REPDA classification of uses does not exactly follow this classification, although it is considered that there is a reasonable degree of correlation.

Although it only represents 4.3% of the total offstream use of water, the grouped use for self-supplying industry presents the growth trend shown in graph 3.6. It should be mentioned that in the 2006-2015 period, the volume allocated from groundwater sources increased significantly, with a growth of 51.4% in that period.

GRAPH 3.6 Evolution in the volume allocated for the grouped use for self-supplying industry by type of source, 2006-2015 (thousands of hm³)



Source: Produced based on CONAGUA (2016c).

3.6 Use in Energy generation excluding hydropower

[Tablero:Registro Público de Derechos de Agua (Repda) / Volúmenes Inscritos]

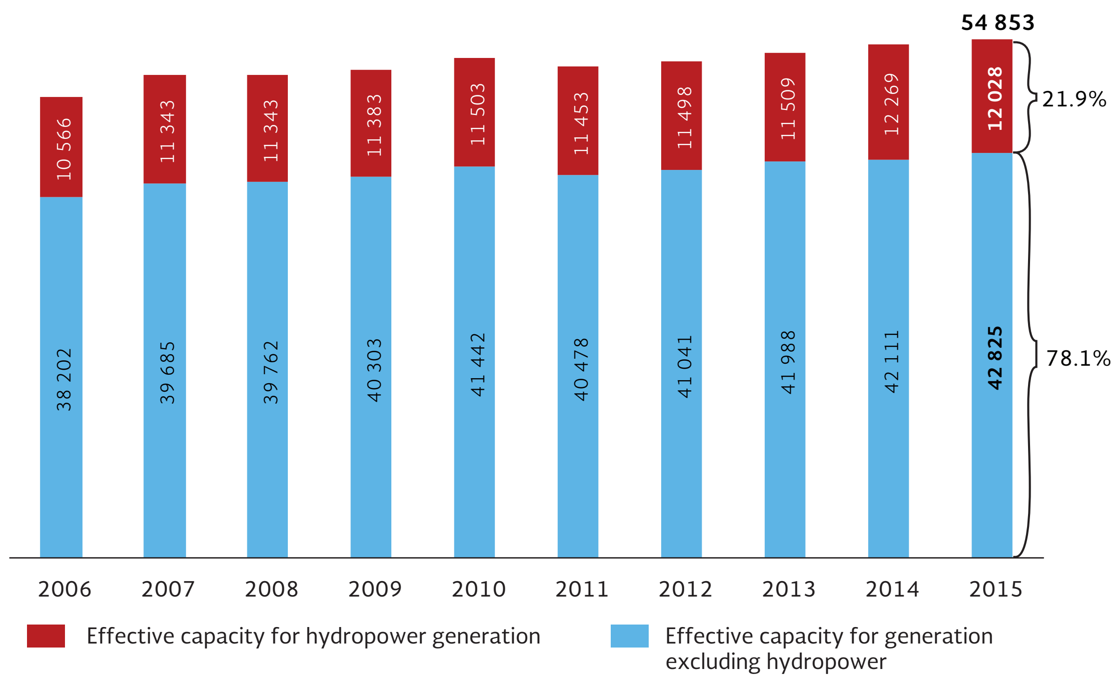
This grouped use refers to dual steam, coal-electric, combined cycle, turbo-gas and internal combustion plants, which are an ins-tream use of water, and includes renewable technologies (wind, photovoltaic solar and geothermal). Hydropower is excluded, and will be dealt with under 3.7, since it represents an instream use of water resources.

According to the Ministry of Energy (Sener 2016), in 2015 the Federal Commission for Electricity's (CFE's) plants considered in this use, including External Energy Producers (EEPs) for public ser-vice, had an **effective capacity** of 42 825 MW, which represented 78.1% of the national total. The gross generation of these plants was 231 TWh, or 88.5% of the national total.

It should be noted that 75.2% of the water allocated for this use corresponds to the coal-electric plant in Petacalco, situated on the Guerrero coast, close to the estuary of the Balsas river.

Graph 3.7 shows the annual evolution in the effective capacity of generation under this use in the period from 2006 to 2015, where-as graph 3.8 shows the gross generation for this same period.

Graph 3.7 Effective capacity for energy generation, 2006-2015 (MW)



Source: Produced based on Conagua (2016c).

3.7 Use in hydropower

[Tablero: Registro Público de Derechos de Agua (Repda) / Volúmenes Inscritos, Generación de energía. Volúmenes declarados]

Nationwide, the HARs XI Southern Border and IV Balsas are those which have the greatest allocation of water for this use, since they are home to the mightiest rivers and consequently the country's largest hydropower plants, as shown in table 3.3. The volume allocated for this use nationwide is 180.9 billion cubic meters (Conagua 2016c), of which variable quantities are used every year.

In 2015, hydropower plants used 138.7 billion cubic meters of water (table 3.3), which allowed 30.1 TWh of electricity to be generated, corresponding to 11.5% of Mexico's total **generation** at that point. The installed capacity in these hydropower plants in 2015 was 12 028 MW, which corresponds to 21.9% of Mexico's installed capacity (see graphs 3.7 and 3.8).

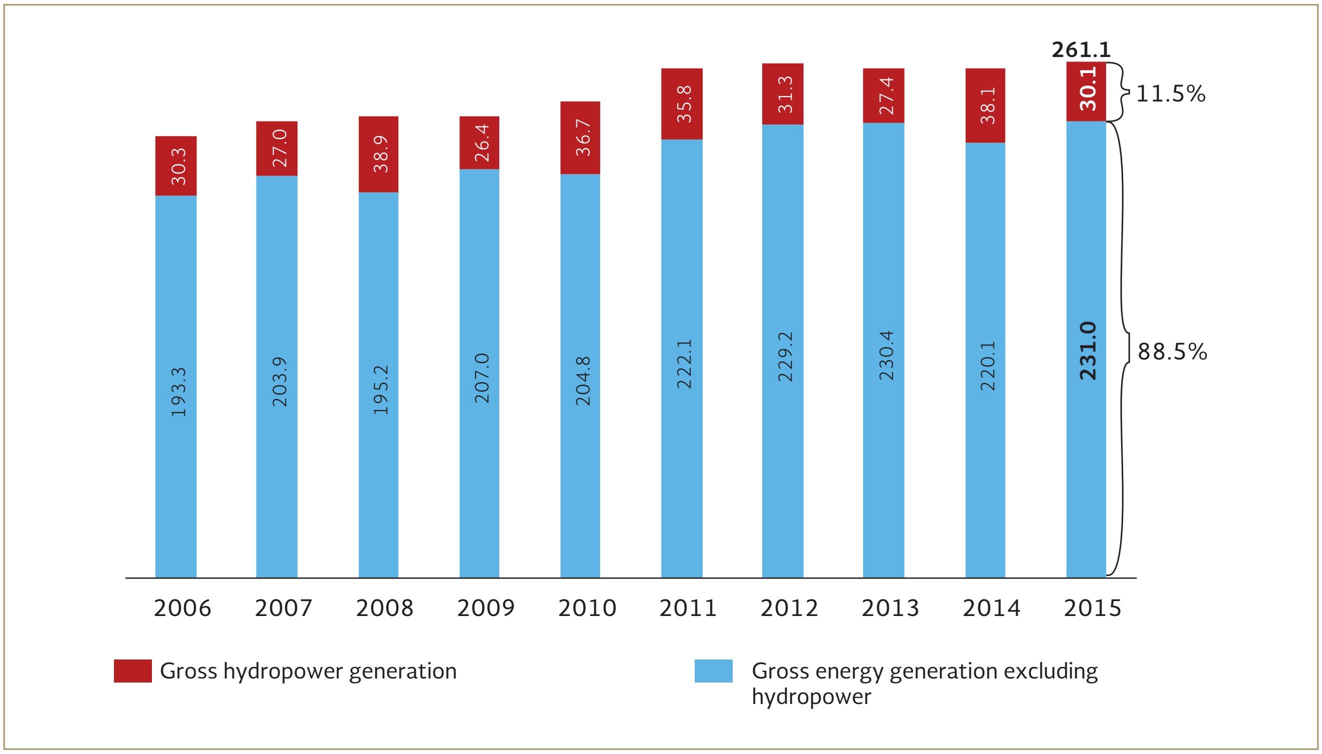
138 662 hm³
were used in 2015 for hydropower

Table 3.3 Volumes declared for the payment of duties for hydropower production, 2006-2015

HAR number	Volume of water declared (hm³)									
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7
II	2 928.6	3 350.7	3 404.7	3 127.7	4 140.6	3 416.5	3 032.7	2 627.2	2 456.3	3 963.2
III	10 747.0	11 183.9	13 216.7	11 405.1	11 912.1	11 100.3	5 176.6	6 127.9	7 475.4	11 050.9
IV	21 820.3	31 099.4	30 572.8	28 059.6	34 487.9	35 539.9	32 177.7	28 126.2	29 688.3	31 076.7
V	1 949.1	2 139.6	2 244.7	2 063.4	3 528.0	16 313.8	2 028.2	1 716.9	26.3	242.0
VI	2 262.7	2 889.6	1 967.7	2 960.4	2 987.7	3 350.1	3 771.8	2 556.8	2 125.5	1 652.6
VII	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
VIII	4 657.8	10 516.6	13 516.9	9 030.9	11 764.6	7 741.4	5 733.5	5 598.0	10 693.3	15 070.4
IX	809.7	1 105.3	2 912.1	1 441.0	1 525.9	1 243.0	1 312.4	1 273.5	1 225.7	1 911.6
X	17 835.0	14 279.1	14 040.5	13 673.7	15 029.1	4 254.6	17 286.7	16 463.1	12 319.4	15 472.3
XI	77 245.7	46 256.8	68 793.3	64 304.7	49 406.9	81 813.4	85 197.3	48 325.9	67 007.6	58 220.7
XII	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
XIII	39.1	10.6	0.0	18.8	0.5	0.0	0.0	0.3	0.5	0.3
Total	**140 294.9**	**122 831.6**	**150 669.4**	**136 085.3**	**134 783.3**	**164 773.0**	**155 716.9**	**112 815.9**	**133 018.3**	**138 662.4**

Source: Produced based on Conagua (2016c).

Graph 3.8 Gross energy generation, 2006-2015 (TWh)



Source: Produced based on Conagua (2016c).

3.8 Degree of water stress

[Tablero: Registro Público de Derechos de Agua (Repda) /Volúmenes Inscritos, Grado de presión, Agua renovable]

The percentage of water used for offstream uses as compared to the renewable water resources is an indicator of the **degree of water stress** in any given country, catchment or region. The degree of water stress can be very high, high, medium, low and with no stress. It is considered that if the percentage is greater than 40%, there is a high or very high degree of water stress (see the scale of water stress in map 3.4).

Nationwide, Mexico is experiencing a degree of water stress of 19.2%, which is considered low; however, the central, northern and northwestern areas of the country are experiencing a high degree of water stress. In table 3.4 and map 3.4, this indicator is shown for each of the country's HARs.

Nationwide the degree of water stress in 2015 was

19.2%

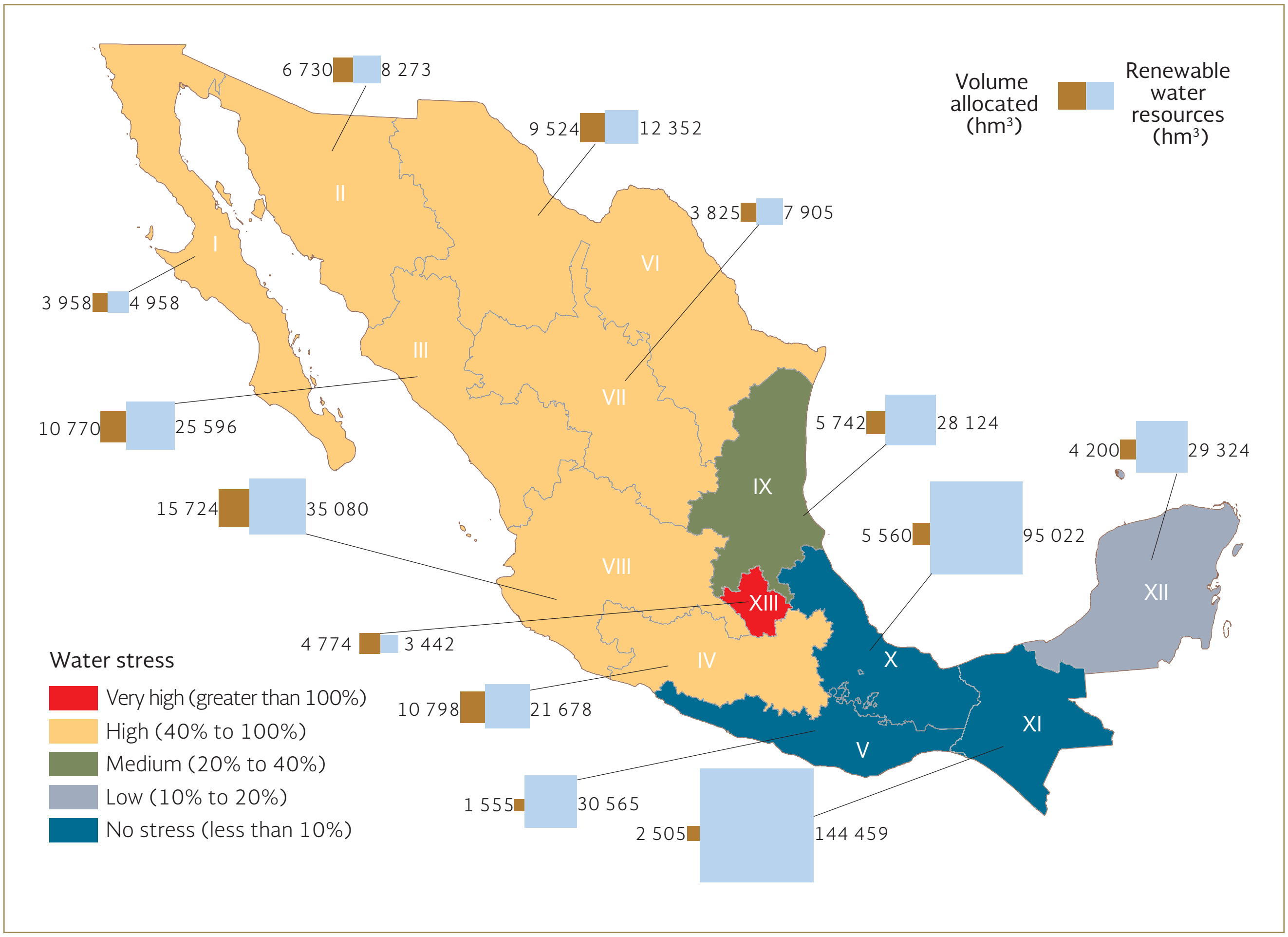
which is considered low

Table 3.4 Degree of water stress, 2015

HAR number	Total volume of water allocated 2015 (hm^3)	Renewable water resources 2015 (hm^3/year)	Degree of water stress (%)	Classification of water stress
I	3 958	4 958	79.8	High
II	6 730	8 273	81.4	High
III	10 770	25 596	42.1	High
IV	10 798	21 678	49.8	High
V	1 555	30 565	5.1	No stress
VI	9 524	12 352	77.1	High
VII	3 825	7 905	48.4	High
VIII	15 724	35 080	44.8	High
IX	5 742	28 124	20.4	Medium
X	5 560	95 022	5.9	No stress
XI	2 505	144 459	1.7	No stress
XII	4 200	29 324	14.3	Low
XIII	4 774	3 442	138.7	Very high
Total	**85 664**	**446 777**	**19.2**	**Low**

Source: Produced based on Conagua (2016b), Conagua (2016c).

Map 3.4 Degree of water stress, 2015



Source: Produced based on Conagua (2016b), Conagua (2016c).

3.9 Virtual water in Mexico

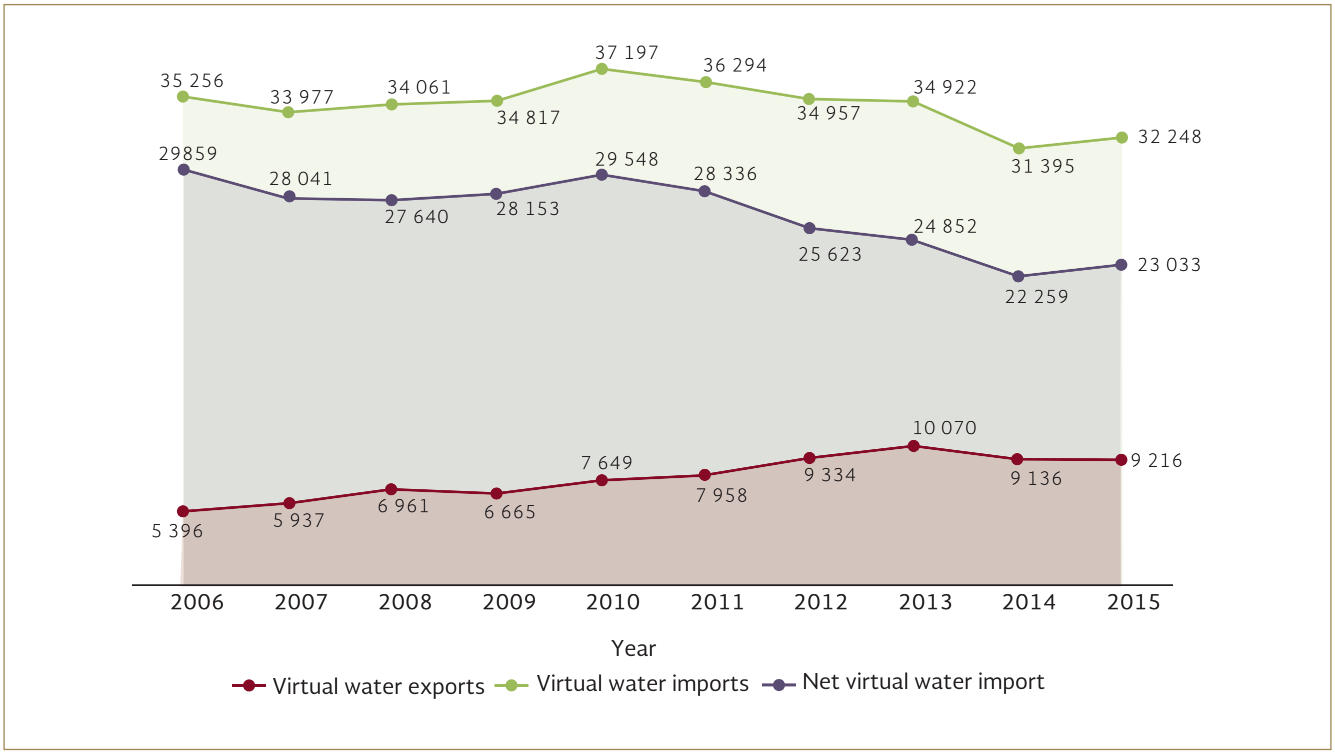
[Tablero: Agua virtual / Huella hídrica]

Virtual water is defined as the total quantity of water used by or embedded in a product, good or service. For example, one kilogram of corn in Mexico requires an average of 1 860 liters of water (Mekonnen and Hoekstra 2010a), whereas a kilogram of beef requires 15 415 liters (Mekonnen and Hoekstra 2010b); these values vary between countries.

As a result of Mexico's commercial exchanges with other countries, in 2015 Mexico exported 9 216 million cubic meters of virtual water (VWE), and imported 32 248 (VWI), meaning that it had a **net virtual water import** (NVWI) of 23 033 million cubic meters of water. In graph 3.9 [Adicional: Table 3.B] the evolution in the 2006-2015 period is shown.

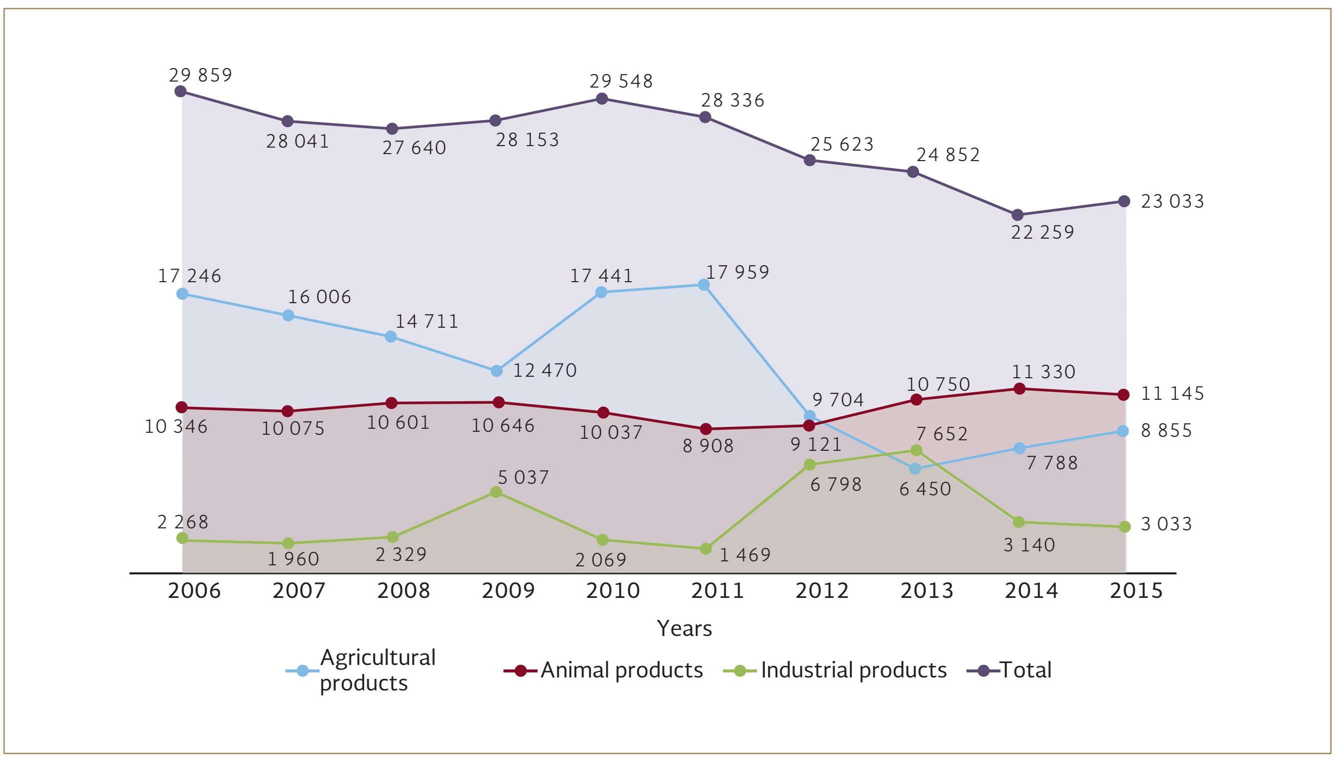
Of the resulting net virtual water import (NVWI), the evolution registered in the 2006-2015 period shows relevant variations, with a general trend towards the reduction in the import of agricultural products, which brings about a similar reduction in the total imports, as can be observed in graph 3.10.

Graph 3.9 Virtual water imports and exports in Mexico 2006-2015 (hm³)



Source: Produced based on Economía (2016).

Graph 3.10 Net virtual water import 2006 to 2015 (hm³)



Source: Produced based on Economía (2016).

3.10 Water accounts

The System of Environmental-Economic Accounting (SEEA), developed through international collaboration (United Nations, European Commission, Organisation for Economic Cooperation and Development, World Monetary Fund and World Bank), is a statistical framework which guides the compilation of comparable and consistent statistics and indicators for the formulation of policies, analysis and research on the interaction between the economy and the environment (Unstats 2016a).

Through the concept of **physical flows** established in the SEEA, the flows of materials and energy between the economy and the environment can be described, which allows them to be analyzed in parallel to the flows of products in monetary terms, compiled in turn in the National Accounting Systems (see figure 3.3).

At present the SEEA consists of a central framework and subsystems which provide greater detail on specific topics. The SEEA-Water, known as "**Water Accounts**", is one such subsystem of the SEEA, the finality of which is to standardize concepts and methods of water accounting and to provide information on economic and hydrological aspects so as to make a systematic analysis of water's contribution to the economy possible, as well as the effects of the economy on water resources.

Figure 3.4 shows the general scheme of flows between the economy and water, employing the standard SEEA-Water terminology.

Based on the information generated by the Conagua, the physical flows of water are registered in tables of use and supply of water and of transfers within the economy. The economic activities follow the North American Industrial Classification System (NAICS).

In a simplified way, figure 3.5 shows the interactions between water and the economy in Mexico, in terms of physical flows of water.

It can be observed that in total, 228 721 hm^3 of water are extracted from the environment, of which 191 016 are surface water (83.5%), 33 310 are groundwater (14.6%) and 4 395 are rainwater (1.9%). Additionally, 29 619 hm^3 are consumed through evapotranspiration and integration into goods produced. In figure 3.5 the difference between extraction and return is shown.

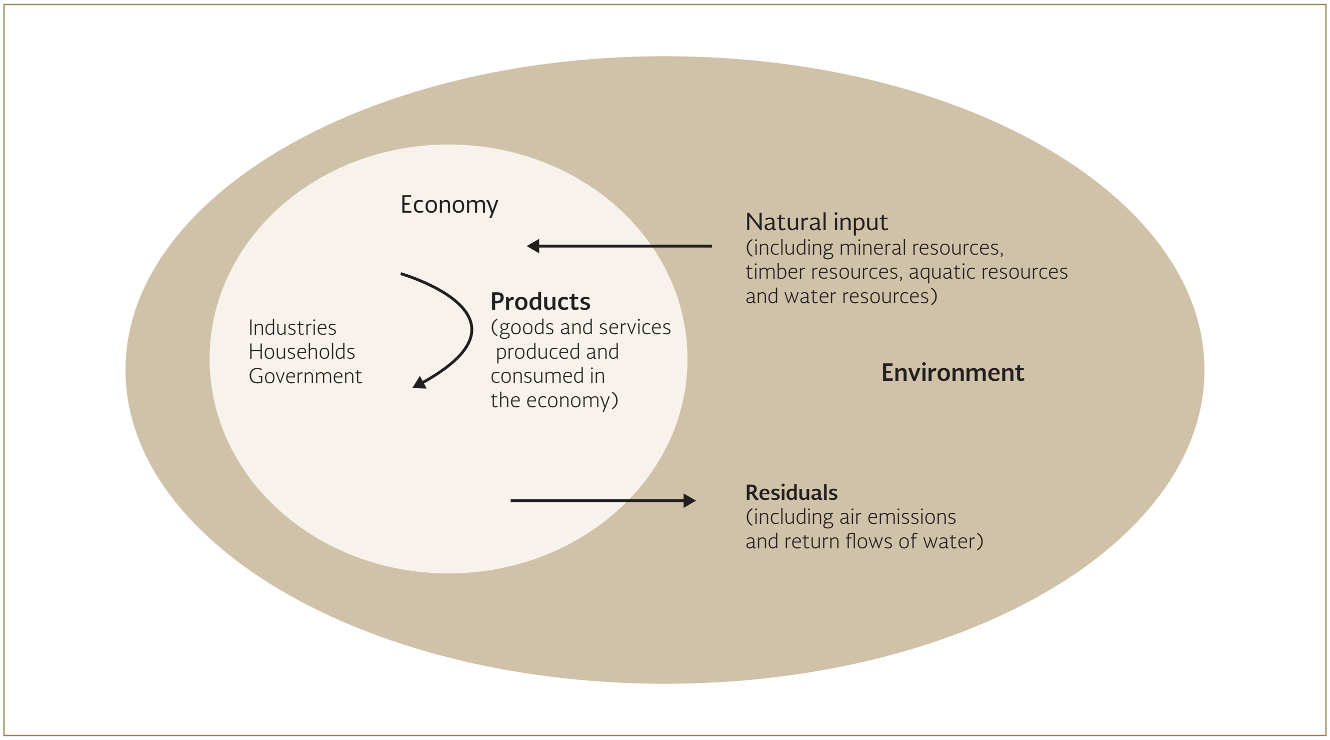
According to the Water Accounts, in 2015

29 619

hm^3/ year

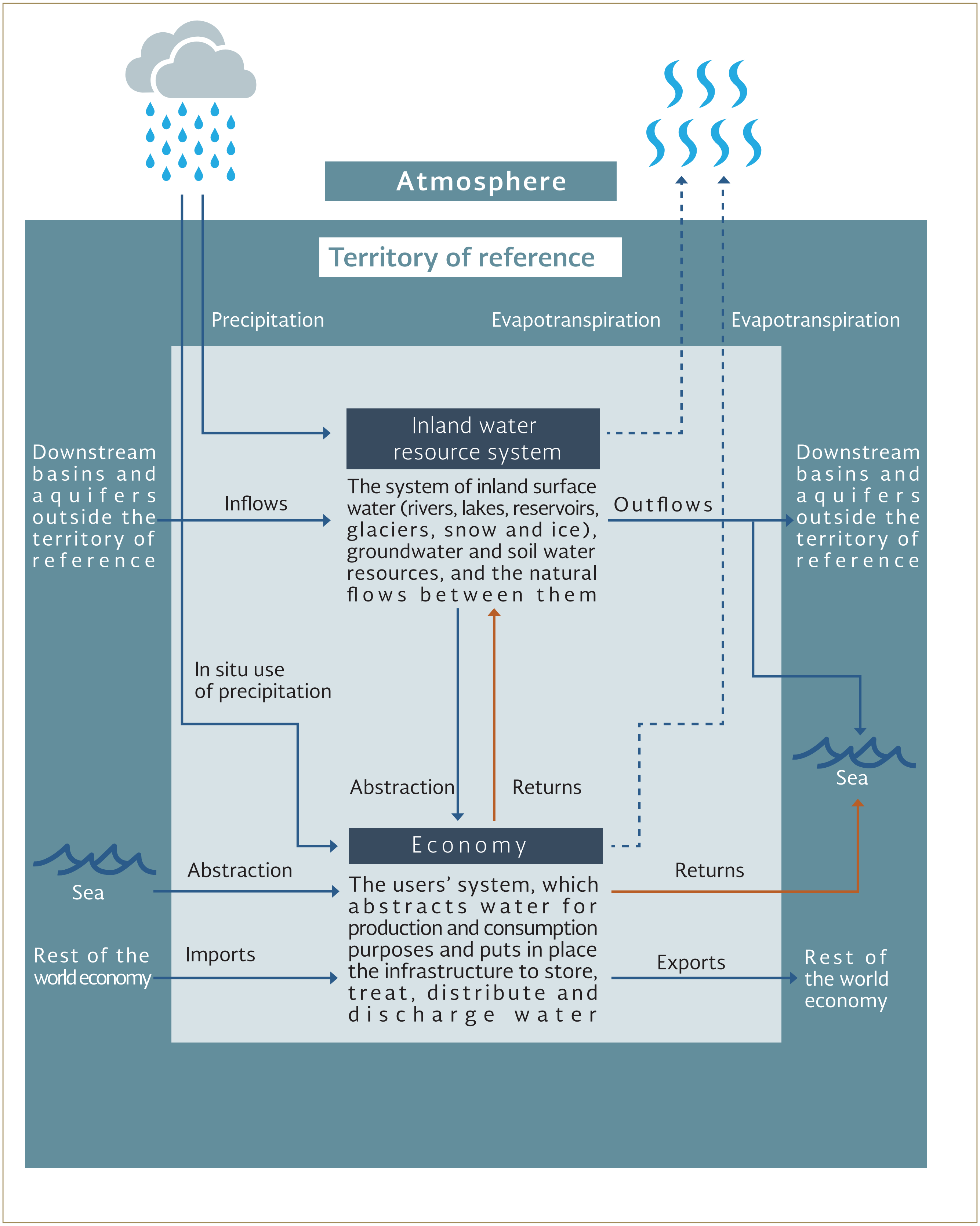
were consumed

FIGURE 3.3 Physical flows of natural inputs, products and residuals



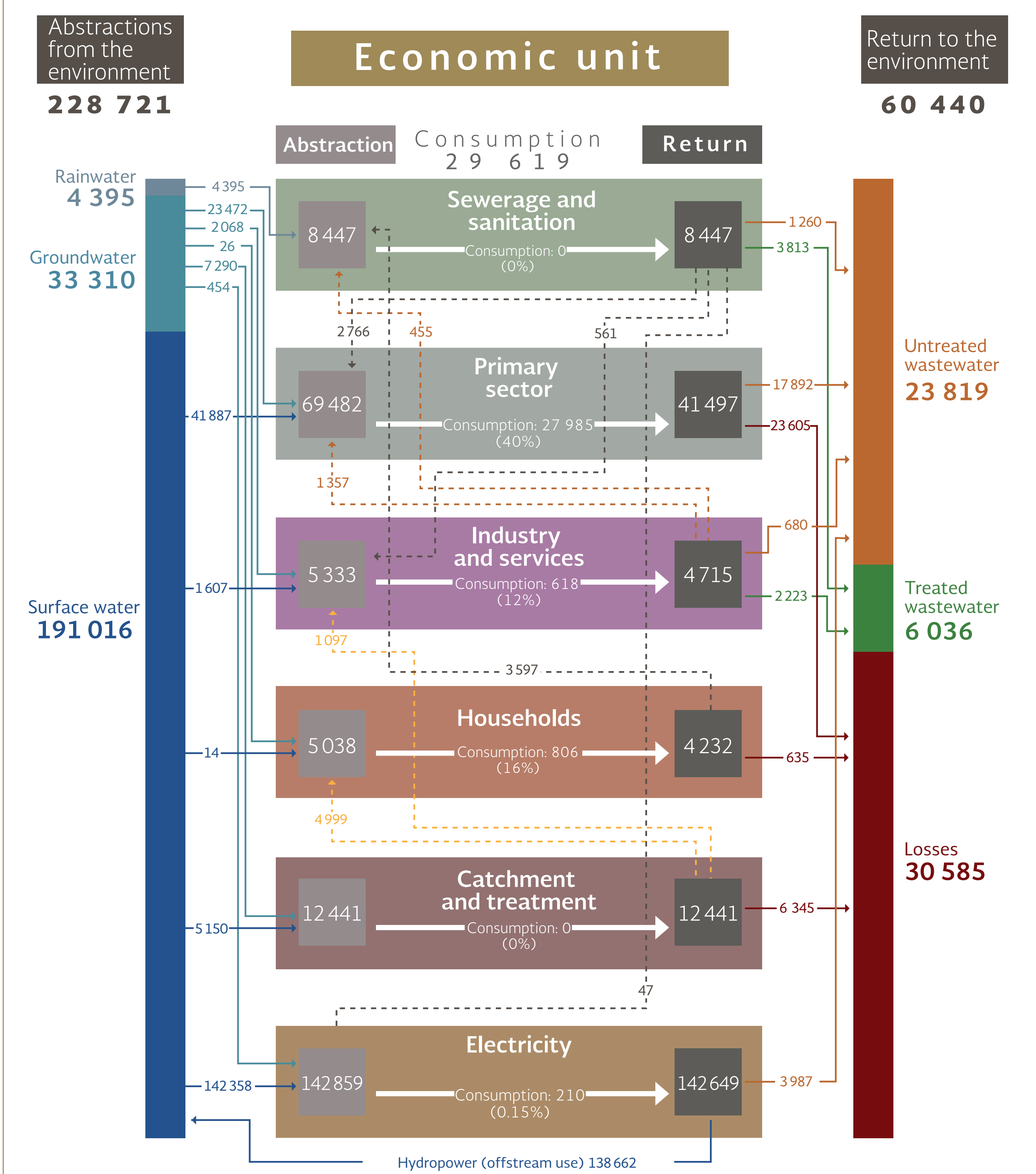
Source: UNSTATS (2016a).

FIGURE 3.4 General scheme of flows between the economy and water



Source: UNSTATS (2013).

FIGURE 3.5 Simplified flow of water between the environment and the economy in Mexico (hm³/year)



Source: Produced based on INEGI (2013g), INEGI (2016k).

Given that hydropower returns to the environment practically 100% of the water it uses, the total returns are 60 440 hm³, made up of 23 819 of untreated wastewater (39.4%), 6 036 of treated wastewater (10%) and 30 585 of losses (50.6%), due to leaks in the catchment and distribution systems.

By combining physical flows with economic ones, the hybrid charts of supply (table 3.5) and use (table 3.6) are obtained, which allow water economy to be studied, through the presentation of conventional national accounts together with physical information on water extraction, meaning its supply and use of its economy and the discharge of wastewater and pollutants towards the environment.

As an example of the way in which the hybrid charts of supply and use can be interpreted, the **primary sector** can be observed (agriculture, rearing and use of animals, forest production, fishing and hunting), which generated in 2015 a gross production of 917.4 billion pesos; of which 344.9 billion pesos corresponded to its intermediate consumption, generating in this way a value added of 572.6 billion pesos.

As regards the primary sector, it extracted from the environment 65 359 hm³ of water for the realization of its productive activities; it also received 4 123 hm³ from other economic units (industry and services and sewerage and sanitation). On the other hand, the agriculture and livestock sector returned to the environment a volume of 41 497 hm³. The difference between extraction and return is the water consumption, for 27 895 hm³ throughout the year.

Table 3.5 Hybrid chart of supply of water-related activities and products, 2015

Description	Primary sector	Industry and services	Electricity	Water catchment and treatment	Sewerage and sanitation	Households	Imports	Taxes minus subsidies on production	Total offer at buyer price
1. Total production and supply (millions of current pesos)	917 444	28 367 635	406 633	50 501	50 501	NA	6 767 103	1 067 967	37 627 785
2. Total supply of water (hm³)	41 497	4 715	142 649	12 441	8 447	4 232			213 981
2.a Supply of water to other economic units	0	1 812	0	6 096	3 374	3 597			14 879
2.b Total returns	41 497	2 903	142 649	6 345	5 073	635			199 102
3. Total emissions of BOD_5 (millions of tons)	U	10	U	U	2	U	NA	NA	12

Note: U: Unavailable. NA: not applicable.
Source: Produced based on Inegi (2016k).

3 Termed in this way since they present both monetary (pesos) and physical information (cubic meters of water).

This project complements the statistical heritage as regards environmental accounting, since additional information is made available on the environmental impact as a consequence of the production, distribution and consumption of goods and services.

As regards the environmental accounting of water resources, it is possible to quantify in monetary values the annual depletion of groundwater, which for 2015 was estimated at 27.9 billion pesos. Another element of environmental accounts refers to the estimation of the cost of treating untreated wastewater treatment in 2015, for 57.4 billion pesos.

The information thus produced provides context for decision making on public policy. In 2015, the total costs for environmental depletion and degradation (907.5 billion pesos) are more than five times higher than expenditure in environmental production for that year (141.9 billion pesos) (Conagua 2016d, Inegi 2016k).

Table 3.6 Hybrid chart of use of water-related activities and products, 2015

Description	Intermediate consumption by industries					Final effective consumption		Gross formation of fixed capital	Exports	Variation of existences and statistical discrepancies	Total uses at buyer prices
	Primary sector	Industry and services	Electricity	Water catchment and treatment	Sewerage and sanitation	Households	Government				
1. Intermediate consumption and total use (millions of current pesos)	344 878	12 142 241	149 400	14 703	14 703	12 448 130	2 272 262	4 101 358	6 409 507	- 269 396	37 627 785
Of which:											
1.a Drinking water	670	25 640	25	158	0	24 073	NA	NA	NA	NA	50 565
1.b Sewerage and sanitation services	89	328	0	0	0	0	NA	NA	NA	NA	417
2. Total value added (millions of current pesos)	572 566	16 225 395	257 233	35 798	35 798	NA	NA	NA	NA	NA	17 126 791
3. Total use of water (hm^3)	69 482	5 333	142 859	12 441	8 447	5 038	NA	NA	NA	NA	243 600
3.a Total extraction	65 359	3 675	142 812	12 441	4 395	39	NA	NA	NA	NA	228 721
3.b Use of water received from other economic units	4 123	1 658	47	0	4 052	4 999	NA	NA	NA	NA	14 879
Including: Water catchment and treatment	*0*	*1 097*	*0*	*0*	*0*	*4 999*	*NA*	*NA*	*NA*	*NA*	*6 096*
7. Consumption (hm^3)	27 985	618	210	0	0	806	NA	NA	NA	NA	29 619

Note: NA: Not applicable.
Source: Produced based on Inegi (2016k).

CHAPTER

4

Water infrastructure

WATER INFRASTRUCTURE

Coverage 2015

Access to services

Tap water

95.3%

97.8% urban
87.0% rural

Sewerage and basic sanitation

92.8%

97.4% urban
77.5% rural

Conagua

Drinking water

92.5%

95.7% urban
81.6% rural

Sanitation

91.4%

96.6% urban
74.2% rural

21 Regional emergency attention centers

Cutzamala System

17% of the supply of the Valley of Mexico

Supply in 2015

497 hm^3

Water treatment

Drinking water treatment

8 7 4 purification plants

97.9 m³/s treated

Wastewater treatment

2 477 municipal plants

120.9 m³/s treated

2 832 industrial plants

70.5 m³/s treated

Reservoirs and berms

More than **5 000** reservoirs and berms

Total storage
150 000 hm³ approximately
180 main reservoirs represent
80% of storage

Hydro-agricultural infrastructure

6.5 million hectares of irrigation

86 irrigation districts

More than **40 000** irrigation units

2.9 million hectares of technified rainfed

23 technified rainfed districts

4.1 Water infrastructure

The water infrastructure available within the country to provide the water required by the various national users includes the following:

More than 5 000 reservoirs and water retention berms.[1]

6.5 million hectares with irrigation.

2.9 million hectares with technified rainfed infrastructure.

874 drinking water treatment plants in operation.

2 477 municipal wastewater treatment plants in operation.

2 832 industrial wastewater treatment plants in operation..

More than 3 000 km of aqueducts.

Box 4.1 Main water infrastructure projects, 2015

- Sanitation of the Valley of Mexico: Atotonilco wastewater treatment plant (35 m³/s); Eastern Drainage Tunnel (TEO) for 150 m³/s, Western Drainage Tunnel II for 112 m³/s and General Canal Tunnel for 20 m³/s.
- Monterrey VI: 372 km aqueduct to supply 5 m³/s to Monterrey
- El Zapotillo: Reservoir and 140 km aqueduct to supply Guadalajara, Leon and Los Altos de Jalisco.
- El Purgatorio: Reservoir and infrastructure to provide 5.6 m³/s in conjunction with El Zapotillo to supply the Guadalajara metropolitan area.
- Cutzamala: third line of the system (12 m³/s and 77.6 km) to offer greater security in the supply to the Valley of Mexico.
- Vicente Guerrero-Ciudad Victoria: Aqueduct under review, 54.6 km and 0.75 m³/s to supply water to Ciudad Victoria.
- La Laja: Reservoir and aqueduct under review, 32 km and 0.5 m³/s to supply Ixtapa-Zihuatanejo.
- Tijuana I and II: Desalinization plant under review, 1 m³/s to supply Tijuana.
- Riviera Veracruzana System: Aqueduct under review, 30.8 km and 1.5 m³/s for supply.
- Hermosillo: 2.5 m³/s treatment plant.
- La Paz: Desalinization plant under review, with a flow of 0.2 m³/s in the first stage.
- Picachos-Mazatlan: aqueduct under review, with a flow of 0.75 m³/s in the first stage to supply water to Mazatlan.

Source: Produced based on Conagua (2016h).

1 An approximate number, due to the insufficient registry of berms..

4.2 Reservoirs and berms

[Tablero: Presas principales]

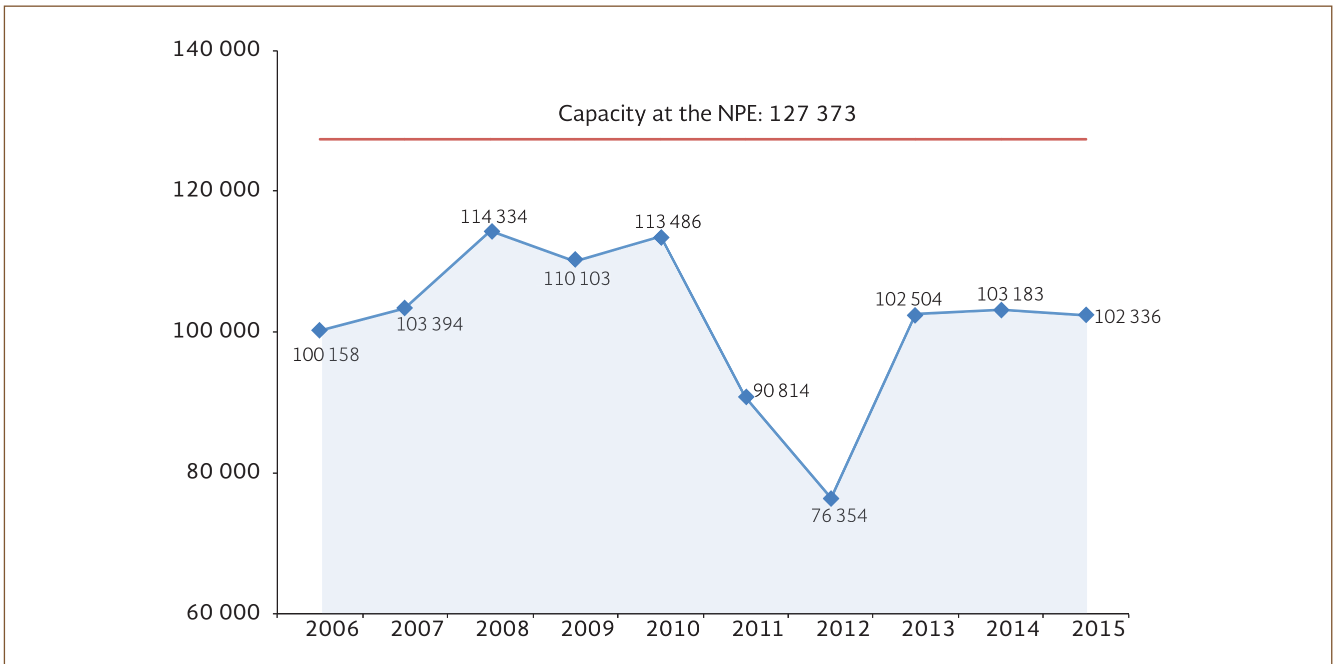
There are more than 5 000 **reservoirs and water retention berms** in Mexico, some of which are classified as large dams, according to the definition of the International Commission on Large Dams.**2**

There is an incomplete registry of water retention berms. Efforts are currently underway to register these small storage works, mainly present on dirt tracks.

The storage capacity in the country's reservoirs is approximately 150 billion m³. This edition presents statistics on the 180 reservoirs that represent 80% of the national storage capacity. The annual volume stored in these 180 reservoirs in the period from 2006 to 2015 is shown at the national scale in graph 4.1 and regionally in [Adicional: G4.A]. This volume depends upon the precipitation and runoff in the different regions of the country, as well as the reservoirs' operation policies, determined by their storage purposes for various uses and flood control. Graph 4.1 shows the volume stored as of December 31 each year, with the reference of the normal pool elevation (NPE).

180 large dams represent 80% of Mexico's storage capacity

Graph 4.1 Volume in the 180 main reservoirs

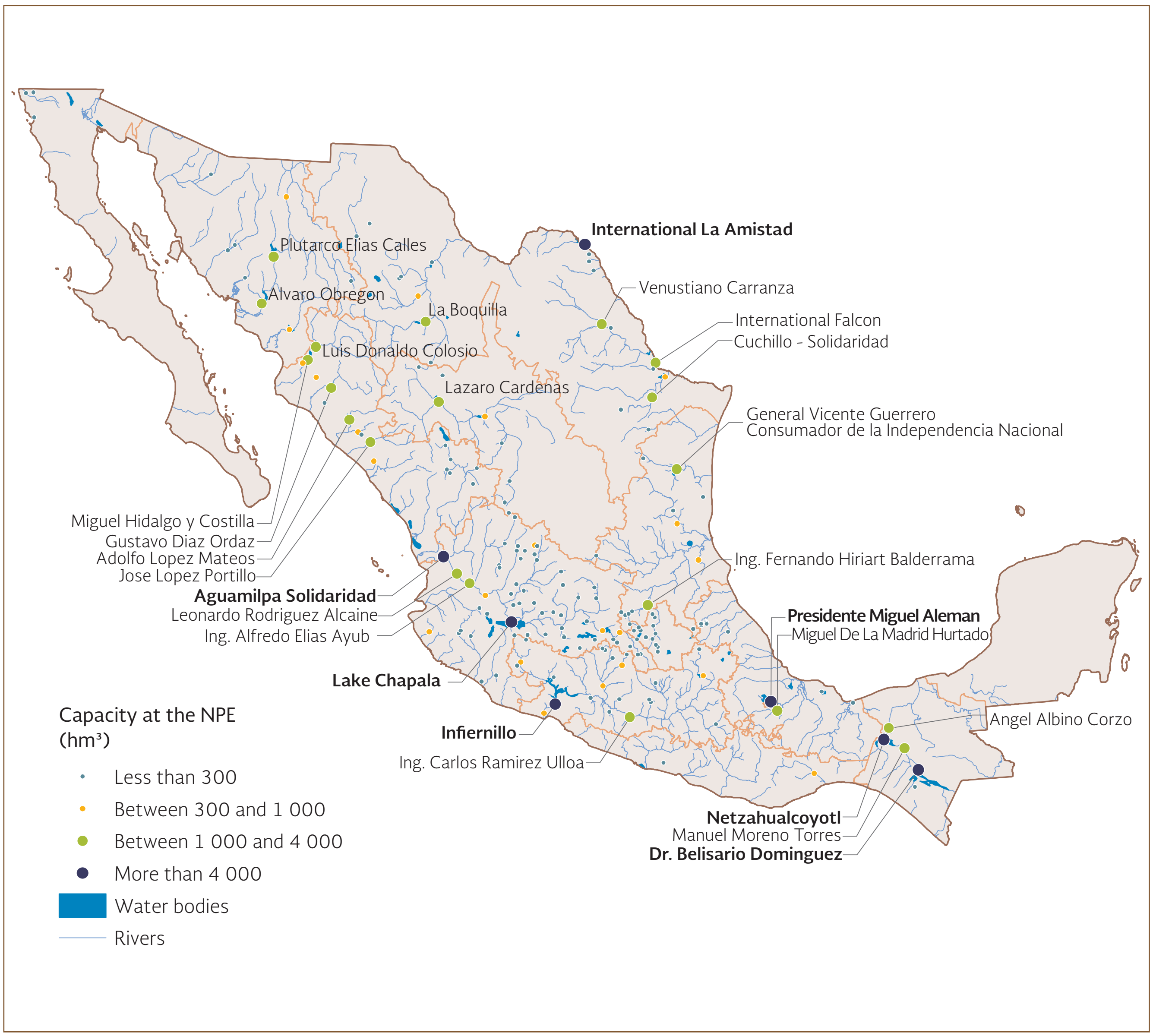


Source: Conagua (2016b).

2 The reservoir's crest should be at least 15 meters high; or between 10 and 15 meters high with a storage volume of more than 3 hm³ (ICOLD 2007).

The location of these reservoirs is shown in map 4.1 and their main characteristics in table 4.1. The localization of those reservoirs follows, among other factors, the hydrological regime of the current, the topography and the geological characteristics of the site, as well as the uses for which they were intended, among them electricity generation, public supply, irrigation and flood control. Table 4.1 employs the following abbreviations: G: Electricity generation. I: Irrigation. P: Public supply. C: Flood control; the code corresponds to the one used in the inventory of the CONAGUA's Deputy Director General's Office for Technical Affairs.

MAP 4.1 Mexico's main reservoirs



Note: The names of the reservoirs with a capacity greater than 1 000 hm³ are shown.
Source: CONAGUA (2016b).

Table 4.1 Volume in the 180 main reservoirs

Number	SGT code	Official name	Given name	Capacity at the NPE (hm³)	HAR	Uses
1	693	Dr. Belisario Dominguez	La Angostura	13 169.00	Southern Border	G
2	706	Netzahualcoyotl	Malpaso or Raudales	12 373.10	Southern Border	G, I, C
3	1453	Infiernillo	Infiernillo	9 340.00	Balsas	G, C
4	1810	Lake Chapala	Chapala	7 634.00	Lerma-Santiago-Pacific	I, P
5	2754	Presidente Miguel Aleman	Temascal	8 119.10	Central Gulf	G, I, C
6	2516	Aguamilpa Solidaridad	Solidaridad	5 540.00	Lerma-Santiago-Pacific	G, I
7	345	International La Amistad	International La Amistad	4 040.33	Rio Bravo	G, I, P, C
8	3617	General Vicente Guerrero Consumador de la Independencia Nacional	Las Adjuntas	3 910.67	Northern Gulf	P, I
9	3440	International Falcon	Falcon	3 264.81	Rio Bravo	P, C, G
10	3148	Adolfo Lopez Mateos	El Humaya or El Varejonal	3 086.61	Northern Pacific	G, I
11	3243	Alvaro Obregon	El Oviachic	2 989.20	Northwest	G, I, P
12	3218	Miguel Hidalgo y Costilla	El Mahone	2 921.42	Northern Pacific	G, I
13	3216	Luis Donaldo Colosio	Huites	2 908.10	Northern Pacific	G, I
14	750	La Boquilla	Lago Toronto	2 893.57	Rio Bravo	G, I
15	1084	Lazaro Cardenas	El Palmito	2 872.97	Central Basins of the North	I, C
16	3320	Plutarco Elias Calles	El Novillo	2 833.10	Northwest	G, I
17	2742	Miguel de La Madrid Hurtado	Cerro de Oro	2 599.51	Central Gulf	I
18	3210	Jose Lopez Portillo	El Comedero	2 580.19	Northern Pacific	G, I
19	2538	Leonardo Rodriguez Alcaine	El Cajon	2 551.70	Lerma-Santiago-Pacific	G
20	2519	Ing. Alfredo Elias Ayub	La Yesca	2 292.92	Lerma-Santiago-Pacific	G
21	3203	Gustavo Diaz Ordaz	Bacurato	1 859.83	Northern Pacific	G, I
22	1463	Ing. Carlos Ramirez Ulloa	El Caracol	1 458.21	Balsas	G
23	1679	Ing. Fernando Hiriart Balderrama	Zimapan	1 390.11	Northern Gulf	G
24	701	Manuel Moreno Torres	Chicoasen	1 384.86	Southern Border	G
25	494	Venustiano Carranza	Don Martin	1 312.86	Rio Bravo	P, C, I
26	2689	Cuchillo - Solidaridad	El Cuchillo	1 123.14	Rio Bravo	P, I
27	688	Angel Albino Corzo	Peñitas	1 091.10	Southern Border	G
28	3241	Adolfo Ruiz Cortines	Mocuzari	950.30	Northwest	G, I, P
29	1436	Solis	Solis	800.03	Lerma-Santiago-Pacific	I, C
30	3490	Marte R. Gomez	El Azucar	781.70	Rio Bravo	I
31	2708	Presidente Benitez Juarez	El Marques	963.70	Southern Pacific	I
32	3302	Lazaro Cardenas	Angostura	703.36	Northwest	P, I
33	3229	Sanalona	Sanalona	673.47	Northern Pacific	G, I, P
34	2206	Constitucion de Apatzingan	Chilatan	590.04	Balsas	I, C
35	3557	Estudiante Ramiro Caballero Dorantes	Las Animas	571.07	Northern Gulf	I
36	2257	Jose Maria Morelos y Pavon	La Villita	540.80	Balsas	G, I
37	3211	Josefa Ortiz de Dominguez	El Sabino	595.13	Northern Pacific	I
38	1710	Cajon de Peñas	Tomatlan o El Tule	510.56	Lerma-Santiago-Pacific	P, I
39	3693	Paso de Piedras	Chicayan	456.92	Northern Gulf	I
40	2382	Tepuxtepec	Tepuxtepec	425.20	Lerma-Santiago-Pacific	G, I
41	3154	Ing. Aurelio Benassini Vizcaino	El Salto or Elota	415.00	Northern Pacific	I, C
42	1825	Manuel M. Dieguez	Santa Rosa	403.00	Lerma-Santiago-Pacific	G
43	1477	El Gallo	El Gallo	400.00	Balsas	I

Number	SGT code	Official name	Given name	Capacity at the NPE (hm^3)	HAR	Uses
44	2126	Valle de Bravo	Valle de Bravo	394.39	Balsas	P
45	813	Francisco I. Madero	Las Virgenes	355.29	Rio Bravo	I, C
46	49	Plutarco Elias Calles	Plutarco Elias Calles	340.00	Lerma-Santiago-Pacific	I
47	1045	Francisco Zarco	Las Tortolas	309.24	Central Basins of the North	I, C
48	2826	Manuel Avila Camacho	Valsequillo or Balcon del Diablo	303.71	Balsas	I
49	2631	Jose Lopez Portillo	Cerro Prieto	300.00	Rio Bravo	P, I
50	3202	Ing. Guillermo Blake Aguilar	El Sabinal or El Cajon	300.60	Northern Pacific	I, C
51	825	Ing. Luis L. Leon	El Granero	292.47	Rio Bravo	I, C
52	1507	Vicente Guerrero	Palos Altos	250.00	Balsas	I
53	1782	General Ramon Corona Madrigal	Trigomil	250.00	Lerma-Santiago-Pacific	I
54	1035	Federalismo Mexicano	San Gabriel	245.43	Rio Bravo	P, C, I
55	3478	Presidente Lic. Emilio Portes Gil	San Lorenzo	230.78	Northern Gulf	I
56	4365	Solidaridad	Trojes	220.00	Lerma-Santiago-Pacific	I
57	3239	Abelardo Rodriguez Lujan	Hermosillo	219.50	Northwest	P, C, I
58	2167	El Bosque	El Bosque	202.40	Balsas	P, C
59	2286	Melchor Ocampo	El Rosario	200.00	Lerma-Santiago-Pacific	I
60	1328	Laguna de Yuriria	Yuriria	187.90	Lerma-Santiago-Pacific	I
61	2136	Villa Victoria	Villa Victoria	185.72	Balsas	P
62	3662	Canseco	Laguna de Catemaco	163.60	Central Gulf	G
63	1583	Endho	Endho	182.00	Waters of the Valley of Mexico	I, C
64	1315	Ignacio Allende	La Begoña	150.05	Lerma-Santiago-Pacific	I, C
65	1926	Tacotan	Tacotan	149.00	Lerma-Santiago-Pacific	I, C
66	1702	Basilio Vadillo	Las Piedras	145.72	Lerma-Santiago-Pacific	I
67	3747	El Chique	El Chique	140.00	Lerma-Santiago-Pacific	I
68	1203	Santiago Bayacora	Santiago Bayacora	130.05	Northern Pacific	I
69	3308	Ing. Rodolfo Felix Valdes	El Molinito	130.20	Northwest	I, C
70	1499	Revolucion Mexicana	El Guineo	126.69	Southern Pacific	I, C
71	917	El Tintero	El Tintero	138.48	Rio Bravo	I, C
72	2011	Huapango	Huapango	119.00	Northern Gulf	I
73	3790	Gobernador Leobardo Reynoso	Trujillo	118.00	Central Basins of the North	I
74	1365	La Purisima	La Purisima	110.03	Lerma-Santiago-Pacific	I, C
75	1459	Andres Figueroa	Las Garzas	102.50	Balsas	I
76	3197	Lic. Eustaquio Buelna	Guamuchil	174.56	Northern Pacific	P, C, I
77	731	Abraham Gonzalez	Guadalupe	85.44	Northwest	I, C
78	1887	El Salto	El Salto	83.30	Lerma-Santiago-Pacific	P
79	2202	Cointzio	Cointzio	76.80	Lerma-Santiago-Pacific	P, I
80	1057	Presidente Guadalupe Victoria	El Tunal	75.90	Northern Pacific	I
81	5133	Las Blancas	Derivadora Las Blancas	83.78	Rio Bravo	I, C
82	836	Las Lajas	Las Lajas	91.00	Rio Bravo	I, C
83	1800	Ing. Elias Gonzalez Chavez	Puente Calderon	82.00	Lerma-Santiago-Pacific	P
84	237	Rodriguez	Abelardo L. Rodriguez	76.90	Baja California Peninsula	P, C
85	1040	Francisco Villa	El Bosque	73.26	Northern Pacific	I
86	3807	Miguel Aleman	Excame	71.20	Lerma-Santiago-Pacific	G, I, C
87	2886	Constitucion de 1917	Hidalgo	65.00	Northern Gulf	I
88	711	Juan Sabines	El Portillo or Cuxtepeques II	100.20	Southern Border	I
89	2113	San Andres Tepetitlan	Tepetitlan	67.62	Lerma-Santiago-Pacific	I
90	2359	San Juanico	La Laguna	60.00	Balsas	I, C

Number	SGT code	Official name	Given name	Capacity at the NPE (hm³)	HAR	Uses
91	2005	Guadalupe	Guadalupe	56.70	Waters of the Valley of Mexico	I
92	4677	Ing. Juan Guerrero Alcocer	Vinoramas	22.50	Northern Pacific	P, C, I
93	3562	Republica Española	Real Viejo or El Sombrero	54.78	Northern Gulf	I
94	3639	San Jose Atlanga	Atlanga	54.50	Balsas	I
95	2931	El Tepozan	El Tepozan	48.31	Northern Gulf	I
96	1639	Requena	Requena	52.50	Waters of the Valley of Mexico	I
97	4531	Ing. Guillermo Lugo Sanabria	La Polvora	51.70	Lerma-Santiago-Pacific	I
98	867	Pico del Aguila	Pico del Aguila	51.21	Rio Bravo	I
99	2408	Zucuiran	La Peña	36.29	Balsas	I
100	1602	Javier Rojo Gomez	La Peña	32.00	Waters of the Valley of Mexico	I
101	461	San Miguel	San Miguel	21.17	Rio Bravo	I
102	2782	Yosocuta	San Marcos Arteaga	46.80	Balsas	P, I
103	981	Caboraca	Canoas	45.00	Northern Pacific	I
104	1918	Ing. Santiago Camarena	La Vega	44.04	Lerma-Santiago-Pacific	I
105	1666	La Laguna	Tejocotal	43.53	Central Gulf	G
106	1664	Taxhimay	Taxhimay	42.80	Waters of the Valley of Mexico	I
107	3267	Cuauhtemoc	Santa Teresa	41.50	Northwest	I
108	241	El Carrizo	El Carrizo	40.87	Baja California Peninsula	P
109	2668	Rodrigo Gomez	La Boca	39.49	Rio Bravo	P
110	514	Laguna de Amela	Laguna de Amela	38.34	Lerma-Santiago-Pacific	I
111	4559	Guaracha	San Antonio	38.20	Lerma-Santiago-Pacific	I
112	2024	Jose Antonio Alzate	San Barnabe	34.50	Lerma-Santiago-Pacific	I
113	3782	Ing. Julian Adame Alatorre	Tayahua	38.00	Lerma-Santiago-Pacific	I
114	1120	Peña del Aguila	Peña del Aguila	27.95	Northern Pacific	I
115	3524	Pedro Jose Mendez	Pedro Jose Mendez	31.26	Northern Gulf	P, I
116	1995	Danxho	Danxho	31.05	Northern Gulf	I
117	1505	Valerio Trujano	Tepecoacuilco	39.39	Balsas	P, I
118	1757	El Cuarenta	El Cuarenta	30.17	Lerma-Santiago-Pacific	I
119	1945	El Tule	El Tule	28.90	Lerma-Santiago-Pacific	I
120	2829	Necaxa	Necaxa	29.06	Central Gulf	G
121	2458	La Laguna	El Rodeo	18.00	Balsas	I
122	3827	Ramon Lopez Velarde	Boca del Tesorero	27.00	Lerma-Santiago-Pacific	I
123	3739	El Cazadero	El Cazadero	22.18	Central Basins of the North	I
124	2848	Tenango	Tenango	26.82	Central Gulf	G
125	2840	Los Reyes	Omiltepec	24.03	Central Gulf	G
126	1237	Villa Hidalgo	Villa Hidalgo	23.08	Central Basins of the North	I, P
127	363	El Centenario	El Centenario	24.59	Rio Bravo	I
128	1357	Peñuelitas	Peñuelitas	17.46	Lerma-Santiago-Pacific	I
129	2282	Malpais	La Cienega	23.74	Lerma-Santiago-Pacific	I
130	777	Chihuahua	Chihuahua	23.38	Rio Bravo	P
131	2298	Los Olivos	Los Olivos	10.26	Balsas	I
132	1799	Hurtado	Valencia	22.00	Lerma-Santiago-Pacific	I
133	1337	Mariano Abasolo	San Antonio de Aceves	21.00	Lerma-Santiago-Pacific	I
134	381	La Fragua	La Fragua	47.30	Rio Bravo	I
135	1107	Los Naranjos	Naranjos	26.00	Central Basins of the North	I
136	1673	Vicente Aguirre	Las Golondrinas	21.62	Northern Gulf	I
137	2013	Ignacio Ramirez	La Gavia	20.50	Lerma-Santiago-Pacific	I
138	2671	Salinillas	Salinillas	19.01	Rio Bravo	I

Number	SGT code	Official name	Given name	Capacity at the NPE (hm³)	HAR	Uses
139	3661	La Cangrejera	La Cangrejera	28.54	Central Gulf	I
140	2161	Aristeo Mercado	Wilson	19.11	Lerma-Santiago-Pacific	I
141	1487	Laguna de Tuxpan	Tuxpan	9.17	Balsas	I
142	2045	Ñado	Ñado	16.80	Northern Gulf	I
143	152	El Niagara	El Niagara	16.30	Lerma-Santiago-Pacific	I
144	3297	Ignacio R. Alatorre	Punta de Gua	17.78	Northwest	I
145	2	Abelardo L. Rodriguez	Abelardo L. Rodriguez	16.00	Lerma-Santiago-Pacific	I
146	2144	Agostitlan	Mata de Pinos	15.95	Balsas	I
147	2194	Tercer Mundo	Chincua	15.57	Lerma-Santiago-Pacific	I
148	1078	Jose Jeronimo Hernandez	Santa Elena	15.10	Northern Pacific	I
149	142	Media Luna	Media Luna	15.00	Lerma-Santiago-Pacific	I
150	1950	Vicente Villaseñor	Valley de Juarez	19.00	Lerma-Santiago-Pacific	I
151	1879	La Red	La Red	14.25	Lerma-Santiago-Pacific	I
152	2400	Urepetiro	Urepetiro	12.80	Lerma-Santiago-Pacific	I
153	2037	Madin	Madin	15.95	Waters of the Valley of Mexico	v
154	2830	Nexapa	Nexapa	12.50	Central Gulf	G
155	1989	La Concepcion	La Concepcion	12.11	Waters of the Valley of Mexico	I
156	2263	Laguna del Fresno		12.08	Lerma-Santiago-Pacific	I
157	3850	Santa Rosa	Santa Rosa	10.48	Central Basins of the North	I
158	118	Jocoqui	Jocoqui	10.60	Lerma-Santiago-Pacific	I
159	1935	Tenasco	Boquilla de Zaragoza	6.13	Lerma-Santiago-Pacific	I
160	2253	Jaripo	Jaripo	10.20	Lerma-Santiago-Pacific	I
161	1354	El Palote	El Palote	10.00	Lerma-Santiago-Pacific	P
162	3780	Jose Maria Morelos	La Villita	10.00	Lerma-Santiago-Pacific	I
163	2003	Francisco Jose Trinidad Fabela	Isla de las AVes or El Salto	6.50	Lerma-Santiago-Pacific	I
164	2321	Pucuato	Pucuato	9.58	Balsas	I
165	3019	Ing. Valentin Gama	Ojo Caliente	10.00	Central Basins of the North	I
166	1462	La Calera	La Calera	22.00	Balsas	I
167	2903	La Llave	Divino Redentor	10.88	Northern Gulf	I
168	2881	El Centenario	El Centenario	13.76	Northern Gulf	I
169	2847	La Soledad	Apulco or Mazatepec	8.99	Central Gulf	G
170	2039	El Molino	Arroyo Zarco	7.30	Northern Gulf	I
171	1762	Cuquio	Los Gigantes	7.50	Lerma-Santiago-Pacific	I
172	881	El Rejon	El Rejon	6.53	Rio Bravo	P
173	2207	Copandaro	Copandaro	5.99	Lerma-Santiago-Pacific	I
174	1773	El Estribon	El Estribon	6.50	Lerma-Santiago-Pacific	P, I
175	1307	La Golondrina	La Golondrina	5.40	Lerma-Santiago-Pacific	I
176	67	La Codorniz	La Codorniz	5.37	Lerma-Santiago-Pacific	I
177	2347	Sabaneta	Sabaneta	5.19	Balsas	I
178	1585	La Esperanza	La Esperanza	3.92	Northern Gulf	I
179	242	Emilio Lopez Zamora	Ensenada	2.73	Baja California Peninsula	v
180	2954	La Venta	La Venta	2.48	Northern Gulf	I
		Total		**127 372.89**		

Source: Conagua (2016b).

4.3 Hydro-agricultural infrastructure

In Mexico, the area with infrastructure that allows irrigation is approximately 6.5 million hectares, of which 3.3 million correspond to 86 irrigation districts (IDs) and the remaining 3.2 million to more than 40 000 irrigation units (IUs).

IDs and IUs considered the prevailing technology at the time of their design for the application of water to plots by means of gravity. In some cases, only the networks of channels and main drains were built, with the construction on the plots being the responsibility of the users. This situation, along with the deterioration of the infrastructure, which has worsened over decades through the insufficient economic resources for their conservation and improvement, has brought about a decrease in the overall efficiency of water management.

It should be mentioned that the yield in areas under irrigation regimes is higher than in areas using rainfed agriculture. In 2013, for the main crops by area harvested -corn grain, sorghum grain and beans-, the yield in areas under irrigation, measured in tons/ha, was 2.2 to 3.3 times higher than in rainfed areas (produced based on SIAP 2014).

The agricultural year in Mexico includes the period from October to September of the following year.

Irrigation infrastructure covers

6.5

million hectares

Irrigation districts (IDs)

[Tablero: Distritos de riego]

IDs are irrigation projects developed by the Federal Government since 1926, the year in which the National Irrigation Commission was created, and include various works, such as storage basins, direct diversions, pumping plants, wells, channels and pathways, among others.

There are currently 86 IDs, which are shown in map 4.2. The ID 113 Alto Río Conchos, inaugurated on January 27, 2012, is the latest one constituted. Table 4.2 describes the main characteristics of the IDs by HAR. In that table, an estimation is included of the economic productivity measured in pesos per cubic meter: this is the value of the agricultural production divided by the volume of water employed in its irrigation. In [Adicional: Table 4.A] data on the IDs is presented.

Water is employed in IDs by means of gravity or pumping. Graph 4.2 illustrates the evolution in the water employed in the IDs, distinguishing between surface water and groundwater origin, for the agricultural years 2005-2006 and 2014-2015. In turn, the surface water source may be a dam, diversion or pump directly from the current; whereas the groundwater source is used by pumping wells. The volume distributed by each type of use is shown in [Adicional: Table 4.B].

Map 4.2 Irrigation districts, 2015

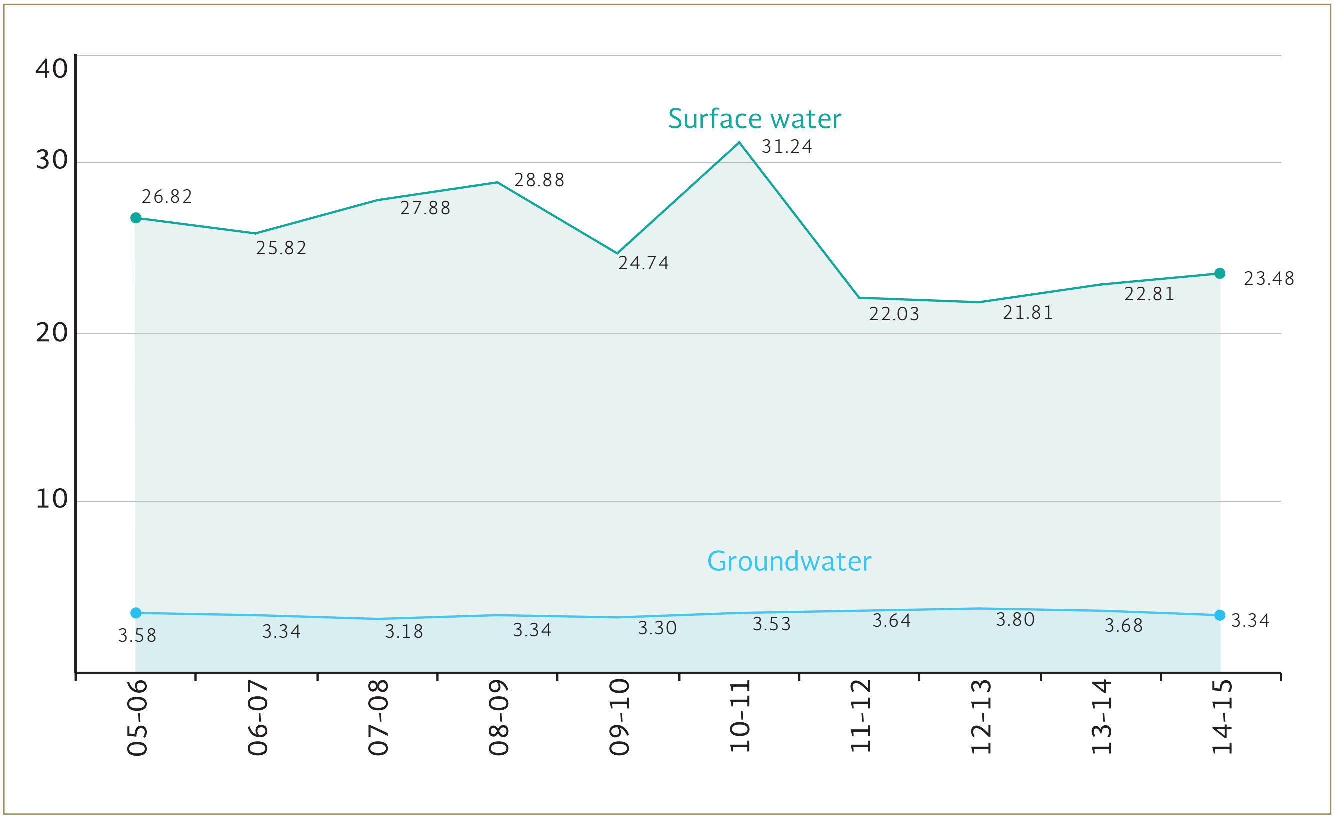
Source: Conagua (2016i).

Table 4.2 Irrigation districts by hydrological-administrative region, agricultural year 2014-2015

HAR number	Number of irrigation districts	Value of crops (millions of pesos)	Users	Physical surface irrigated (ha)	Volume distributed (hm³)	Value of crops (millions of pesos)	Economic productivity ($/m³)
I	2	245 693	18 593	222 309	2 523	8 966	3.55
II	7	466 590	34 861	405 611	4 215	20 590	4.88
III	10	860 112	89 184	776 608	8 239	36 041	4.37
IV	9	199 373	56 835	162 790	2 464	7 905	3.21
V	11	230 558	17 803	93 027	770	4 534	5.89
VI	5	73 343	10 191	33 703	507	445	0.88
VII	13	469 468	32 467	202 972	1 894	10 195	5.38
VIII	1	71 964	33 387	48 386	793	1 713	2.16
IX	13	450 034	71 301	281 707	2 995	14 031	4.68
X	2	41 805	6 483	29 556	554	1 105	1.99
XI	4	36 250	6 923	27 476	347	2 746	7.91
XII	2	17 785	4 988	14 505	85	597	7.00
XIII	7	122 174	67 932	87 047	1 430	3 074	2.15
Total	**86**	**3 285 148**	**450 948**	**2 385 696**	**26 819**	**111 942**	**4.17**

Note: Pesos at constant 2012 prices due to compatibility with the methodology of the National Catalogue of Indicators.
Source: Conagua (2016i).

Graph 4.2 Volume employed in IDs by source and agricultural year (thousands of hm^3)



Source: Conagua (2016i).

The **physical productivity** of water in IDs, measured in kilograms per cubic meter, is agricultural production divided by the volume of water employed in its irrigation. It is a key indicator to evaluate the efficiency with which water is used for food production, and depends upon the conveyance from the supply sources to plots and its use there. The evolution in this aspect is shown in graph 4.3, which shows the gross volume used corresponding to the vegetative cycle, which is why it does not coincide with the annual volumes used. Graph 4.3 shows the evolution in the total physical productivity within the scope of irrigation districts for the period of agricultural years from 2005-06 to 2014-15.

In 2014-2015,
40%
of the surface harvested was corn grain and sorghum grain

In the current context in which a decrease in availability is predicted as a result of climate change, it is imperative to increase conveyance efficiencies. It should be mentioned that water productivity may fluctuate significantly according to the meteorological conditions, as well as the phenological characteristics of each crop.

For the 2014-15 agricultural year in IDs, the **main crops** by area harvested were corn grain and wheat grain, which together represented 50% of the harvested area. It should be mentioned that these two crops combined were 23% of the production in tons and 34% of the value of production. The main crops are shown in [Adicional: Table 4.C].

The transfer of IDs to the users commenced with the creation of the Conagua in 1989 and the passing of the new National Water Law in 1992, with the support of a program of partial rehabilitation of the infrastructure that has been licensed via irrigation modules to irrigation user associations.

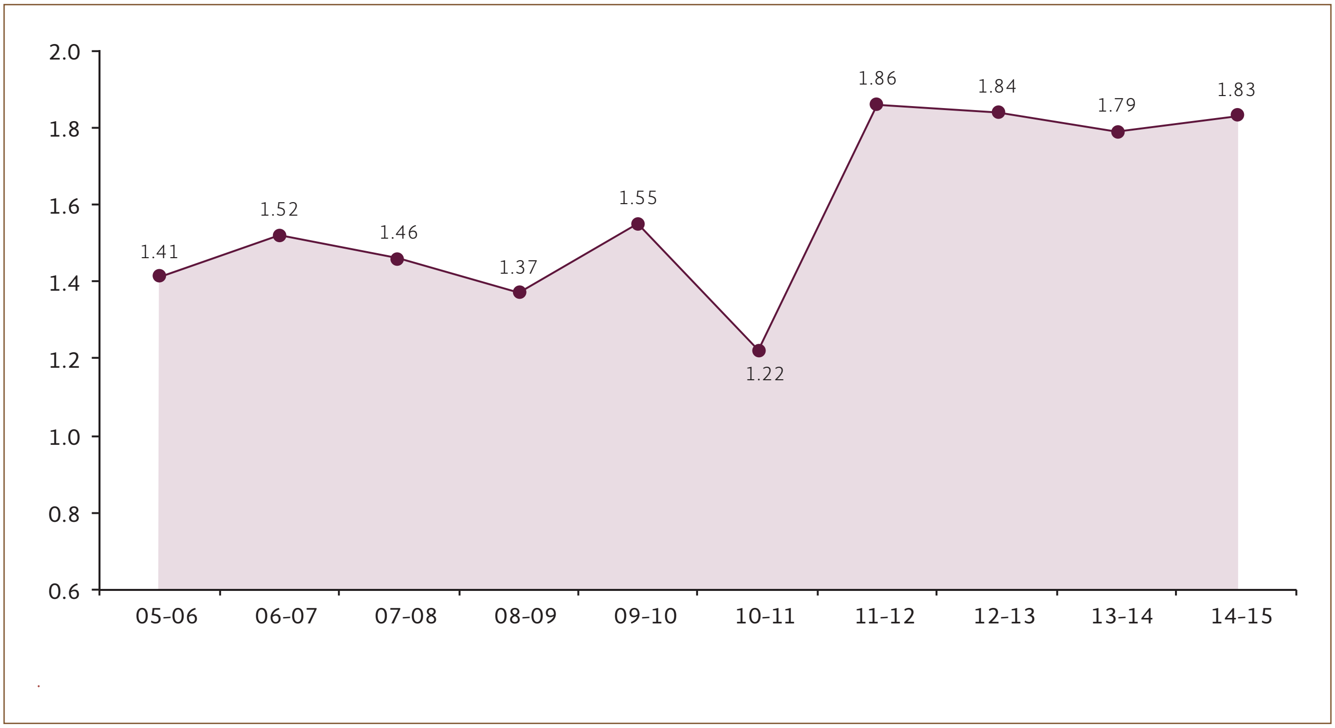
Up to December 2015, more than 99% of the total surface of the IDs had been transferred to the users. Up to that date, only two districts had not been totally transferred to the users, as shown in [Adicional: Table 4.D].

Irrigation units (IUs)

[Tablero: Distritos de temporal y unidades de riego]

IUs are agricultural areas with irrigation infrastructure and systems, different from irrigation districts and in general of a smaller surface area. They may be made up of user associations or other figures of organized producers, who join forces to provide irrigation services with autonomous management systems, and operate water infrastructure for the catchment, diversion, piping, regulating and distribution and removal of the nation's water resources destined for agricultural irrigation. The latest data available is from the agricultural year 2013-2014, in which it was estimated that there were approximately 40 407 IUs, with a total surface or around 3.2 million hectares (Conagua 2016j). Map 4.3 shows the IUs from 2014.

Graph 4.3 Productivity of water in IDs per agricultural year (kg/m³)



Source: Conagua (2016i).

Map 4.3 Irrigation units, 2014

Source: Conagua (2016i).

In that year the production was estimated as having a total value of 160 billion pesos, from 3 480 159 hectares harvested. Statistics on IUs distinguished between products counted by tons (which represented 99.7% of the area harvested and 96.8% of the production value) and other crops which are counted by plants, bunches, bulks or square meters. Those crops that are counted by tons are summarized in table 4.3.

It should be mentioned that the area harvested was greater than the total area due to second crops and the inventory underway of IUs.

The economic productivity of IUs is estimated at 5.03 pesos per cubic meter[3] for the agricultural year 2013-2014, whereas the physical productivity was calculated at 2.81 kilograms per cubic meter for that year.

Table 4.3 Irrigation units by hydrological-administrative region, agricultural year 2013-2014

HAR number	Area sown (ha)	Area harvested (ha)	Production (tons)	Yield (ton/ha)	Value of production (millions of pesos)
I	60 857	55 065	1 366 684	24.80	8 881
II	194 618	179 750	3 636 173	20.20	11 210
III	325 411	276 589	3 439 751	12.40	10 635
IV	352 987	339 451	8 610 426	25.40	22 696
V	80 456	78 322	1 105 418	14.10	3 025
VI	793 093	762 494	11 672 938	15.30	26 683
VII	318 137	314 400	10 353 452	32.90	15 933
VIII	986 605	915 724	23 603 692	25.80	36 378
IX	326 107	297 846	8 749 028	29.40	9 238
X	86 376	83 174	3 694 757	44.40	4 049
XI	34 516	33 955	1 484 982	43.70	2 560
XII	59 977	56 225	955 571	17.00	1 849
XIII	79 865	77 676	2 779 168	35.80	1 753
Total	**3 699 003**	**3 470 671**	**81 452 039**	**23.47**	**154 888**

Note: Considers only crops counted by tons.
Source: Conagua (2016j).

3 In pesos at constant 2012 prices to make them compatible with the methodology of the National Catalogue of Indicators.

Technified Rainfed Districts (TRDs)

[Tablero: Distritos de temporal y unidades de riego]

In Mexico's tropical and subtropical plains, which have an excess of humidity and constant floods, the Federal Government has established TRDs, in which water infrastructure has been built to remove the excess volumes of water.

Table 4.4 lists the main characteristics of the TRDs. Similarly to the irrigation districts, TRDs have gradually been transferred to organized users.

Table 4.4 Characteristics of the technified rainfed districts, 2015

N°	Code	Name	HAR number	HAR	State	Area (thousands of ha)	Users (number)
1	1	La Sierra	XI	Southern Border	Tabasco	32.1	1 178
2	2	Zanapa Tonala	XI	Southern Border	Tabasco	106.9	6 919
3	3	Tesechoacan	X	Central Gulf	Veracruz de Ignacio de la Llave	18.0	1 139
4	5	Pujal Coy II	IX	Northern Gulf	San Luis Potosi, Tamaulipas and Veracruz de Ignacio de la Llave	236.0	9 987
5	6	Acapetahua	XI	Southern Border	Chiapas	103.9	5 050
6	7	Centro de Veracruz	X	Central Gulf	Veracruz de Ignacio de la Llave	75.0	6 367
7	8	Oriente de Yucatan	XII	Yucatan Peninsula	Yucatan	667.0	25 021
8	9	El Bejuco	III	Northern Pacific	Nayarit	24.0	2 261
9	10	San Fernando	IX	Northern Gulf	Tamaulipas	505.0	13 975
10	11	Margaritas - Comitan	XI	Southern Border	Chiapas	41.9	5 397
11	12	La Chontalpa	XI	Southern Border	Tabasco	91.1	10 344
12	13	Balancan-Tenosique	XI	Southern Border	Tabasco	115.6	4 289
13	15	Edzna - Yohaltun	XII	Yucatan Peninsula	Campeche	85.1	1 120
14	16	Sanes Huasteca	XI	Southern Border	Tabasco	26.4	1 321
15	17	Tapachula	XI	Southern Border	Chiapas	94.3	5 852
16	18	Huixtla	XI	Southern Border	Chiapas	107.6	6 010
17	20	Margaritas - Pijijiapan	XI	Southern Border	Chiapas	67.9	4 712
18	23	Isla Rodriguez Clara	X	Central Gulf	Veracruz de Ignacio de la Llave	13.7	627
19	24	Zona sur de Yucatan	XII	Yucatan Peninsula	Yucatan	26.1	880
20	25	Rio Verde	XII	Yucatan Peninsula	Campeche	134.9	1 984
21	26	Valle de Ucum	XII	Yucatan Peninsula	Quintana Roo	104.8	1 739
22	27	Frailesca	XI	Southern Border	Chiapas	56.8	3 083
23	35	Los Naranjos	X	Central Gulf	Veracruz de Ignacio de la Llave	92.6	6 045
	Total					**2 826.7**	**125 300**

Source: Conagua (2016i).

4.4 Drinking water and sanitation infrastructure

Drinking water coverage

[Tablero: Cobertura universal]

The provision of water for human consumption in the necessary quantity and quality has a direct incidence on public health and wellbeing. This fact is recognized through the inclusion of information related to water for supply to the population in the National Catalogue of Indicators, which is a series of key indicators for the design, follow up and evaluation of public policies stipulated by the Law of the National System of Statistical and Geographic Information and administered by Inegi.

In 2015, 92.5% of the population had drinking water coverage

For the 2015 Intercensal Survey (see chapter 1), Inegi reformulated the questions regarding water services, now specifying the source or origin of water. Based on this available information, the Conagua defined in 2015 the **drinking water coverage**, emphasizing the potability of the water. The population that has access to drinking water is thus calculated, be if through tap water in their housing or grounds or their grounds coming only from public water service, a community well or a private well,[4] or through transportation from a community faucet. Following that definition, the national drinking water coverage is 92.5% (95.7% urban, 81.6% rural).

There are complementary indicators. One of them is the **coverage of tap water services.**[5] In this term the population that has tap water within their household or grounds, from a public faucet or hydrant or from another household is included. The information for the calculation of this coverage is obtained based on the various censuses and the 2015 intercensal survey, for the 1990-2015 period.

Based on this definition of coverage of access to tap water, a subset of information can be calculated, the **coverage of tap wate**r in the household or plot.[6]

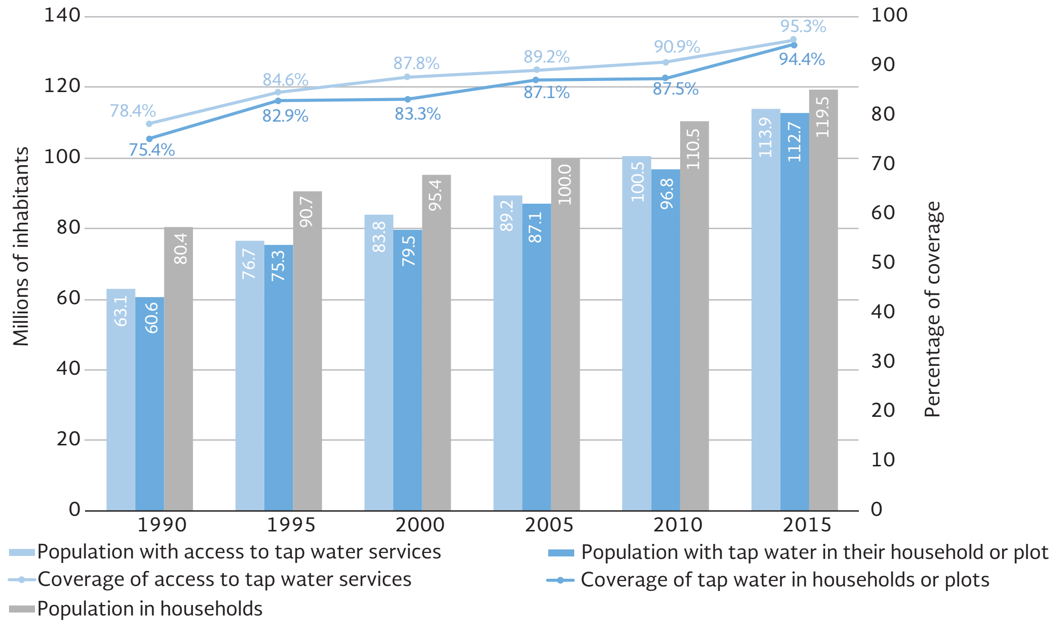
The behavior of the coverage of access to tap water and the coverage of tap water in the household or plot for the 1990-2015 period can be contemplated in graphs 4.4, 4.5 and 4.6, nationwide, and in urban and rural contexts, respectively. The evolution in the percentages of coverage should be contemplated in the context of population growth and urban concentration, which is possible through those graphs.

4 Does not consider the population with tap water in their household or plot coming from a water truck, from another household, from another place or unspecified.

5 Corresponds to the indicator "Population with access to tap water services" (PAP) from the National Catalogue of Indicators.

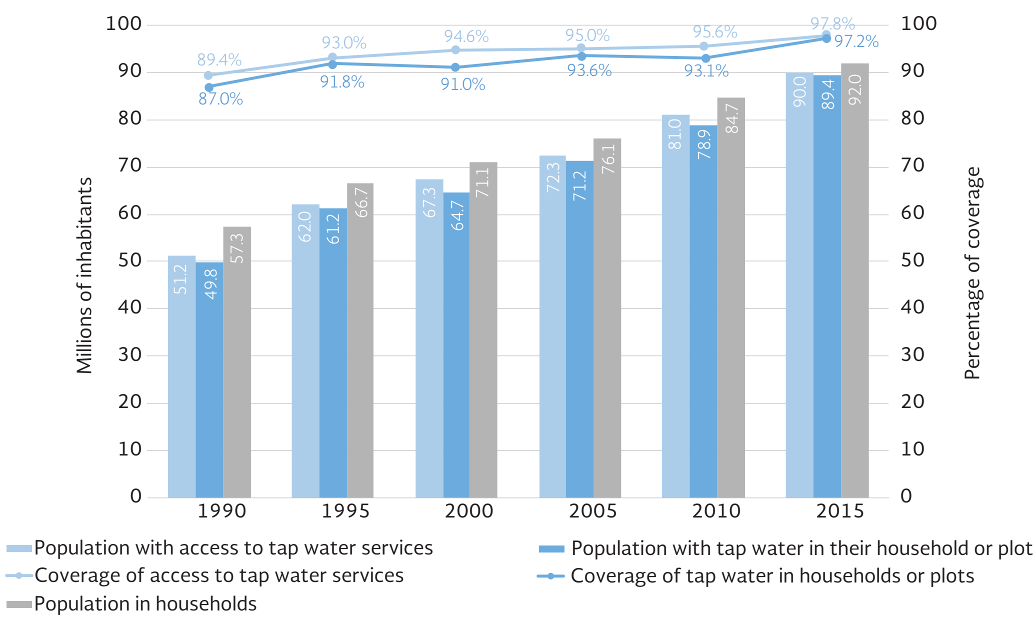
6 This has been proposed as the indicator "Percentage of the population with tap water in their household or plot" (PAENT) in the National Catalogue of Indicators.

Graph 4.4 National population with tap water coverage



Source: Produced based on Conagua (2007), Conagua (2016k), Inegi (2016c), Inegi (2016d).

Graph 4.5 Urban population with tap water coverage



Source: Produced based on Conagua (2007), Conagua (2016k), Inegi (2016c), Inegi (2016d).

As of 2015, the national coverage of access to tap water was 95.3% (97.8% urban, 87.0% rural), whereas the national coverage of tap water in households or plots was 94.4% (97.2% urban, 85.00% rural).

The urban population generally speaking has a higher coverage than the rural one (graph 4.5). The increase in the urban population with water services is relatively favored by the concentration of the population, in contrast with the dispersion of the rural population in multiple, smaller localities. However, the increase of services in the rural context should be highlighted (graph 4.6).

Sanitation coverage

[Tablero: Cobertura universal]

Similarly to drinking water, the sanitation of wastewater generated in homes also determines the health and quality of life of the population, so information related to sanitation is included in the National Catalogue of Indicators.

In 2015, the Conagua defined the **coverage of sanitation through a public network or septic tank**, which considers the population with sanitation in this way. In addition there is the **coverage of access to sewerage and basic sanitation services,**[7] which considers the population with sanitation connected to the public network, a septic tank or with a wastepipe connected to the ground, a ravine, crack, river, lake or sea. The information for the calculation of this coverage is generated in the various censuses and 2015 intercensal survey (see chapter 1), for the 1990-2015 period.

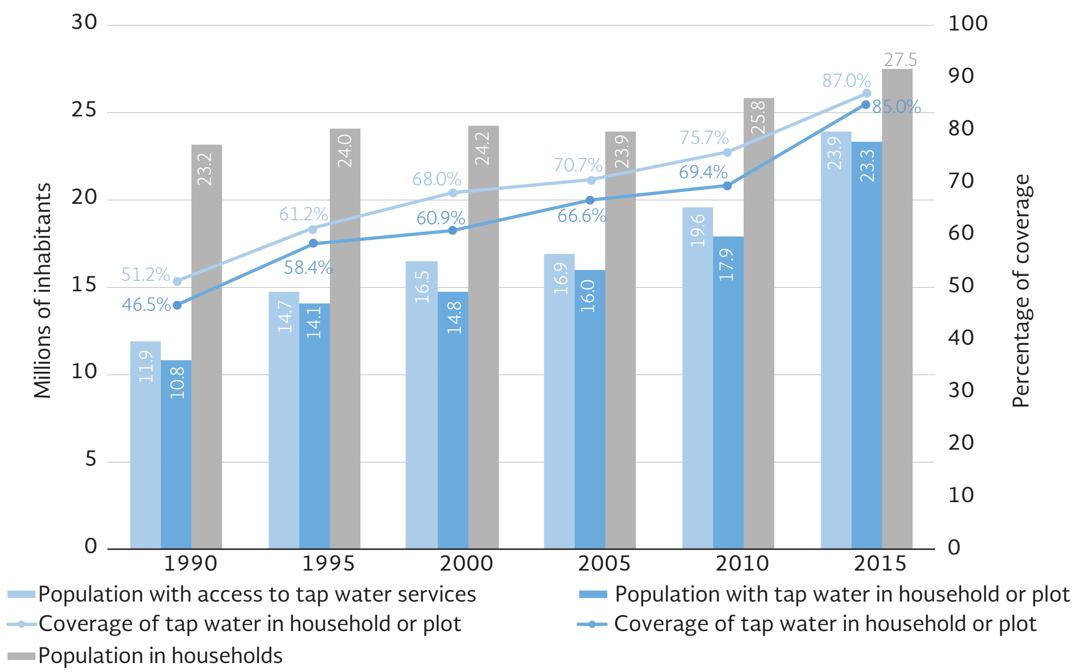
The behavior of sanitation coverage through a public network or a septic tank and the coverage of sanitation services during the 1990-2015 period is illustrated in graphs 4.7, 4.8 and 4.9, nationwide and in the urban and rural contexts, respectively. Similarly to drinking water, the evolution in the percentages of coverage is shown in conjunction with the demographic dynamic and the urban concentration.

In 2015, the national coverage of access to sanitation services was 92.8% (97.4% urban, 77.5% rural), whereas the national sanitation coverage through a public network or septic tank was 91.4% (96.6% urban, 74.2% rural).

In 2015
91.4%
of the population had sanitation coverage through a public network or septic tank

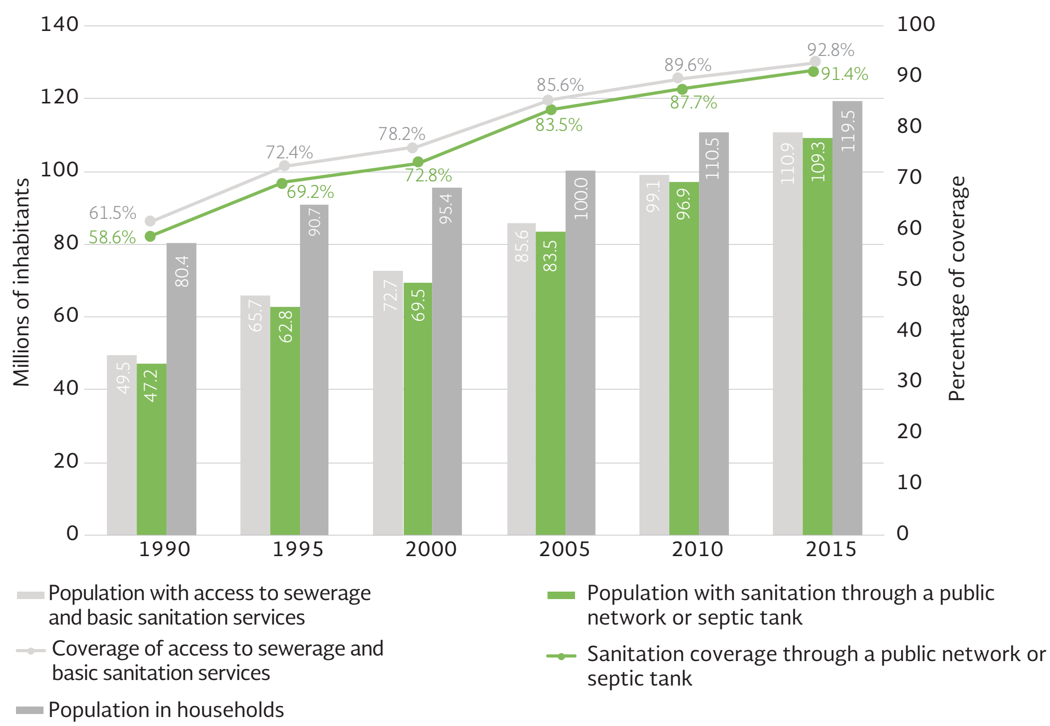
7 Corresponds to the indicator "Population with access to sewerage and basic sanitation services" (PAS) from the National Catalogue of Indicators.

Graph 4.6 Rural population with tap water coverage



Source: Produced based on Conagua (2007), Conagua (2016k), Inegi (2016c), Inegi (2016d).

Graph 4.7 National population with sanitation coverage

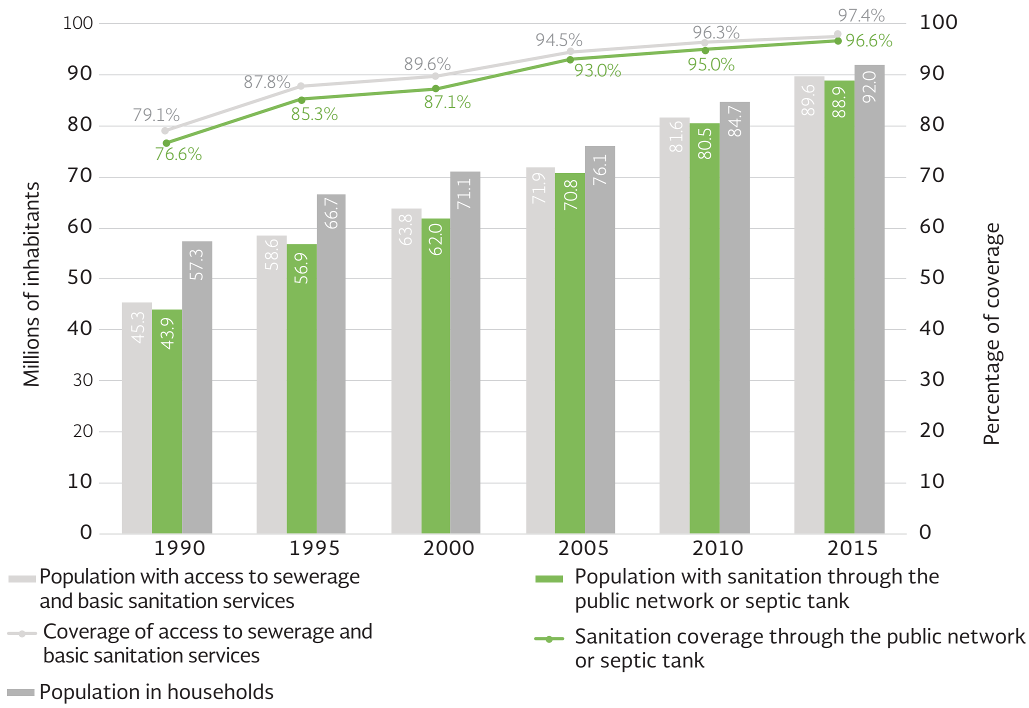


Source: Produced based on Conagua (2007), Conagua (2016k), Inegi (2016c), Inegi (2016d).

The urban setting generally possesses a higher coverage than the rural one (graph 4.8). The provision of sanitation services in urban areas is relatively favored by the concentration of the population, in contrast with the dispersion of the rural population in multiple, smaller localities. However, the rural context has shown significant increases in this area (graph 4.9).

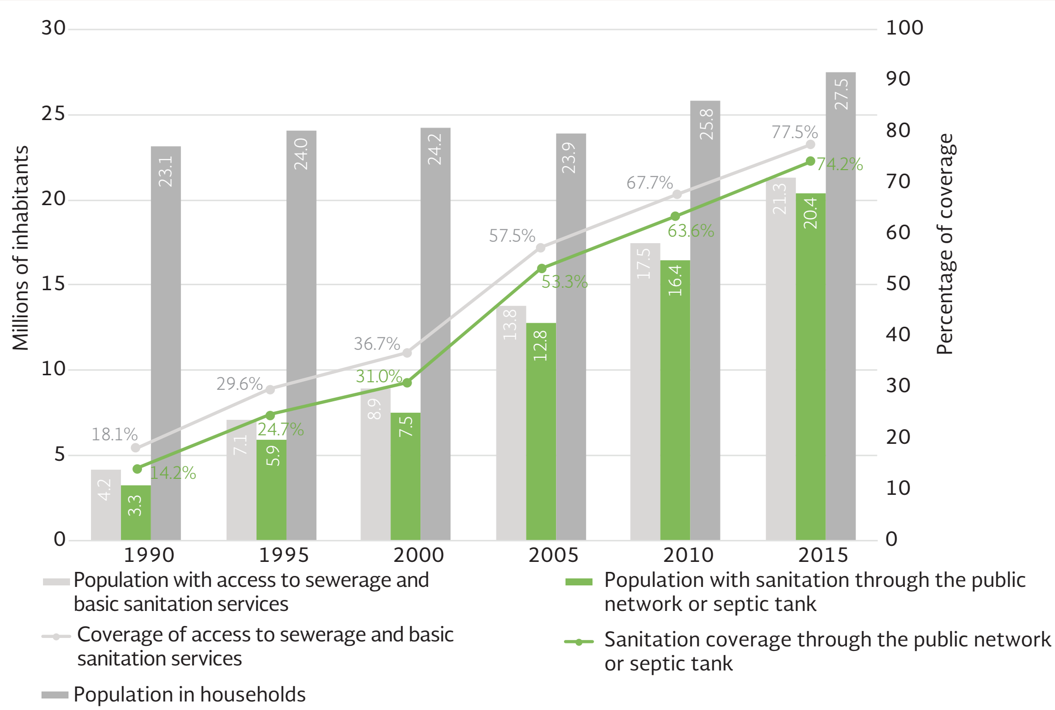
The coverage by HAR and state is presented in annexes A and B for drinking water and sanitation.

Graph 4.8 Urban population with sanitation coverage



Source: Produced based on Conagua (2007), Conagua (2016k), Inegi (2016c), Inegi (2016d).

Graph 4.9 Rural population with sanitation coverage



Source: Produced based on Conagua (2007), Conagua (2016k), Inegi (2016c), Inegi (2016d).

Aqueducts

[Tablero: Acueductos principales]

There are more than 3 000 kilometers of aqueducts in Mexico that convey water to various cities and rural communities around the country, with a total capacity of more than 112 cubic meters per second. The main ones, as regards their length and flow, are listed in table 4.5.

Table 4.5 Main aqueducts in Mexico, 2015

N°	Aqueduct	Region	Length (km)	Design flow (l/s)	Year of completion	Supplies	Operator
1	Lerma	VIII Lerma-Santiago-Pacific and XIII Waters of the Valley of Mexico	60	14 000	1975	Mexico City with water from the aquifers located in the upper area of Lerma River	Sistema de Aguas de la Ciudad de México.
2	Chicbul-Ciudad del Carmen	XII Yucatan Peninsula	122	390	1975	Sabancuy, Isla Aguada and Ciudad del Carmen, Campeche	Sistema Municipal de Agua Potable de Ciudad del Carmen, Camp.
3	Colorado River-Tijuana	I Baja California Peninsula	130	4 000	1982	Cities of Tijuana and Tecate and the village of La Rumorosa in Baja California.	Comisión de Servicios de Agua del Estado de Baja California (Cosae).
4	Linares-Monterrey	VI Rio Bravo	133	5 000	1984	The Metropolitan Area of the city of Monterrey, Nuevo Leon, with water from the Cerro Prieto reservoir	Servicios de Agua y Drenaje de Monterrey, I.P.D.
5	Uxpanapa-La Cangrejera	X Central Gulf	40	20 000	1985	22 industries located in the southern part of the state of Veracruz	Conagua
6	Yurivia-Coatzacoalcos and Minatitlan	X Central Gulf	64	2 000	1987	Coatzacoalcos and Minatitlan, Veracruz with water from the Ocotal and Tizizapa rivers	Comisión Municipal de Agua y Saneamiento de Coatzacoalcos, Ver. (CMAPS Coatzacoalcos).
7	Armeria-Manzanillo	VIII Lerma-Santiago-Pacific	50	250	1987	Manzanillo, Colima.	Comisión de Agua Potable, Drenaje y Sanitationde Manzanillo, Col.
8	Vizcaino-Northern Pacific	I Baja California Peninsula	206	62	1990	Localities of Bahia Asuncion, Bahia Tortugas and the fishing villages of Punta Abreojos in Baja California	Organismo operador del municipio de Mulegé, B.C.
9	Chapala-Guadalajara	VIII Lerma-Santiago-Pacific	42	7 500	1991	The Metropolitan Area of the city of Guadalajara with water from Lake Chapala	Sistema Intermunicipal para los Servicios de Agua Potable y Sanitation(Siapa).
10	Vicente Guerrero reservoir-Ciudad Victoria	IX Northern Gulf	54	1 000	1992	Ciudad Victoria, Tamaulipas, with water from the Vicente Guerrero reservoir	Comisión Municipal de Agua Potable y Sanitation (Comapa Victoria).
11	Cutzamala System	IV Balsas and XIII Waters of the Valley of Mexico	162	19 000	1993	The Metropolitan Area of the Valley of Mexico with water from the Valle de Bravo, Villa Victoria and El Bosque reservoirs, among others	Conagua

N°	Aqueduct	Region	Length (km)	Design flow (l/s)	Year of completion	Supplies	Operator
12	El Cuchillo-Monterrey	VI Rio Bravo	91	5 000	1994	The Metropolitan Area of the city of Monterrey, Nuevo Leon, with water from the Cuchillo reservoir	Servicios de Agua y Drenaje de Monterrey, I.P.D.
13	Huitzilapan River-Xalapa	X Central Gulf	55	1 000	2000	Xalapa-Enriquez, Veracruz	Comisión Municipal de Agua y Saneamiento de Xalapa (CMAS Xalapa).
14	Conejos-Medanos	VI Rio Bravo	25	1 000	2009	Ciudad Juarez, Chihuahua	Junta Municipal de Agua y Saneamiento de Ciudad Juárez, Chihuahua - Administradora de Proyectos Hidráulicos de Ciudad Juárez, S.A. de C.V. (Grupo Carso).
15	Aqueduct II Queretaro	VIII Lerma-Santiago-Pacific and IX Northern Gulf	122	1 500	2011	Santiago de Queretaro, Queretaro	Comisión State-wide de Aguas - Controladora de Operaciones de Infraestructura S.A. de C.V. (ICA).
16	Independencia	II Northwest	135	2 380	2013	Hermosillo, Sonora	Conagua
17	Lomas de Chapultepec	V Southern Pacific	34	1 250	2014	Acapulco, Guerrero	Comisión de Agua Potable, Alcantarillado y Saneamiento del Estado de Guerrero (CAPASEG)
18	Paralelo Chicbul-Ciudad del Carmen	XII Yucatan Peninsula	120	420	2014	Sabancuy, Isla Aguada and Ciudad del Carmen, Campeche	Sistema Municipal de Agua Potable de Ciudad del Carmen, Camp.
19	Realito-San Luis Potosi		133	1 000	2015	San Luis Potosi, San Luis Potosi	Comisión State-wide del Agua de San Luis Potosí - Aquos El Realito S.A. de C.V.
	Total		**1 778**	**86 752**			

Source: Produced based on Conagua (2016a), Conagua (2016h), Semarnat (2010), CAPASEG (2014), Gobierno de República (2014).

Cutzamala System

[Tablero: Sistema Cutzamala]

The Cutzamala System, which supplies 11 delegations of the Federal District (Mexico City) and 11 municipalities of the State of Mexico, is one of the biggest drinking water supply systems in the world, not only for the **quantity** of water that it supplies (approximately 450 million cubic meters every year –see table 4.6–), but also because of the **difference in elevation** (1 100 m) that it overcomes. It contributes 17% of the supply for all uses in the Valley of Mexico catchment, calculated at 88 m^3/s, which is complemented by the Lerma System (5%), groundwater extraction (68%) and rivers and springs (3%) and water reuse (7%) (WB 2013).

The Cutzamala System is made up of seven diversion and storage reservoirs, six pumping stations and one treatment plant with the characteristics indicated in [Adicional: Table 4.E]. The evolution in storage in the main reservoirs is shown in graph 4.10.

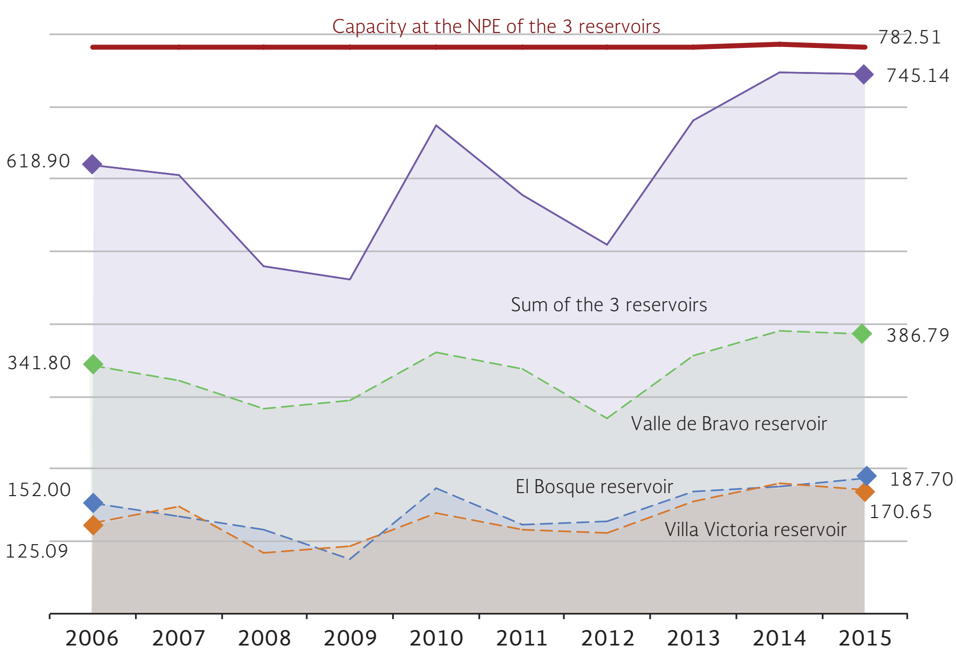
Figure 4.1 shows the location of the system and the difference in elevation that has to be overcome from the lowest point of Pumping Plant No. 1 to convey water to Oscillation Tower No. 5 and subsequently by gravity to the Metropolitan Area of the Valley of Mexico (MAVM).

Table 4.6
Volumes and flows supplied by the Cuztamala system (hm^3)

Year	Delivered to Federal District (Mexico City)	Delivered to the state of Mexico	Total
2006	303.53	177.26	**480.79**
2007	303.90	174.56	**478.46**
2008	306.25	179.47	**485.72**
2009	244.60	155.38	**399.98**
2010	266.85	165.84	**432.69**
2011	296.46	182.17	**478.63**
2012	272.54	190.96	**463.50**
2013	255.05	165.19	**420.24**
2014	294.86	181.85	**476.71**
2015	303.26	194.15	**497.41**

Source: Conagua (2016l).

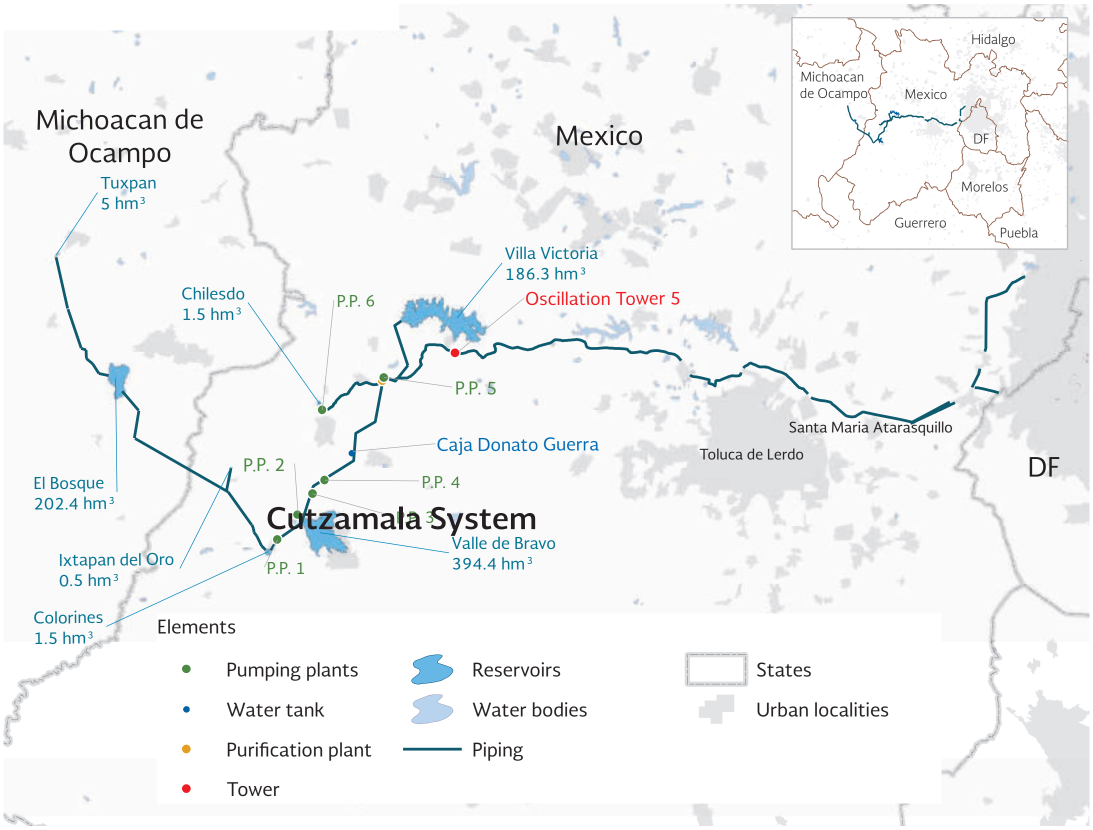
Graph 4.10 Evolution in the storage of the reservoirs of the Cutzamala system (hm^3)



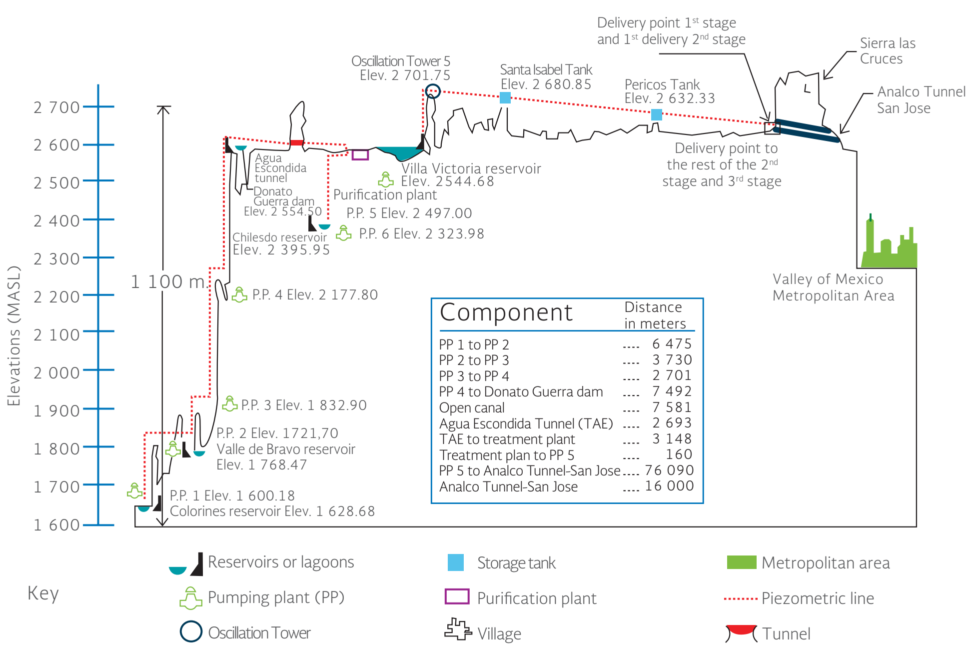
Source: Produced based on Conagua (2016l).

Figure 4.1 Cutzamala System

Plant



Cross-section



Source: Produced based on Conagua (2016l), Inegi (2013c), Inegi (2013d).

Purification plants

[Tablero: Plantas potabilizadoras]

Municipal purification plants improve the water quality in surface and/or groundwater sources to make them suitable for **human consumption.** In 2015, 97.9 m³/s were treated in the 874 plants in operation in Mexico. The evolution in the flow treated annually is illustrated in graph 4.11.

The distribution of purification plants is listed in table 4.7 by hydrological-administrative region, and at the state level in [Adicional: Table 4.F]. It should be mentioned that the Los Berros treatment plant is included, found in the hydrological-administrative region IV Balsas. This plant is in the locality of the same name in the municipality of Villa de Allende, State of Mexico, and is part of the Cutzamala System. It is operated by the Waters of the Valley of Mexico River Basin Organization.

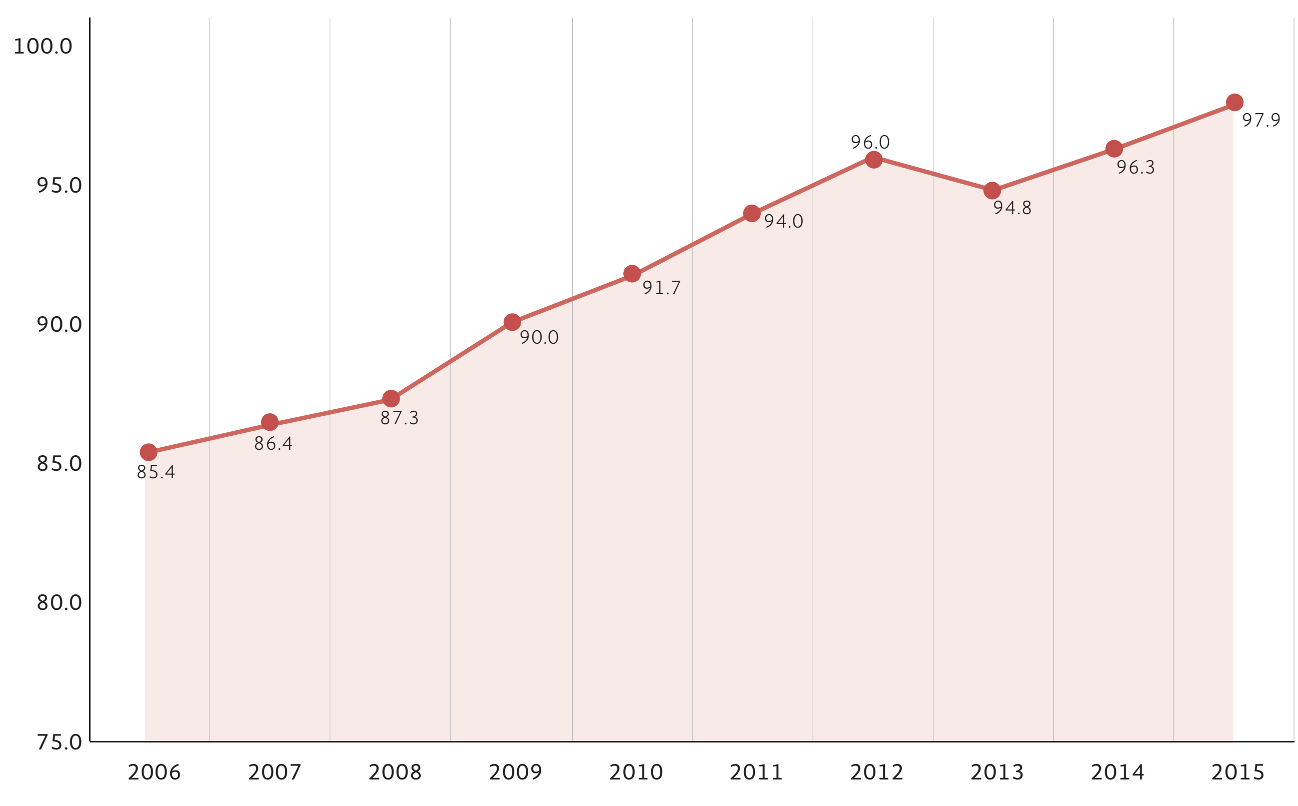
Table 4.8 illustrates the main treatment processes applied in those plants.

In 2015

97.9 m³/s

were treated in 874 plants

Graph 4.11 Municipal flow treated (m³/s)



Source: Conagua (2016a).

TABLE 4.7 Purification plants in operation, 2015

HAR number	Number of plants in operation	Installed capacity (m^3/s)	Flow treated (m^3/s)
I	48	12.36	7.18
II	24	5.58	2.29
III	156	9.47	8.44
IV	23	22.82	17.18
V	19	3.46	2.78
VI	107	27.67	15.00
VII	158	2.36	1.53
VIII	163	19.89	14.96
IX	48	8.19	7.44
X	14	7.51	5.20
XI	46	14.72	11.09
XII	1	0.01	0.01
XIII	67	6.71	4.81
Total	**874**	**140.74**	**97.90**

Source: CONAGUA (2016a).

TABLE 4.8 Main purification processes applied, 2015

Central process	Purpose	Plants		Flow treated	
		No	%	(m^3/s)	%
Softening	Elimination of hardness	18	2.1	0.47	0.48
Adsorption	Elimination of organic traces	3	0.3	0.06	0.07
Conventional clarification	Elimination of suspended solids	215	24.6	69.53	71.02
Patented clarification	Elimination of suspended solids	154	17.6	5.06	5.17
Direct filtration	Elimination of suspended solids	101	11.6	16.22	16.57
Slow filtering	Elimination of suspended solids	10	1.1	0.06	0.06
Carbon activated filters	Elimination of suspended solids	35	4.0	0.03	0.03
Inverse osmosis	Elimination of dissolved solids	301	34.4	1.87	1.91
Removal of iron and manganese		21	2.4	4.39	4.48
Other		16	1.8	0.22	0.22
	Total	**874**	**100.0**	**97.90**	**100.00**

Source: CONAGUA (2016a).

4.5 Water treatment and reuse

Wastewater discharge

[Tablero: Descarga de aguas residuales]

Wastewater discharges are classified as either municipal or non-municipal. **Municipal** ones are those which are generated in population centers and are collected in urban and rural sanitation systems, whereas the **non-municipal** discharges are those that are generated by other uses, such as self-supplying industry, and which are discharged directly to national receiving water bodies, without being collected by sewerage systems.

The sequence of wastewater generation, its collection in sewerage systems and its treatment/disposal is shown in table 4.9. The table employs the abbreviation BOD_5, which corresponds to the parameter of 5-day Biochemical Oxygen Demand.

In 2015, **120.9 m³/s** of wastewater were treated in **2 477** municipal plants

Municipal wastewater treatment plants

[Tablero: Plantas de tratamiento de agua residual]

During 2015, the 2 477 plants in operation throughout the country treated 120.9 m³/s, meaning 57.0% of the 212.0 m³/s collected through sewerage systems. The evolution in the flow treated annually can be appreciated in graph 4.12.

Table 4.9 Municipal and non-municipal wastewater discharges, 2015

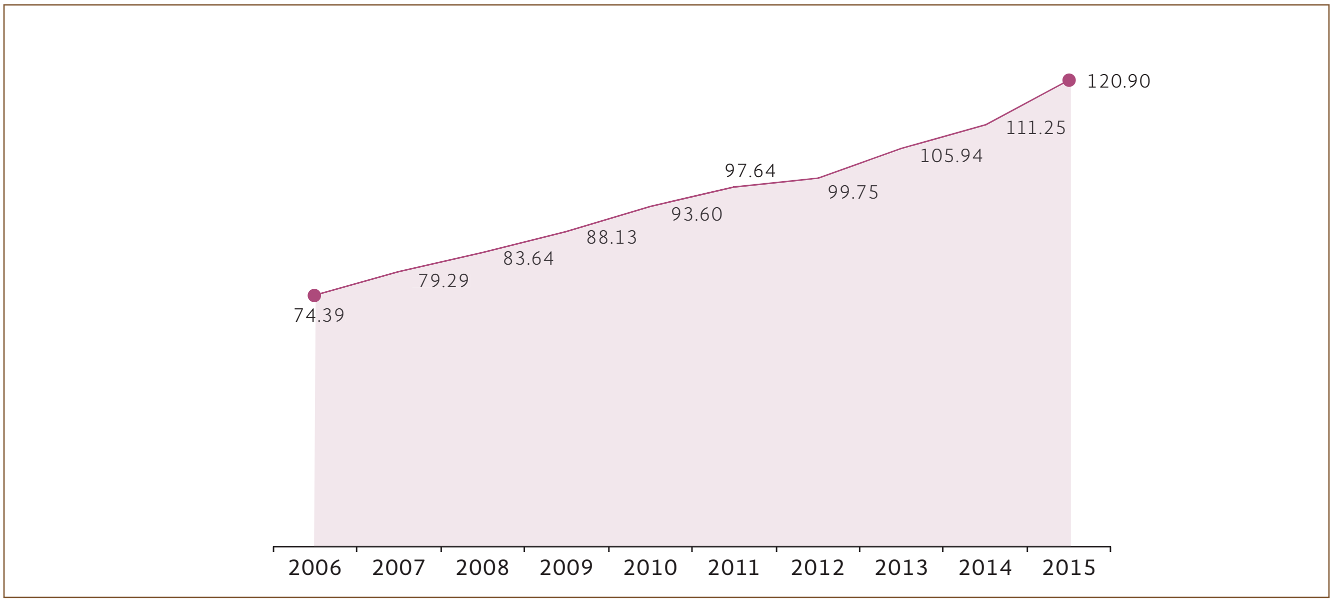
Urban centers (municipal discharges)		
Volume		
Municipal wastewater	7.23	thousand hm³/year (229.1 m³/s)
Collected in sewerage systems	6.69	thousand hm³/year (212.0 m³/s)
Treated	3.81	thousand hm³/year (120.9 m³/s)
Polluting load		
Generated	1.95	million tons of BOD_5 per year
Collected in sewerage systems	1.81	million tons of BOD_5 per year
Removed in treatment systems	0.84	million tons of BOD_5 per year
Non-municipal uses, including industry:		
Volume		
Non-municipal wastewater	6.77	thousand hm³/year (214.6 m³/s)
Treated	2.22	thousand hm³/year (70.5 m³/s)
Polluting load		
Generated	10.15	million tons of BOD_5 per year
Removed in treatment systems	1.49	million tons of BOD_5 per year

Source: Conagua (2016a), Conagua (2016b).

Table 4.10 shows the wastewater treatment plants in operation by hydrological-administrative region, and [Adicional: Table 4.G] shows this data by state.

The distribution of treatment plants is shown in map 4.4, in which the names of the main plants by the flow treated are labelled. The main treatment processes are illustrated in graph 4.13.

Graph 4.12 Flow of municipal wastewater treated (m^3/s)



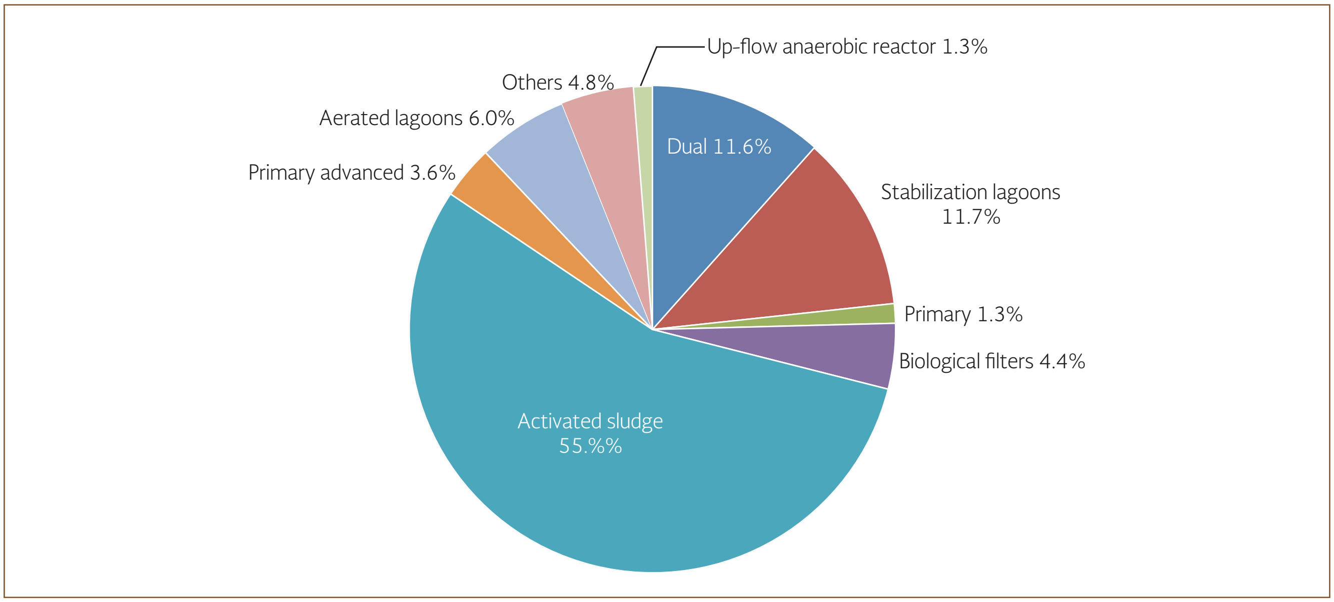
Source: Conagua (2016a).

Table 4.10 Municipal wastewater treatment plants in operation, 2015

HAR number	Number of plants in operation	Installed capacity (m^3/s)	Flow treated (m^3/s)
I	71	9.43	6.72
II	103	5.54	3.75
III	400	10.69	8.19
IV	218	10.43	8.10
V	88	4.74	3.72
VI	227	32.36	23.59
VII	153	6.92	5.42
VIII	592	41.43	29.76
IX	110	5.38	4.17
X	159	7.57	5.90
XI	115	4.74	2.69
XII	84	3.17	2.11
XIII	157	35.58	16.78
Total	**2 477**	**177.97**	**120.90**

Source: Conagua (2016a).

Graph 4.13 Main municipal wastewater treatment processes by flow treated, 2015



Source: Conagua (2016a).

Map 4.4 Municipal wastewater treatment plants, 2015

Source: Conagua (2016a).

Industrial wastewater treatment plants

[Tablero: Plantas de tratamiento de agua residual]

In 2015, industry treated 70.5 m^3/s of wastewater, in 2 832 plants in operation nationwide.

Table 4.11 shows the main processes into which industrial treatment is broken down; the 2006-2015 evolution is shown in graph 4.14, whereas table 4.12 illustrates the distribution by states.

Table 4.11 Types of industrial wastewater treatment, 2015

Type of treatment	Purpose	Number of plants	Operating flow (m^3/s)	Percentage
Primary	To adjust the pH and remove organic and/or inorganic materials in suspension, with a size equal to or greater than 0.1 mm.	913	27.65	39.2
Secondary	To remove colloidal and dissolved organic materials.	1660	35.37	50.2
Tertiary	To remove dissolved materials, including gases, natural and synthetic organic substances, ions, bacteria and viruses.	85	1.47	2.1
Not specified		174	6.02	8.5
	Total	**2 832**	**70.50**	**100.0**

Source: Conagua (2016a).

Graph 4.14 Flow of industrial wastewater treated (m^3/s)

Source: Produced based on Conagua (2016a).

Table 4.12 Industrial wastewater treatment plants in operation by state, 2015

State	Number of plants in operation	Installed capacity (m^3/s)	Flow treated (m^3/s)
Aguascalientes	74	0.37	0.18
Baja California	71	0.61	0.61
Baja California Sur	26	4.96	4.96
Campeche	134	2.89	2.88
Coahuila de Zaragoza	62	0.80	0.53
Colima	13	0.44	0.29
Chiapas	93	8.38	5.26
Chihuahua	15	0.65	0.28
Federal District (Mexico City)	7	0.01	0.00
Durango	41	1.08	0.62
Guanajuato	139	0.80	0.73
Guerrero	7	0.03	0.02
Hidalgo	46	1.84	1.38
Jalisco	93	1.84	1.73
Mexico	262	3.07	2.20
Michoacan de Ocampo	104	5.68	5.24
Morelos	97	2.13	2.09
Nayarit	16	0.80	0.80
Nuevo Leon	187	4.09	2.96
Oaxaca	19	5.70	5.38
Puebla	216	0.94	0.76
Queretaro	156	1.25	0.66
Quintana Roo	4	0.06	0.05
San Luis Potosi	63	0.99	0.59
Sinaloa	96	8.37	5.07
Sonora	236	6.46	6.26
Tabasco	118	0.93	0.92
Tamaulipas	109	8.47	7.88
Tlaxcala	72	0.70	0.37
Veracruz de Ignacio de la Llave	156	12.75	9.40
Yucatan	80	0.33	0.21
Zacatecas	20	0.20	0.17
Total	**2 832**	**87.64**	**70.50**

Source: Conagua (2016a).

Box 4.2 Water reuse

- The Conagua estimates that in 2015, 19.8 m^3/s of treated wastewater were directly reused (before being discharged)
- On the other hand, 88.1 m^3/s of treated wastewater were indirectly reused (after being discharged).
- The exchange of treated wastewater, in which it replaces first-use water, was estimated at 5.1 m^3/s.
- Among the advantages of reuse is its lower cost, that it reduces the pressure on sources and meets needs that do not require drinking water quality.

Source: Conagua (2016a).

4.6 Emergency attention and flood protection

[Tablero: Atención a emergencias]

As part of the Infrastructure Protection and Emergency Attention program (IPEA), the Conagua has set up 21 Regional Emergency Attention Centers (REACs) in various areas of the country, with the aim of supporting states and municipalities in supplying drinking water and sanitation in situations of **risk**. Map 4.5 shows the location of these centers.

Among the equipment at the disposal of the REACs are mobile treatment plants, pumping equipment, generators for independent electricity generation, water trucks and transportation equipment for the machinery. This emergency attention is carried out by the Conagua in coordination with the states, municipalities and federal agencies.

As regards the impacts of extreme hydro-meteorological phenomena, the most obvious manifestation of which is **floods**, attention actions range from early warning on risks, to the development of prevention plans, the construction and maintenance of protection infrastructure and inter-institutional coordination.

The Conagua has set up **21** regional emergency attention centers

Map 4.5 Regional Emergency Attention Centers, 2015

Source: Produced based on Conagua (2016a).

CHAPTER

5

Water management tools

WATER MANAGEMENT TOOLS

Legal framework

Availability to extract additional volumes

627
out of
731
watersheds

448
out of
653
aquifers

Legal instruments

146
Groundwater prohibition zones

7
Aquifer regulations and regulated zones

3
Reserve declarations

333
aquifers with suspension of free withdrawal

349
surface water prohibition zones

Deeds in the REPDA

Surface water
121 513
deeds

Groundwater
275 300
deeds

Discharge permits
16 603

Federal zone and material extraction permits
112 795

Participation mechanisms

26 river basin councils

auxiliary bodies

36 commissions (for watersheds)

88 technical committees (for aquifers)

50 committees (for micro-watersheds)

41 clean beach committees

Water economy and finances

In 2015,
16.5
billion pesos were collected in duties corresponding to
149 076 hm³

The budget for water governance functions in 2015
12.0
billion pesos

Water pays for water: the duty collection provided sufficient resources to fund the water governance functions.

5.1 Water-related institutions in Mexico

The National Water Commission of Mexico (Conagua), an administrative, regulatory, technical, consultative and decentralized agency of the Ministry of the Environment and Natural Resources (Semarnat), has the following mission and vision:[1]

Mission

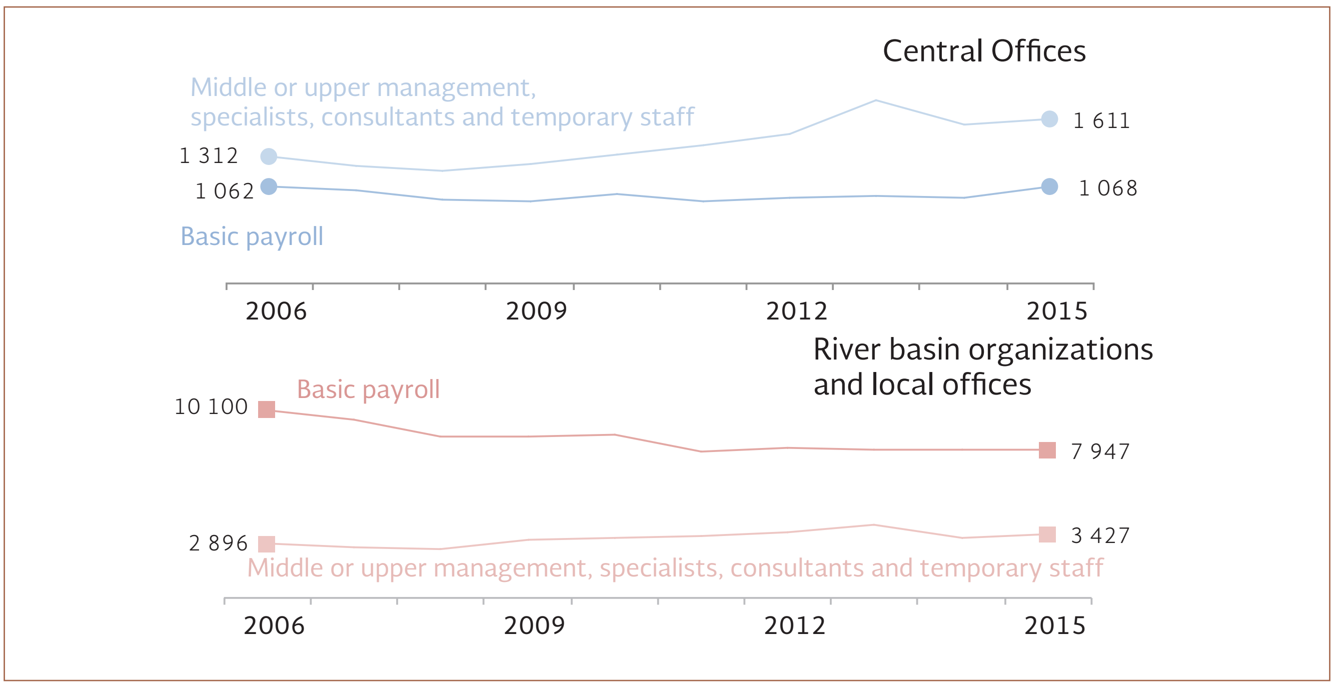
To preserve the nation's water resources and its inherent public goods for its sustainable administration and to guarantee water security with the responsibility of the tiers of government and society-at-large.

Vision

To be an institution of excellence in the preservation and management of the nation's water resources and water security for the population.

In 1989, the year in which the Conagua was created, it had 38 188 employees, which in recent years has been reduced. Thus in December 2015, the Conagua had 14 053 employees, of which 2 679 (1 068 basic payroll and 1 611 middle or upper management, specialists, consultants and temporary staff) were assigned to its central offices and the remainder to the river basin organizations (RBOs) and local offices (LOs). This trend can be observed for the last ten years in graph 5.1.

Graph 5.1 Conagua staff, 2006-2015



Source: Produced based on Conagua (2016a).

1 Conagua (2016o).

In order to carry out the functions assigned to it, the Conagua works in **conjunction** with various federal, state and municipal bodies; water user associations and companies; institutions from the private sector and civil society as well as international organizations. Figure 5.1 shows the organization chart of the Conagua, whereas figure 5.2 indicates the main institutions with which the Conagua coordinates for meet the goals of national water planning.

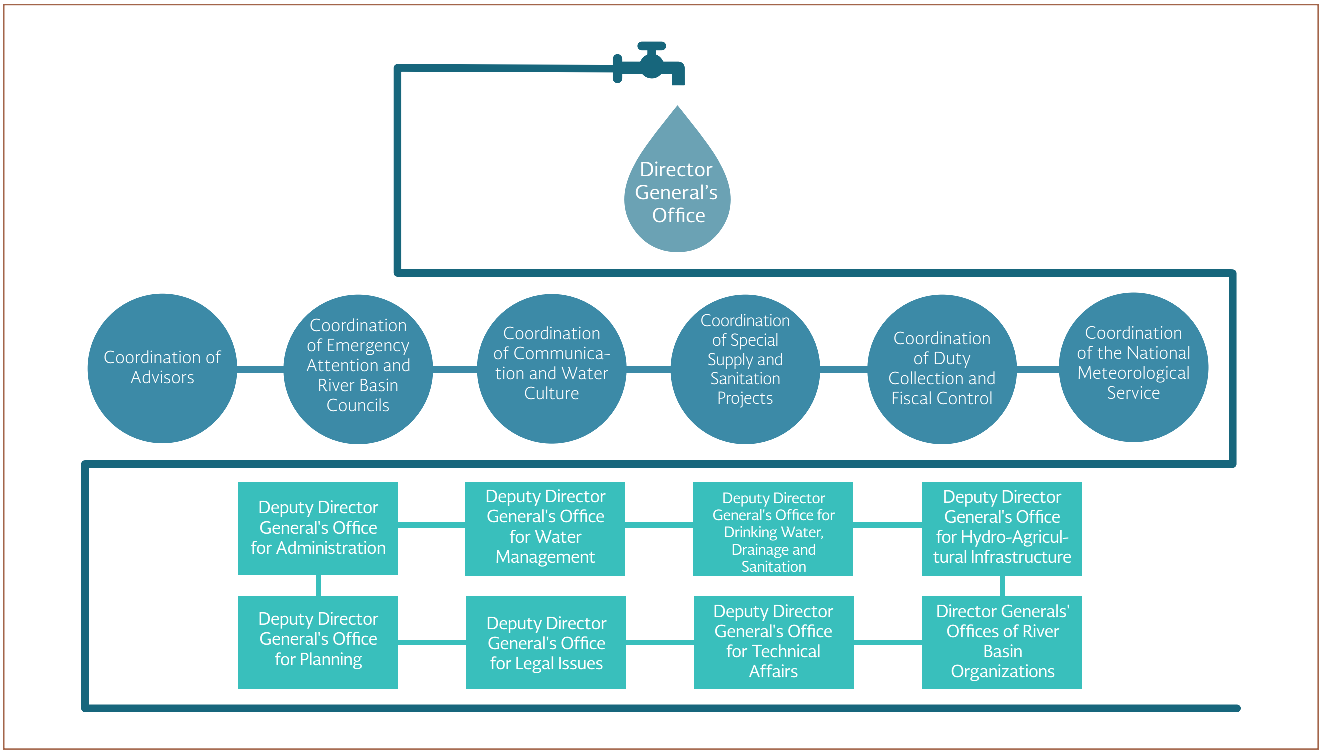
According to article 115 of the Mexican Constitution, municipalities are responsible for providing drinking water, sewerage and sanitation services, subject to the compliance with both federal and state laws. The 2014 economic census found that in 2013 the number of people employed in the provision of drinking water, sewerage and sanitation services was 122 798 (Inegi 2016l).

For drinking water service provision there were

122 798

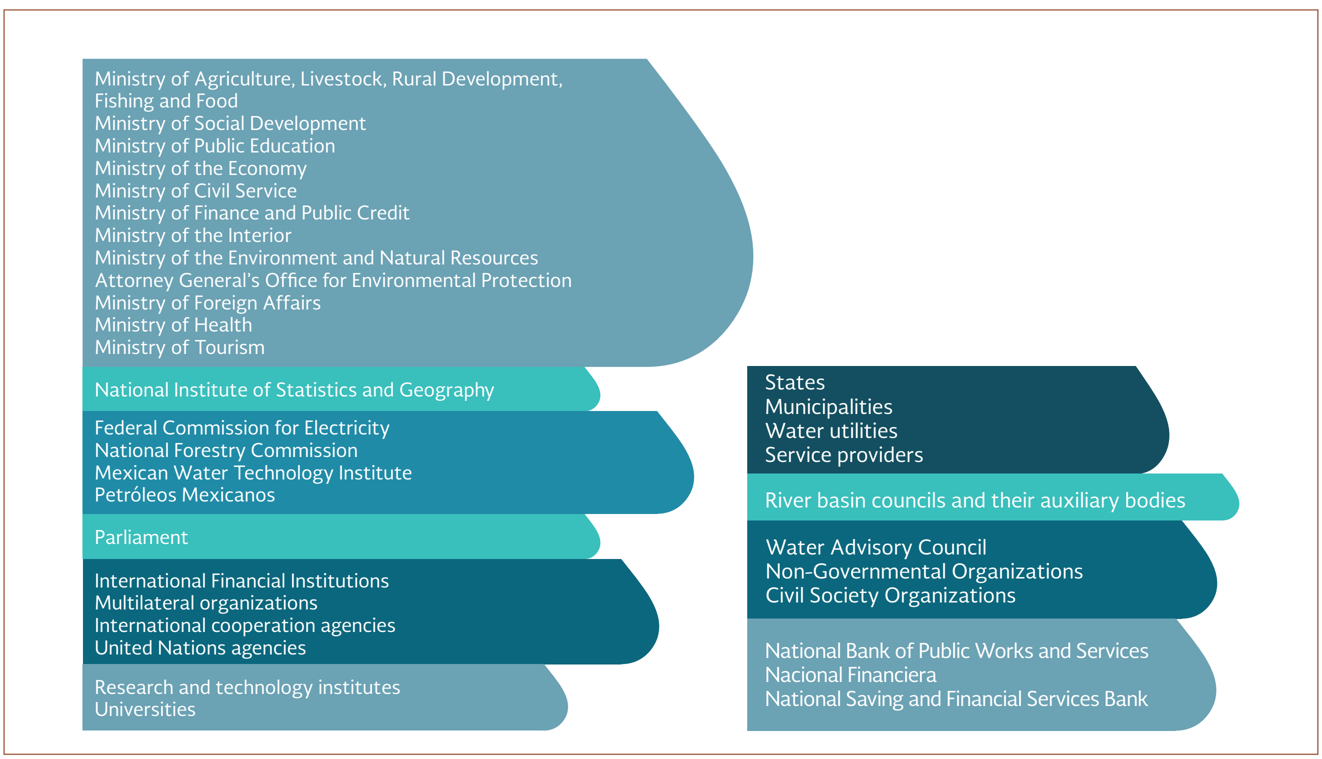
people employed in 2013

Figure 5.1 Organization chart of the Conagua, 2015



Source: Produced based on INAI (2016), National Water Law.

Figure 5.2 Main institutions, entities and agencies in coordination with the Conagua, 2015



Source: Produced based on Conagua (2005).

5.2 Legal framework for the use of water in Mexico

The National Water Law (NWL) establishes that the use of the nation's water resources will be carried out through the assigning of concession or allocation deeds by the Federal Executive Branch, through the Conagua, by means of the RBOs, or directly by the former when within its responsibilities, according to the rules and conditions laid down within the NWL and its By-Laws. Similarly, for wastewater discharges, it is necessary to have a discharge permit issued by the same institution.

In 2015 there were **486 896** deeds registered in the **Repda**

Deeds registered in the Public Registry of Water Duties (Repda)

[Tablero: Registro Público de Derechos de Agua (Repda) /Volúmenes Inscritos, Registro Público de Derechos de Agua (Repda) / Títulos Inscritos]

Since the NWL was passed (1992), concession or allocation deeds and discharge permits have been registered in the Repda.

Up to December 2015, there were 486 896 concession or allocation deeds for the use of the nation's water resources registered in the Repda, which corresponded to a volume of 85 664 million cubic meters (hm^3) allocated for offstream uses and 180 895 hm^3 for instream uses (see chapter 3).

The distribution of deeds by use is shown in table 5.1. In table 5.2 they are grouped by hydrological-administrative region (HAR), considering discharge permits, federal zone permits and material extraction permits. By number, regions VI Rio Bravo, VIII Lerma-Santiago-Pacific and X Central Gulf concentrate 40% of the total number of concession and/or allocation deeds.

It should be noted that one concession deed may cover one or more uses or permits. The term "grouped use" is employed (see chapter 3) for their analysis. The grouped use for **agriculture** includes the agricultural, livestock, aquaculture, multiple and others headings of the Repda classification; **public supply** includes public urban and domestic, **self-supplying industry** considers industrial, agro-industrial, services and trade. There may be slight variations in the figures owing to the dates in which the Repda was consulted.

Table 5.1 Concession or allocation deeds registered in the Repda, 2015

Grouped uses	Deeds registered in the Repda	
	Number	Percentage
Agriculture	312 053	64.09
Public supply	144 832	29.75
Self-supplying industry	29 804	6.12
Thermoelectric	55	0.01
Subtotal offstream uses	**486 744**	**99.97**
Ecological conservation (instream use)	1	0.00
Hydropower (instream use)	151	0.03
Total	**486 896**	**100.00**

Source: Conagua (2016c).

Table 5.2 Deeds by hydrological-administrative region in 2015

HAR number	Concessions and/or allocations				
	Surface water	Groundwater	Discharge permits	Federal zone permits	Material extraction
I	2 367	9 373	603	1 643	217
II	3 968	18 200	539	2 665	83
III	12 123	13 545	656	7 566	481
IV	14 847	13 806	1 550	8 111	402
V	10 277	18 326	628	10 461	207
VI	6 046	37 393	728	6 181	61
VII	3 706	27 884	937	3 587	119
VIII	19 075	59 605	3 084	22 163	760
IX	9 462	14 703	863	13 634	179
X	13 002	19 510	1 770	18 873	676
XI	25 271	9 284	1 026	12 346	443
XII	207	31 308	3 371	80	3
XIII	1 162	2 363	848	1 854	0
Total	**121 513**	**275 300**	**16 603**	**109 164**	**3 631**

Source: Conagua (2016c).

Legal instruments

[Tablero: Ordenamientos]

Mexico's Political Constitution authorizes the Federal Executive Branch to establish regulatory means, if it is in the public interest and utility, in order to maintain control over the extraction of the nation's groundwater resources through the issuing of prohibitions, regulations, reserves and rescues.

The different current legal control instruments have been issued since 1948. The NWL establishes that **prohibition zones** are necessary in those aquifers in which there is no mean annual availability of groundwater, as a result of which it is not possible to authorize concessions or allocations of water in addition to those legally authorized, due to the deterioration of water in quantity or quality, which affects hydrological sustainability.

Regulations are for those aquifers in which there is still mean annual availability of groundwater, which may be granted as a concession or allocation, for any use, within the limits of the available volume. When this type of legal instrument is applied to a portion of an aquifer, it is termed a **regulated zone**.

Reserve zones are specific areas of aquifers in which limits are established on the use of a part or all of the available water, with the aim of providing a service or setting up a restoration or conservation program. The Federal Executive Branch may declare the total or partial reserve of water resources for the following purposes: domestic and public-urban use, power generation for public service, and guaranteeing minimal flows for ecological protection, including the conservation of vital ecosystems.

Up to December 31, 2015, there were 146 current groundwater prohibition decrees, four aquifer regulations, three regulated zones and three declarations of reserve zones for public urban use, which together cover approximately 55% of the national territory (see map 5.1). It is established that to use groundwater within the territories outlined within them, it is necessary to request the corresponding concession or allocation. The Conagua, considering the results of the studies it carries out, may authorize or reject the concession or allocation.

In 2015 there were

146

groundwater prohibitions

For the remaining 45% of the country, in 2013 general agreements were published for a total of 333 aquifers, previously not subject to legal restrictions, and in which the digging or the construction of infrastructure to extract water from the subsoil is no longer permitted, nor is the increase in the previously authorized volume (62 aquifers), or a concession or allocation is required to extract water from the subsoil as well as authorization from the Conagua to increase the volume (271 aquifers). This measure is collectively known as the suspension of free extraction, meaning the free extraction of the nation's groundwater resources.

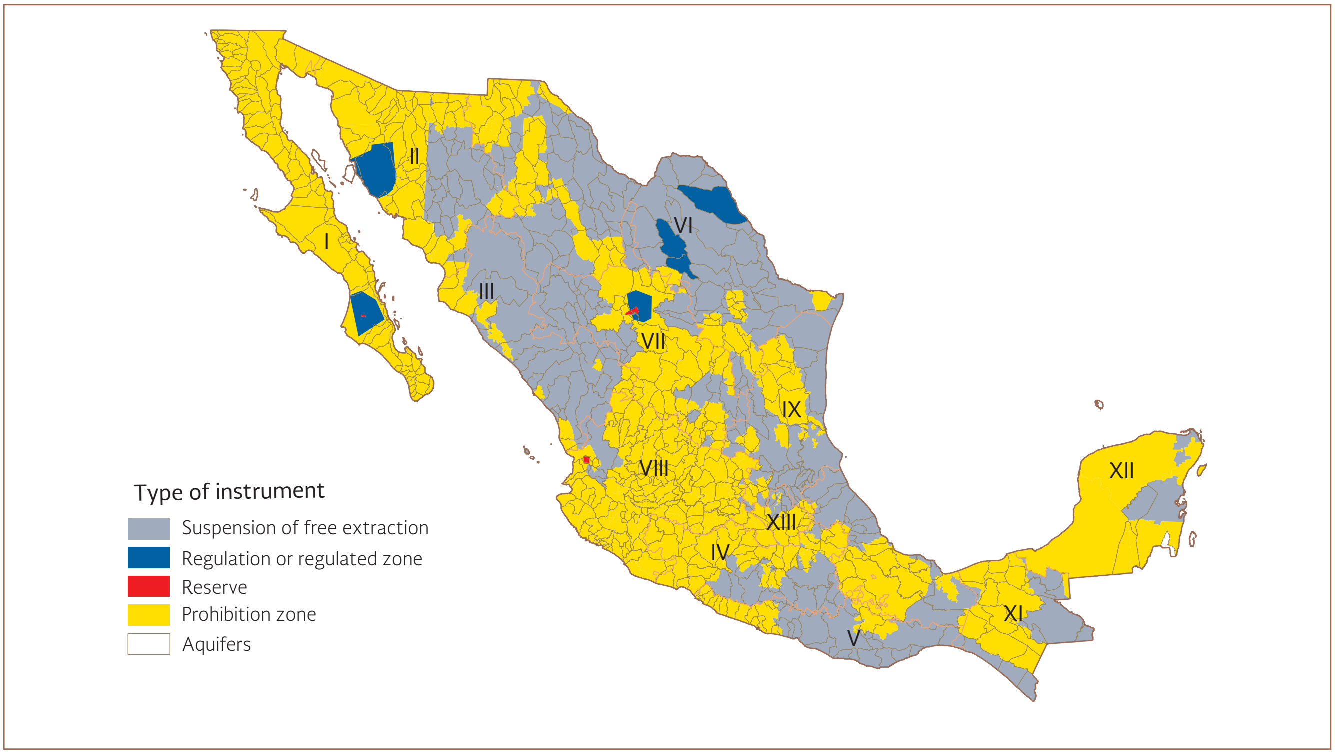
Surface prohibition zones are those specific areas of regions of watersheds in which no additional uses of water other than those that are legally established are authorized, and the latter are controlled through specific regulations, by virtue of the deterioration in the quantity or quality of water, due to the impact on hydrological sustainability or the damage to surface water bodies. The Conagua consults with users and civil society organizations, within the scope of the river basin councils, and resolves the limitations resulting from the existence, declaration and implementation of prohibition zones. The surface prohibition zones are shown in map 5.2.

In 2015 there were

349

surface water prohibitions

Map 5.1 Groundwater instruments, 2015



Source: Produced based on Conagua (2016b).

Map 5.2 Areas with surface water prohibitions, 2015

Source: Produced based on Conagua (2016b).

Publication of mean annual water availabilities

[Tablero: Cuencas]

The NWL establishes that in order to grant concession or allocation deeds, the mean annual availability of water in the watershed or aquifer in which the use is to be made should be taken into account. When it is determined that an additional volume to those already allocated may be extracted from an aquifer or watershed without compromising the ecosystem, this condition is termed "availability". The Conagua is bound to publish these availabilities, for which the standard NOM-011-CONAGUA-2000 was created, "Conservation of Water Resources which establishes the specifications and the method to determine the mean annual availability of the nation's water resources".

Up to December 31, 2015, the availabilities of the 653 hydrogeological units or aquifers into which the country has been divided had been published in the DOF, as well as that of the 731 watersheds into which Mexico is subdivided.

Maps 5.3 and 5.4 show the location of Mexico's watersheds and aquifers whose availability had been published in the DOF up to December 31, 2015.

Classification declarations for Mexico's water bodies

[Tablero: Acuíferos]

The NWL establishes that in order to grant wastewater discharge permits, the classification declarations of the national water bodies should be consulted. The Conagua has the responsibility of drawing up and publishing these declarations in the DOF.

According to article 87 of the NWL, classification declarations contain the outlines of the water bodies studied in which the pollution assimilation and dilution capacity is determined, referring to their capacity to self-purify; as well as the quality parameters that wastewater should comply with and the maximum discharge limits of these parameters in the classified areas. Furthermore, they include quality targets in the receiving water bodies as regards the pollutants, as well as the timelines to achieve those targets.

For the management of its water resources, Mexico has been divided into

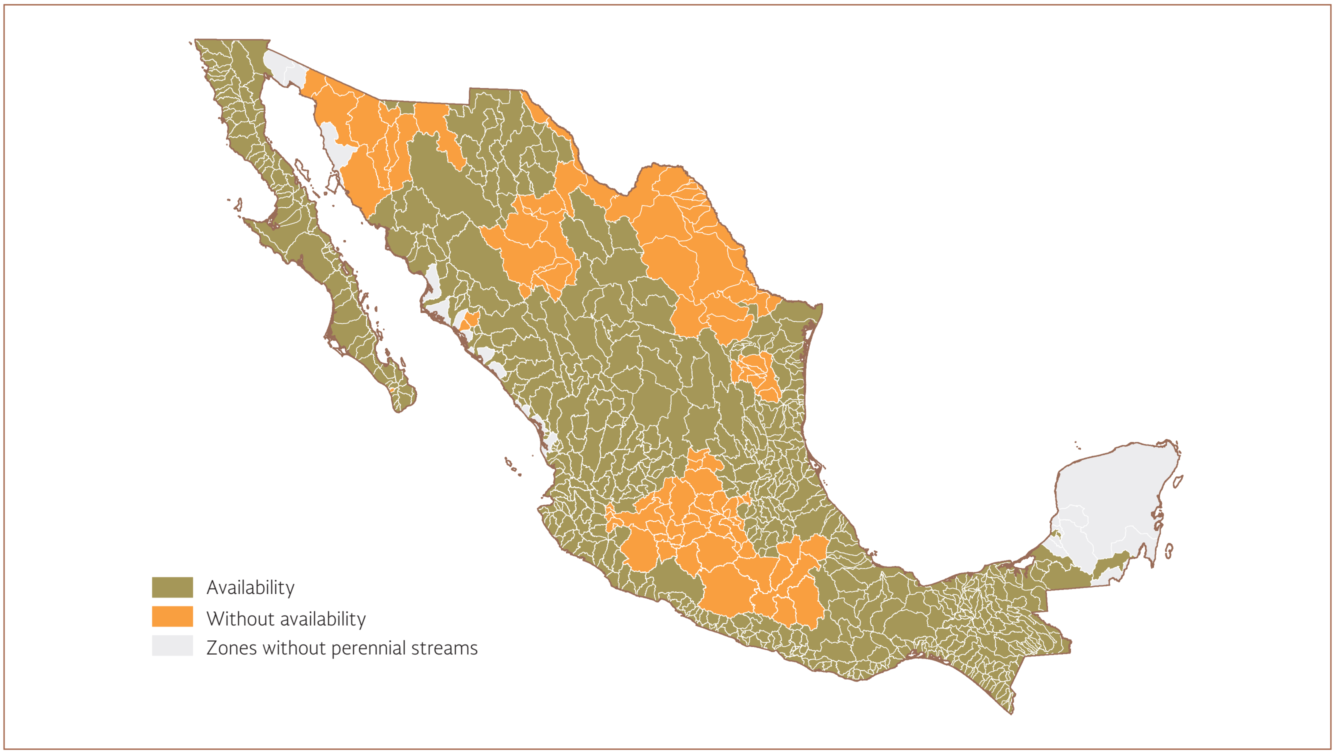
731

watersheds and

653

aquifers

Map 5.3 Watersheds with availability published in the DOF, 2015



Source: Produced based on Conagua (2016b).

Map 5.4 Aquifers with availability published in the DOF, 2015

Source: Produced based on Conagua (2016b).

5.3 Water economy and finances

Duties for the use of the nation's water resources

Both companies and individuals that make use of Mexico's water resources are bound to pay the corresponding duties, be it with or without the benefit of concession or allocation deeds, authorizations or permits issued by the Federal Government. The same also applies to those who discharge wastewater into rivers, catchments, reservoirs, seawater or water currents, as well as into the soil or into grounds which are public property or which could pollute the subsoil or aquifers, be it permanently, intermittently or on a one-off basis. In the same case are those who make use of public goods which belong to the federation, in ports, terminals and port installations, the federal sea zone, dikes, channels, reservoirs, areas with currents and tanks which are the property of the nation.

In the decree that reformed the Federal Duties Law (FDL) on December 11, 2013, article 231 was modified, in which an algorithm was specified for the calculation of the availability zone in terms of surface and groundwater. As a consequence of this reform, each watershed is classified into one of four possible availability zones for surface water. Similarly, each aquifer is classified into one of four possible availability zones for groundwater. Since 2014 the Conagua has published no later than the third month of every fiscal year the availability zone that corresponds to each of the country's watersheds and aquifers.

In general the cost per cubic meter is higher in the zones of lesser availability, as can be observed in table 5.3 for surface water and table 5.4 for groundwater. In both tables, "General regime" refers to any use other than those mentioned. The values are taken from the publication in the DOF (30/12/2014) of Annex 19 of the tax law for 2015 - Updated quantities established in the 2015 Federal Duties Law. It should be mentioned that no payment is made for the extraction of seawater, nor for brackish water with concentrations of more than 2 500 mg/l of total dissolved solids (certified by the Conagua).

The availability zones are shown in maps 5.5 for surface water and 5.6 for groundwater.

For the purpose of charging duties for wastewater **discharges**, receiving bodies (rivers, lakes and lagoons, among others) are classified into three types: A, B or C, according to the effects caused by the pollution. The C-type receiving bodies are those in which the pollution has the greatest effects. The list of the receiving bodies that belong to each category can be found in the Federal Duties Law (FDL).

The rates for wastewater discharges are related to the volume of the discharge and the load of the pollutants; to make this calculation, both the discharge that is characteristic of the activity that generated the discharge and the type of receiving body are taken into account. The methodology may be consulted in Article 278-B of the FDL.

Table 5.3 Duties for the use of the nation's surface water resources, by availability zone, 2015 (pesos per cubic meter)

Use	Zone			
	1	2	3	4
General regime	14.3910000	6.6252000	2.1723000	1.6611000
Drinking water, consumption of more than 300 l/inhabitant/day (on the excess)	0.8554000	0.4102700	0.2048800	0.1019900
Drinking water, consumption equal to or less than 300 l/inhabitant/day	0.4277000	0.2051300	0.1024400	0.0510000
Agriculture and livestock, without exceeding the concession	0.0000000	0.0000000	0.0000000	0.0000000
Agriculture and livestock, for every m^3 that exceeds the concession	0.1632000	0.1632000	0.1632000	0.1632000
Spas and recreation centers	0.0105976	0.0059144	0.0027587	0.0011378
Hydropower and geothermal generation	0.0049444	0.0049444	0.0049444	0.0049444
Aquaculture	0.0035555	0.0017739	0.0008146	0.0003778

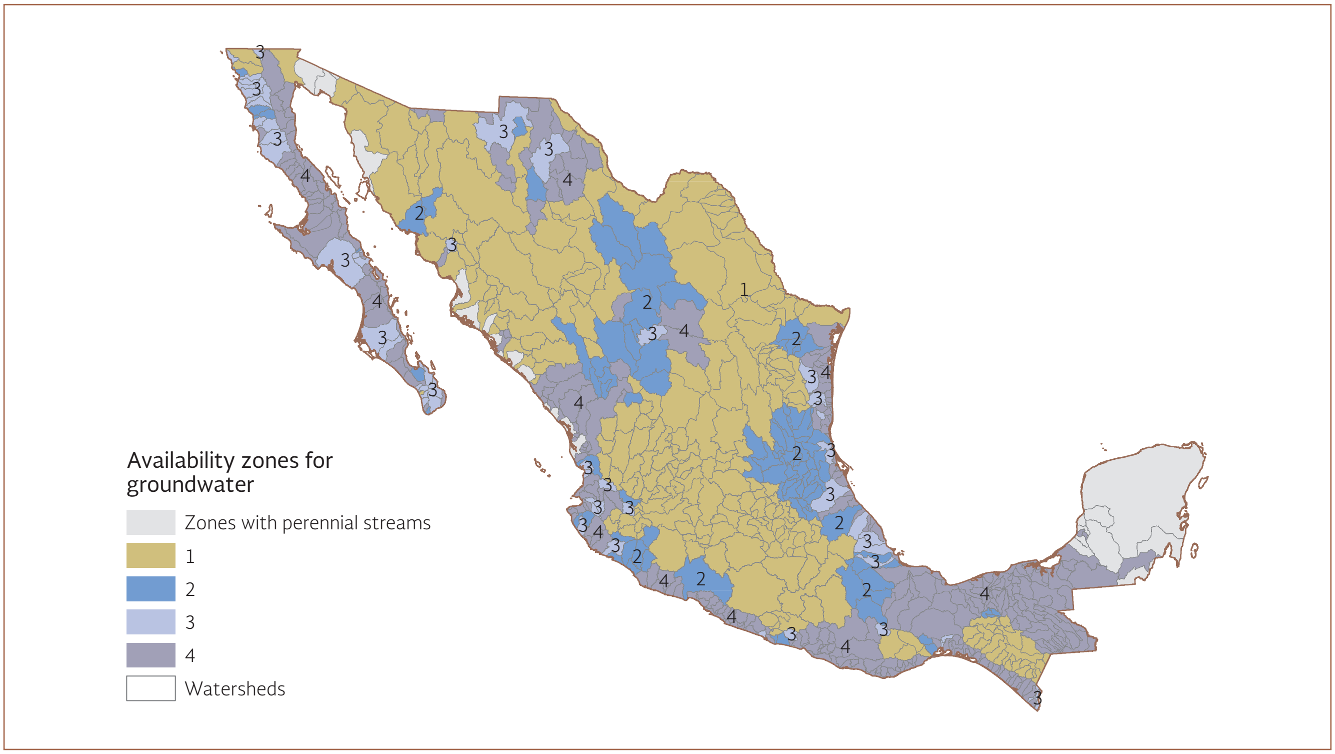
Source: Conagua (2016n).

Table 5.4 Duties for the use of the nation's groundwater resources, by availability zone, 2015 (pesos per cubic meter)

Use	Zone			
	1	2	3	4
General regime	19.3914000	7.5060000	2.6135000	1.8998000
Drinking water, consumption of more than 300 l/inhabitant/day (on the excess)	0.8929200	0.4117200	0.2321100	0.1082000
Drinking water, consumption equal to or less than 300 l/inhabitant/day	0.4464600	0.2058600	0.1160600	0.0541000
Agriculture and livestock, without exceeding the concession	0.0000000	0.0000000	0.0000000	0.0000000
Agriculture and livestock, for every m^3 that exceeds the concession	0.1632000	0.1632000	0.1632000	0.1632000
Spas and recreation centers	0.0125539	0.0061847	0.0030336	0.0013546
Hydropower and geothermal generation	0.0049444	0.0049444	0.0049444	0.0049444
Aquaculture	0.0039041	0.0018085	0.0008983	0.0004118

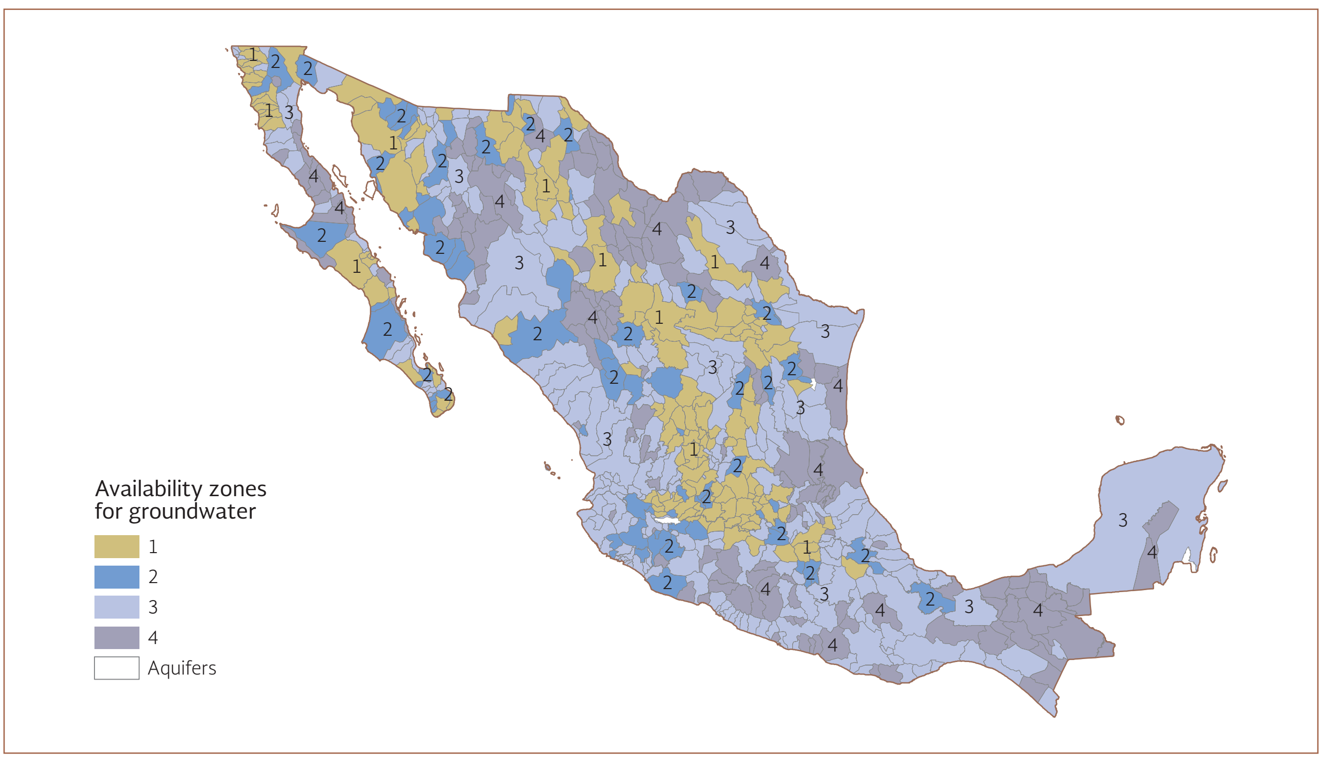
Source: Conagua (2016n).

Map 5.5 Availability zones for surface water, 2015



Source: Produced based on Conagua (2016n).

Map 5.6 Availability zones for groundwater, 2015



Source: Produced based on Conagua (2016n).

The Conagua's income collection

[Tablero: Recaudación de la Conagua, Volúmenes declarados]

As a fiscal authority, the Conagua intervenes in the charging of duties for the use of Mexico's water resources and its inherent public goods. In tables 5.5 and 5.6, its income through the charging of duties may be visualized, which includes the concepts of the use of the nation's water resources; the use of receiving bodies; material extraction; bulk water supply to urban and industrial centers; irrigation services; use of federal zones; and various, such as transaction services, VAT and fines, among others. It should be mentioned that since 2013, the "*Programa Ponte al Corriente*" (Get Up-to-date Program) has been in force. Based on the implementation of the reforms to the Federal Duties Law, from January 1, 2014, a new concept of payment was included, referring to the inter-basin transfer of the nation's water.

The conversions to constant 2015 prices employed in the following section were carried out based on the average National Consumer Price Index for each year.

In 2015, **16.5** billion pesos were collected

Table 5.5 The Conagua's income collection through the charging of duties and concepts, 2008-2015 (millions of pesos at constant 2015 prices)

Concept	2008	2009	2010	2011	2012	2013	2014	2015
Use of the nation's water resources	9 954.6	9 873.5	9 419.4	9 930.0	10 506.5	9 894.0	10 990.1	10 552.6
Bulk water supply to urban and industrial centers	2 672.2	2 580.3	2 886.4	3 210.2	3 125.9	3 001.9	3 544.8	3 725.5
Irrigation services	254.8	280.7	262.7	316.8	231.5	207.0	226.5	244.5
Material extraction	55.8	56.8	58.6	34.8	41.2	23.2	24.5	24.6
Use of receiving bodies	76.1	223.2	265.1	309.2	332.3	417.0	667.4	1 153.9
Use of federal zones	41.0	47.5	43.9	45.3	51.3	45.0	53.8	60.9
Various (transaction services, regularization and fines, among others)	433.6	266.0	246.7	250.6	783.4	458.8	565.4	545.1
Income through fiscal credits	1 246.5	94.2	92.1	505.4	645.6	508.8	213.7	97.3
Income through "Programa ponte al corriente"	0.0	0.0	0.0	0.0	0.0	1 174.0	0.0	0.0
Inter-basin transfer of the nation's water	0.0	0.0	0.0	0.0	0.0	0.0	10.4	55.0
Total	**14 734.5**	**13 422.1**	**13 274.9**	**14 602.3**	**15 717.7**	**15 729.9**	**16 296.6**	**16 459.3**

Source: Produced based on Conagua (2016n).

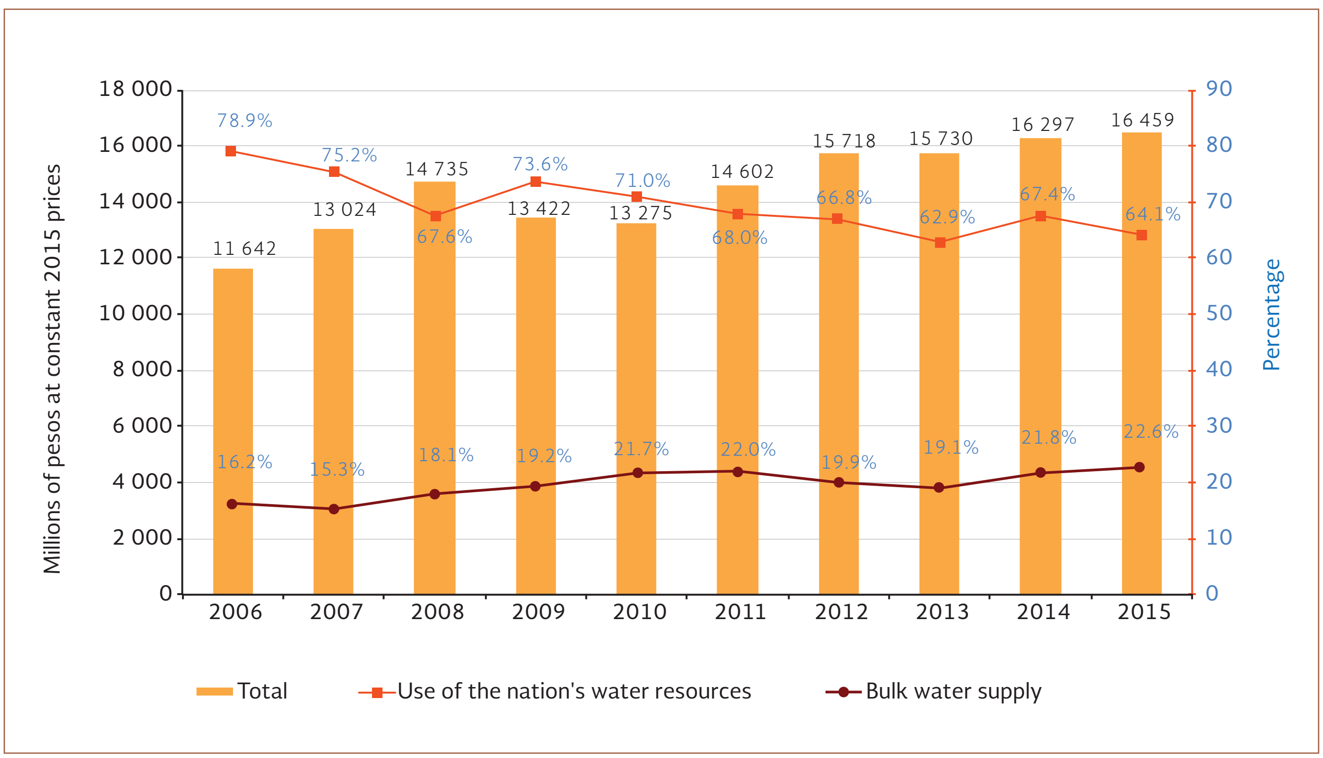
Periodically, the Ministry of Finance and Public Credit (SHCP in Spanish) authorizes the Conagua to apply charges for services, for example: bulk water supply from the Cutzamala System to the Metropolitan Area of the Valley of Mexico or to irrigation district (ID) modules.

The Conagua's income collection followed a growing trend through the 2006-2015 period, at constant 2015 prices. As can be observed in graph 5.2, the composition of this collection changed slightly during that period. In percentage terms, the concept of extraction and use of the nation's water resources decreased, going from 78.9% per year in 2006 to 64.1% in 2015.

Since the creation of the Conagua in 1989, the income collection through the charging of duties has increased every year. In graph 5.2 the period from 2006 to 2015 can be observed, during which it increased from 11.6 to 16.5 billion pesos, at constant 2015 prices.

By hydrological-administrative region, the income collection for 2015 is presented in table 5.6. Particularly worth highlighting is that the regions VIII Lerma-Santiago-Pacific, XIII Waters of the Valley of Mexico and VI Rio Bravo contribute 72% of the income. In that table the concept of "Various" refers to transaction services, regularizations and fines, among others.

Graph 5.2 Evolution in the Conagua's income collection, showing the two main components by amount, 2006-2015 (millions of pesos at constant 2015 prices)



Source: Produced based on Conagua (2016n).

Table 5.7 shows the evolution in the 2006-2015 period in income collection corresponding to each of the uses indicated in Article 223 of the FDL as regards water. Similarly, table 5.9 shows the values for 2015 by HAR.

The volumes reported by users in their declarations for the payment of duties are shown in table 5.8 for the 2006-2015 period, classified by uses, as well as in table 5.10 by hydrological-administrative region for 2015.

Table 5.6 Income collection by hydrological-administrative region, 2015 (millions of pesos)

HAR n°	Conceptos									Total
	Use of the nation's water resources	Bulk water supply to urban and industrial centers	Irrigation services	Material extraction	Wastewater discharges	Use of federal zones	Inter-basin transfers of the nation's water resources	Income from federal credits	Various (transaction services, regularization and fines, among others)	
I	177.02	0.00	66.30	2.17	70.09	9.56	0.81	1.99	8.06	**335.99**
II	753.86	0.00	25.11	0.36	13.94	1.25	0.00	4.97	41.52	**841.00**
III	182.96	0.00	64.26	8.58	8.83	5.50	0.02	1.67	10.44	**282.24**
IV	755.17	32.72	7.39	0.51	95.82	2.29	4.59	5.78	73.84	**978.10**
V	309.81	0.00	1.10	0.78	10.16	0.57	0.00	1.93	2.45	**326.79**
VI	1 455.14	0.00	16.54	0.97	44.54	6.35	1.90	9.26	32.77	**1 567.47**
VII	625.06	0.00	11.96	0.75	14.74	1.83	0.00	4.04	25.51	**683.89**
VIII	2 653.13	93.06	24.45	2.98	178.64	17.71	2.24	18.50	140.59	**3 131.32**
IX	730.67	0.00	11.76	0.67	23.31	4.66	1.57	4.68	15.03	**792.34**
X	612.83	0.00	4.40	0.93	90.85	0.68	19.46	4.86	88.06	**822.06**
XI	413.91	0.00	0.70	5.87	48.93	1.29	0.00	2.83	6.16	**479.69**
XII	97.31	0.00	0.58	0.00	60.17	0.02	0.00	1.03	15.32	**174.42**
XIII	1 785.78	3 599.76	9.95	0.00	493.87	9.21	24.42	35.72	85.33	**6 044.03**
Total	**10 552.64**	**3 725.54**	**244.48**	**24.56**	**1 153.88**	**60.90**	**55.00**	**97.26**	**545.07**	**16 459.34**

Source: Conagua (2016n).

Table 5.7 Collection for the use of the nation's water resources, 2006-2015 (millions of pesos at constant 2015 prices)

Use	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
General regime	6 345.5	6 813.3	6 815.2	6 695.1	6 290.6	6 673.3	7 334.0	7 304.1	8 115.9	7 804.4
Public urban	2 188.8	2 354.5	2 415.3	2 503.3	2 478.6	2 500.5	2 428.5	2 068.1	2 054.0	2 067.2
Hydropower	624.5	599.1	687.2	635.7	620.1	732.1	724.8	519.3	818.4	679.3
Spas and recreational centers	28.0	26.9	36.0	38.7	29.4	23.5	18.5	2.1	1.1	0.9
Aquaculture	0.5	0.7	0.9	0.7	0.7	0.7	0.6	0.5	0.7	0.8
Overall total	**9 187.2**	**9 794.6**	**9 954.6**	**9 873.5**	**9 419.4**	**9 930.0**	**10 506.5**	**9 894.0**	**10 990.1**	**10 552.6**

Source: Conagua (2016n).

Table 5.8 Volumes declared for the payment of duties, 2006-2015 (hm^3)

Use	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
General regime	1 306	1 764	1 796	1 939	1 675	1 373	1 132	1 180	1 082	1 029
Public urban	8 240	7 584	7 639	5 609	5 617	6 967	6 185	10 262	8 010	8 841
Hydropower	140 295	122 832	150 669	136 085	134 783	164 773	155 717	112 816	133 018	138 662
Spas and recreational centers	115	84	86	64	56	109	78	85	94	129
Aquaculture	159	308	309	344	222	218	256	258	337	415
Overall total	**150 115**	**132 571**	**160 499**	**144 041**	**142 353**	**173 440**	**163 368**	**124 602**	**142 542**	**149 076**

Source: Conagua (2016n).

Table 5.9 Duty collection for the use of the nation's water resources, by hydrological-administrative region, 2015 (millions of pesos)

HAR number	General regime	Public urban	Hydropower	Spas and recreational centers	Aquaculture	Total
I	88.0	89.0	0.0	0.0	0.0	177.0
II	720.4	14.0	19.4	0.0	0.0	753.9
III	83.4	45.4	54.1	0.0	0.0	183.0
IV	441.8	160.6	152.0	0.3	0.4	755.2
V	296.5	12.1	1.2	0.0	0.0	309.8
VI	1 190.4	256.6	8.1	0.0	0.0	1 455.1
VII	552.0	73.0	0.0	0.0	0.0	625.1
VIII	2 075.9	502.6	74.2	0.3	0.1	2 653.1
IX	656.2	65.0	9.4	0.1	0.0	730.7
X	505.5	31.7	75.5	0.1	0.0	612.8
XI	119.4	9.1	285.4	0.0	0.0	413.9
XII	72.4	24.9	0.0	0.0	0.0	97.3
XIII	1 002.4	783.2	0.0	0.1	0.0	1 785.8
Total	**7 804.4**	**2 067.2**	**679.3**	**0.9**	**0.8**	**10 552.6**

Source: Conagua (2016n).

Table 5.10 Volumes declared for the payment of duties for the use of the nation's water resources, by hydrological-administrative region, 2015 (hm^3)

HAR number	General regime	Public urban	Hydropower	Spas and recreational centers	Aquaculture	Total
I	10.9	234.5	1.7	0.4	2.2	249.7
II	63.3	55.3	3 963.2	0.4	9.6	4 091.8
III	10.8	207.2	11 050.9	2.0	102.2	11 373.1
IV	89.7	676.5	31 076.7	35.4	127.1	32 005.4
V	25.0	80.1	242.0	0.0	0.0	347.1
VI	86.9	636.0	1 652.6	0.8	0.3	2 376.6
VII	56.9	169.1	0.0	1.5	1.3	228.8
VIII	141.6	1 292.7	15 070.4	31.8	49.8	16 586.3
IX	97.3	232.5	1 911.6	5.9	51.7	2 299.0
X	214.7	219.4	15 472.3	36.3	52.3	15 995.0
XI	61.3	113.7	58 220.7	0.1	4.3	58 400.1
XII	28.8	160.6	0.0	8.1	0.2	197.7
XIII	141.7	4 763.4	0.3	6.0	13.7	4 925.1
Total	**1 028.9**	**8 841.0**	**138 662.4**	**128.7**	**414.7**	**149 075.7**

Source: Conagua (2016n).

The Conagua's budget

[Tablero: Presupuesto ejercido, Presupuesto invertido]

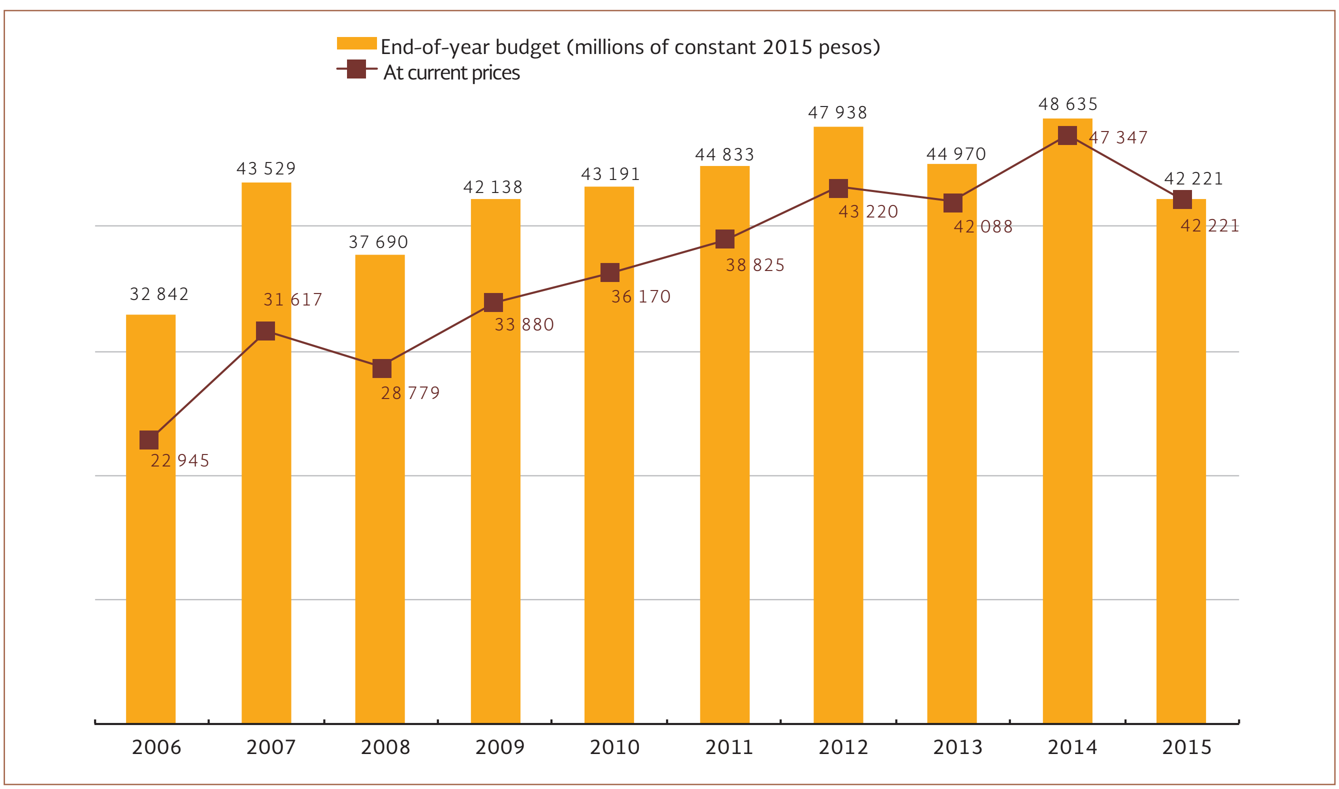
The budget authorized for the Conagua for any given fiscal year is defined at the end of the previous year. Throughout the fiscal year budgetary adjustments take place, as a result of which the end-of-year budget, the evolution of which is shown in graph 5.3, may vary from the originally authorized budget.

Water pays for water

One of the principles that supports national water policy, in accordance with the dispositions in the NWL (Article 14 Bis 5), is the so-called "water pays for water". That principle disposes that "water management should generate the necessary economic and financial resources to carry out its inherent tasks".

In this context, and with the intention of evaluating its compliance, a series of budgetary programs have been defined, linked with water governance functions [Adicional: Table 5.A], which are part of the budget assigned by the Conagua each year, to be contrasted with the amount of the collection of contributions and use of the nation's water resources and its inherent public goods. In this way

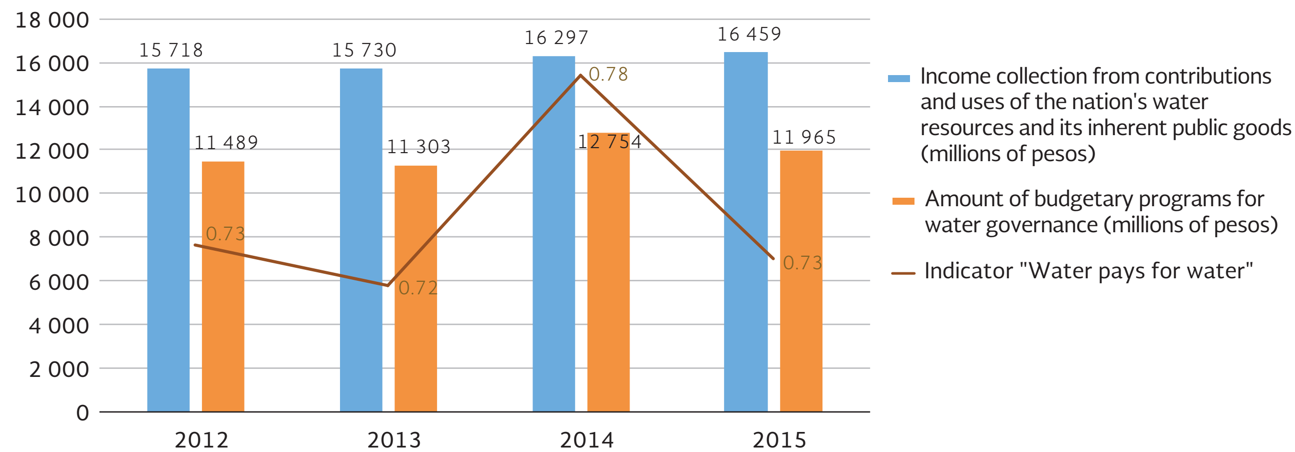
Graph 5.3 Evolution in the Conagua's end-of-year budget (millions of pesos)



Source: Produced based on Conagua (2016m).

the amount of the budgetary programs linked with water governance is divided by the collection. When the result of the **indicator** is **lower than the unit**, it is considered that the income provides sufficient resources to finance the water governance activities, as shown in graph 5.4.

Graph 5.4 Indicator "Water pays for Water" (at constant 2015 prices)



Source: Produced based on Conagua (2016m), Conagua (2016n).

Table 5.11 Investments by budget line in the drinking water, sewerage and sanitation sub-sector, 2002-2015 (millions of pesos at constant 2015 prices)

Year	Drinking water	Sewerage	Sanitation	Improving efficiency	Others	Total
2002	6 023	6 823	2 586	2 020	138	**17 590**
2003	8 366	7 965	1 953	1 510	284	**20 077**
2004	8 257	8 395	2 374	1 673	109	**20 807**
2005	12 448	12 219	4 846	2 363	175	**32 050**
2006	7 794	8 335	2 607	3 425	353	**22 513**
2007	12 866	10 216	2 389	3 372	780	**29 624**
2008	13 747	12 254	3 028	3 995	1 445	**34 469**
2009	12 389	13 492	2 833	6 751	2 155	**37 619**
2010	10 937	14 775	3 410	5 807	2 687	**37 616**
2011	10 444	16 122	8 900	5 298	2 511	**43 275**
2012	12 069	8 209	17 650	4 190	2 805	**44 923**
2013	11 352	13 661	7 929	4 922	1 791	**39 655**
2014	10 638	10 291	5 728	6 507	1 973	**35 137**
2015	**9 500**	**12 988**	**5 616**	**5 417**	**1 584**	**35 104**

Source: Conagua (2016a).

The evolution in the investment in the drinking water, drainage and sanitation sub-sector is shown in table 5.11. The table considers the programs operated through the Conagua, Sedesol, Cdi, Banobras, state bodies, the private sector and credits. The "Others" concept considers studies, projects and supervision.

It should be mentioned that this investment has diverse origins, as can be observed in table 5.12. 68.3% of the investment was of federal origin, whereas state contributions were 12.1%, municipalities 8.7% and other sources, including state commissions, housing developers, credits, contributions of the private sector and others, accounted for the remaining 10.8%. For table 5.12, in the "Prome" and "Prossapys" concepts, the state investment includes municipal resources; the "Valley of Mexico" concept refers to the federal resources from the 1928 Trust Fund, derived from the payment of duties for the concept of bulk water supply; and the "Other projects" concept includes infrastructure projects such as El Zapotillo, El Realito and Bicentenario.

Table 5.12 Investments reported by program and agency by the sector of origin of the resources, 2015 (millions of pesos at constant 2015 prices)

Concept	Federal	State	Municipal	Credit/Private/Others	Total
Conagua investments	**20 644.61**	**3 891.26**	**2 666.68**	**671.23**	**27 873.78**
Agua Limpia	60.88	47.48	0.00	0.00	108.35
APAZU	4 500.28	2 451.34	802.72	300.04	8 054.37
Prodder	1 389.07	0.00	1 389.07	0.00	2 778.14
Promagua	428.59	323.46	0.00	212.13	964.18
Prome	186.90	47.07	103.56	0.00	337.53
Prossapys	2 698.82	416.69	247.08	0.00	3 362.58
Protar	1 213.52	592.88	124.26	159.05	2 089.71
Valley of Mexico	9 173.01	0.00	0.00	0.00	9 173.01
Other projects	993.54	12.35	0.00	0.00	1 005.89
Other agencies	**3 348.64**	**356.65**	**400.17**	**3 124.30**	**7 229.75**
Cdi	2 504.10	256.91	217.30	0.00	2 978.31
Conavi	0.00	0.00	0.00	3 084.29	3 084.29
Sedesol	844.54	99.74	182.87	40.01	1 167.16
Total	**23 993.24**	**4 247.91**	**3 066.86**	**3 795.52**	**35 103.53**

Source: Conagua (2016a).

Drinking water and sanitation tariffs

[Tablero: Tarifas]

Drinking water tariffs are established independently for each municipality, depending on the provisions of the corresponding state's legislation. In some states, the tariffs are approved by the local state congress, whereas in others they are approved by the governing body or Board of Directors of the municipality's or locality's drinking water utility or the state water commission [Adicional: Table 5.B].

In principle, tariffs have the objective of recovering the costs incurred by the service provider. There is a Mexican standard on the evaluation of tariffs (NMX-AA-147-SCFI-2008), published in April 2009, which includes a definition of these costs.

The tariff level, or the payment due, is expressed in a tariff structure, more often than not differentiated by the type of users (domestic, commercial and industrial, among others). On occasions the tariff structure contains some mechanism of redistribution of costs through crossed subsidies, in which users in poorer socio-economic conditions are assigned lower tariffs than those considered as being in better conditions.

Tariff structures for metered services (when the charge is calculated based on the volume consumed) are generally in increasing blocks, meaning that the price per cubic meter is higher for a greater consumption of water. It should be mentioned that there is a great variety of mechanisms, including the fixed price, meaning when the user pays a certain amount independently of the water that has been used.

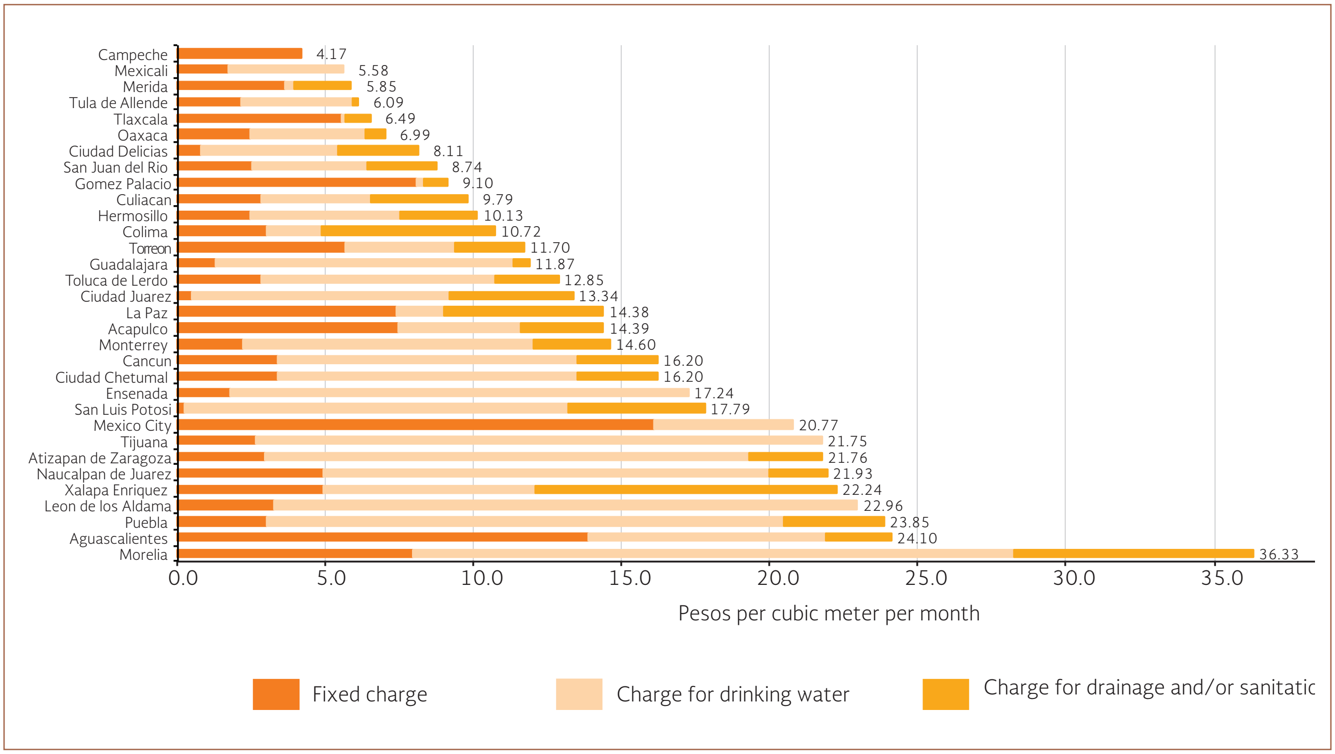
Water tariffs generally include:

- Fixed costs, independent from the volume used,
- Variable charges for the water supplied, according to the volume used,
- Variable charges for the concept of sewerage and wastewater treatment, generally applied as a percentage of the costs for water supply.

Graph 5.5 indicates, for some cities in Mexico, the drinking water, sewerage and/or sanitation tariffs for a consumption of 30 m^3/month for domestic use, as well as the highest tariff applicable.

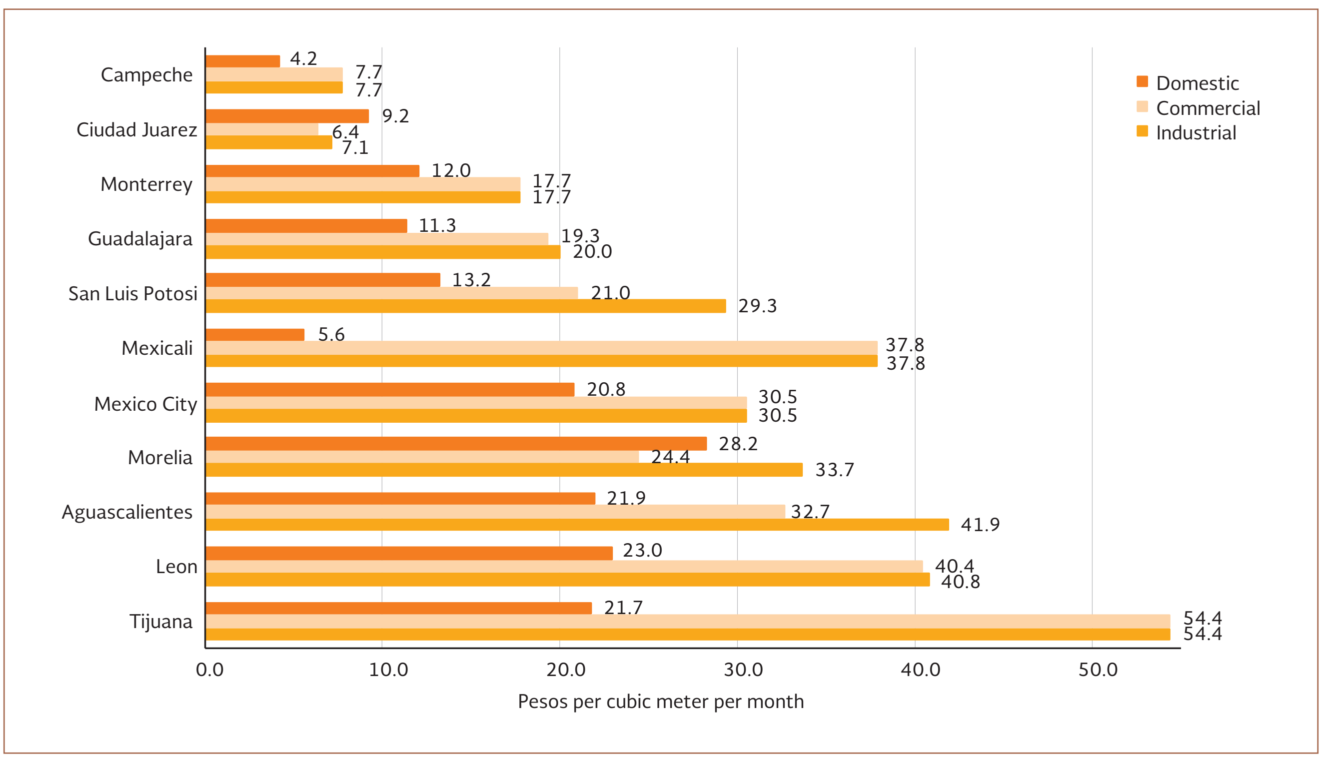
Graph 5.6 indicates the tariffs for domestic, industrial and commercial use in several localities in Mexico, assuming a consumption of 30 m^3/month, as well as the highest tariff applicable for that consumption.

GRAPH 5.5 Domestic drinking water, sewerage and/or sanitation tariffs in selected cities, 2015



Source: CONAGUA (2016a).

GRAPH 5.6 Comparison between tariffs for domestic, industrial and commercial use in selected cities, 2015



Source: Produced based on CONAGUA (2016n).

It should be mentioned that with the level of the tariff established, the service provider carries out the **billing** to users as a necessary step to charge for the service. The payment of these bills by users represents the **income collected** by the service provider. There are payments that are carried out in the same billing period, whereas others are late payments, fines or surcharges.

External funding and international cooperation

The resources destined for the sector include those that come from international financial institutions, as well as technical cooperations, which have the specific objective of transferring knowledge and skills.

In external credit, in 2015 the Conagua executed two projects with a disbursement that year of 154 million dollars, on the issues of:

- Improving efficiencies of water utilities (Prome), financed by the IBRD
- Drinking water and sanitation for rural communities (Prossapys IV), financed by the IDB

Another project with external credit was also formalized with the IDB, for the integral development of water and sanitation utilities, for an approximate amount of 200 million dollars.

In 2015 **technical cooperations** with international financial organizations were on the subject of the efficient use of energy (IDB); strengthening of the sustainability of drinking water and sanitation services in rural communities; and public policies with French-German cooperation, for which a second loan of approximately 100 million Euros was signed. The diagnosis for integral watershed management for the Cutzamala System was concluded (WB) and a consultancy to disseminate it was agreed upon. Technical cooperations and collaboration agreements were formalized for the issues of water reserves (second phase, with the WB); the environment in municipal governments; and the prioritization of investments, public-private partnerships and multi-stakeholder platforms (WB).

In 2015 the Conagua had bilateral actions with 5 countries and multilateral ones with several international organizations, among them the Mexican proposal for the Inter-Governmental Panel on Water is worth mentioning; actions as part of the International Hydrological Program and the World Water Council; participation in the 7th World Water Forum, the 21st Conference of the Parties (COP) of the United Nations Framework Convention on Climate Change 2015, and in events of the Conference of Ibero-American Water Directors (CODIA).

In 2015

154

million dollars were disbursed in external credit

5.4 Participation mechanisms

[Tablero: Mecanismos de participación]

River basin councils and auxiliary bodies

The NWL establishes that river basin councils are multi-stakeholder collegiate bodies, which are coordination and consensus-reaching bodies providing support, consultation and advice, between the Conagua, including the corresponding river basin organization, the agencies and entities of the federal, state or municipal governments and representatives of water users and civil society organizations, in the respective watershed or hydrological region.

As of December 31, 2015, there were 26 river basin councils [Adicional: Map 5.A].

In the process of consolidating the river basin councils, it was necessary to attend very specific issues in more localized geographic zones, as a result of which **auxiliary bodies** were created, known as river basin commissions to attend sub-catchments; river basin committees for micro-catchments; technical groundwater committees (Cotas) and clean beach committees in the country's coastal zones.

The clean beach committees are worth special mention. They have the purpose of promoting the cleaning up of beaches, watersheds and the aquifers associated with them, as well as preventing and rectifying the pollution of Mexico's beaches, respecting the biodiversity and making the beaches competitive for tourism, both nationally and internationally, as well as raising the standard and quality of living of the local population.

As regards the auxiliary bodies, up to 2015 there was a total of 215 auxiliary bodies of the river basin councils, with 36 commissions, 50 committees, 88 Cotas and 41 clean beach committees [Adicional: Table 5.C].

Box 5.1 Actions of river basin councils and their auxiliary bodies, 2015

Environmental certifications. Combining the efforts of different stakeholders, the Clean Beach Committee for Santa Maria Huatulco, Oaxaca has been instrumental in obtaining different recognitions for this tourist resort, among them the Earth-Check Golden (the third resort in the world to receive it), the certification of two beaches under the Mexican standard NMA-AA-120-SCFI-2006, one of them also with a Blue Flag certification.

Training in organic agriculture. Workshops have been implemented to train farmers, cattle ranchers and foresters in the watershed through the Copalita-Tonameca River Basin Committee. The result of the program of organic agriculture is the training of 300 farmers and a direct impact on 650 hectares with a positive effect in the ecosystem dynamic and an increase in the farmers' income.

Reforestation of 600 hectares. In 2015 the Operational Management of the Copalita-Tonameca River Basin Committee signed an agreement with the private sector for the reforestation of 600 hectares of a strategic ecosystem in that watershed, as part of the Environmental Compensation program for the Ventanilla-Barranca Larga highway.

Source: Produced based on Conagua (2016e).

5.5 Water-related standards

Official Mexican Standards

Due to the crosscutting nature of the water sector, there are several standards related to water issues. Table 5.13 shows some of the relevant standards. It is worth highlighting that, according to the Federal Law on Metrology and Standardization, the Official Mexican Standards (NOMs in Spanish) are technical regulations to be obligatorily observed, whereas the Mexican Norms (NMX) are voluntarily applied.

NOM-011-CONAGUA-2000 is a standard worth mentioning, given that it lays the foundations for the calculation of the availability of water in watersheds and aquifers, and it thus makes it possible to comply with one of the Conagua's legal obligations.

Similarly, the Conagua has issued standards that establish the dispositions, specifications and testing methods that guarantee that the products and services associated with the water sector comply efficiently with preserving water in quality and quantity.

Additionally, NOM-127-SSA1-1994 establishes the guidelines to guarantee water supply for human use and consumption with appropriate quality. This standard establishes permissible limits of bacteriological characteristics (fecal coliforms and total coliforms); physical and sensory characteristics (color, smell, taste and cloudiness); chemical characteristics (which include 34 parameters, such as aluminum, arsenic, barium, etc.), as well as treatment methods which should be applied according to the pollutants encountered.

Of special interest is NOM-001-SEMARNAT-1996, given that it establishes compliance deadlines for its requirements regarding maximum permissible limits in wastewater discharges into the nation's water and public goods (see table 5.14).

NOM-127-SSA1-1994 to guarantee supply for human use and consumption considers

34

chemical parameters

Table 5.13 Mexican standards related with the water sector

No.	Group: Semarnat
1	NOM-001-SEMARNAT-1996 - Maximum permissible limits of pollutants in wastewater discharges in the nation's water resources and goods
2	NOM-002-SEMARNAT-1996 - Maximum permissible limits of pollutants in wastewater discharges to urban and municipal sewerage systems
3	NOM-003-SEMARNAT-1997 - Maximum permissible limits of pollutants for treated wastewater that is reused in services to the public
4	NOM-004-SEMARNAT-2002 - Environmental protection. Sludge and biosolids. Specifications and maximum permissible limits of contaminants for their use and final disposal.
5	NOM-022-SEMARNAT-2003 - Preservation, conservation, sustainable use and restoration of coastal wetlands in areas of mangrove swamps
6	NOM-060-SEMARNAT-1994 - Specifications to mitigate the adverse effects caused on soil and water bodies by forest activities.
No.	**Group: Conagua**
1	NOM-001-CONAGUA-2011 – Drinking water systems, domestic intakes and sanitary sewerage- Airtightness-Specifications and testing methods
2	NOM-003-CONAGUA-1996 - Requirements for the construction of wells for the prevention of aquifer pollution
3	NOM-004-CONAGUA-1996 - Requirements for the protection of aquifers during maintenance and rehabilitation of water wells, and the closing of wells in general
4	NOM-006-CONAGUA-1997 - Specifications and testing methods for pre-manufactured septic tanks
5	NOM-008-CONAGUA-1998 - Specifications and testing methods for showers
6	NOM-009-CONAGUA-2001 - Specifications and testing methods for lavatories
7	NOM-010-CONAGUA-2000 - Specifications and testing methods for valves for lavatories
8	NOM-011-CONAGUA-2000 - Conservation of water resources. Specifications and the method to determine the mean annual availability of the nation's water resources
9	NOM-014-CONAGUA-2003 - Requirements for artificial aquifer recharge with treated wastewater
10	NOM-015-CONAGUA-2007 - Characteristics and specifications of works and of water for its artificial infiltration into aquifers
No.	**Group: Energía**
1	NOM-006-ENER-2015 - Electro-magnetic energy efficiency in pumping systems for deep wells in operation. Limits and testing methods
No.	**Group: Salud**
1	NOM-117-SSA1-1994 - Testing method for the determination of cadmium, arsenic, lead, tin, copper, iron, zinc and mercury in food, drinking water and treated water by atomic absorption spectrometry.
2	NOM-127-SSA1-1994 - Environmental health. Water for human use and consumption. Permissible limits of quality and treatment to which water should be submitted for its purification
3	NOM-179-SSA1-1998 - Monitoring and evaluation of the control of drinking water quality in networks
4	NOM-201-SSA1-2002 - Products and services. Water and ice for human consumption, packaging and bulk. Sanitary specifications
5	NOM-230-SSA1-2002 - Health requirements for water management in drinking water networks
6	NOM-244-SSA-2008- Equipment and germicidal substances for domestic water treatment. Sanitary requirements
No.	**Group: Mexican Standards**
1	NMX-AA-120-SCFI-2006 - Requirements and specifications for the sustainability of beach quality
2	NMX-AA-147-SCFI-2008 - Methodology for the evaluation of drinking water, sewerage and sanitation tariffs
3	NMX-AA-148-SCFI-2008 - Methodology to evaluate the quality of drinking water, drainage and sanitation services. Guidelines for the evaluation and improvement of services to users
4	NMX-AA-149/1-SCFI-2008 - Methodology to evaluate the efficiency of drinking water, drainage and sanitation service providers. Guidelines for wastewater service provision and evaluation
5	NMX-AA-149/2-SCFI-2008 - Methodology to evaluate the efficiency of drinking water, drainage and sanitation service providers. Guidelines for drinking water service provision and evaluation

Source: Produced based on Conagua (2016n).

TABLE 5.14 Compliance dates of NOM-001-SEMARNAT-1996

Municipal discharges		
Modified compliance dates from:	**Population range (according to 1990 Census)**	**Number of localities (according to 1990 Census)**
January 1, 2000	More than 50 000 inhabitants	139
January 1, 2005	From 20 001 to 50 000 inhabitants	181
January 2, 2010	From 2 501 to 20 000 inhabitants	2 266
Non-municipal discharges		
Modified compliance dates from:	**Biochemical Oxygen Demand per day (t/day)**	**Total Suspended Solids (t/day)**
January 1, 2000	More than 3.0	More than 3.0
January 1, 2005	From 1.2 to 3.0	More than 3.0
January 2, 2010	Less than 1.2	Less than 1.2

Source: CONAGUA (2016d).

CHAPTER

6

Water, health and the environment

WATER, HEALTH AND THE ENVIRONMENT

Environmental protection

The National Forest Program provides support for plots in overdrafted aquifers and catchments with low availability

Protected areas

177 under federal jurisdiction **2015**

370 voluntarily allocated

25.6 million hectares

400 000 hectares

Water and health

	1990		2015
Coverage of access to tap water services	78.4%	↗	95.3%
Coverage of access to sewerage and basic sanitation services	61.5%	↗	92.8%
Child mortality rate through diarrheal diseases	122.7	↘	7.5

Use of soil and vegetation

Vegetation cover

- Protects soil
- Intercepts rain

Wetlands

Ecosystems with a rich biodiversity and which provide environmental services

6 331 wetlands in the national inventory

10 million hectares

1 4 2 **Ramsar** sites

8.6 million hectares

Soil

- Its degradation decreases the capacity to provide goods and services
- Subject to water and wind erosion

6.1 Health

[Tablero: Agua y salud]

The provision of drinking water and sanitation is a significant factor in public health, by avoiding exposure to pathogenic agents. Appropriate access to these services is fundamental for the reduction of mortality and morbidity among the population under the age of five; the decrease in water-borne diseases (viral hepatitis, typhoid fever, cholera, dysentery and other causes of diarrhea), as well as illnesses resulting from the consumption of pathogenic chemical components (arsenic, nitrates or fluoride).

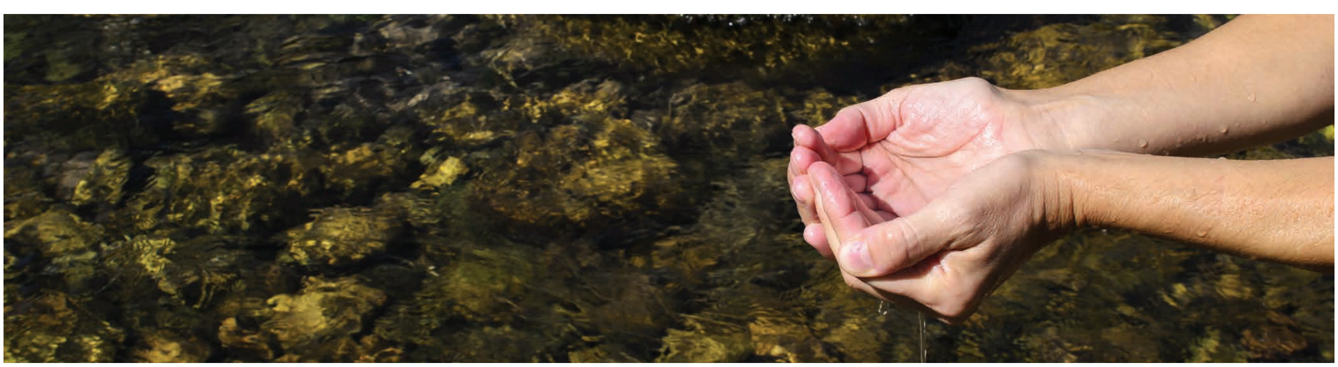
In the case of diarrheal diseases, child mortality in Mexico has fallen as a result of several public health-related actions and interventions [Adicional: Graph 6.A], including the distribution of oral serum from 1984 onwards, vaccination campaigns since 1986, the Clean Water Program in 1991, and the increase in drinking water, sewerage and Sanitation coverage (Sepúlveda et al. 2007). In addition to these factors are questions of hygiene, education, access to health services and the improvement in socio-economic and environmental conditions.

Start of the Clean Water Program in

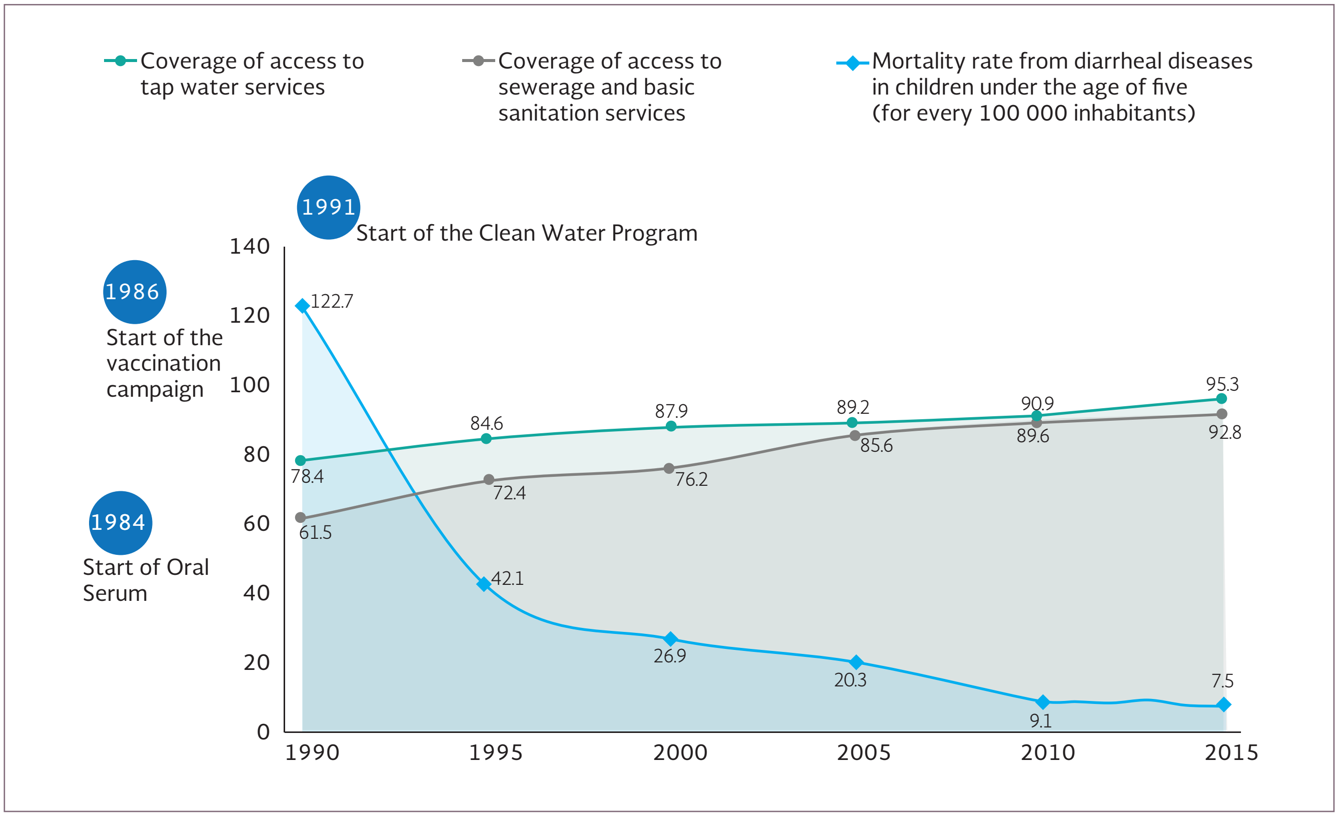
1991

It is interesting to compare the increasing trend in the coverage of access to tap water services and access to sewerage and basic sanitation services against the reduction in the mortality rate through diarrheal diseases in children under the age of five, which can be observed in graph 6.1. It should be mentioned that the data on the mortality rate for 2015 is preliminary.

In Mexico, drinking water service providers, generally speaking municipalities, also carry out the disinfection of water through chlorination (which is necessary in order to destroy pathogenic agents or microscopic parasites), in accordance with official Mexican standard NOM-127-SSA1-1994. The water disinfection procedure is evaluated through the determination of free residual chlorine in the domestic outlet. Figure 6.1 shows the evolution in the percentage of drinking water samples with residual chlorine within the required range for that standard. The data for 2015 is preliminary.



Graph 6.1 Coverage of tap water services and sewerage and basic sanitation services and the mortality rate through diarrheal diseases in children under the age of five, 1990 to 2015



Source: Produced based on Conagua (2016a), Salud (2016).

Figure 6.1 Drinking water samples with residual chlorine within the parameters of NOM-127-SSA1-1994

Code	State	2002 (%)	Evolution 2002-2015	2015 (%)
01	Aguascalientes	88.9		96.1
02	Baja California	57.4		98.1
03	Baja California Sur	44.7		89.9
04	Campeche	89.4		99.0
05	Coahuila de Zaragoza	88.4		98.4
06	Colima	81.4		97.2
07	Chiapas	47.2		66.2
08	Chihuahua	77.9		97.7
09	Federal District (Mexico City)	67.0		97.5
10	Durango	49.9		90.3
11	Guanajuato	62.7		97.8
12	Guerrero	60.8		75.3
13	Hidalgo	87.3		95.1
14	Jalisco	78.8		84.0
15	Mexico	91.3		85.3
16	Michoacan de Ocampo	67.4		80.3
17	Morelos	88.4		92.8
18	Nayarit	70.5		80.6
19	Nuevo Leon	83.8		100.0
20	Oaxaca	71.0		80.0
21	Puebla	93.5		95.8
22	Queretaro	69.1		99.7
23	Quintana Roo	89.1		100.0
24	San Luis Potosi	86.6		99.8
25	Sinaloa	79.3		92.5
26	Sonora	71.0		88.9
27	Tabasco	40.9		72.0
28	Tamaulipas	71.6		99.3
29	Tlaxcala	95.1		96.9
30	Veracruz de Ignacio de la Llave	69.6		91.8
31	Yucatan	64.9		88.2
32	Zacatecas	61.5		85.4
	National	**75.3**		**91.6**

Source: Produced based on Salud (2016), Cofepris (2016).

6.2 Vegetation

[Tablero: Uso de suelo y vegetación]

According to data from the "Charter of Soil and Vegetation Use" (INEGI 2013a), Mexico is classified into twelve vegetation groups compatible with the Rzedowski classification system. It should be mentioned that over time, INEGI has generated updates to this charter, the result of which is series I (updated in the 1980-1990 period), II (1993), III (2002), IV (2007) and V (2011-2012) (map 6.1).

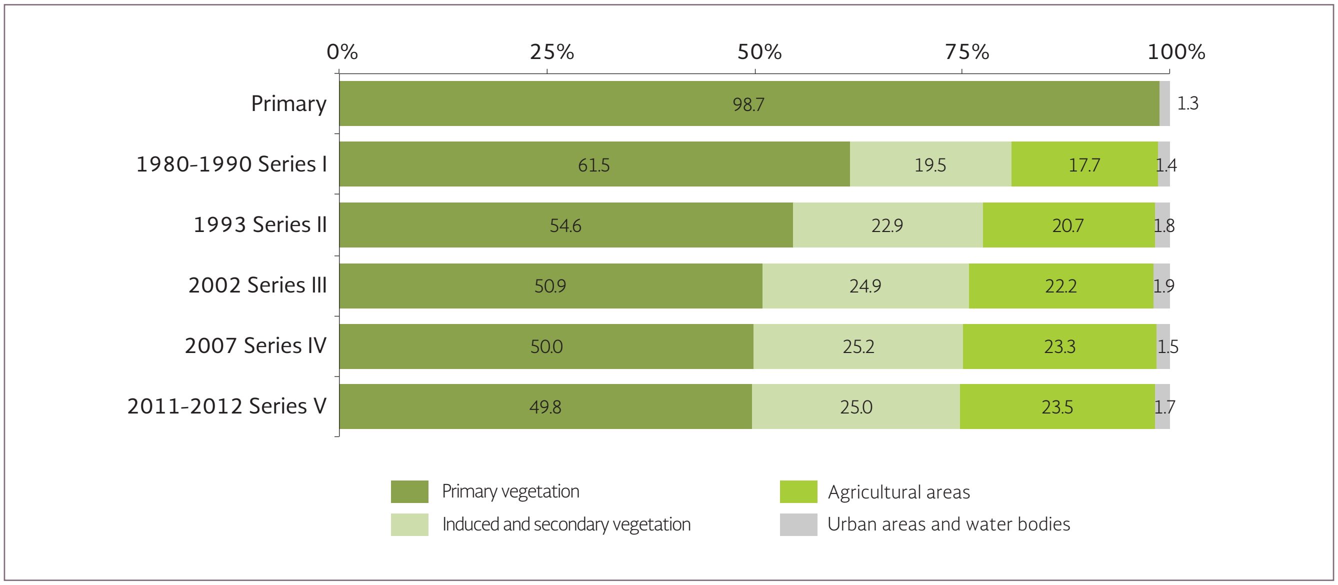
Series V was generated during the 2011-2012 period, based on the information presented in series IV of Soil and Vegetation Use and updated based on Landsat satellite images from 2011.

It is possible to compare the evolution from series I to V, as can be observed in graph 6.2. Vegetation is referred to as **primary** when it develops naturally according to the site's environmental factors, and has not been significantly modified by human activity. **Secondary** refers to a successional state of vegetation, when there is an indication that the original vegetation has been eliminated or strongly disturbed. **Induced** vegetation is that which develops when the original vegetation has been eliminated, or in abandoned agricultural areas.

MAP 6.1 Main uses of soil and vegetation, INEGI series V (2011-2012)

Source: Produced based on INEGI (2013a).

Graph 6.2 Evolution in the use of soil and vegetation based on Inegi's charters (percentage of the national territory)

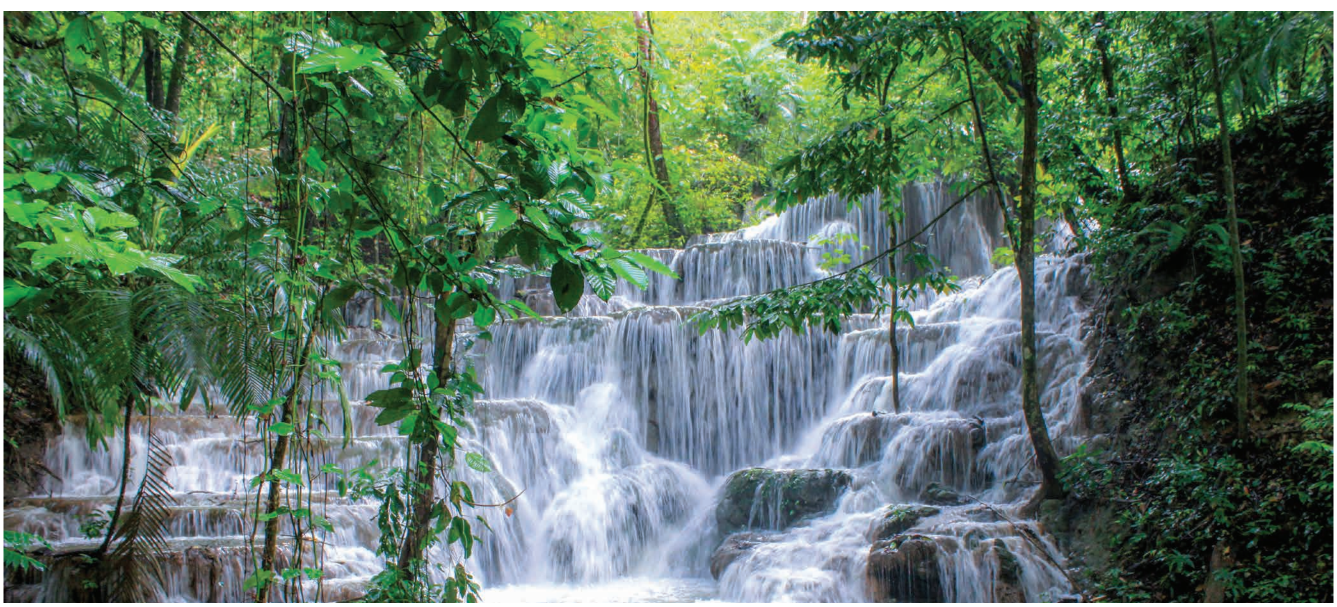


Source: Produced based on Inegi (2015a).

Table 6.1 Soil degradation: surface area affected by processes, types and levels of degradation (percentage of the national territory)

Degradation process	Light	Moderate	Severe	Extreme	Total
Physical degradation	3.43	1.19	0.30	0.61	5.53
Chemical degradation	9.55	7.51	0.28	0.03	17.38
Wind erosion	2.73	6.17	0.35	0.01	9.25
Water erosion	6.54	4.61	0.43	0.02	11.60

Source: Semarnat (2015).



As can be observed, the graph reflects the progressive increase in induced and secondary vegetation, of agricultural areas and urban zones, linked to the corresponding decrease in primary vegetation. The years correspond to the period in which the information used in each series was captured.

Soil **degradation** reduces its capacity to provide goods and services for the ecosystem and the latter's beneficiaries. It is physically expressed through the loss of productivity, the availability of water, water logging or landslides. Chemical degradation increases the levels of pollution, salinization, alkalinization as well as eutrophication, which reduce the fertility and the content of organic matter in the soil.

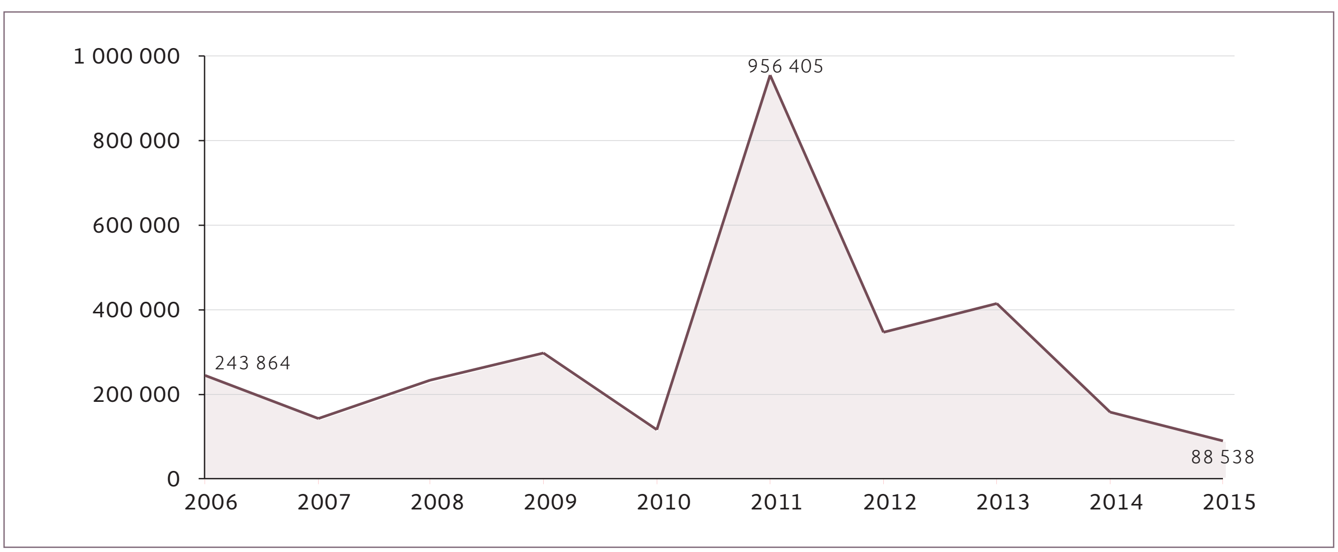
When the loss of the vegetation cover which acts as a a protective layer occurs, the soil is more vulnerable to water-based and wind **erosion**. The effects of erosion and degradation, estimated in 2002 and updated to 2013 (the latest year available), are shown in table 6.1.

The change in soil use is highlighted by the increase in secondary and induced vegetation in urban and agricultural areas. The process of erosion gradually reduces the capacity of rivers and water bodies, leading to flood impacts during intense or sustained rainfall. Another vector of change in vegetation is forest fires. Graph 6.3 shows the hectares affected by this phenomenon every year in Mexico.

It is estimated that in the 1990-2000 period, almost 190 400 hectares of forest changed to another soil use in Mexico. For the 2000-2010 period, the rate of change slowed down to 135 800 hectares per year, and for the latest period reported on, from 2010 to 2015, it dropped to 91 600 hectares per year (FAO 2016a).

Every year
91 600
hectares of forest change to another soil use

Graph 6.3 Surface area affected by fires in Mexico (hectares)



Source: Semarnat (2016a).

6.3 Biodiversity

Nature provides water-related **environmental services**, since soil and vegetation cover impacts upon water resources retention, which determines the accumulation of surface flows and aquifer recharge. Consequently, the conservation of soil and vegetation cover helps to maintain the integrity and balance of the natural elements that are part of the water cycle.

In this sense Protected Areas (PAs) are relevant, as terrestrial or aquatic portions that are representative of different ecosystems, which have not suffered anthropogenic alteration, and which produce ecological benefits which are increasingly recognized and valued, hence them being subject to special regimes of protection, conservation, restoration and development (Conanp 2016c). In core areas of PAs it is possible to limit or prohibit extractions that alter ecosystems, as well as there being a prohibition on interrupting, filling, drying out or deviating hydrological flows. One of the management categories of PAs, natural resource protection areas, focuses on the preservation and protection of watersheds, as well as protection areas for national water bodies (General Law on Ecological Balance and Environmental Protection).

In Mexico, the PAs that are under federal jurisdiction are administered by the National Commission for Protected Areas (Conanp), and are described in table 6.2. Additionally, the Conanp supports 370 areas voluntarily allocated for conservation, covering 399 643 hectares.

Hydrological environmental services are the objective of the National Forestry Program (Operating Rules of the National Forestry Program 2015). Every year the National Forestry Commission (Conafor) determines the eligible zones. Among the criteria taken into account are whether the polygons proposed to receive resources under this program are located within overdrafted aquifers or in watersheds with a low availability of surface water.

Map 6.2 shows the PAs under federal jurisdiction, as well as the eligible zones determined by the Conafor for 2015.

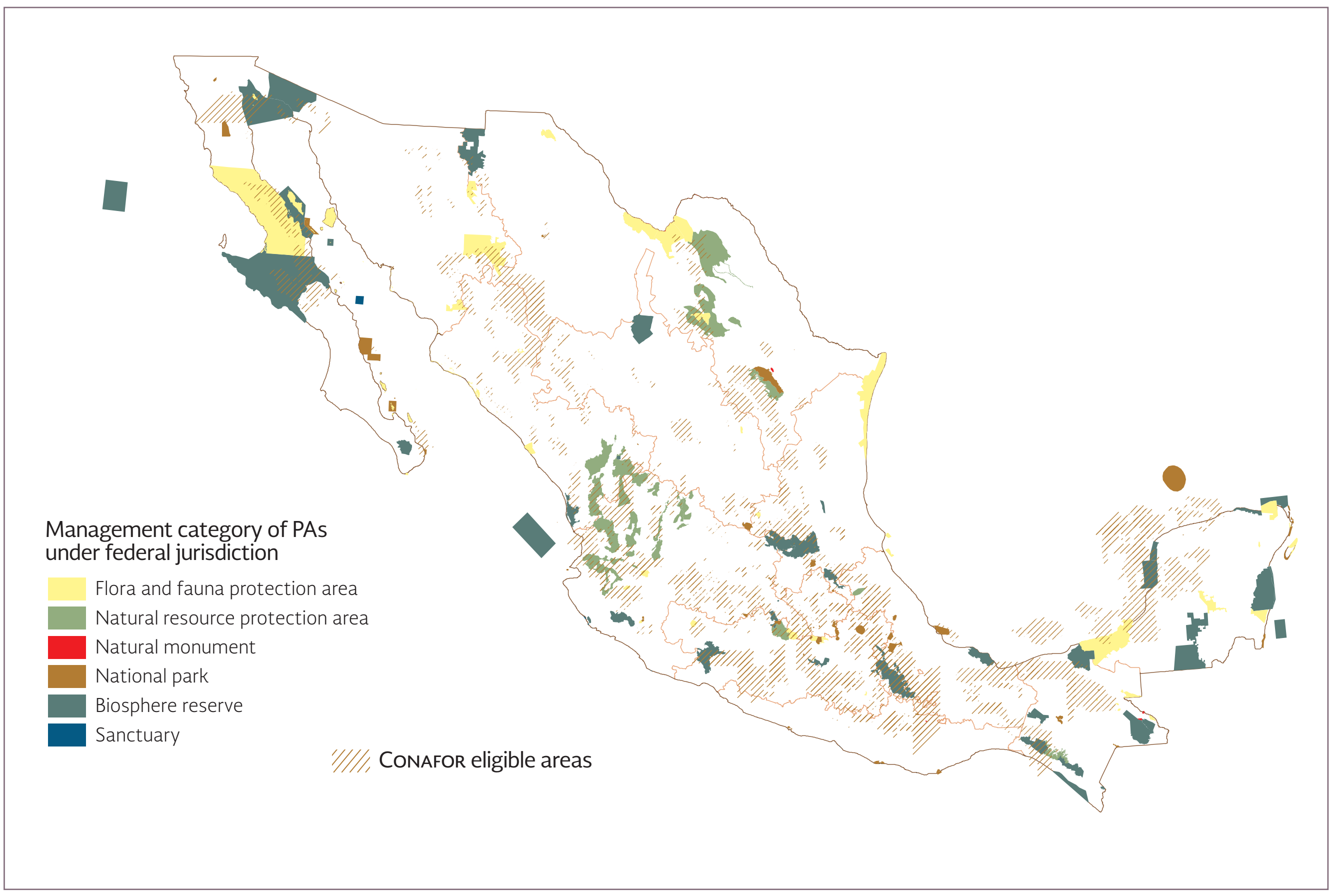
There are 177 protected areas under federal jurisdiction

Table 6.2 Protected areas under federal jurisdiction, 2015

Category	Description	Quantity	Surface area (hectares)
Biosphere reserves	Non-altered ecosystems or which need to be preserved or restored, with species that are representative of the national biodiversity.	41	12 751 149
National parks	Ecosystems with scenic beauty, scientific, educational, recreational or historic value, the existence of flora or fauna or suitable for the development of tourism.	66	1 411 319
Natural monuments	Areas with unique or exceptional natural elements with esthetic, scientific or historic value. Does not require the variety of ecosystems or total area of other categories.	5	16 269
Natural resource protection areas	Areas allocated for the preservation and protection of soil, watersheds, water and resources in forest grounds (and which are not included in other categories).	8	4 503 345
Flora and fauna protection areas	Places with habitat on whose balance and preservation the existence, transformation and development of forest species depends	39	6 795 963
Sanctuaries	Areas with considerable wealth of flora and fauna or species, sub-species or habitat with restricted distribution.	18	150 193
Total		**177**	**25 628 239**

Source: Produced based on Conanp (2016c), General Law on Ecological Balance and Environmental Protection.

Map 6.2 Conservation of nature and its services, 2015



Source: Conanp (2016a), Conafor (2015).

6.4 Wetlands

[Tablero: Sitios Ramsar]

Wetlands are transition areas between aquatic and terrestrial systems, constituting temporary or permanent floods zones with characteristic absorbent vegetation, or permanently humid soils as a result of aquifer discharge. The conservation and sustainable management of wetlands can ensure the rich biodiversity and environmental services that they provide, such as: water storage, the conservation of aquifers, water purification through the retention of nutrients, sediments and pollutants, storm protection and flood mitigation, the stabilization of coasts and erosion control.

These ecosystems have undergone transformation processes with various purposes. The lack of knowledge on wetlands and their inappropriate management constitute some of the problems that adversely affect their conservation. As stipulated in the National Water Law, it is the Conagua's responsibility to carry out and update the National Inventory of Wetlands (NIW), as well as to define their contours, classify them and propose standards for their protection, restoration and use. In 2012, the study "Wetlands of the Mexican Republic" was produced, which found 6 331 wetlands with a total surface area of 10 million hectares.

Mexico has 142 wetlands on the Ramsar List

Internationally, an intergovernmental convention was signed in the city of Ramsar, Iran (1971), known as the Ramsar Convention. This convention "...provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources" (Ramsar 2016). A List of Wetlands of International Importance (also called the Ramsar List) is maintained, in which wetlands of recognized value are registered, through criteria of representativity and conservation of rich biodiversity. A wetland registered in the List is known as a Ramsar site.

At the time of going to press, 142 Mexican wetlands had been registered in the Ramsar List, with a total surface area of 8.6 million hectares (Conanp 2016d). Map 6.3 shows the Ramsar sites in Mexico, as well as the wetlands in the NIW.

Map 6.3 Wetlands and Ramsar sites in Mexico

Source: Produced based on Conagua y UNAM (2012), Conanp (2016b).

CHAPTER

7

Future Scenarios

FUTURE SCENARIOS

Trends

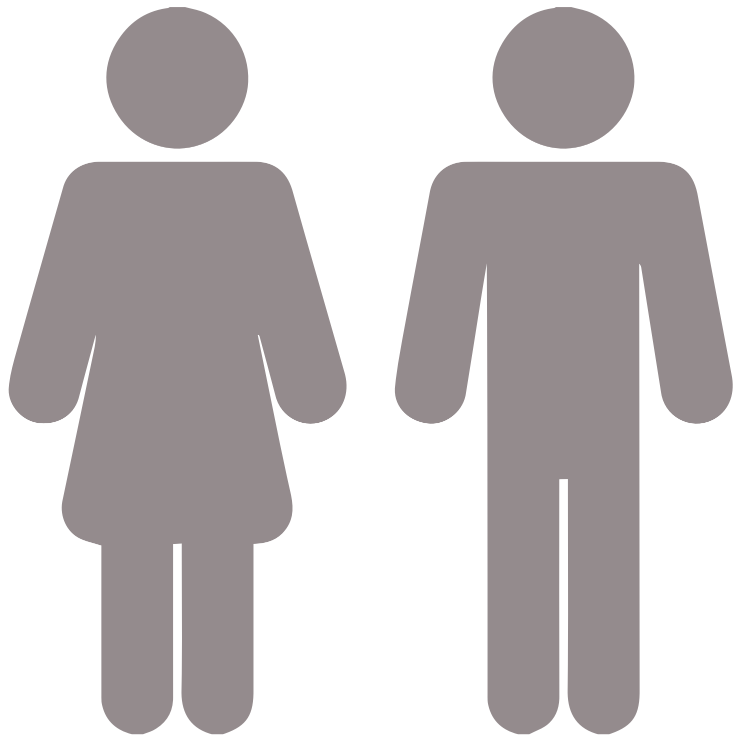
Concentration in urban localities **2030:**

73.7

million Mexicans in

38

population centers



Population growth

From 2015 to 2030

16.48 million people

Rural
2.45 million

Urban
14.03 million

This affects the per capita renewable water resources

2015
3 692
m^3/inhabitant/year

2030
3 250
m^3/inhabitant/year

Sustainable water policy

20th century
supply-oriented

End of the 20th century
demand-focused and on decentralization

21st century
targeting water sustainability

2014-2018 National Water Program

- Based on the 2013-2018 National Development Plan
- Articulates public policy around the water sector

6 objectives

1. Strengthen integrated and sustainable water management
2. Increase water security to face droughts and floods
3. Strengthen water supply and access to drinking water, sanitation and sewerage services
4. Increase the technical, scientific and technological capacities in the sector
5. Sustainably ensure water for agricultural irrigation, energy, industry, tourism and other economic and financial activities
6. Consolidate Mexico's participation in the international context on water issues

7.1 Sustainable water policy

In the history of Mexico's water policy, three clear phases can be discerned:

First stage: At the beginning of the 20th century, the emphasis was placed on the supply side, thus explaining why a large number of storage reservoirs, irrigation districts, aqueducts and water supply systems were built.

Second stage: From the 1980s-1990s onwards, water policy focused more on demand and decentralization. The responsibility for providing drinking water, sewerage and sanitation services was transferred to the municipalities, and the Conagua was created as an institution that concentrated the tasks of managing the nation's water resources. Among the actions which aimed to meet this objective was the creation of the Public Registry of Water Duties (Repda), as a mechanism to provide order to the use of water resources.

Third stage: At the dawn of the 21st century, a new phase is coming to the fore focused on water sustainability, in which wastewater treatment is being significantly increased, the reuse of water is being promoted and the emphasis is being placed on the management of the nation's water resources through the verification of extractions, regulations around aquifers and watersheds and the updating of the methodology for the payment of duties for the use of the nation's water resources.

7.2 Trends

[Tablero: Población, Grado de presión, Agua renovable]

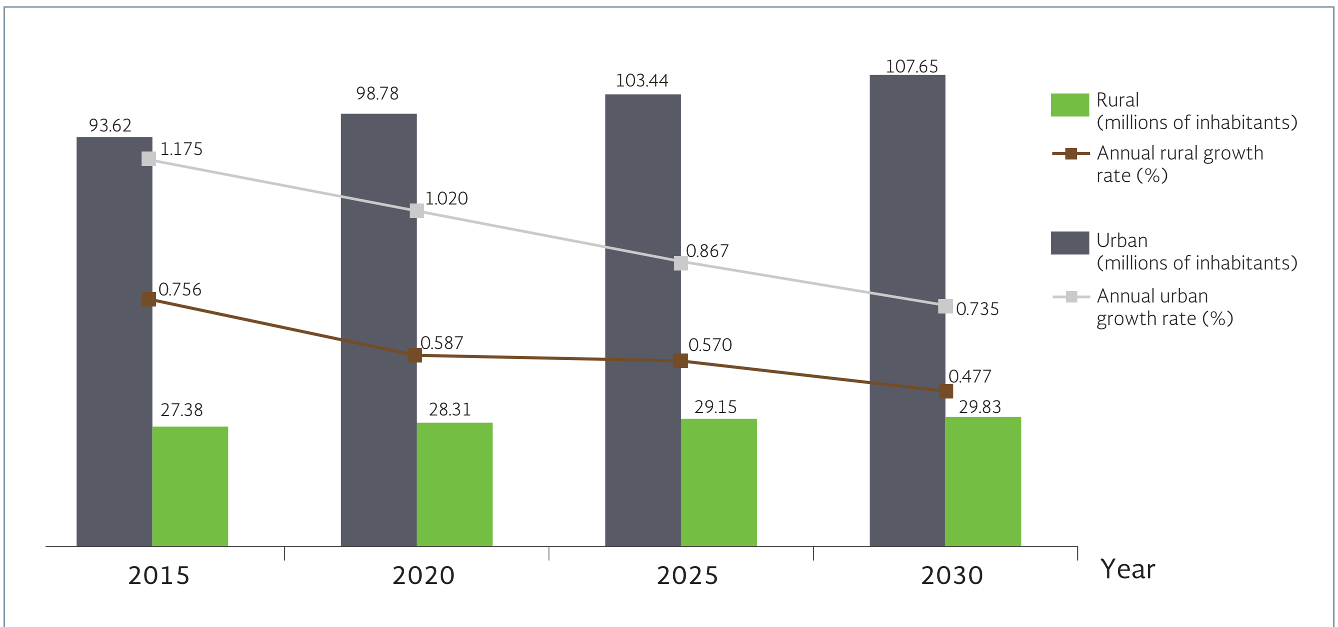
One very important aspect to be considered in Mexico's future scenarios is the population **growth** and its concentration in urban areas.

According to estimates from the Conapo, between 2015 and 2030, the population of Mexico will increase by 16.5 million people, although the growth rate will tend to decrease. Furthermore, by 2030 approximately 78.3% of the total population will be based in urban localities, as can be observed in graph 7.1. The data in the graph is at the mid-year point. The rural population is considered as that which lives in localities of less than 2 500 inhabitants, whereas the urban population refers to that of 2 500 inhabitants or more.

It is calculated that for the 2015-2030 period, more than half of the population growth will occur in the hydrological-administrative regions (HARs) IV Balsas, VI Rio Bravo, VIII Lerma-Santiago-Pacific and XIII Waters of the Valley of Mexico. On the other hand, the four HARs with the lowest growth (II Northwest, III Northern Pacific, V Southern Pacific and VII Central Basins of the North) will represent only 12% of the growth during that period, as shown in table 7.1. Rurally, the proportion of the regional population growth is greater than the national proportion for the HARs V Southern Pacific, XI Southern Border, X Central Gulf, IV Balsas, IX Northern Gulf and VIII Lerma-Santiago-Pacific, whereas in the remaining HARs the proportion of urban growth is above the national rate.

Between 2015 and 2030, the population will increase by 16.5 million

Graph 7.1 Projection for the growth of the urban and rural population in Mexico



Source: Produced based on Conapo (2012).

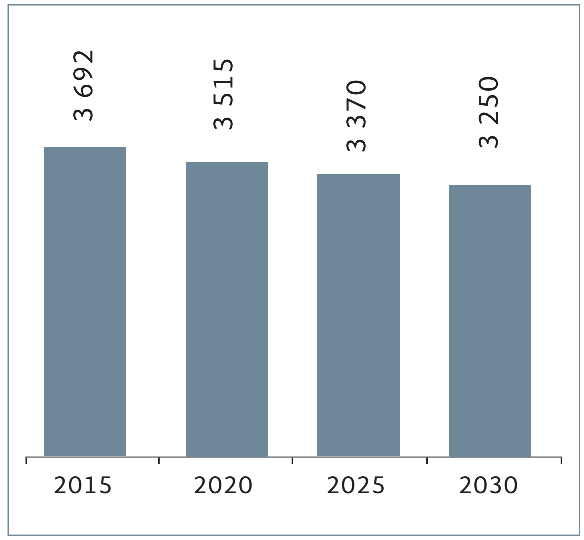
It should be noted that some of the HARs in which the highest population growth is expected are at the same time those where there is already a degree of water stress that is higher than the national average, as can be appreciated in graph 7.2. In contrast, in some HARs with a lower degree of water stress (V Southern Pacific and X Central Gulf) a lower population growth is expected.

In 2030, it is expected that 53.6% of the population of Mexico, or 73.7 million inhabitants, will be living in 38 population centers (35 metropolitan areas and three non-suburban municipalities) with more than 500 000 inhabitants (map 7.1).

The increasing population will bring about a reduction in the per capita renewable water resources nationwide. The decrease foreseen is shown in graph 7.3, from 3 692 m^3/inhabitant/year in 2015 to 3 250 in 2030. It is worth mentioning that in this chapter the value of renewable water resources for 2015 (446 777 hm^3) remains constant throughout the 2015-2030 period.

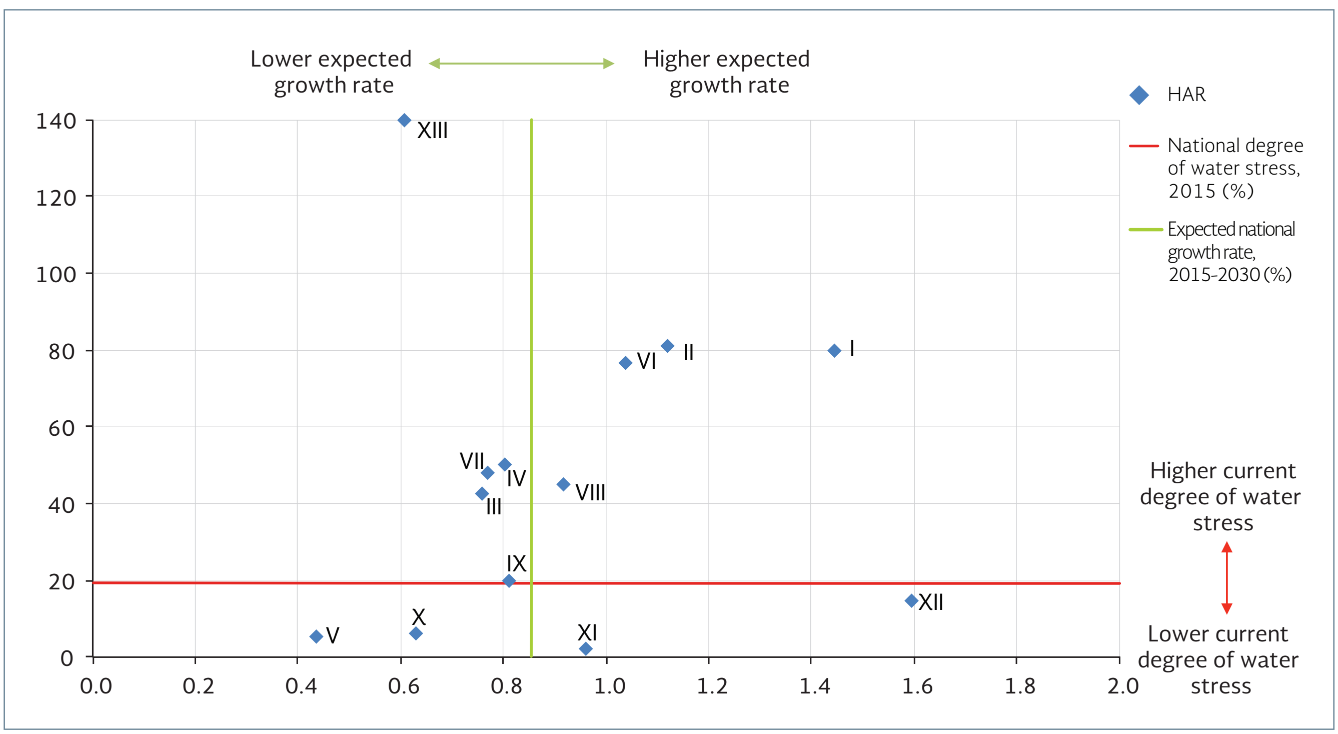
It is estimated that by 2030 in some of the country's HARs, the per capita renewable water resources will reach levels close to or even lower than 1 000 m^3/inhabitant/year, a condition classified as scarcity.

Graph 7.3 Projections of the per capita renewable water resources in Mexico, selected years, 2015-2030 (m^3/inhabitant/year)



Source: Produced based on Conagua (2016b), Conapo (2012).

Graph 7.2 Current degree of water stress and growth rate, 2015-2030



Source: Produced based on Conagua (2016b), Conagua (2016c), Conapo (2012).

Map 7.1 Main population centers in 2030

Source: Produced based on Conapo (2012), Sedesol et al. (2012).

Table 7.1 Population in 2015 and 2030 (thousands of inhabitants)

HAR number	Rural population			Urban population			Total population		
	2015	2030	Increase 2015-2030	2015	2030	Increase 2015-2030	2015	2030	Increase 2015-2030
I	392	537	145	4 053	4 975	922	4 446	5 513	1 067
II	460	524	64	2 381	2 833	451	2 841	3 357	515
III	1 381	1 395	15	3 129	3 662	532	4 510	5 057	547
IV	3 454	3 844	390	8 354	9 471	1 117	11 808	13 315	1 507
V	2 009	2 143	134	3 051	3 257	206	5 060	5 400	340
VI	843	925	82	11 461	13 443	1 981	12 305	14 368	2 063
VII	1 143	1 202	60	3 420	3 922	502	4 562	5 125	562
VIII	5 237	5 839	602	18 936	21 860	2 924	24 172	27 699	3 526
IX	2 415	2 488	72	2 866	3 475	610	5 281	5 963	682
X	4 456	4 727	270	6 110	6 880	771	10 566	11 607	1 041
XI	3 653	4 001	348	4 010	4 843	833	7 663	8 844	1 181
XII	729	830	101	3 872	5 004	1 132	4 601	5 834	1 233
XIII	1 211	1 378	167	21 980	24 023	2 043	23 191	25 401	2 210
Total	**27 384**	**29 834**	**2 450**	**93 622**	**107 647**	**14 025**	**121 006**	**137 481**	**16 476**

Source: Produced based on Conapo (2012).

Table 7.2 and figure 7.1 show the evolution in renewable water resources between 2015 and 2030. As can be observed, the HARs I Baja California Peninsula, VI Rio Bravo and XIII Waters of the Valley of Mexico will present low levels of per capita renewable water resources in 2030.

Special attention should be paid to groundwater, the overdrafting of which leads to the reduction of phreatic levels, land subsidence and wells having to to be dug ever deeper. The majority of the rural population, especially in arid areas, depends almost exclusively on groundwater.

With the aim of addressing the decrease in the availability of water in the coming years, it will be necessary to carry out actions to reduce demand, by increasing the efficiency in the use of water in irrigation and in water distribution systems in cities. Furthermore, the volumes of wastewater that are treated and reused should increase significantly, so as to increase the availability and quality of water for the uses for which it is destined.

In addition, in order to continue guaranteeing social development, it will be necessary to significantly increase drinking water, drainage and sanitation coverage in rural settings.

These trends should be contemplated while taking into account climate change, the effects of which will impact upon the global water cycle in an uneven manner, as a result of which there is expected to be greater variability in the quality and quantity of water available for society (see chapters 2 and 8).

In 2030, the per capita renewable water resources will be

3 250

m^3/inhabitant/year

Table 7.2 Per capita renewable water resources, 2015 and 2030

HAR number	Renewable water resources, 2015 (hm^3/year)	Per capita renewable water resources, 2015 (m^3/inhabitant/year)	Per capita renewable water resources, 2030 (m^3/inhabitants/year)
I	4 958	1 115	899
II	8 273	2 912	2 465
III	25 596	5 676	5 062
IV	21 678	1 836	1 628
V	30 565	6 041	5 660
VI	12 352	1 004	860
VII	7 905	1 733	1 543
VIII	35 080	1 451	1 266
IX	28 124	5 326	4 717
X	95 022	8 993	8 187
XI	144 459	18 852	16 334
XII	29 324	6 373	5 026
XIII	3 442	148	136
Total	**446 777**	**3 692**	**3 250**

Source: Produced based on Conagua (2016b), Conapo (2012).

FIGURE 7.1 Per capita renewable water resources

Source: Produced based on CONAGUA (2016b), CONAPO (2012).

7.3 National water planning 2013-2018

The Political Constitution of the United Mexican States establishes the planning of national development as the basis for the articulation of public policies in the government of the republic, as well as the direct source of participatory democracy through consultation with society-at-large. The 2013-2018 National Development Plan (NDP) establishes the national targets and guiding objectives of public policies.

Within the scheme of the National System of Democratic Planning, the 2014-2018 National Water Program (NWP)[1] is derived from and aligned with the NDP. The NWP articulates the government of the republic's public policies around the water sector and is part of the water-related planning formalized in the National Water Law. Water-related planning is mandatory for integrated water resources management, the conservation of natural resources, vital ecosystems and the environment.

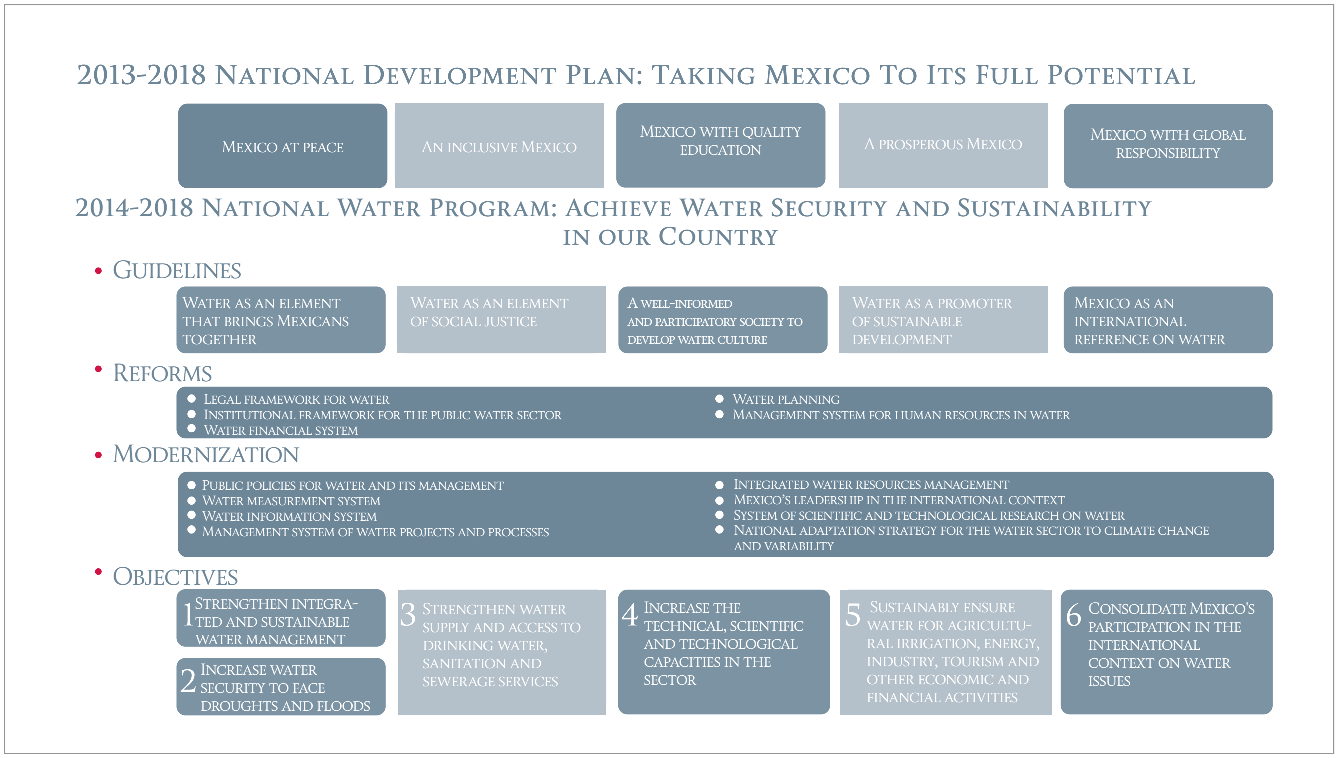
The NWP was developed with the collaboration of and contributions from institutions and agencies, experts as well as a public consultation process carried out in regional fora with the participation of water users, academics, civil society organizations, communicators, legislators and scholars.

Figure 7.2 shows the alignment of the national targets of the NDP with the NWP by means of the latter's five overarching guidelines, articulated through the reforms and modernizations proposed for the water sector in the NWP's six objectives.

It is worth mentioning the eight indicators proposed for the follow up and evaluation of the NWP's impacts, which are shown in table 7.3.

[1] Due to its publication date, it is referred to as 2014-2018.

Figure 7.2 Alignment between the NDP and the NWP



Source: Conagua (2014).

Table 7.3 Indicators for the follow up and evaluation of the NWP's impacts

Objective	Indicator
1. Strengthen integrated and sustainable water management	1. Global Water Sustainability Index
2. Increase water security to face droughts and floods	2. Water reserve decrees formulated for environmental use
	3. Population and productive surface area protected against floods.
	4. Drought management programs produced and approved by River Basin Councils.
3. Strengthen water supply and access to drinking water, sewerage and sanitation services.	5. Global Index of Access to Basic Water Services.
4. Increase the technical, scientific and technological capacities of the sector.	6. Influence of the technological development of the water sector in decision making.
5. Sustainably ensure water for irrigated agriculture, energy, industry, tourism and other economic and financial activities.	7. Productivity of water in irrigation districts (kg/m³)
6. Consolidate Mexico's participation in the international context on water issues.	8. International cooperation projects duly attended to.

Source: Conagua (2014), Conagua (2016d).

CHAPTER

8

Water in the world

WATER IN THE WORLD

Water and health

Reduction in annual child mortality through diarrheal diseases

1.5 million **(1990)** ▶ **600 000** **(2012)**

Hydrological cycle

Mexico

3 692 m^3/inhabitant/year

per capita renewable water resources

94th place worldwide

Water in the world

1 386 trillion hm^3

97.5% saltwater

2.5% freshwater

Climate change

Accentuation of the world hydrological cycle	Non-uniform changes between countries and regions	Collaboration is necessary to mitigate risks

Socio-economic and demographic

Mexico 2015:

Population	GDP per capita	Total GDP
121 million inhabitants	9 009.28 dollars	1.14 billion dollars
11th	70th	15th

Place worldwide

Uses of water and infrastructure

Water footprint of consumption

m³/inhabitant/year

Mexico	United States
1 978	2 842

Industrial use	Agricultural use
19 %	70 %

Virtual water:

Liters for 1kg of:

corn	beef
1 222	15 415

Millennium Development Goals

(1990-2015)

by 2015, reduce by half the population without safe access as compared to 1990

	Worldwide:	Mexico:
Drinking water:	✓	✓
Sanitation:	✗	✓

8.1 Socio-economic and demographic aspects

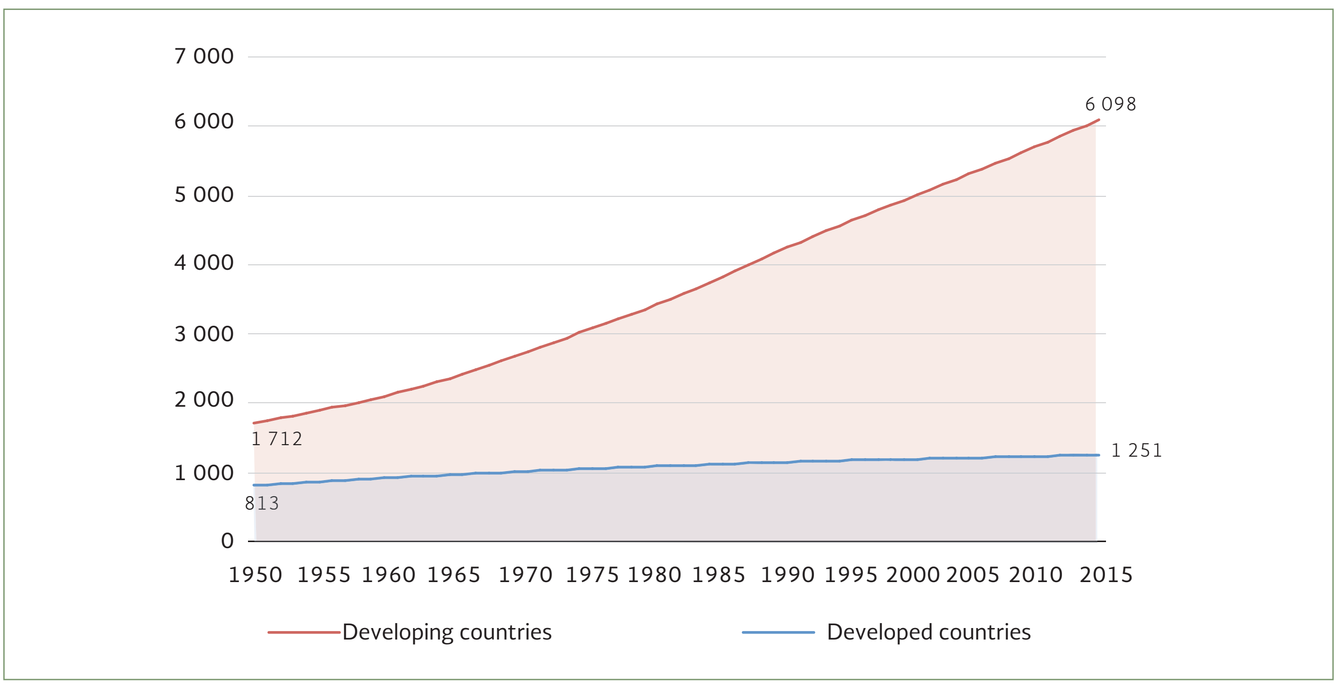
[Tablero: Indicadores económicos]

The United Nations periodically refines estimations of the world population. In the latest exercise (UN-DESA 2016), it is estimated that in 1950 the world population was 2.5 billion people, whereas for 2015, it will have increased to 7.4 billion. Over the last 65 years, this growth has been mainly concentrated in **developing regions**, as can be observed in graph 8.1 [Adicional: Table 8.A].

By the year 2100, UN-DESA (2016) estimates that the world population will have risen to approximately 11.2 billion inhabitants, with an increasingly slower growth, as shown in graph 8.2. Like any population projection, there is an associated range of uncertainty. With a 95% degree of certainty, the population in that year will be between 9.5 and 13.3 billion people.

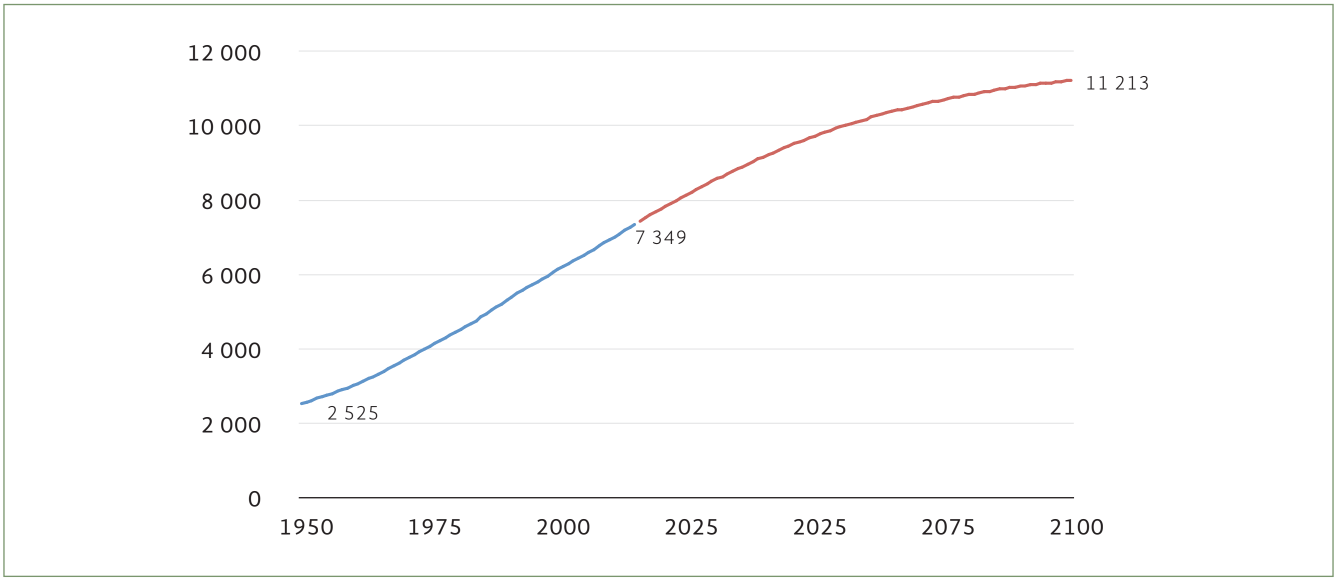
The growing concentration of the population in **urban areas** should be highlighted. Conversely, the rural population, both in developed and developing countries, shows a stable or decreasing trend. The pressure placed on the environment by cities is significant: as readily-available water resources are exhausted, cities will have to transport water from greater distances or extract it from greater depths, or depend on advanced technologies to desalinize or reuse water (WWAP 2015).

Graph 8.1 World population, according to level of development 1950-2015 (millions of inhabitants)



Source: Produced based on UN-DESA (2016).

Gaph 8.2 World population 1950-2100 (millions of inhabitants)



Source: Produced based on UN-DESA (2016).

Table 8.1 Countries with the highest population, 2015

No.	Country	Population (millions of inhabitants)	Population density (inhabitants/km²)
1	China	1 407.31	146.6
2	India	1 311.05	398.8
3	United States of America	321.77	32.7
4	Indonesia	257.56	134.8
5	Brazil	207.85	24.4
6	Pakistan	188.93	237.3
7	Nigeria	182.20	197.2
8	Bangladesh	161.00	1 084.4
9	Russian Federation	143.46	8.4
10	Japan	126.57	334.9
11	**Mexico**	**121.01**	**61.8**
12	Philippines	100.70	335.7
13	Ethiopia	99.39	90.0
14	Vietnam	93.45	282.3
15	Egypt	91.51	91.4
16	Germany	80.69	225.9
17	Iran (Islamic Republic of)	79.11	45.3
18	Turkey	78.67	100.4
19	Democratic Republic of Congo	77.27	33.0
20	Thailand	67.96	132.4
21	United Kingdom	64.72	265.7
22	France	64.40	117.3
23	Italy	59.80	198.4
24	South Africa	54.49	44.7
25	Myanmar	53.90	79.7

Source: Produced based on FAO (2016b), Conapo (2012), Inegi (2016a).

In table 8.1, the countries with the world's highest population are shown, among which Mexico is in eleventh place worldwide. In each table of this chapter, in addition to the countries in the first places for each concept (for example population and irrigation surface, among others), five countries appear as references (Brazil, United States of America, France, South Africa and Turkey), as well as Mexico, in order to facilitate comparisons. The population for Mexico corresponds to the definition of Conapo (2012).

In table 8.2 information is presented on the countries with the largest per capita Gross Domestic Product (GDP). Some values are estimated.

Mexico is ranked 70th worldwide in terms of its per capita GDP. In terms of the total GDP, the country is ranked fifteenth worldwide.

Mexico is the country with the **15th** highest GDP in the world

Table 8.2 Countries with the highest total and per capita GDP, 2015

Total GDP			Per capita GDP		
No.	Country	GDP (billions of US dollars)	No.	Country	Per capita GDP (US dollars)
1	United States	17 947.00	1	Luxembourg	101 994.09
2	China	10 982.83	2	Switzerland	80 675.31
3	Japan	4 123.26	3	Qatar	76 576.08
4	Germany	3 357.61	4	Norway	74 822.11
5	United Kingdom	2 849.35	5	Macao SAR	69 309.42
6	France	2 421.56	6	United States	55 805.20
7	India	2 090.71	7	Singapore	52 887.77
8	Italy	1 815.76	8	Denmark	52 114.17
9	Brazil	1 772.59	9	Ireland	51 350.74
10	Canada	1 552.39	10	Australia	50 961.87
11	South Korea	1 376.87	11	Iceland	50 854.58
12	Russia	1 324.73	12	Sweden	49 866.27
13	Australia	1 223.89	13	San Marino	49 846.90
14	Spain	1 199.72	14	United Kingdom	43 770.69
15	**Mexico**	**1 144.33**	15	Austria	43 724.03
16	Indonesia	858.95	16	Netherlands	43 603.12
17	Netherlands	738.42	17	Canada	43 331.96
18	Turkey	733.64	18	Hong Kong	42 389.63
19	Switzerland	664.60	19	Finland	41 973.99
20	Saudi Arabia	653.22	22	France	37 675.01
21	Argentina	585.62	66	Turkey	9 437.37
22	Taiwan	523.58	**70**	**Mexico**	**9 009.28**
23	Sweden	492.62	74	Brazil	8 670.00
33	South Africa	312.96	94	South Africa	5 694.57

Source: Produced based on FAO (2016b), Conapo (2012), Inegi (2016a).

8.2 Components of the water cycle

[Tablero: Distribución global del agua en el mundo]

The mean annual availability of water in the world is approximately 1 386 trillion hm^3, of which 97.5% is saltwater and only 2.5%, or 35 trillion hm^3, is freshwater. Of that amount, almost 70% is unavailable for human consumption since it is locked up in glaciers, snowpack and ice (figure 8.1).

Of the water that is technically available for human consumption, only a small percentage is found in lakes, rivers, soil humidity and relatively shallow groundwater deposits, the replenishment of which is the result of infiltration. Much of this theoretically usable water is far from populated areas, making it difficult or expensive to effectively use. It is estimated that only 0.77% is freshwater accessible to humans.

Of the world's water, only **0.77%** is freshwater that is accessible to humans

FIGURE 8.1 Distribution of water in the world

Source: Produced based on Clarke and King (2004).

Precipitation

Precipitation constitutes an important part of the water cycle, since it produces the planet's **renewable water resources**. However, precipitation varies from region to region and seasonally.

In figure 8.2 the different patterns of annual rainfall (in green) in selected cities around the world can be observed, as well as their monthly averages (in red). In general, cities at higher latitudes are characterized by having a uniform precipitation throughout the world, whereas cities closer to the Equator have an accentuated precipitation in the summer.

Of 200 countries, Mexico is in **94th** place in per capita renewable water resources

FIGURE 8.2 Variability in precipitation

Source: Produced based on World Climate (2011).

Renewable water resources

[Tablero: Agua renovable]

A country's per capita renewable water resources may be calculated by dividing its renewable resources by the number of inhabitants. According to this criterion, Mexico is in 94th place worldwide out of 200 countries on which data is available, as shown in table 8.3. In this table the value for Mexico is from 2015, and from other countries the value is the latest one available.

Table 8.3 Countries with the highest per capita renewable water resources

No.	Country	Population (thousands of inhabitants)	Renewable water resources (thousands of hm^3)	Per capita renewable water resources (m^3/inhabitant/year)
1	Iceland	329	170	516 090
2	Guyana	767	271	353 279
3	Suriname	543	99	182 320
4	Congo	4 620	832	180 087
5	Papua New Guinea	7 619	801	105 132
6	Bhutan	775	78	100 671
7	Gabon	1 725	166	96 232
8	Canada	35 940	2 902	80 746
9	Salomon Isles	584	45	76 594
10	Norway	5 211	393	75 417
11	New Zealand	4 529	327	72 201
12	Belize	359	22	60 479
13	Peru	31 377	1 880	59 916
14	Paraguay	6 639	388	58 412
15	Bolivia (Plurinational State of)	10 725	574	53 520
16	Liberia	4 503	232	51 521
17	Chile	17 948	923	51 432
18	Uruguay	3 432	172	50 175
19	Lao People's Democratic Republic	6 802	334	49 030
20	Colombia	48 229	2 360	48 933
22	Brazil	207 848	8 647	41 603
61	United States of America	321 774	3 069	9 538
94	**Mexico**	**121 006**	**447**	**3 692**
99	France	64 395	211	3 277
109	Turkey	78 666	212	2 690
152	South Africa	54 490	51	942

Source: Produced based on FAO (2016b), Conapo (2012), Conagua (2016b).

Climate change

In the 2014 Climate Change Synthesis Report (IPCC 2014) corresponding to the fifth cycle of climate change reporting, the warming of the climate system is considered unequivocal, with changes without any historical precedent. The atmosphere and oceans have warmed,[1] snow and ice cover have diminished, and the sea level has risen. The emission of man-made greenhouse gases has increased since the pre-industrial era, driven by economic and demographic growth. The concentration in the atmosphere of carbon dioxide, methane and nitrous oxide has no comparison in the last 800 000 years. It is considered as highly likely that these emissions, in conjunction with other anthropogenic factors, is the predominant cause of the warming observed in the second half of the 20th century.

The report consideres that changes in the global water cycle, due to climate change, will not be uniform. The contrast in precipitation will increase between dry and humid regions, and between wet and dry seasons, although it is possible that there may be regional exceptions. This will result in risks related to the quantity and quality of water available for society.

It is considered that the impacts of recent extreme hydro-meteorological events, including heatwaves, droughts, floods, cyclones and fires reveal the significant vulnerability and risk exposure of certain ecosystems and many human systems to climate variability

In terms of freshwater, it is foreseen that during the 21st century the renewable surface and groundwater resources will be reduced in the majority of sub-tropical dry regions, which will increase the competition between users. The effects of climate change will be accentuated in areas with rapid processes of urbanization, without disregarding the impacts in rural areas on the availability of water and changes in temperature, which could result in a shift in crop zones and the consequent impact both on rural population and on food security in general.

Mitigation, understood as an anthropogenic intervention to reduce the sources or improve greenhouse gas sinks, and adaptation, defined as the process of adjusting human or natural systems as a response to projected or real climate stimuli and their effects, will only be possible through joint collaborative efforts, which in turn involve issues of equity, justice and impartiality between stakeholders in a context of decision making through value judgments, ethical considerations and perceptions of risks and opportunities for individuals and organizations.

1 The report State of the Climate (NOAA 2016) establishes that 2015 surpassed 2014 as the warmest year since the mid-19th century.

Extreme hydro-meteorological phenomena

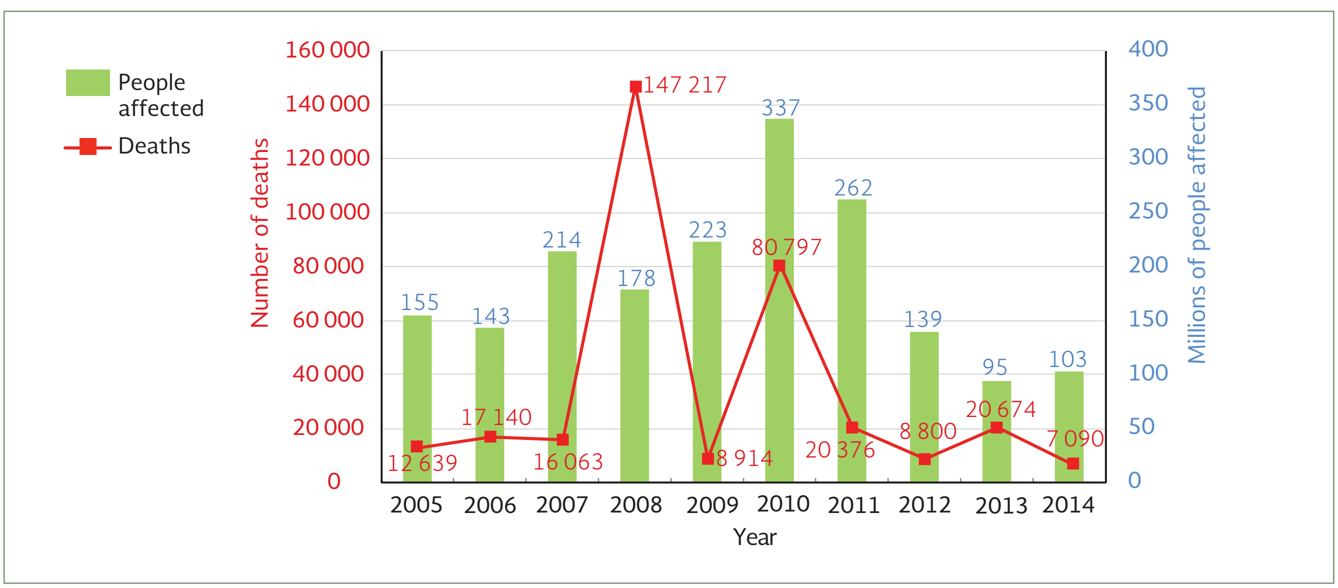
Extreme hydro-meteorological phenomena, such as droughts, floods and hurricanes, are natural events that frequently result in disasters with human and material losses. In the analysis of disasters, it can be seen that the damages estimated as a percentage of GDP are significantly higher in developing countries, which may be further accentuated if the global trend towards the concentration of population in urban localities continues.

Droughts, the lack of food security, extreme temperatures, floods, forest fires, insect infestations, water-related landslides and windstorms are all considered disasters of climate and hydro-meteorological origin (IFRC 2015). This type of events represents a significant proportion of the estimated damage caused by disasters, which in 2014 (the latest year available at the source) represented 91.8 billion dollars [Additional: 8.A], or 93% of the total damage caused by all types of disasters.

The number of people affected by climate and hydro-meteorological disasters in the period between 2005 and 2014 is shown in graph 8.3, which reveals the annual **variability** in the occurrence of major disasters due to hydro-meteorological phenomena.

It should be noted that disasters are expected to increase, both in number and as regards their consequences, as a result of climate change. The **risk** of disasters will be the result of the coming together of climate and weather events, vulnerability and exposure of social groups, environmental services and resources, infrastructure and economic, social and cultural assets (IPCC 2012).

Graph 8.3 People affected by climate-related and hydro-meteorological disasters



Source: Produced based on IFRC (2015).

8.3 Uses of water and infrastructure

[Reporteador:Usos del agua]

While the world population tripled in the 20th century, water extractions multiplied six-fold, thus increasing the degree of water stress. In the future, in the context of population growth and climate change, it is expected that this pressure will increase.

In table 8.4, the countries with the highest water extractions are shown, in which it can be observed that Mexico is ranked in seventh place. The classification of uses in this table considers agriculture, industry –including cooling of power stations– and public supply. The values for each country vary since they are the latest available at the source; for Mexico they are updated to 2015.

The main use of water resources worldwide, according to estimations from the FAO (2011), is agriculture, with 70% of the total extraction.

Table 8.4 Countries with the highest extraction of water and percentage of use in agriculture, industry and public supply

No.	Country	Total extraction of water (billions of m³/year)	% use for agriculture	% use for industry	% use for public supply
1	India	761.00	90.4	2.2	7.4
2	China	607.80	64.5	23.1	12.3
3	United States of America	485.60	36.1	51.2	12.8
4	Pakistan	183.50	94.0	0.8	5.3
5	Indonesia	113.30	81.9	6.5	11.6
6	Iran (Islamic Republic of)	93.30	92.2	1.2	6.6
7	**Mexico**	**85.66**	**76.3**	**9.1**	**14.6**
8	Viet Nam	82.03	94.8	3.7	1.5
9	Philippines	81.56	82.2	10.1	7.6
10	Japan	81.45	66.8	14.3	18.9
11	Egypt	78.00	85.9	2.6	11.5
12	Brazil	74.83	60.0	17.0	23.0
13	Iraq	66.00	78.8	14.7	6.5
14	Russian Federation	61.00	19.9	59.8	20.2
15	Thailand	57.31	90.4	4.8	4.8
16	Uzbekistan	56.00	90.0	2.7	7.3
17	Italy	53.75	44.1	35.9	17.6
18	Turkey	42.01	80.9	10.7	15.5
19	Canada	38.80	12.2	80.2	14.2
20	Argentina	37.78	73.9	10.6	15.5
21	Spain	37.35	68.2	17.6	14.2
22	Bangladesh	35.87	87.8	2.1	10.0
26	France	30.23	10.4	71.5	18.1
37	South Africa	15.50	62.5	10.5	27.0

Source: Produced based on FAO (2016b), Conagua (2016c).

Industrial use

[Tablero: Usos del agua]

Industry is one of the main motors of growth and economic development. Around 19% of water extracted worldwide is employed in industry (FAO 2011). Of this volume, more than half is used in thermoelectric stations in cooling processes. Among the greatest consumers of water under this heading are oil stations, and the metal, paper, wood, food processing and manufacturing industries.

It is estimated that the global demand for water for the manufacturing industry will increase by 400% between 2000 and 2050, mainly in emerging economies (WWAP 2015).

Worldwide, **40%** of crops are produced through irrigated agriculture

Use for agriculture

[Tablero: Distritos de riego]

Irrigation is fundamental for the world's food requirements. Only 19% of the area on which crops are grown has irrigation infrastructure, but that area produces more than 40% of the world's crops (FAO 2011). In recent years agriculture has used greater quantities of agrochemical products, resulting in pollution of soil and aquifers.

The perspective is that by 2050, agriculture will need to increase its production by 60% globally, and 100% in developing countries, which will be difficult to achieve with the current growth trends in use and inefficiency (WWAP 2015).

Mexico is ranked seventh worldwide in terms of the surface area with irrigation infrastructure, the first places being occupied by India, China and the United States of America, as shown in table 8.5. This table shows the latest values available at the source.

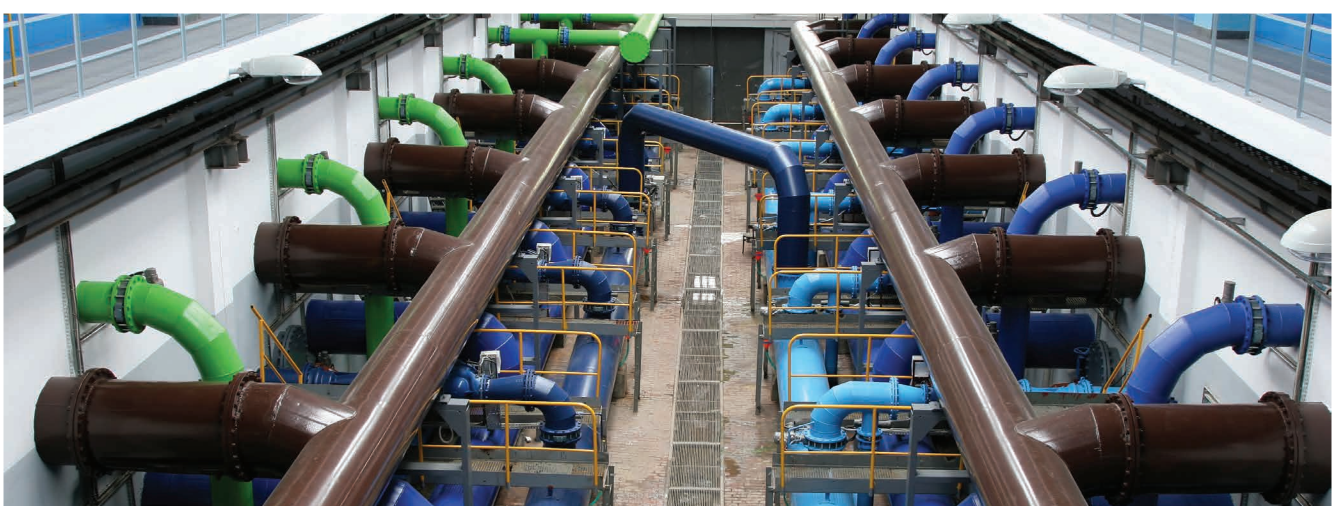


Table 8.5 Countries with the largest irrigation infrastructure

No.	Country	Area with full control irrigation infrastructure (thousands of has)	Area farmed (thousands of has)	Irrigation infrastructure compared to the area farmed (%)
1	China	69 860	122 524	57.0
2	India	66 334	170 000	39.2
3	United States of America	26 708	154 437	16.9
4	Pakistan	19 270	31 280	64.4
5	Iran (Islamic Republic of)	8 700	16 684	51.8
6	Indonesia	6 722	46 000	16.0
7	**Mexico**	**6 485**	**25 668**	**25.3**
8	Thailand	6 415	21 310	33.8
9	Brazil	5 400	82 808	6.8
10	Turkey	5 340	23 806	22.5
11	Bangladesh	5 050	8 508	59.3
12	Vietnam	4 585	10 232	48.7
13	Uzbekistan	4 198	4 770	89.5
14	Italy	4 004	9 087	44.1
15	Egypt	3 610	3 761	97.7
16	Spain	3 470	17 539	19.8
17	Afghanistan	3 208	7 910	41.4
18	France	2 811	19 302	14.6
19	Peru	2 580	5 534	46.7
20	Australia	2 546	46 611	5.7
21	Japan	2 500	4 537	55.0
22	Russian Federation	2 375	123 840	1.9
23	Argentina	2 357	40 699	5.8
29	South Africa	1 670	12 913	12.9

Source: Produced based on FAO (2016b).

Energy generation

[Tablero: Generación de energía]

Electricity performs a key function in poverty alleviation, the promotion of economic activities and the improvement of the quality of life, health and education opportunities, especially for women and children.

The International Energy Agency (IEA) considers that energy generation practically doubled in the period from 1973 to 2014 (the latest year available at the source), going from 6.1 to 13.7 billion metric tons of oil equivalent (IEA 2016).

Water has a significant link with energy, since on the one hand energy is used in water supply and treatment, and on the other water is employed in virtually every phase of energy generation (IEA 2014).

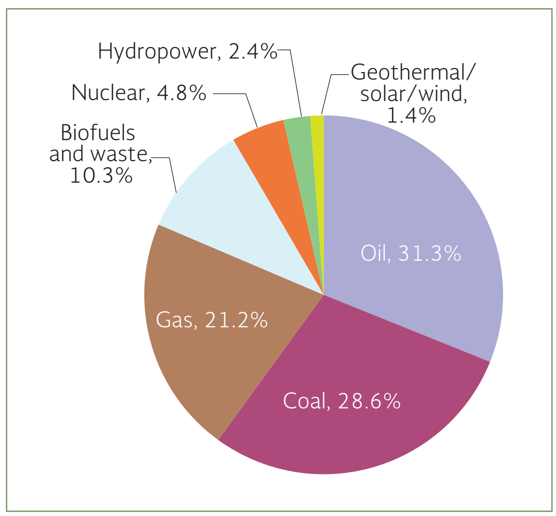
It is estimated that electricity represents between 5 and 30% of the total cost of operation of water and sanitation services, and in some cases like India and Bangladesh, that figure may reach 40% (WWAP 2015).

In fuel production it is used to extract fossil fuel, to grow biofuel and in processing and refining. It is used in the generation of steam and cooling in thermal plants (fossil fuels, bioenergy, geothermal, nuclear and some types of solar stations), which represent more than 90% of the world energy generation. 2.4% of the world's energy is generated through the water contained in dams through hydropower stations. In this sense, energy generation is a use of water that has potential impacts on the quantity and quality of water available (IEA 2012).

The composition of the total energy supply in 2014 can be observed in graph 8.4.

Energy generation should be considered from the perspective of greenhouse gas emissions, which cause climate change. Hydropower is considered a source of renewable energy, together with geothermal, solar and wind energy.

Graph 8.4 Sources of energy supply, 2014



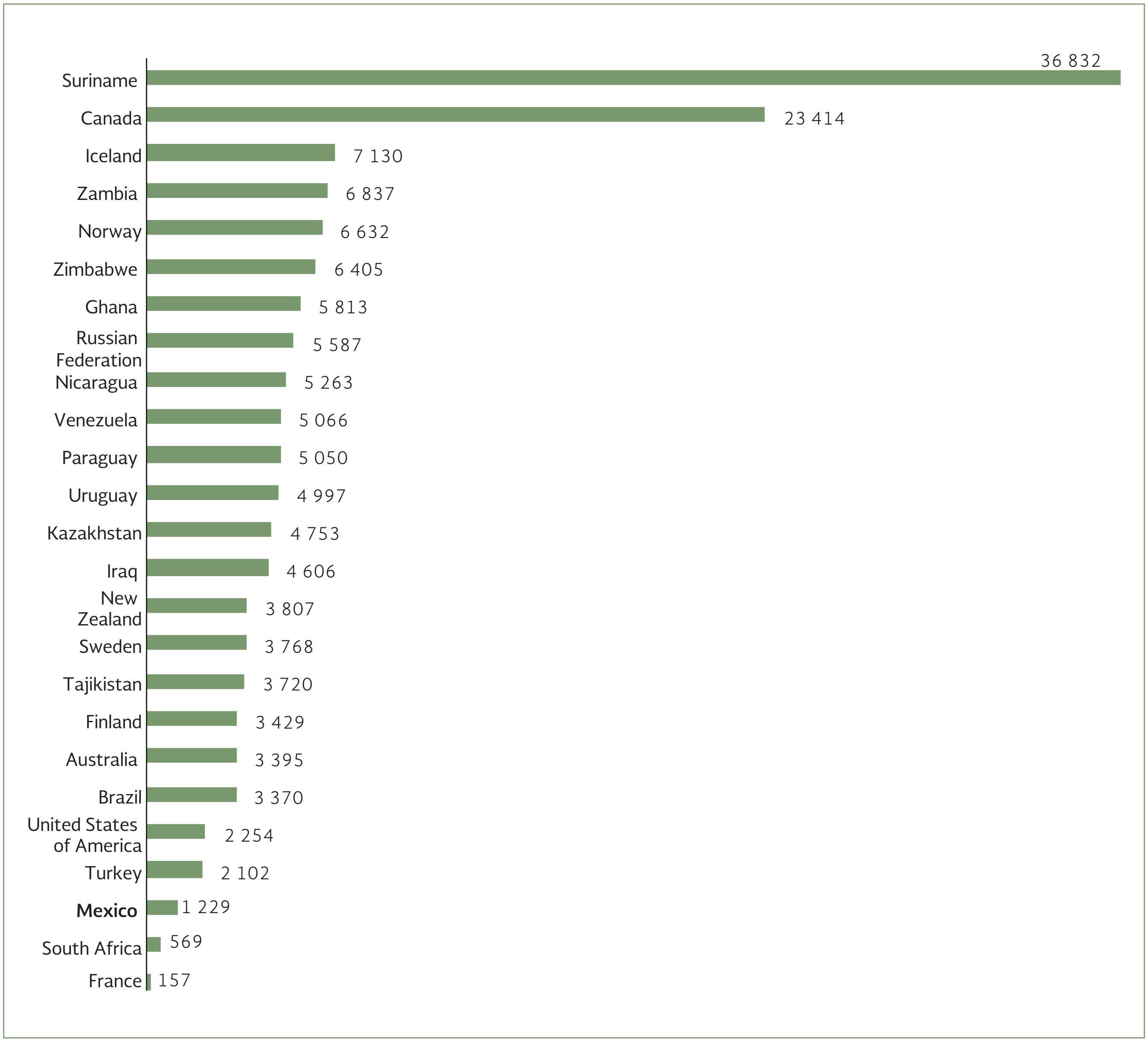
Source: IEA (2016).

Storage reservoirs in the world

[Tablero: Presas principales]

The water storage capacity for various uses and for flood control is directly proportional to the degree of water-related development of any given country. An indicator that allows this degree to be appreciated is the per capita storage capacity. It should be mentioned that according to the FAO, Mexico is in 34th place worldwide in terms of the per capita storage capacity, as shown in graph 8.5. This graph shows the latest data available for each country.

Graph 8.5 Per capita storage capacity (m³/inhabitant)



Source: FAO (2016b).

Water footprint

[Tablero: Agua virtual / Huella hídrica]

One means of measuring the impact of human activities on water resources is the so-called water footprint. This concept, created in 2002 by Hoekstra (WFN 2016a), has evolved to become a mechanism that allows an understanding of how the population's consumption habits and production affects the environment. Water footprints can be calculated by person, process, product, business, watershed or country. In this way it is possible to understand the risks related to supply, the dependence on water, and the water used in products and services.

Mexico's water footprint is

1 978

m³/inhabitant/year

The national water footprint has two perspectives. The water footprint of **production** is the volume of local water resources employed to produce goods and services in a country. From the perspective of **consumption**, it is calculated for all goods and services consumed by the population of a country, and generally occurs both inside and outside a country, according to whether the products are local or imported.

The average worldwide water footprint, associated to consumption and estimated for the 1996-2005 period, is 1 385 m^3 per person per year [Adicional: Table 8.B]. The annual value for the United States is 2 842 m^3, for China it is 1 071 m^3 and for Mexico it is 1 978 m^3 (Mekonnen and Hoekstra 2011).

In these calculations, both the water extracted from aquifers, lakes, rivers and streams (referred to as **blue water**), and the rainwater that feeds rainfed crops (**green water**) are included. Another concept employed in the calculation of the water footprint is **grey water**, which is the volume of water required to assimilate the contaminant load, based on existing water quality standards.

Virtual water

[Tablero: Agua virtual / Huella hídrica]

A concept that is closely related to the water footprint is that of virtual water content. The virtual water content of a product is the volume of water employed in its productive process.

Commercial trade between countries entails an implicit **flow** of virtual water, corresponding to the water that is employed in the generation of the products or services imported or exported. The total volume of virtual water exchanged between the countries of the world is 2.32 trillion m^3 per year, of which approximately 76% corresponds to agricultural products, and the remainder to industrial products and livestock (Mekonnen and Hoekstra 2011).

Growing one kilogram of corn requires on average 1 222 liters of water (1 860 in Mexico), whereas one kilogram of white rice employs 1 673 liters (Mekonnen and Hoekstra 2010a). On the other hand, the production of one kilogram of beef requires 15 415 liters (Mekonnen and Hoekstra 2010b), which includes the water drunk by the animal throughout its lifetime and the water required to grow the grain that served as its food. The values are different from country to country, depending on the climate conditions and the efficiency in the use of water [Adicional: table 8.C].

Importing virtual water may be an option to reduce the problems of water scarcity in some countries. Countries that export virtual water should evaluate the impact of this activity on the availability of their water resources and the possible distortions derived from subsidies applied to agricultural production.

Water stress

[Tablero: Grado de presión]

The degree of water stress is calculated by dividing the extraction by the renewable water resources. Due to their low availability, the Middle East countries suffer from very high water stress, as can be observed in map 8.1 [Adicional: Table 8.D], whereas Mexico is in 53rd place according to this indicator. This map represents the latest data available for each country

Drinking water, sanitation and wastewater treatment

[Tablero: Cobertura universal]

The Millennium Development Goals (MDGs) were established in 2000, with the aim of reducing extreme poverty by 2015. Goal number 7, "Ensuring environmental sustainability", includes target 7.C, which establishes the aim of reducing by half the proportion of people without sustainable access to safe drinking water[2] and improved sanitation services,[3] between 1990, the reference year, and 2015.

In 2015 the period of the MDGs concluded. For drinking water, the global target was met in 2010. It is estimated that in 2015, 91% of the world population employed an improved drinking water source, which can be broken down into 96% of the urban population and 84% of the rural population. In the 1990-2015 period, 2.6 billion people obtained access to those sources. However, some regions of the world did not meet the target: the Caucasus-Central Asia, Northern Africa, Oceania and Sub-Saharan Africa. By 2015, 663 million people still lacked access to improved drinking water sources. The final results are shown in table 8.6 and map 8.2.

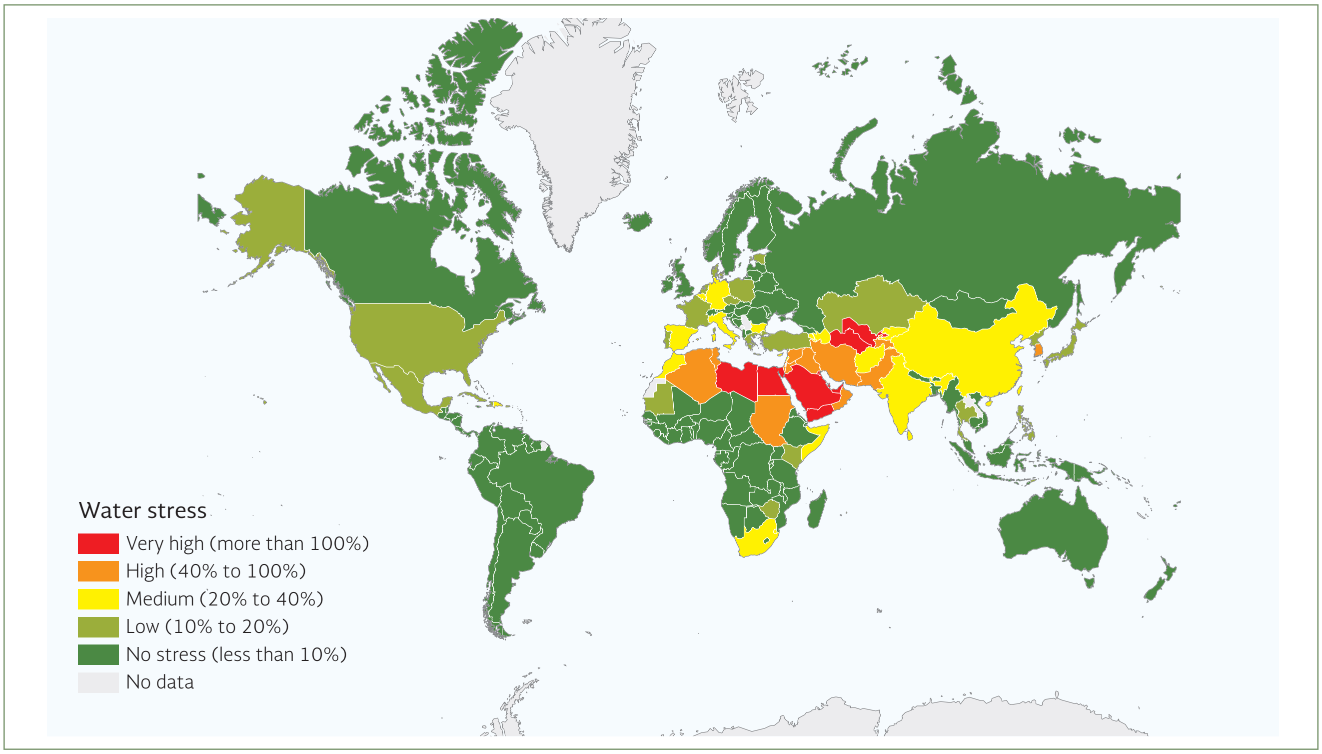
Table 8.6
Final results of the MDG target on access to improved drinking water sources, 2015

Group	Number of countries
Met the target	151
Good progress	11
Moderate progress	14
Limited or no progess	17
Unavailable	32
Total	**225**

Source: Produced based on WHO-UNICEF (2015).

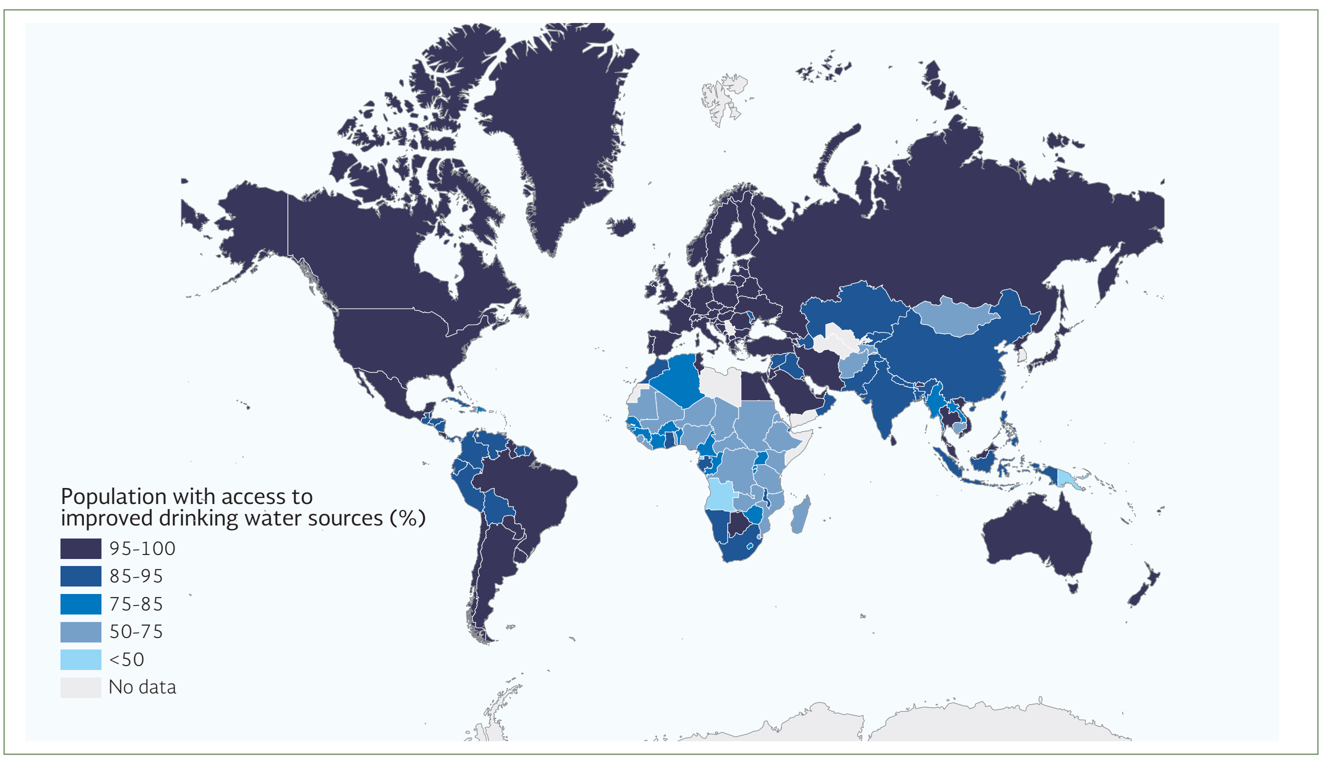
2 Those that are protected against outside pollution, especially fecal matter
3 Those that hygienically ensure that there is no contact between people and fecal matter.

Map 8.1 Degree of water stress



Source: Produced based on FAO (2016b).

Map 8.2 Access to improved drinking water sources



Source: Produced based on WHO-UNICEF (2015).

Mexico was one of the countries that met the target. Up to 2015, 96% of the population of Mexico (96% urban and 92% rural) had access to improved drinking water sources.

As regards sanitation, at the end of 2015, the MDG period, unlike the drinking water target, globally the sanitation target was not met, with 700 million people missing up to that point.

It is estimated that in 2015, 68% of the world population used improved sanitation services, composed of 82% of the urban population and 51% rurally. In the 1990-2015 period, 2.1 billion people obtained access to those services. Up to 2015, 2.4 billion people, mainly in Asia, Sub-Saharan Africa, Latin America and the Caribbean, still did not have access to improved sanitation services. It is currently estimated that 946 million people defecate in the open air. The final results are shown in table 8.7 and map 8.3.

Mexico also met the sanitation target. Up to 2015, 85% of the population of Mexico (88% urban and 74% rural) had access to improved sanitation services.

In 2015, the United Nations resolution "Transforming our world: the 2030 Agenda for Sustainable Development" defined the goals and targets that succeed the MDGs, now known as the Sustainable Development Goals (SDGs). Goal 6 of the SDGs "Ensure availability and sustainable management of water and sanitation for all" contains six targets.

Target 6.1 aims to complete and complement the MDGs as regards drinking water, and is defined as "By 2030, achieve universal and equitable access to safe and affordable drinking water for all". Target 6.2 is a complement of the MDG sanitation target, and is defined as "By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations".

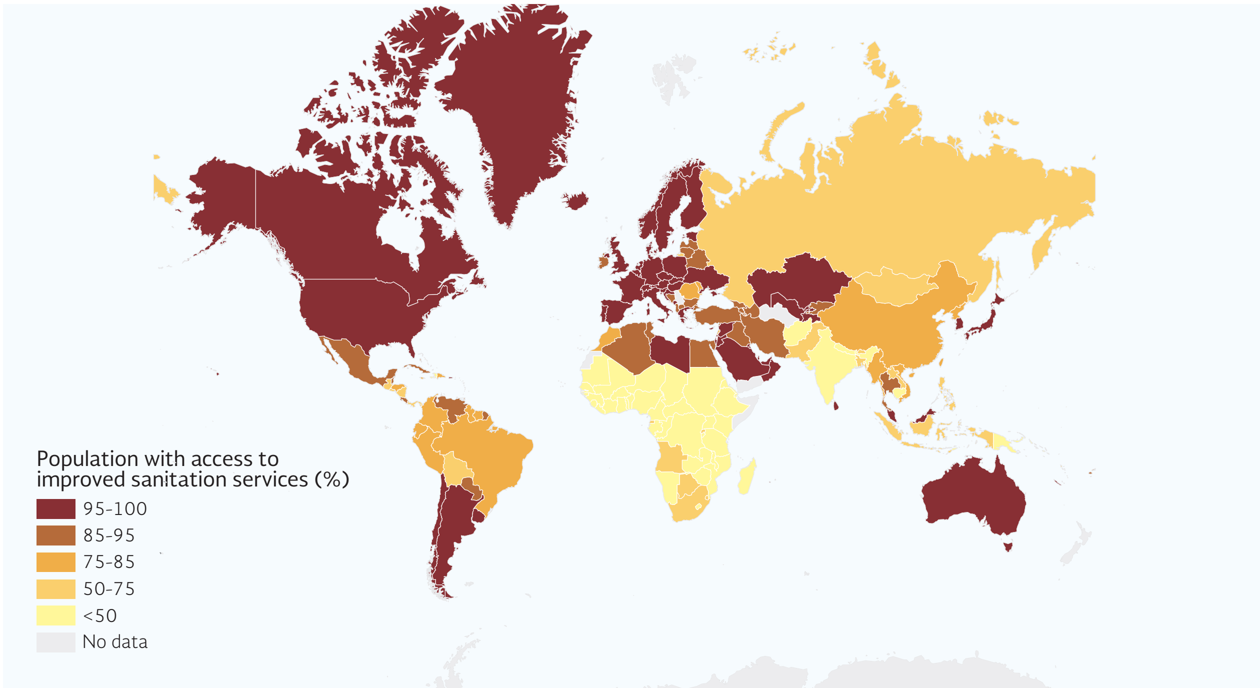
The other targets refer to water quality, water-use efficiency, integrated water resources management and ecosystem protection. Similarly, there are targets on international cooperation and the participation of local communities.

Table 8.7
Final results of the MDG target on access to improved sanitation services, 2015

Group	Number of countries
Met the target	98
Good progress	19
Moderate progress	17
Limited or no progess	55
Unavailable	36
Total	**225**

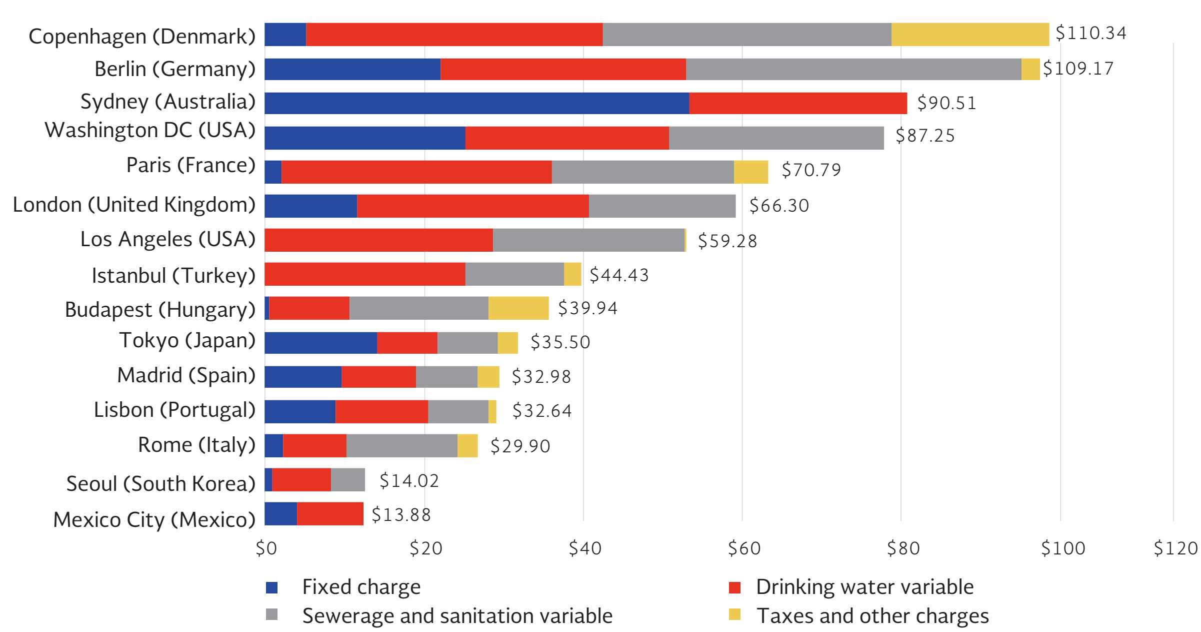
Source: Produced based on WHO-UNICEF (2015).

Map 8.3 Access to improved sanitation services



Source: Produced based on WHO-UNICEF (2015).

Graph 8.6 Domestic tariffs (pesos/m^3 for a consumption of 15 m^3/month)



Source: Produced based on GWI (2016).

Drinking water and sanitation tariffs

[Tablero: Tarifas]

It may be considered that drinking water, sewerage and sanitation services are financed through Tariffs, Transfers and Taxes (known collectively as the 3Ts). There is no uniformly applied definition of the costs derived from service provision, entailing that the relationship between tariffs and costs is also variable. In some regions the aim is for the tariffs to recover the total cost of the service. In others the tariffs recover variable percentages of the cost.

In graph 8.6 the drinking water and sanitation tariffs as well as the taxes associated with this service are indicated for selected world cities, for a domestic consumption of 15 m^3 per month. The graph shows the values in pesos, with an exchange rate of 1 dollar = 18.11 pesos, as of July 1, 2015.

Water and health

[Tablero: Agua y salud]

Drinking water in appropriate quantity and quality, in combination with appropriate sanitation and hygiene, have effects on the population's health and quality of living, on poverty alleviation and hunger, the reduction in child mortality, the improvement of maternal health, the fight against infectious diseases and environmental sustainability.

Estimations from the World Health Organization (WHO) indicate that the incidence of child mortality from diarrheal diseases dropped from 1.5 million deaths per year in 1990 to just over 600 000 in 2012 (WHO, 2014), which can be related to the progress registered as part of the MDGs.

Cholera, typhoid fever and dysentery are diarrheal diseases; all of them associated with the fecal-oral means of transmission. The majority of deaths resulting from these diseases could be avoided through better access to drinking water, sewerage and sanitation services, since it is estimated that 88% of the cases of diarrhea are caused by polluted water, inadequate sanitation and poor hygiene habits (Corcoran et al. 2010). For 2012 it was estimated that 685 000 deaths were attributable to inadequate water and sanitation, a figure that rises to 842 000 when taking into account the combined effect of inadequate hand washing (Prüss-Üstün et al. 2014).

These figures are constantly refined, since the growing availability of data allows the key factors to be identified and analyzed, such as rehydration campaigns, the effects of hand washing, the incomplete coverage of services within the locality and improved sanitation schemes which do not involve treatment, all of which could continue exposing the population to sanitary risks.

It has been estimated that the lack of access to drinking water and adequate sanitation results in a cost of between 1 and 7% of each country's annual GDP (WSP 2012). A study by the WHO calculated that the return on investment for sanitation is around 5.5 for each dollar invested, whereas for drinking water it is 2.0 dollars for every dollar invested (WHO 2012a).

Annexes

HYDROLOGICAL-ADMINISTRATIVE REGIONS AND STATES

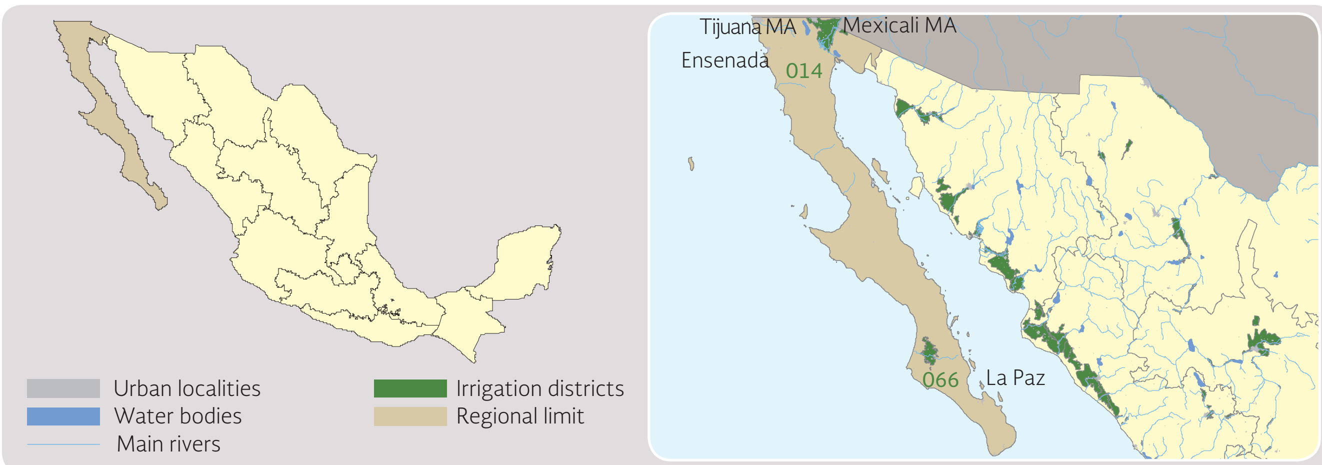
Code	Hydrological-administrative region
I	Baja California Peninsula
II	Northwest
III	Northern Pacific
IV	Balsas
V	Southern Pacific
VI	Rio Bravo
VII	Central Basins of the North
VIII	Lerma-Santiago-Pacific
IX	Northern Gulf
X	Central Gulf
XI	Southern Border
XII	Yucatan Peninsula
XIII	Waters of the Valley of Mexico

Code	State	Code	State
01	Aguascalientes	17	Morelos
02	Baja California	18	Nayarit
03	Baja California Sur	19	Nuevo Leon
04	Campeche	20	Oaxaca
05	Coahuila de Zaragoza	21	Puebla
06	Colima	22	Queretaro
07	Chiapas	23	Quintana Roo
08	Chihuahua	24	San Luis Potosi
09	Federal District (Mexico City)	25	Sinaloa
10	Durango	26	Sonora
11	Guanajuato	27	Tabasco
12	Guerrero	28	Tamaulipas
13	Hidalgo	29	Tlaxcala
14	Jalisco	30	Veracruz de Ignacio de la Llave
15	Mexico	31	Yucatan
16	Michoacan de Ocampo	32	Zacatecas

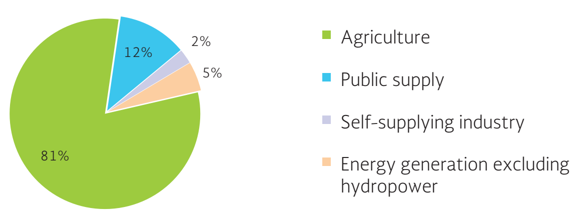
Annex A. Relevant data by hydrological-administrative region

Hydrological-administrative region: I. Baja California Peninsula
River basin organization with its headquarters in: Mexicali, Baja California

Contextual data		Renewable water resources, 2015	
Number of municipalities	11	Normal annual precipitation 1981-2010	168 mm
Total population, 2015	4 445 720 inhabitants	Mean surface runoff	3 300 hm³/year
Urban	4 053 443 inhabitants	Number of aquifers	88
Rural	392 277 inhabitants	Mean aquifer recharge	1 658 hm³/year
Total population, 2030	5 512 727 inhabitants	Per capita renewable water resources, 2015	1 115 m³/inhabitant/year
Irrigation districts	2	Per capita renewable water resources, 2030	899 m³/inhabitant/year
Surface area	245 678 hectares	Water stress, 2015	80% (High)



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	3 202	1 760	1 442
Public supply	463	123	340
Self-supplying industry	97	72	25
Energy generation excluding hydropower	196	<0.5	195
Total	**3 958**	**1 956**	**2 003**
Instream uses			
Hydropower (volume allocated)		126	

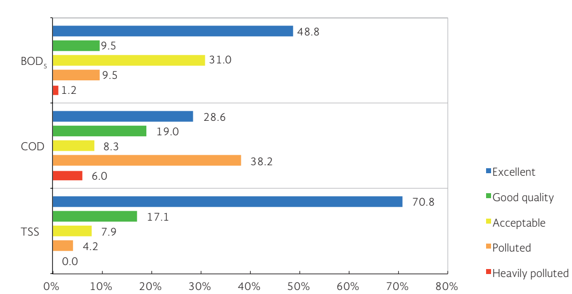
Municipal plants, 2015

	Drinking water	Wastewater
Number in operation	48	71
Installed capacity (m³/s)	12.36	9.43
Flow processed (m³/s)	7.18	6.72

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	84
COD	84
TSS	216

Distribution of sites by indicator and classification (%)



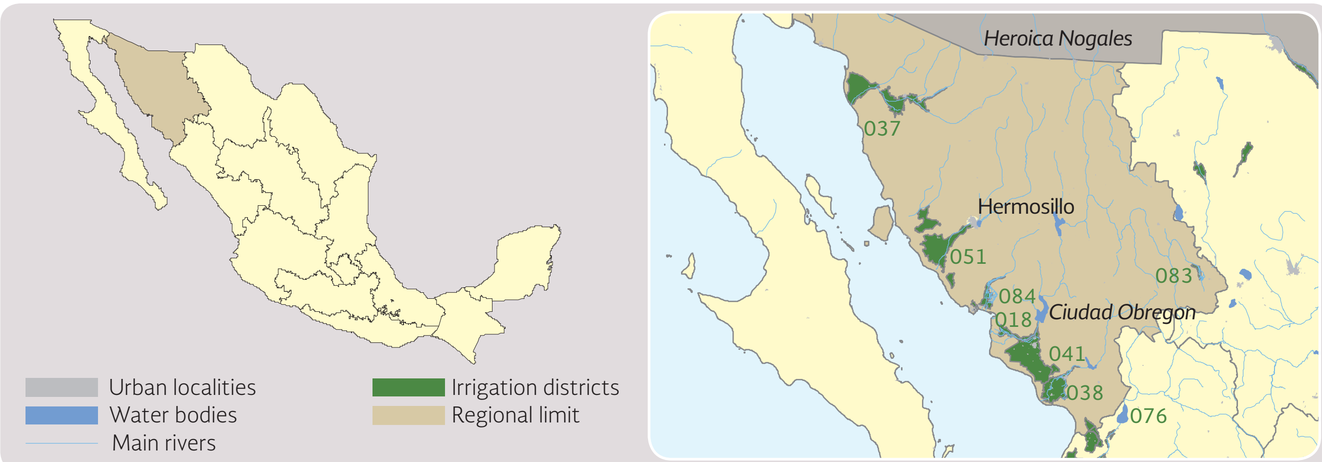
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (CONAGUA)	Access to sewerage and basic sanitation services	Sanitation coverage (CONAGUA)
Regional	97.03	94.74	96.33	96.07
Urban	97.87	96.29	97.61	97.43
Rural	88.72	79.39	83.70	82.66

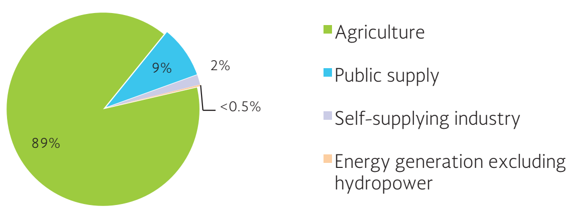
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (CONAGUA) for tap water from the public network, community or private well or public faucet. “Access to drinking water services” corresponds to the “Drinking water coverage” employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (CONAGUA) to distinguish the population that has sewerage through a public network or septic tank. “Access to sewerage and basic sanitation services” corresponds to the “Sanitation coverage” employed in previous editions of Statistics on Water in Mexico.

Hydrological-administrative region: II. Northwest
River basin organization with its headquarters in: Hermosillo, Sonora

Contextual data		Renewable water resources, 2015	
Number of municipalities	78	Normal annual precipitation 1981-2010	428 mm
Total population, 2015	2 841 368 inhabitants	Mean surface runoff	5 066 hm³/year
Urban	2 381 149 inhabitants	Number of aquifers	62
Rural	460 219 inhabitants	Mean aquifer recharge	3 207 hm³/year
Total population, 2030	3 356 804 inhabitants	Per capita renewable water resources, 2015	2 912 m³/inhabitant/year
Irrigation districts	7	Per capita renewable water resources, 2030	2 465 m³/inhabitant/year
Surface area	466 272 hectares	Water stress, 2015	81% (High)



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	6 021	3 782	2 239
Public supply	581	289	292
Self-supplying industry	111	5	106
Energy generation excluding hydropower	16	7	9
Total	**6 730**	**4 083**	**2 647**
Instream uses			
Hydropower (volume allocated)		5 214	

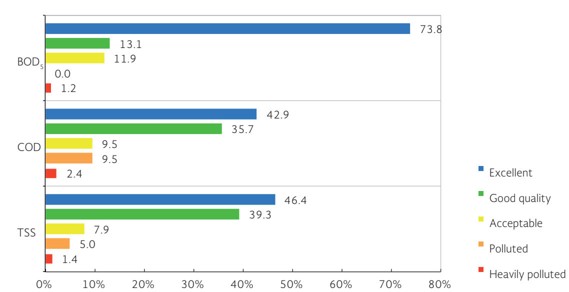
Municipal plants, 2015

	Drinking water	Wastewater
Number in operation	24	103
Installed capacity (m³/s)	5.58	5.54
Flow processed (m³/s)	2.29	3.75

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	84
COD	84
TSS	140

Distribution of sites by indicator and classification (%)

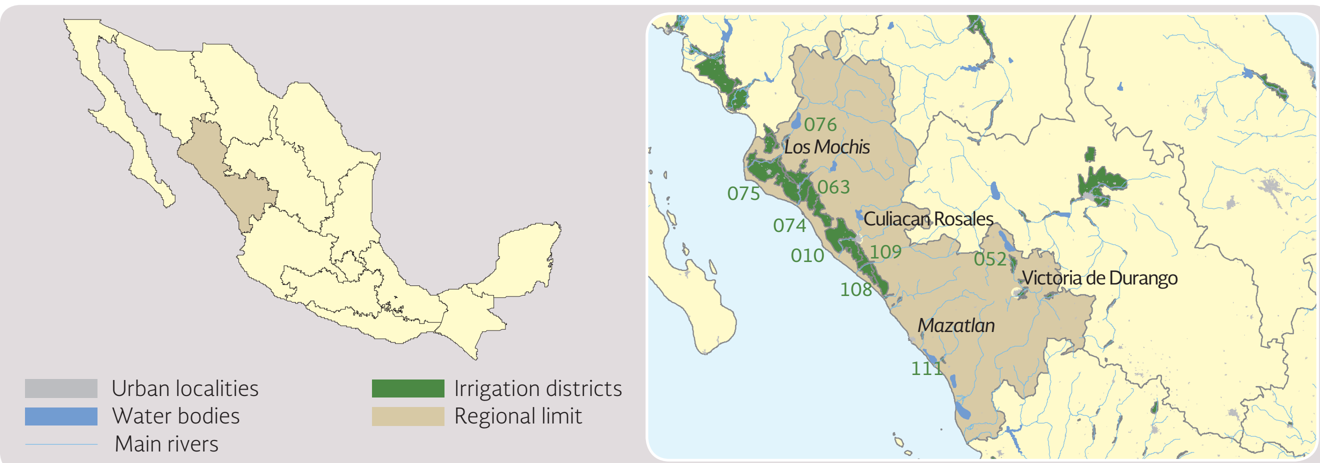


Coverage, 2015 (%)

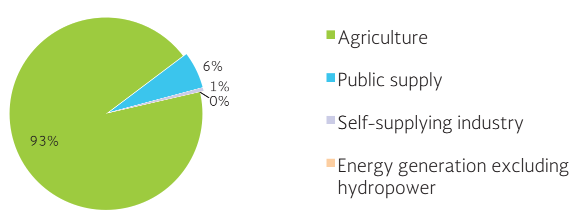
	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (CONAGUA)	Access to sewerage and basic sanitation services	Sanitation coverage (CONAGUA)
Regional	97.09	94.99	91.03	90.78
Urban	97.92	96.10	95.79	95.70
Rural	92.28	88.46	63.26	62.13

Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (CONAGUA) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (CONAGUA) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

Hydrological-administrative region: III. Northern Pacific River basin organization with its headquarters in: Culiacan, Sinaloa			
Contextual data		**Renewable water resources, 2015**	
Number of municipalities	51	Normal annual precipitation 1981-2010	765 mm
Total population, 2015	4 509 785 inhabitants	Mean surface runoff	22 519 hm³/year
Urban	3 129 247 inhabitants	Number of aquifers	24
Rural	1 380 538 inhabitants	Mean aquifer recharge	3 076 hm³/year
Total population, 2030	5 056 867 inhabitants	Per capita renewable water resources, 2015	5 676 m³/inhabitant/year
Irrigation districts	9	Per capita renewable water resources, 2030	5 062 m³/inhabitant/year
Surface area	806 643 hectares	Water stress, 2015	42% (High)



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	10 051	8 915	1 136
Public supply	660	323	337
Self-supplying industry	59	38	21
Energy generation excluding hydropower	0	0	0
Total	**10 770**	**9 276**	**1 494**
Instream uses			
Hydropower (volume allocated)	12 970		

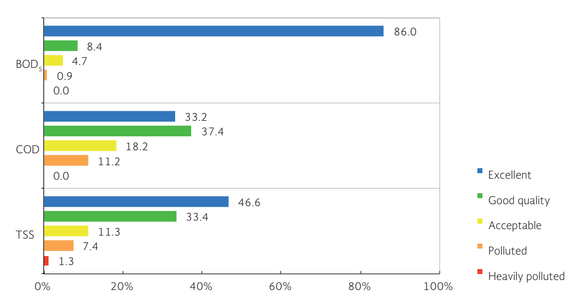
Municipal plants, 2015

	Drinking water	Wastewater
Number in operation	156	400
Installed capacity (m³/s)	9.47	10.69
Flow processed (m³/s)	8.44	8.19

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	214
COD	214
TSS	311

Distribution of sites by indicator and classification (%)



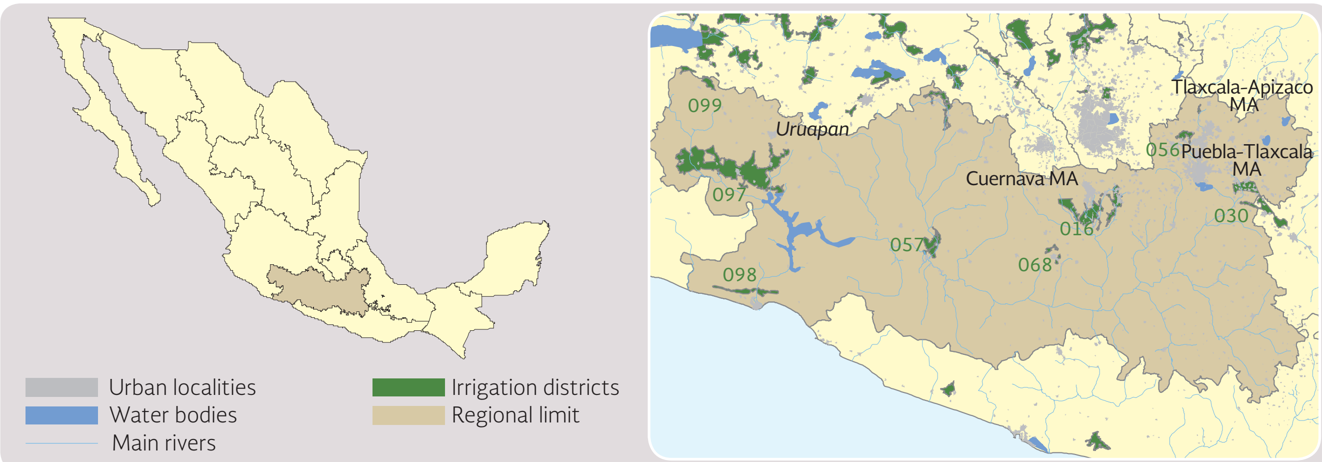
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
Regional	96.47	94.07	91.04	90.11
Urban	99.46	97.86	97.84	97.28
Rural	89.48	85.20	75.13	73.33

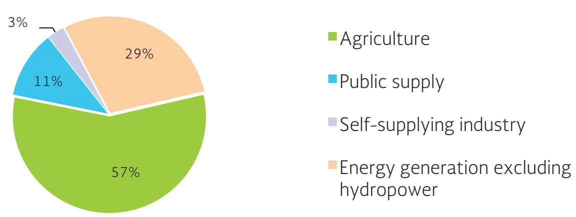
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

Hydrological-administrative region: IV. Balsas
River basin organization with its headquarters in: Cuernavaca, Morelos

Contextual data		Renewable water resources, 2015	
Number of municipalities	420	Normal annual precipitation 1981-2010	962 mm
Total population, 2015	11 807 740 inhabitants	Mean surface runoff	16 805 hm³/year
Urban	8 353 688 inhabitants	Number of aquifers	45
Rural	3 454 052 inhabitants	Mean aquifer recharge	4 873 hm³/year
Total population, 2030	13 315 109 inhabitants	Per capita renewable water resources, 2015	1 836 m³/inhabitant/year
Irrigation districts	9	Per capita renewable water resources, 2030	1 628 m³/inhabitant/year
Surface area	199 396 hectares	Water stress, 2015	50% (High)



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	6 129	5 009	1 120
Public supply	1 214	597	616
Self-supplying industry	307	217	91
Energy generation excluding hydropower	3 148	3 122	26
Total	**10 798**	**8 945**	**1 853**
Instream uses			
Hydropower (volume allocated)	34 232		

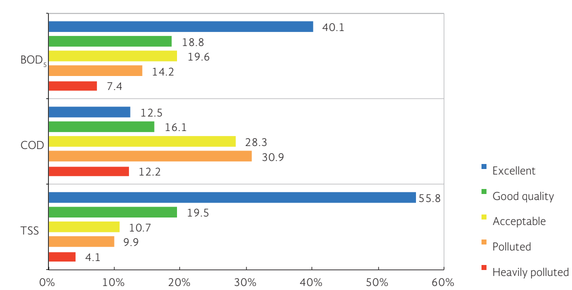
Municipal plants, 2015

	Drinking water	Wastewater
Number in operation	23	218
Installed capacity (m³/s)	22.82	10.43
Flow processed (m³/s)	17.18	8.10

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD$_5$	352
COD	353
TSS	364

Distribution of sites by indicator and classification (%)

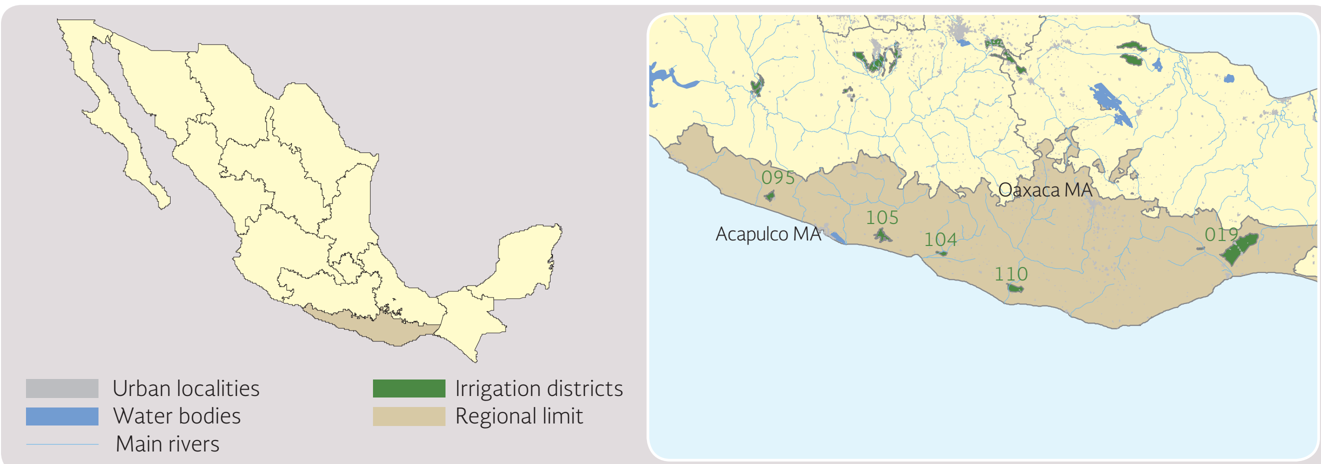


Coverage, 2015 (%)

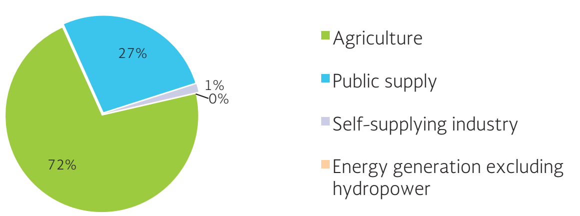
	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
Regional	93.77	89.34	91.58	89.02
Urban	96.51	92.72	96.53	94.94
Rural	87.29	81.33	79.86	74.97

Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

Hydrological-administrative region: V. Southern Pacific River basin organization with its headquarters in: Oaxaca, Oaxaca			
Contextual data		**Renewable water resources, 2015**	
Number of municipalities	378	Normal annual precipitation 1981-2010	1 139 mm
Total population, 2015	5 059 662 inhabitants	Mean surface runoff	28 629 hm³/year
Urban	3 050 690 inhabitants	Number of aquifers	36
Rural	2 008 972 inhabitants	Mean aquifer recharge	1 936 hm³/year
Total population, 2030	5 399 687 inhabitants	Per capita renewable water resources, 2015	6 041 m³/inhabitant/year
Irrigation districts	5	Per capita renewable water resources, 2030	5 660 m³/inhabitant/year
Surface area	71 927 hectares	Water stress, 2015	5% (No stress)



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	1 118	860	258
Public supply	417	187	230
Self-supplying industry	20	1	20
Energy generation excluding hydropower	0	0	0
Total	**1 555**	**1 047**	**508**
Instream uses			
Hydropower (volume allocated)	11 151		

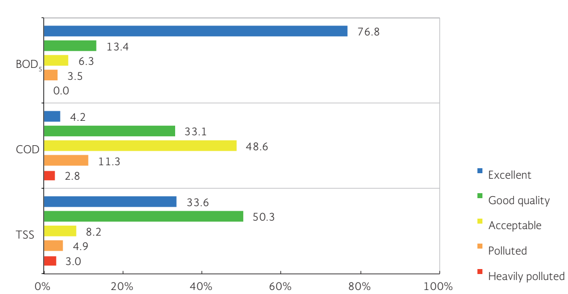
Municipal plants, 2015

	Drinking water	Wastewater
Number in operation	19	88
Installed capacity (m³/s)	3.46	4.74
Flow processed (m³/s)	2.78	3.72

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	142
COD	142
TSS	366

Distribution of sites by indicator and classification (%)

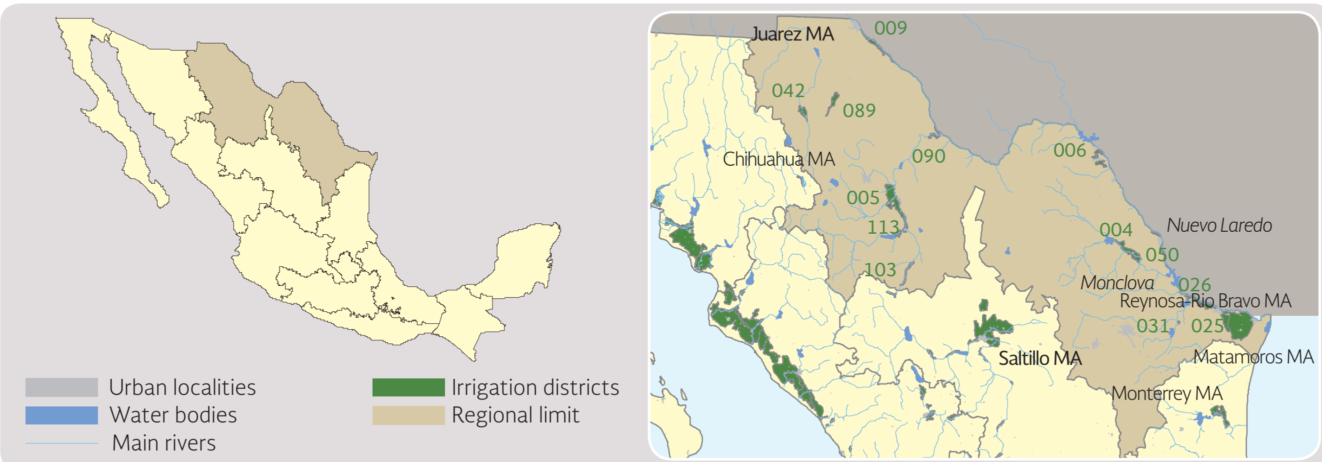


Coverage, 2015 (%)

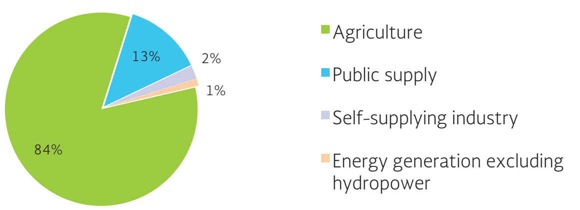
	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
Regional	89.37	84.57	79.13	76.79
Urban	92.08	88.19	92.60	91.06
Rural	85.29	79.10	58.80	55.24

Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

Hydrological-administrative region: VI. Rio Bravo River basin organization with its headquarters in: Monterrey, Nuevo Leon			
Contextual data		**Renewable water resources, 2015**	
Number of municipalities	144	Normal annual precipitation 1981-2010	372 mm
Total population, 2015	12 304 778 inhabitants	Mean surface runoff	6 416 hm³/year
Urban	11 461 354 inhabitants	Number of aquifers	102
Rural	843 425 inhabitants	Mean aquifer recharge	5 935 hm³/year
Total population, 2030	14 368 012 inhabitants	Per capita renewable water resources, 2015	1 004 m³/inhabitant/year
Irrigation districts	13	Per capita renewable water resources, 2030	860 m³/inhabitant/year
Surface area	469 451 hectares	Water stress, 2015	77% (High)



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	7 948	4 313	3 635
Public supply	1 248	549	699
Self-supplying industry	217	14	204
Energy generation excluding hydropower	111	53	58
Total	**9 524**	**4 928**	**4 595**

Instream uses	
Hydropower (volume allocated)	5 400

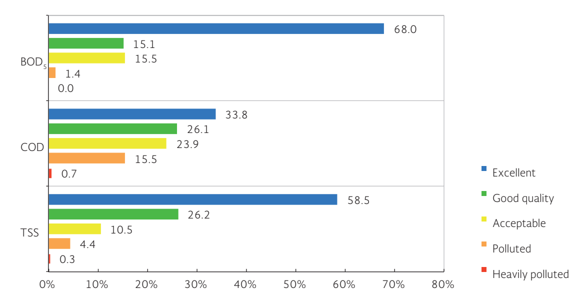
Municipal plants, 2015

	Drinking water	Wastewater
Number in operation	107	227
Installed capacity (m³/s)	27.67	32.36
Flow processed (m³/s)	15.00	23.59

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	284
COD	284
TSS	294

Distribution of sites by indicator and classification (%)



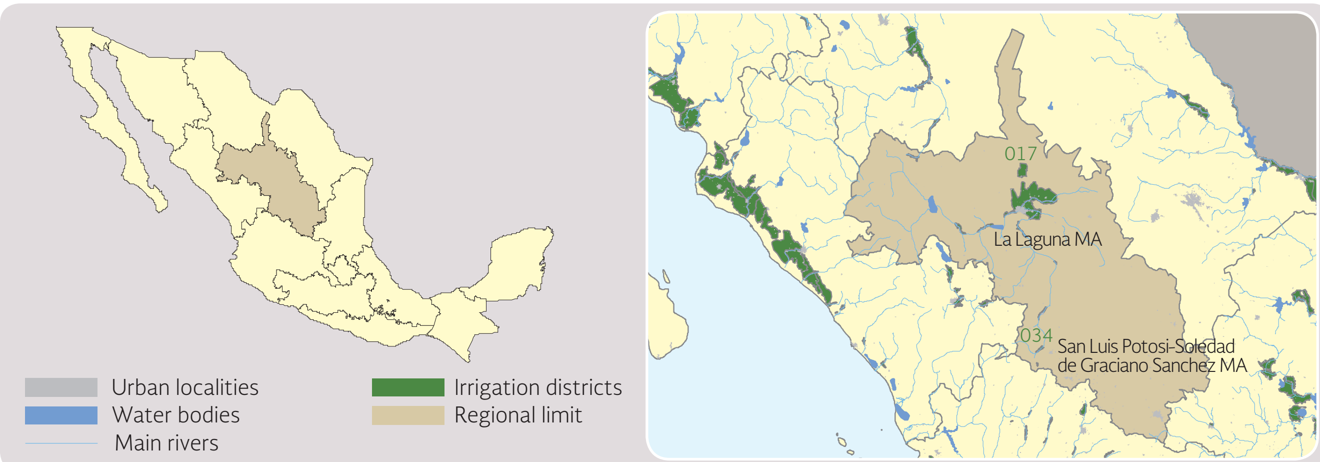
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
Regional	V.52	96.89	96.86	96.76
Urban	99.15	97.67	98.10	98.03
Rural	89.56	86.02	79.54	78.99

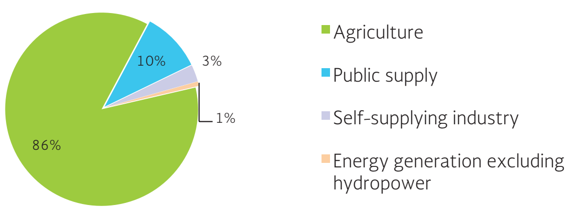
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: **Access to tap water services** for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as **Drinking water (Conagua)** for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is **Access to sewerage and basic sanitation services** for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also **Sanitation (Conagua)** to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

Hydrological-administrative region: VII. Central Basins of the North
River basin organization with its headquarters in: Torreon, Coahuila de Zaragoza

Contextual data		Renewable water resources, 2015	
Number of municipalities	78	Normal annual precipitation 1981-2010	398 mm
Total population, 2015	4 562 371 inhabitants	Mean surface runoff	5 529 hm³/year
Urban	3 419 821 inhabitants	Number of aquifers	65
Rural	1 142 550 inhabitants	Mean aquifer recharge	2 376 hm³/year
Total population, 2030	5 124 677 inhabitants	Per capita renewable water resources, 2015	1 733 m³/inhabitant/year
Irrigation districts	1	Per capita renewable water resources, 2030	1 543 m³/inhabitant/year
Surface area	71 964 hectares	Water stress, 2015	48% (High)



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	3 306	1 290	2 016
Public supply	383	12	371
Self-supplying industry	108	1	107
Energy generation excluding hydropower	28	0	28
Total	**3 825**	**1 303**	**2 522**
Instream uses			
Hydropower (volume allocated)	0		

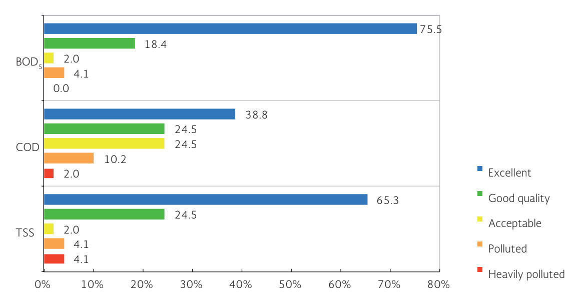
Municipal plants, 2015

	Drinking water	Wastewater
Number in operation	158	153
Installed capacity (m³/s)	2.36	6.92
Flow processed (m³/s)	1.53	5.42

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	49
COD	49
TSS	49

Distribution of sites by indicator and classification (%)



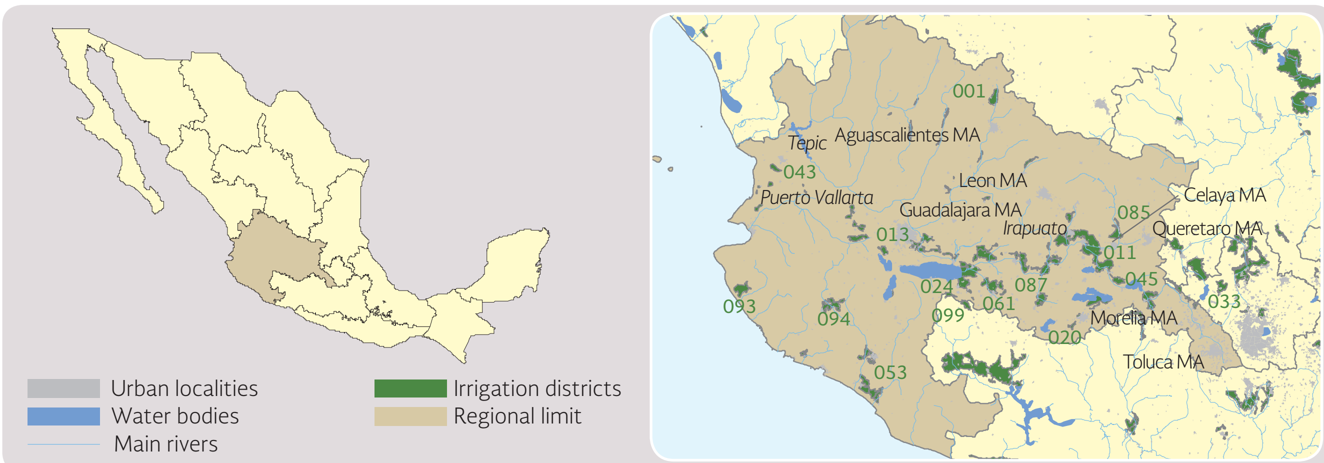
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
Regional	97.18	94.90	94.09	93.74
Urban	99.12	97.26	98.08	97.95
Rural	91.26	87.73	81.92	80.94

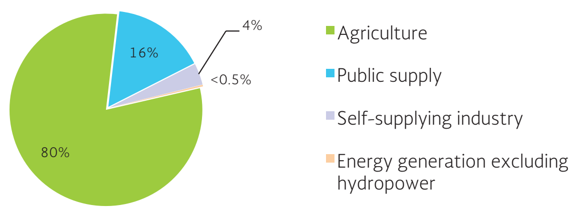
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

Hydrological-administrative region: VIII. Lerma-Santiago-Pacific
River basin organization with its headquarters in: Guadalajara, Jalisco

Contextual data		Renewable water resources, 2015	
Number of municipalities	332	Normal annual precipitation 1981-2010	808 mm
Total population, 2015	24 172 451 inhabitants	Mean surface runoff	25 423 hm³/year
Urban	18 935 659 inhabitants	Number of aquifers	128
Rural	5 236 791 inhabitants	Mean aquifer recharge	9 656 hm³/year
Total population, 2030	27 698 619 inhabitants	Per capita renewable water resources, 2015	1 451 m³/inhabitant/year
Irrigation districts	14	Per capita renewable water resources, 2030	1 266 m³/inhabitant/year
Surface area	501 196 hectares	Water stress, 2015	45% (High)



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	12 651	6 685	5 965
Public supply	2 462	1 006	1 456
Self-supplying industry	568	65	503
Energy generation excluding hydropower	43	<0.5	43
Total	**15 724**	**7 757**	**7 967**
Instream uses			
Hydropower (volume allocated)	22 943		

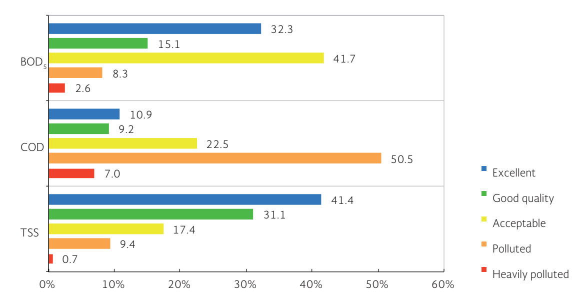
Municipal plants, 2015

	Drinking water	Wastewater
Number in operation	163	592
Installed capacity (m³/s)	19.89	41.43
Flow processed (m³/s)	14.96	29.76

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	654
COD	654
TSS	758

Distribution of sites by indicator and classification (%)

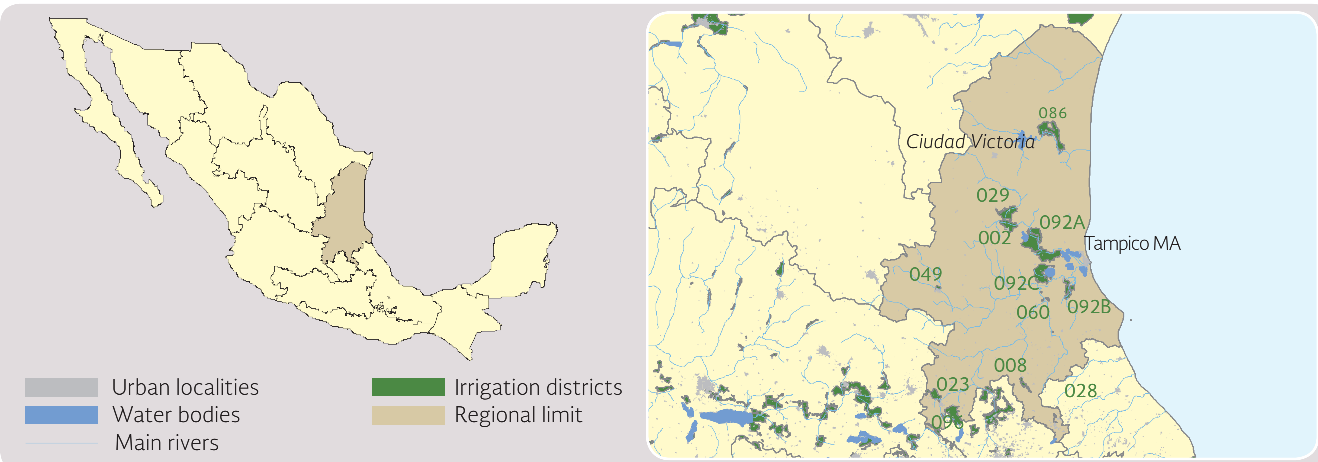


Coverage, 2015 (%)

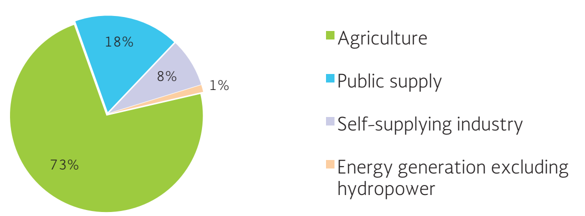
	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
Regional	97.50	95.38	95.55	94.12
Urban	98.54	96.90	98.08	97.29
Rural	93.88	90.11	86.79	83.14

Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

Hydrological-administrative region: IX. Northern Gulf River basin organization with its headquarters in: Ciudad Victoria, Tamaulipas			
Contextual data		**Renewable water resources, 2015**	
Number of municipalities	148	Normal annual precipitation 1981-2010	855 mm
Total population, 2015	5 280 991 inhabitants	Mean surface runoff	24 016 hm³/year
Urban	2 865 538 inhabitants	Number of aquifers	40
Rural	2 415 453 inhabitants	Mean aquifer recharge	4 108 hm³/year
Total population, 2030	5 962 759 inhabitants	Per capita renewable water resources, 2015	5 326 m³/inhabitant/year
Irrigation districts	13	Per capita renewable water resources, 2030	4 717 m³/inhabitant/year
Surface area	257 993 hectares	Water stress, 2015	20% (Medium)



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	4 201	3 294	906
Public supply	1 008	851	156
Self-supplying industry	467	427	40
Energy generation excluding hydropower	67	61	6
Total	**5 742**	**4 634**	**1 108**
Instream uses			
Hydropower (volume allocated)	1 959		

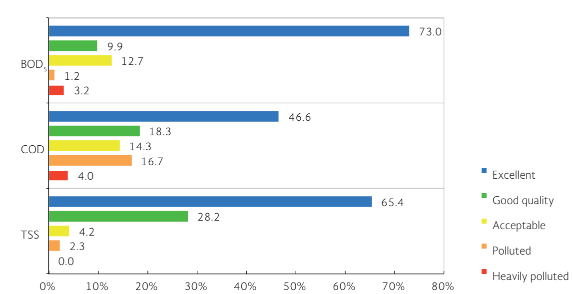
Municipal plants, 2015

	Drinking water	Wastewater
Number in operation	48	110
Installed capacity (m³/s)	8.19	5.38
Flow processed (m³/s)	7.44	4.17

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	252
COD	251
TSS	309

Distribution of sites by indicator and classification (%)



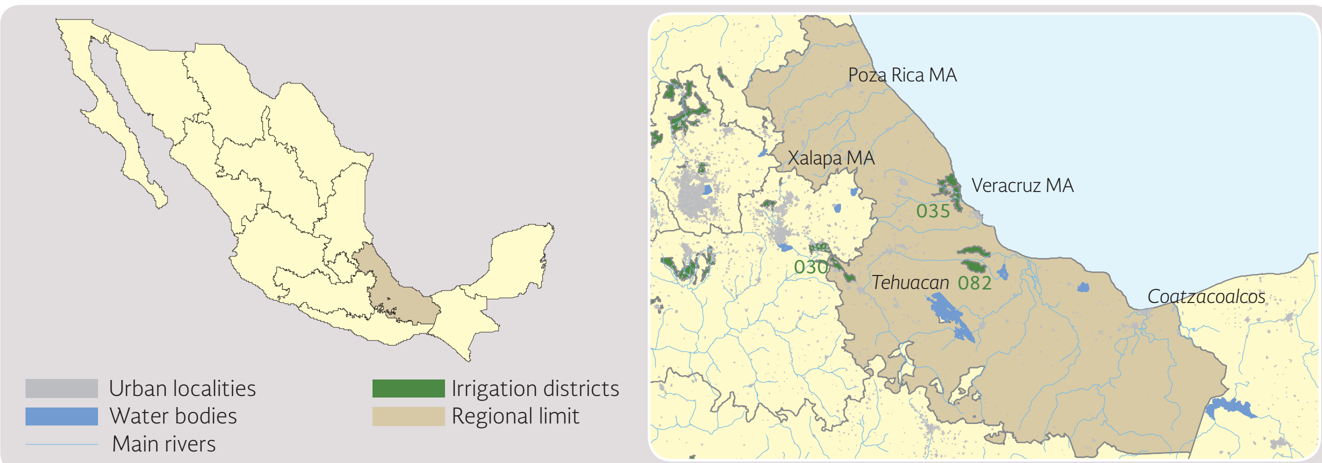
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
Regional	90.52	87.42	80.91	79.75
Urban	98.43	96.72	95.37	94.90
Rural	81.19	76.43	63.84	61.87

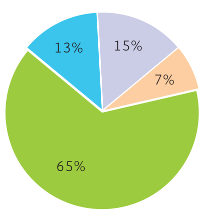
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

Hydrological-administrative region: X. Central Gulf
River basin organization with its headquarters in: Xalapa, Veracruz

Contextual data		Renewable water resources, 2015	
Number of municipalities	432	Normal annual precipitation 1981-2010	1 626 mm
Total population, 2015	10 565 955 inhabitants	Mean surface runoff	90 424 hm³/year
Urban	6 109 731 inhabitants	Number of aquifers	22
Rural	4 456 225 inhabitants	Mean aquifer recharge	4 599 hm³/year
Total population, 2030	11 606 944 inhabitants	Per capita renewable water resources, 2015	8 993 m³/inhabitant/year
Irrigation districts	2	Per capita renewable water resources, 2030	8 187 m³/inhabitant/year
Surface area	41 416 hectares	Water stress, 2015	6% (No stress)



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	3 594	2 597	997
Public supply	729	443	286
Self-supplying industry	823	675	148
Energy generation excluding hydropower	414	406	8
Total	**5 560**	**4 121**	**1 439**
Instream uses			
Hydropower (volume allocated)	24 876		

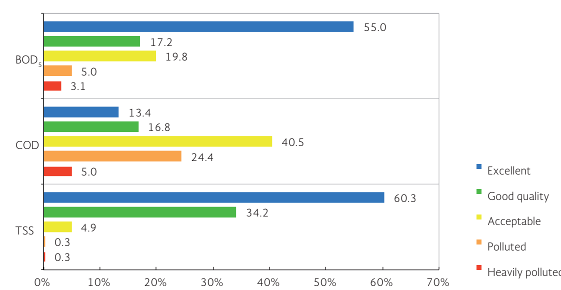
Municipal plants, 2015

	Drinking water	Wastewater
Number in operation	14	159
Installed capacity (m³/s)	7.51	7.57
Flow processed (m³/s)	5.20	5.90

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	262
COD	262
TSS	325

Distribution of sites by indicator and classification (%)



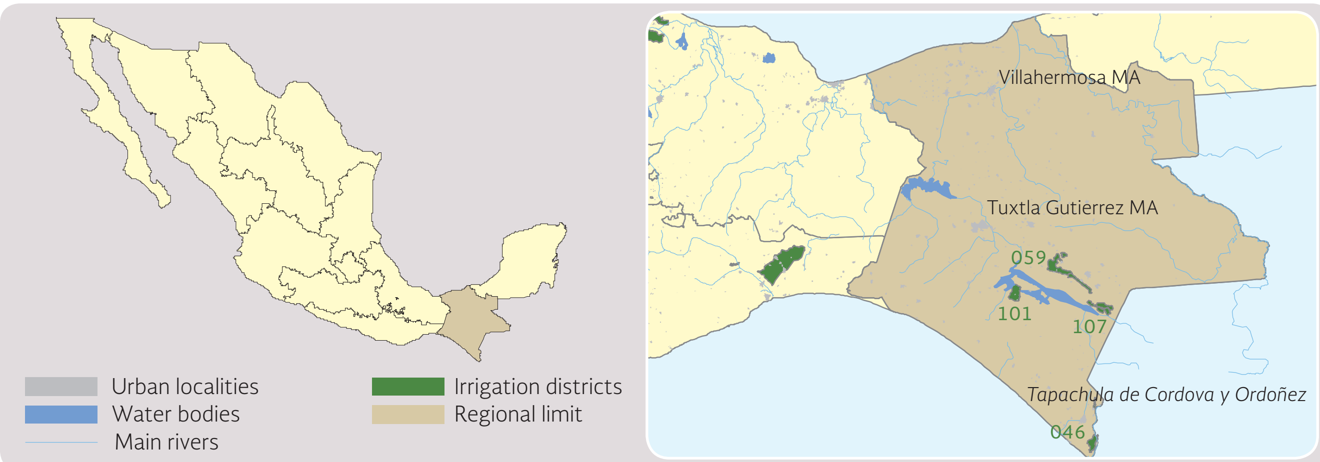
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (CONAGUA)	Access to sewerage and basic sanitation services	Sanitation coverage (CONAGUA)
Regional	88.74	84.60	86.33	82.87
Urban	95.16	92.95	96.05	93.49
Rural	80.04	73.28	73.15	68.49

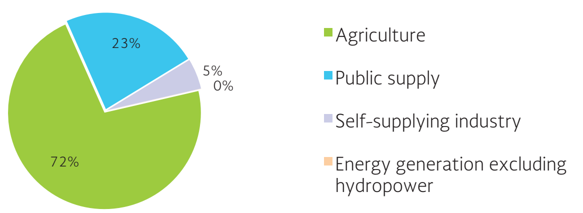
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (CONAGUA) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (CONAGUA) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

Hydrological-administrative region: XI. Southern Border
River basin organization with its headquarters in: Tuxtla Gutierrez, Chiapas

Contextual data		Renewable water resources, 2015	
Number of municipalities	137	Normal annual precipitation 1981-2010	1 842 mm
Total population, 2015	7 662 790 inhabitants	Mean surface runoff	121 742 hm³/year
Urban	4 009 562 inhabitants	Number of aquifers	23
Rural	3 653 228 inhabitants	Mean aquifer recharge	22 718 hm³/year
Total population, 2030	8 844 011 inhabitants	Per capita renewable water resources, 2015	18 852 m³/inhabitant/year
Irrigation districts	4	Per capita renewable water resources, 2030	16 334 m³/inhabitant/year
Surface area	36 180 hectares	Water stress, 2015	2% (No stress)



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	1 802	1 266	537
Public supply	574	433	141
Self-supplying industry	128	62	67
Energy generation excluding hydropower	0	0	0
Total	**2 505**	**1 761**	**744**
Instream uses			
Hydropower (volume allocated)	61 804		

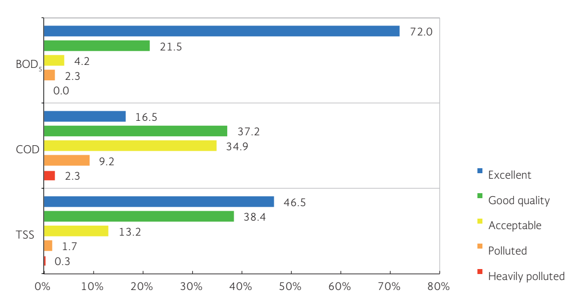
Municipal plants, 2015

	Drinking water	Wastewater
Number in operation	46	115
Installed capacity (m³/s)	14.72	4.74
Flow processed (m³/s)	11.09	2.69

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	261
COD	261
TSS	357

Distribution of sites by indicator and classification (%)

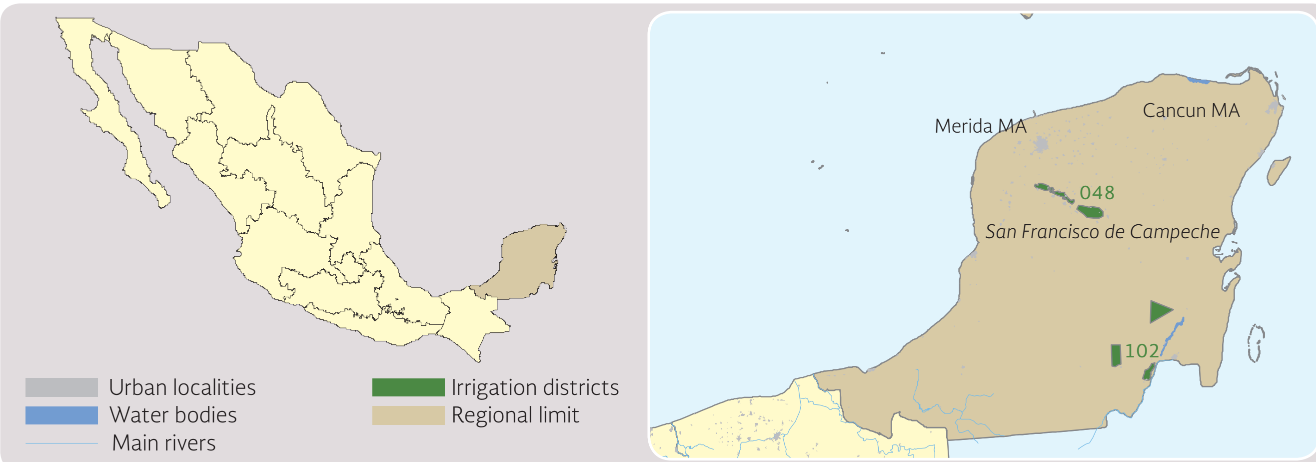


Coverage, 2015 (%)

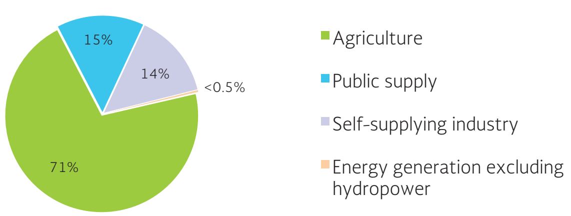
	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
Regional	89.30	84.65	90.20	87.93
Urban	94.93	92.38	97.82	96.62
Rural	83.00	76.01	81.69	78.23

Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. “Access to drinking water services” corresponds to the “Drinking water coverage” employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. “Access to sewerage and basic sanitation services” corresponds to the “Sanitation coverage” employed in previous editions of Statistics on Water in Mexico.

Hydrological-administrative region: XII. Yucatan Peninsula River basin organization with its headquarters in: Merida, Yucatan			
Contextual data		Renewable water resources, 2015	
Number of municipalities	127	Normal annual precipitation 1981-2010	1 207 mm
Total population, 2015	4 601 463 inhabitants	Mean surface runoff	4 008 hm³/year
Urban	3 872 290 inhabitants	Number of aquifers	4
Rural	729 173 inhabitants	Mean aquifer recharge	25 316 hm³/year
Total population, 2030	5 834 470 inhabitants	Per capita renewable water resources, 2015	6 373 m³/inhabitant/year
Irrigation districts	2	Per capita renewable water resources, 2030	5 026 m³/inhabitant/year
Surface area	18 490 hectares	Water stress, 2015	14% (Low)



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	2 981	131	2 850
Public supply	612	<0.5	612
Self-supplying industry	595	<0.5	594
Energy generation excluding hydropower	13	0	13
Total	**4 200**	**131**	**4 069**
Instream uses			
Hydropower (volume allocated)		0	

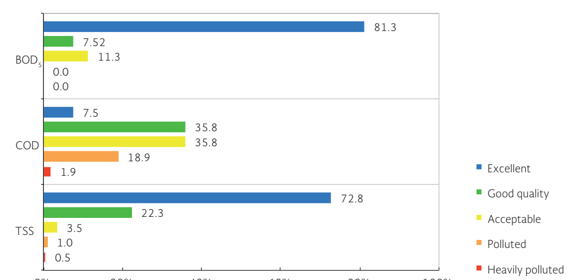
Municipal plants, 2015

	Drinking water	Wastewater
Number in operation	1	84
Installed capacity (m³/s)	0.01	3.17
Flow processed (m³/s)	0.01	2.11

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	53
COD	53
TSS	202

Distribution of sites by indicator and classification (%)



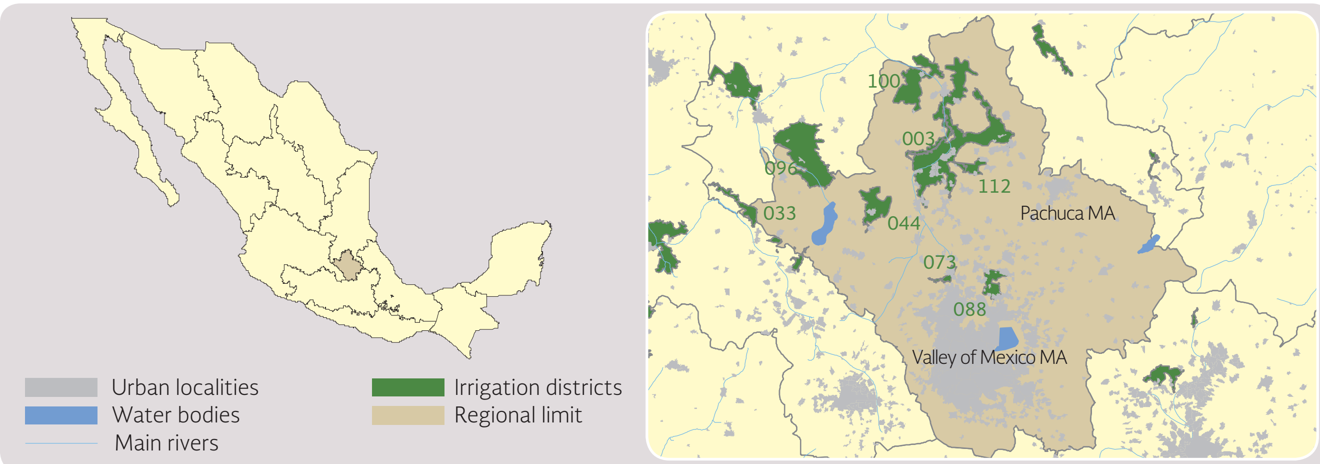
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
Regional	97.98	96.16	91.12	90.67
Urban	98.58	96.93	93.88	93.43
Rural	94.81	92.06	76.48	76.03

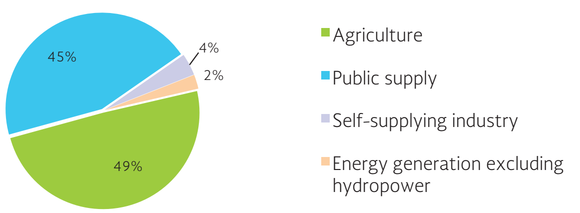
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

Hydrological-administrative region: XIII. Waters of the Valley of Mexico
River basin organization with its headquarters in: Mexico City, Federal District

Contextual data		Renewable water resources, 2015	
Number of municipalities	121	Normal annual precipitation 1981-2010	649 mm
Total population, 2015	23 190 741 inhabitants	Mean surface runoff	1 112 hm³/year
Urban	21 979 840 inhabitants	Number of aquifers	14
Rural	1 210 902 inhabitants	Mean aquifer recharge	2 330 hm³/year
Total population, 2030	25 400 649 inhabitants	Per capita renewable water resources, 2015	148 m³/inhabitant/year
Irrigation districts	5	Per capita renewable water resources, 2030	136 m³/inhabitant/year
Surface area	97 950 hectares	Water stress, 2015	139% (Very high)



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	2 356	1 984	372
Public supply	2 129	350	1 779
Self-supplying industry	175	31	144
Energy generation excluding hydropower	113	46	68
Total	**4 774**	**2 411**	**2 363**
Instream uses			
Hydropower (volume allocated)	221		

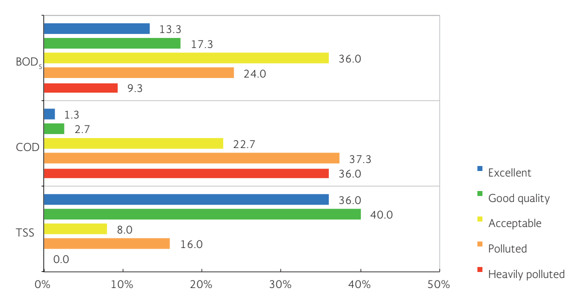
Municipal plants, 2015

	Drinking water	Wastewater
Number in operation	67	157
Installed capacity (m³/s)	6.71	35.58
Flow processed (m³/s)	4.81	16.78

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	75
COD	75
TSS	75

Distribution of sites by indicator and classification (%)



Coverage, 2015 (%)

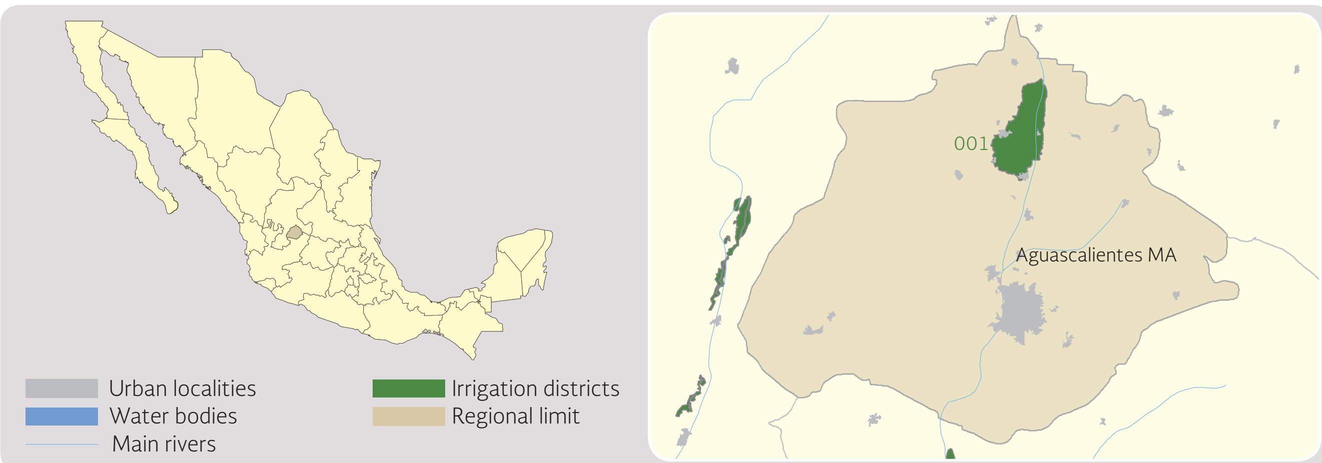
	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (CONAGUA)	Access to sewerage and basic sanitation services	Sanitation coverage (CONAGUA)
Regional	97.90	95.50	98.06	97.32
Urban	98.30	96.19	98.55	97.99
Rural	91.56	84.80	90.28	86.92

Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (CONAGUA) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (CONAGUA) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

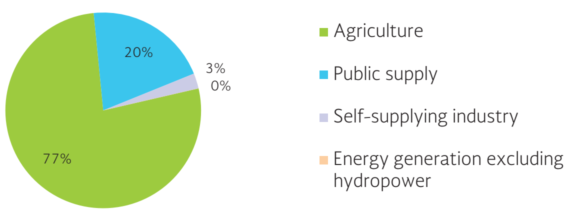
Annex B. Relevant data by state

1. Aguascalientes

Contextual data		Wastewater treatment plants, 2015		
Number of municipalities	11		**Municipal**	**Industrial**
Total population, 2015	1 287 660 inhabitants	Number in operation	134	74
Urban	1 042 859 inhabitants	Installed capacity (m³/s)	4.710	0.373
Rural	244 802 inhabitants	Flow processed (m³/s)	2.253	0.176
Total population, 2030	1 507 807 inhabitants			
Normal annual precipitation 1981-2010	515 mm			



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	479	176	304
Public supply	127	<0.5	127
Self-supplying industry	16	2	14
Energy generation excluding hydropower	0	0	0
Total	**622**	**178**	**444**
Instream uses			
Hydropower (volume allocated)		0	

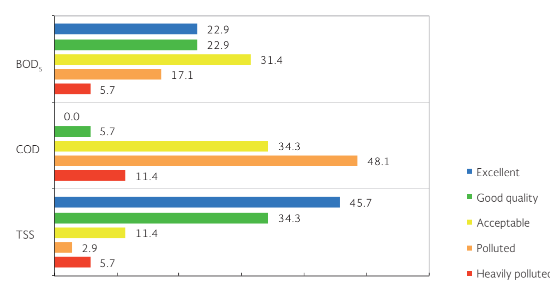
Municipal water treatment plants, 2015

Number in operation	3
Installed capacity (m³/s)	0.044
Flow processed (m³/s)	0.026

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	35
COD	35
TSS	35

Distribution of sites by indicator and classification (%)



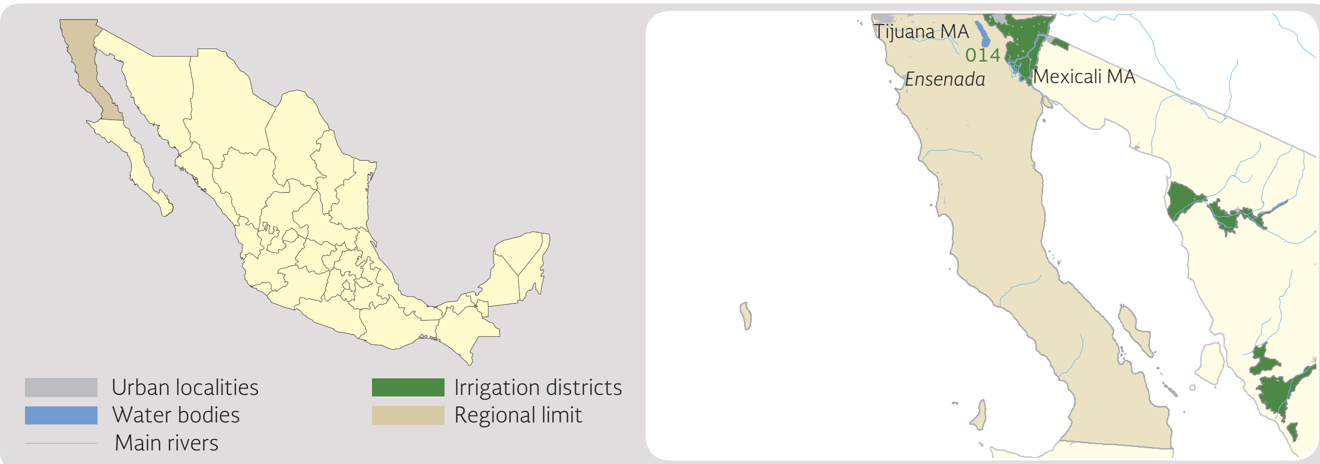
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
State-wide	99.68	98.59	98.86	98.47
Urban	99.90	99.22	99.64	99.51
Rural	98.83	96.09	95.72	94.31

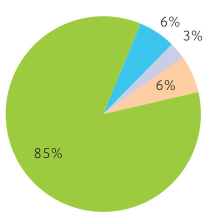
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

2.Baja California

Contextual data		Wastewater treatment plants, 2015		
Number of municipalities	5		Municipal	Industrial
Total population, 2015	3 484 150 inhabitants	Number in operation	43	71
Urban	3 202 534 inhabitants	Installed capacity (m³/s)	7.775	0.613
Rural	281 616 inhabitants	Flow processed (m³/s)	5.480	0.615
Total population, 2030	4 169 240 inhabitants			
Normal annual precipitation 1981-2010	173 mm			



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	2 587	1 521	1 066
Public supply	187	120	68
Self-supplying industry	83	69	14
Energy generation excluding hydropower	192	0	192
Total	**3 049**	**1 711**	**1 339**
Instream uses			
Hydropower (volume allocated)		126	

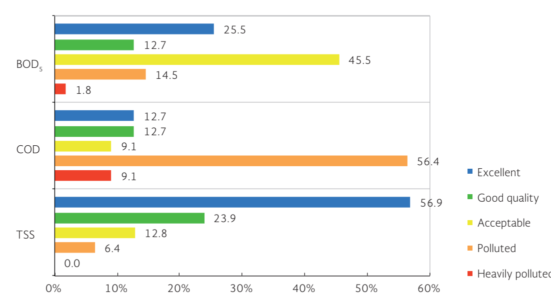
Municipal water treatment plants, 2015

Number in operation	31
Installed capacity (m³/s)	12.146
Flow processed (m³/s)	6.984

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	55
COD	55
TSS	109

Distribution of sites by indicator and classification (%)



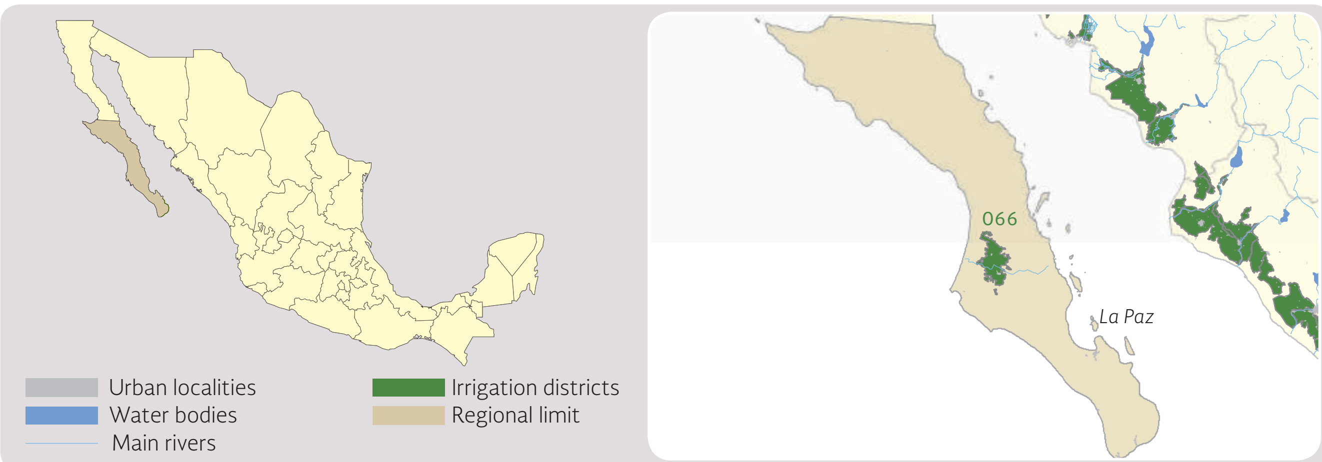
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
State-wide	97.70	95.35	96.42	96.13
Urban	98.64	97.11	97.71	97.50
Rural	87.87	76.99	83.11	81.89

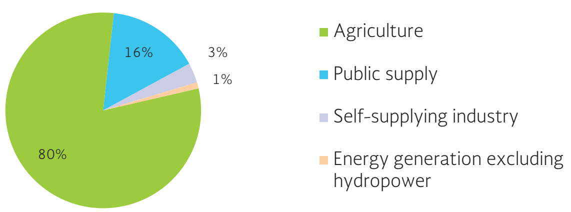
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

3. Baja California Sur

Contextual data		Wastewater treatment plants, 2015		
Number of municipalities	5		**Municipal**	**Industrial**
Total population, 2015	763 929 inhabitants	Number in operation	28	26
Urban	664 805 inhabitants	Installed capacity (m³/s)	1.659	4.962
Rural	99 123 inhabitants	Flow processed (m³/s)	1.242	4.962
Total population, 2030	1 106 468 inhabitants			
Normal annual precipitation 1981-2010	222 mm			



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	339	31	308
Public supply	65	3	62
Self-supplying industry	14	3	11
Energy generation excluding hydropower	4	<0.5	4
Total	**422**	**37**	**385**

Instream uses	
Hydropower (volume allocated)	0

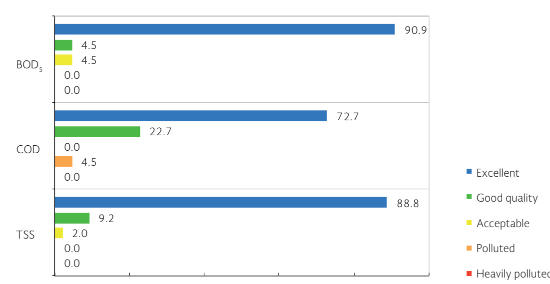
Municipal water treatment plants, 2015

Number in operation	17
Installed capacity (m³/s)	0.215
Flow processed (m³/s)	0.195

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	22
COD	22
TSS	98

Distribution of sites by indicator and classification (%)

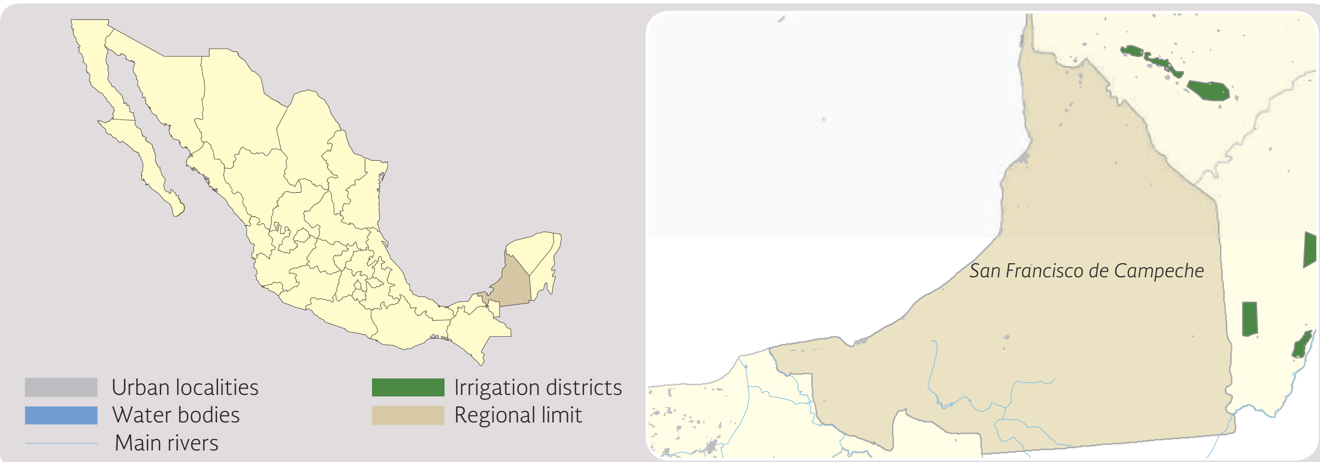


Coverage, 2015 (%)

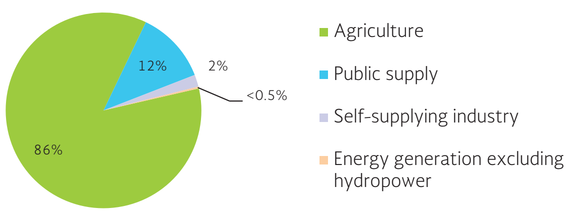
	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
State-wide	93.41	91.16	96.66	96.52
Urban	93.77	91.86	98.00	97.86
Rural	90.80	85.91	86.70	86.58

Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

4. Campeche				
Contextual data		**Wastewater treatment plants, 2015**		
Number of municipalities	11		Municipal	Industrial
Total population, 2015	907 878 inhabitants	Number in operation	22	134
Urban	677 846 inhabitants	Installed capacity (m^3/s)	0.174	2.891
Rural	230 032 inhabitants	Flow processed (m^3/s)	0.153	2.882
Total population, 2030	1 098 636 inhabitants			
Normal annual precipitation 1981-2010	1 251 mm			



Uses of water, 2015 (hm³/year)



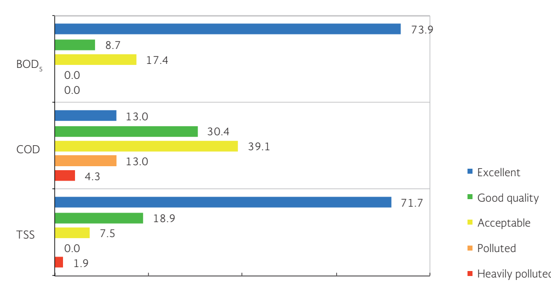
Offstream uses	Total	Surface water	Groundwater
Agriculture	1 030	130	900
Public supply	144	<0.5	144
Self-supplying industry	24	<0.5	24
Energy generation excluding hydropower	4	0	4
Total	**1 202**	**130**	**1 071**
Instream uses			
Hydropower (volume allocated)		0	

Municipal water treatment plants, 2015	
Number in operation	2
Installed capacity (m^3/s)	0.025
Flow processed (m^3/s)	0.023

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	23
COD	23
TSS	53

Distribution of sites by indicator and classification (%)



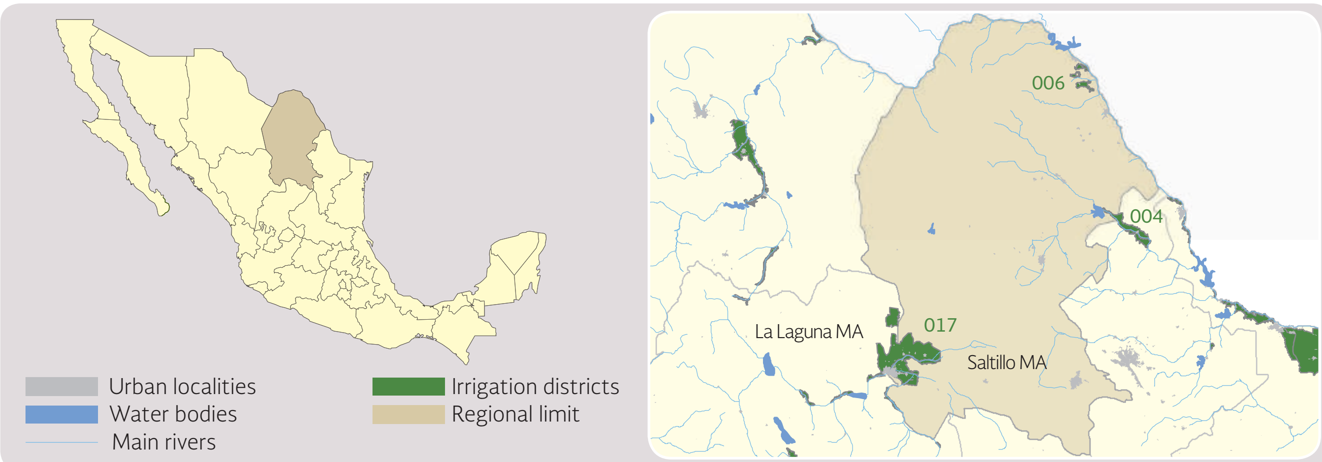
Coverage, 2015 (%)				
	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (CONAGUA)	Access to sewerage and basic sanitation services	Sanitation coverage (CONAGUA)
State-wide	94.68	92.73	91.88	91.69
Urban	96.86	95.57	95.90	95.71
Rural	88.03	84.10	79.62	79.43

Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (CONAGUA) for tap water from the public network, community or private well or public faucet. “Access to drinking water services” corresponds to the “Drinking water coverage” employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (CONAGUA) to distinguish the population that has sewerage through a public network or septic tank. “Access to sewerage and basic sanitation services” corresponds to the “Sanitation coverage” employed in previous editions of Statistics on Water in Mexico.

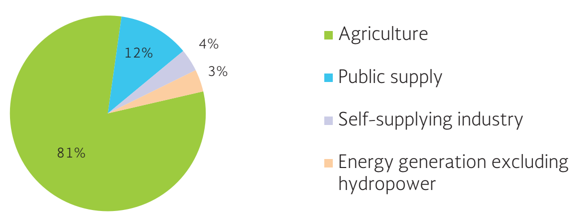
5. Coahuila de Zaragoza

Contextual data	
Number of municipalities	38
Total population, 2015	2 960 681 inhabitants
Urban	2 672 183 inhabitants
Rural	288 498 inhabitants
Total population, 2030	3 427 879 inhabitants
Normal annual precipitation 1981-2010	332 mm

Wastewater treatment plants, 2015	Municipal	Industrial
Number in operation	21	62
Installed capacity (m^3/s)	5.637	0.797
Flow processed (m^3/s)	4.499	0.534



Uses of water, 2015 (hm^3/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	1 648	838	810
Public supply	240	18	222
Self-supplying industry	76	1	75
Energy generation excluding hydropower	75	47	27
Total	**2 039**	**905**	**1 134**

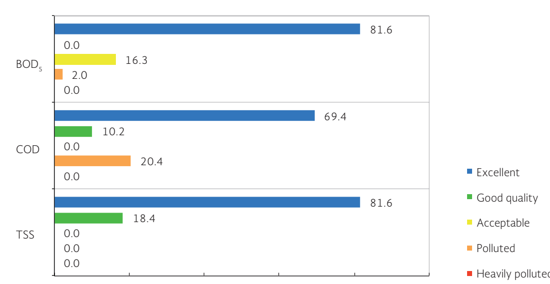
Instream uses	
Hydropower (volume allocated)	1 465

Municipal water treatment plants, 2015	
Number in operation	98
Installed capacity (m^3/s)	2.608
Flow processed (m^3/s)	2.133

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	49
COD	49
TSS	49

Distribution of sites by indicator and classification (%)

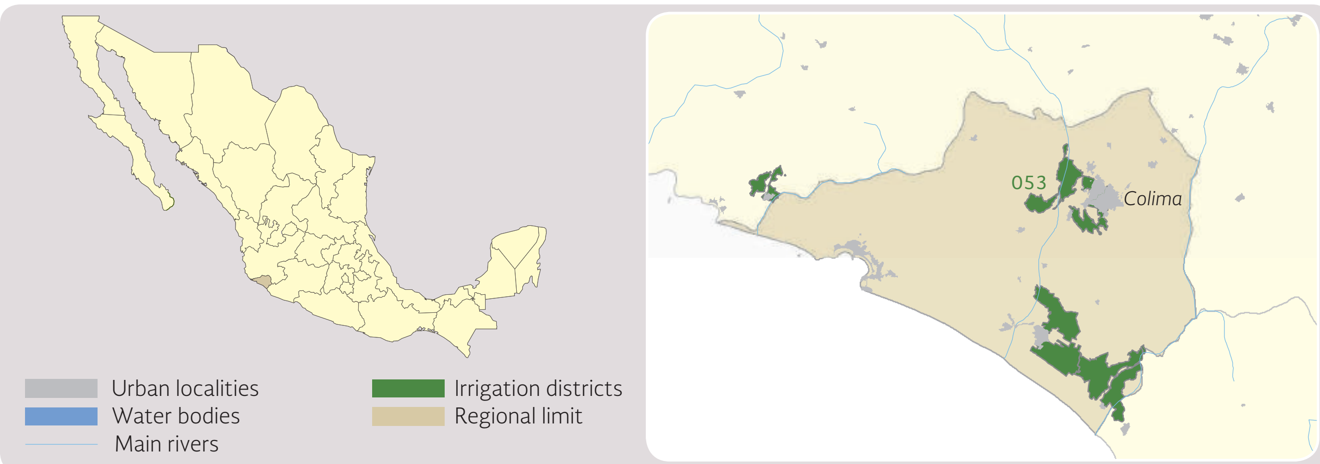


Coverage, 2015 (%)

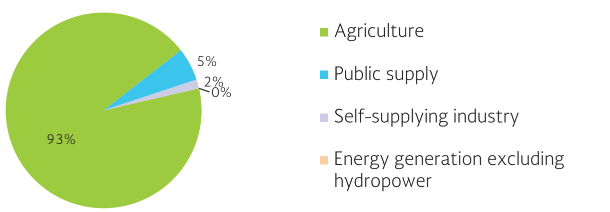
	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
State-wide	99.08	97.13	97.07	96.96
Urban	99.55	97.76	98.19	98.13
Rural	94.33	90.75	85.84	85.35

Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

6. Colima				
Contextual data		**Wastewater treatment plants, 2015**		
Number of municipalities	10		**Municipal**	**Industrial**
Total population, 2015	723 455 inhabitants	Number in operation	67	13
Urban	650 443 inhabitants	Installed capacity (m^3/s)	2.302	0.441
Rural	73 012 inhabitants	Flow processed (m^3/s)	1.614	0.292
Total population, 2030	891 050 inhabitants			
Normal annual precipitation 1981-2010	896 mm			



Uses of water, 2015 (hm³/year)



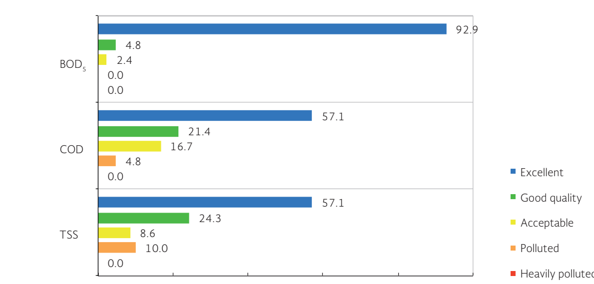
Offstream uses	Total	Surface water	Groundwater
Agriculture	1 669	1 355	313
Public supply	97	39	59
Self-supplying industry	27	4	23
Energy generation excluding hydropower	0	0	0
Total	**1 793**	**1 398**	**395**
Instream uses			
Hydropower (volume allocated)		0	

Municipal water treatment plants, 2015	
Number in operation	58
Installed capacity (m^3/s)	0.014
Flow processed (m^3/s)	0.005

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	42
COD	42
TSS	70

Distribution of sites by indicator and classification (%)



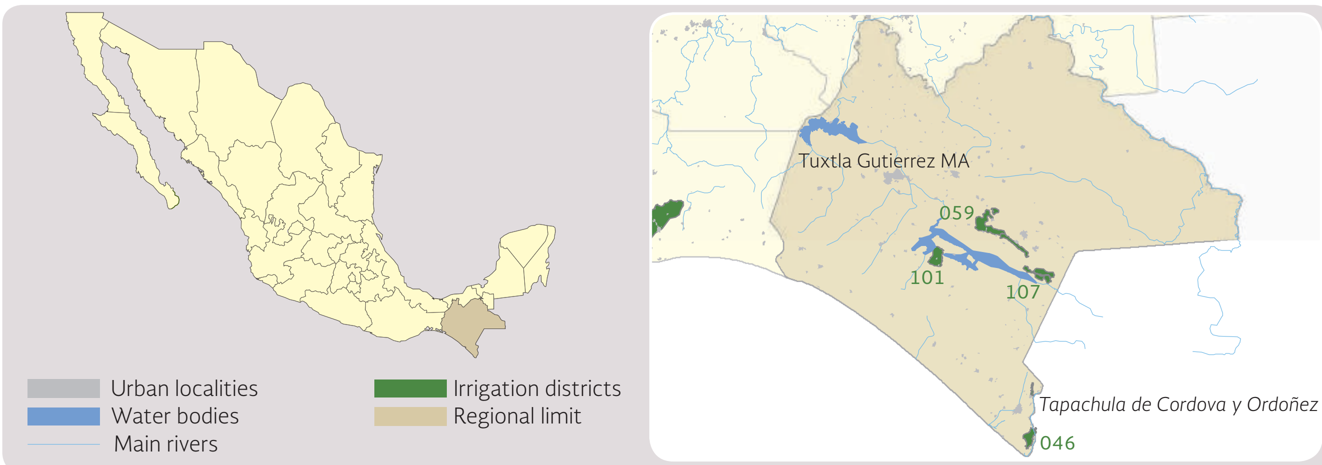
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (CONAGUA)	Access to sewerage and basic sanitation services	Sanitation coverage (CONAGUA)
State-wide	99.54	98.03	99.06	98.91
Urban	99.85	98.74	99.31	99.21
Rural	97.01	92.22	97.00	96.46

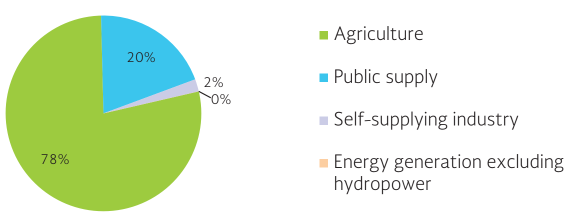
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (CONAGUA) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (CONAGUA) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

7. Chiapas

Contextual data		Wastewater treatment plants, 2015		
Number of municipalities	118		**Municipal**	**Industrial**
Total population, 2015	5 252 808 inhabitants	Number in operation	34	93
Urban	2 598 479 inhabitants	Installed capacity (m³/s)	1.917	8.385
Rural	2 654 330 inhabitants	Flow processed (m³/s)	0.918	5.258
Total population, 2030	6 129 218 inhabitants			
Normal annual precipitation 1981-2010	1 923 mm			



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	1 541	1 138	403
Public supply	389	326	63
Self-supplying industry	40	2	38
Energy generation excluding hydropower	0	0	0
Total	**1 971**	**1 466**	**504**
Instream uses			
Hydropower (volume allocated)	61 804		

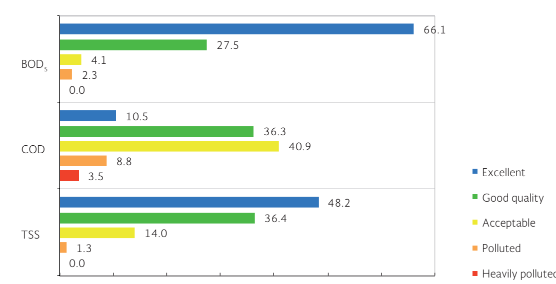
Municipal water treatment plants, 2015

Number in operation	6
Installed capacity (m³/s)	4.740
Flow processed (m³/s)	2.608

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	171
COD	171
TSS	228

Distribution of sites by indicator and classification (%)



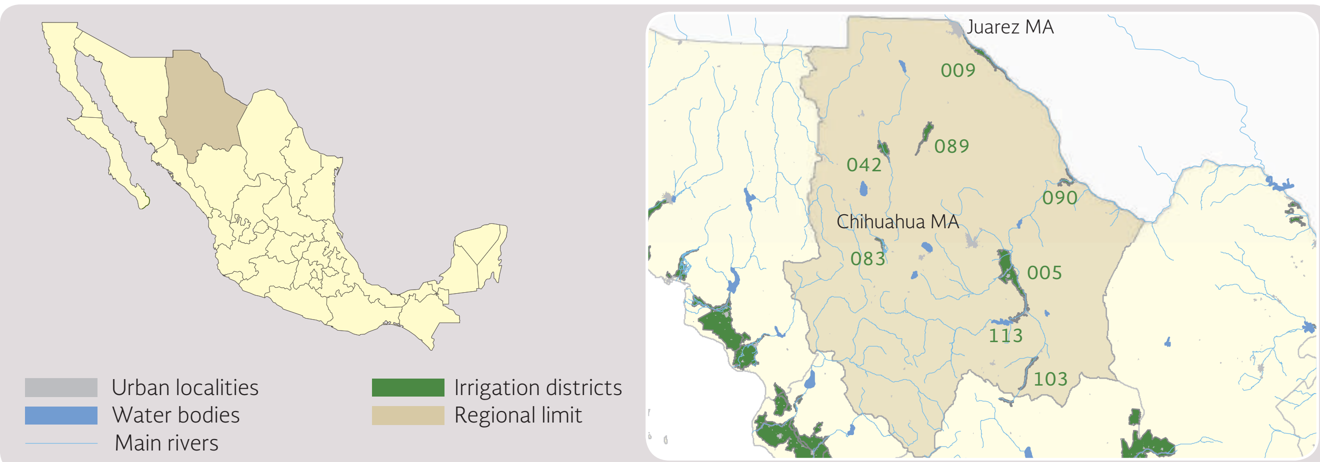
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
State-wide	88.30	82.69	86.93	84.42
Urban	93.89	91.03	97.50	96.34
Rural	82.77	74.45	76.47	72.63

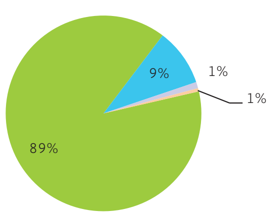
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

8. Chihuahua

Contextual data		Wastewater treatment plants, 2015		
Number of municipalities	67		Municipal	Industrial
Total population, 2015	3 710 129 inhabitants	Number in operation	179	15
Urban	3 160 350 inhabitants	Installed capacity (m³/s)	10.275	0.655
Rural	549 779 inhabitants	Flow processed (m³/s)	7.028	0.283
Total population, 2030	4 177 815 inhabitants			
Normal annual precipitation 1981-2010	377 mm			



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	4 589	1 938	2 651
Public supply	490	51	439
Self-supplying industry	54	6	48
Energy generation excluding hydropower	28	0	28
Total	**5 160**	**1 995**	**3 164**
Instream uses			
Hydropower (volume allocated)	2 311		

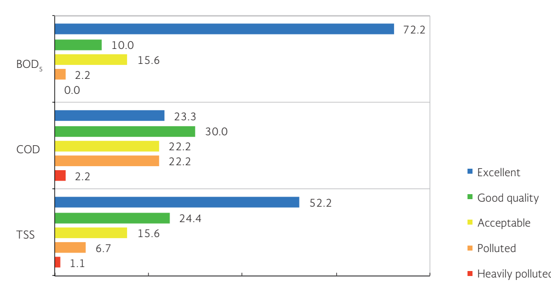
Municipal water treatment plants, 2015

Number in operation	4
Installed capacity (m³/s)	0.650
Flow processed (m³/s)	0.380

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	90
COD	90
TSS	90

Distribution of sites by indicator and classification (%)



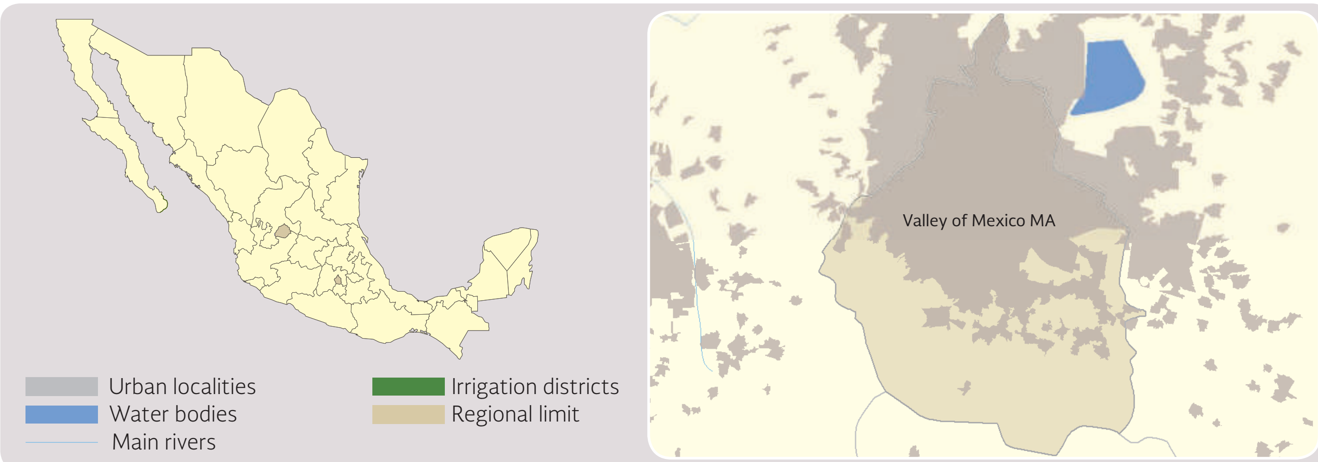
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
State-wide	96.15	94.39	93.15	92.94
Urban	98.67	97.06	97.85	97.74
Rural	80.57	77.87	64.11	63.24

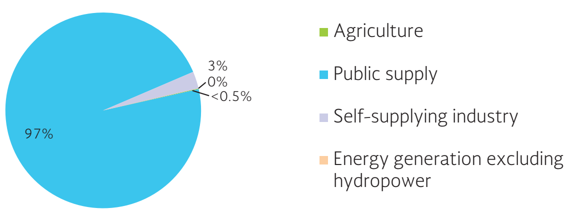
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

9. Federal District (Mexico City)

Contextual data		Wastewater treatment plants, 2015		
Number of delegations	16		**Municipal**	**Industrial**
Total population, 2015	8 854 600 inhabitants	Number in operation	29	7
Urban	8 803 616 inhabitants	Installed capacity (m³/s)	5.605	0.008
Rural	50 983 inhabitants	Flow processed (m³/s)	3.178	0.005
Total population, 2030	8 439 786 inhabitants			
Normal annual precipitation 1981-2010	869 mm			



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	1	1	1
Public supply	1 090	309	781
Self-supplying industry	32	<0.5	32
Energy generation excluding hydropower	0	0	0
Total	**1 123**	**310**	**813**
Instream uses			
Hydropower (volume allocated)	<0.5		

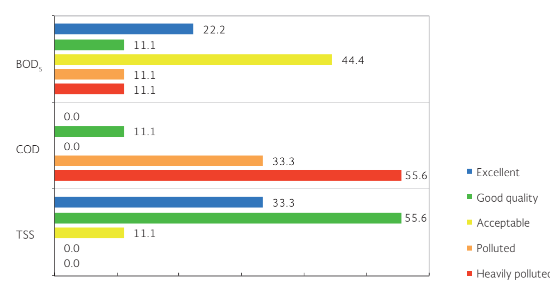
Municipal water treatment plants, 2015

Number in operation	47
Installed capacity (m³/s)	4.999
Flow processed (m³/s)	3.370

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	9
COD	9
TSS	9

Distribution of sites by indicator and classification (%)



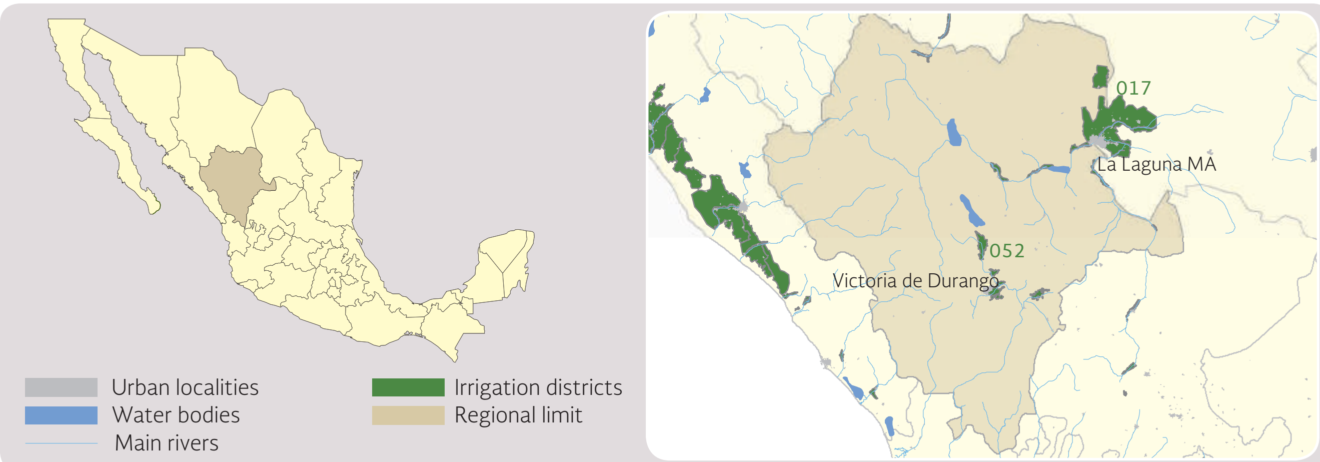
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
State-wide	98.91	96.72	98.83	98.51
Urban	99.09	97.05	98.84	98.54
Rural	66.56	35.67	96.73	93.08

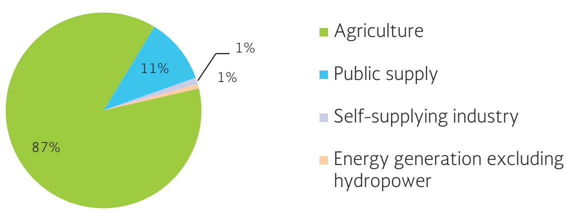
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

10. Durango

Contextual data		Wastewater treatment plants, 2015		
Number of municipalities	39		Municipal	Industrial
Total population, 2015	1 764 726 inhabitants	Number in operation	208	41
Urban	1 229 998 inhabitants	Installed capacity (m^3/s)	4.663	1.077
Rural	534 729 inhabitants	Flow processed (m^3/s)	3.493	0.621
Total population, 2030	1 983 389 inhabitants			
Normal annual precipitation 1981-2010	506 mm			



Uses of water, 2015 (hm^3/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	1 366	744	623
Public supply	170	29	141
Self-supplying industry	17	2	15
Energy generation excluding hydropower	12	0	12
Total	**1 565**	**775**	**790**
Instream uses			
Hydropower (volume allocated)	29		

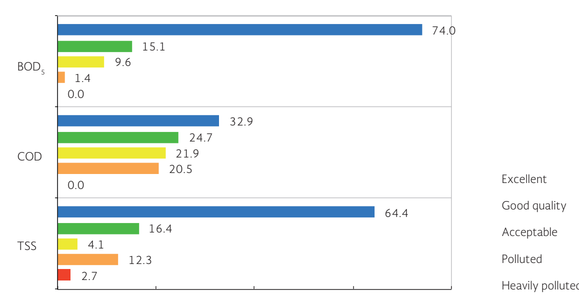
Municipal water treatment plants, 2015

Number in operation	61
Installed capacity (m^3/s)	0.199
Flow processed (m^3/s)	0.195

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	73
COD	73
TSS	73

Distribution of sites by indicator and classification (%)



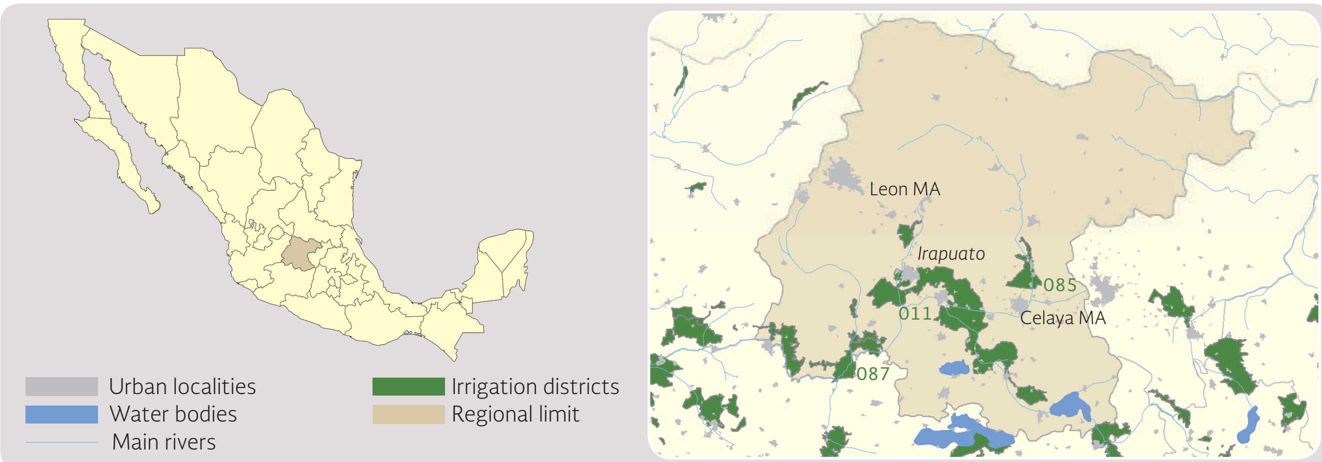
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (CONAGUA)	Access to sewerage and basic sanitation services	Sanitation coverage (CONAGUA)
State-wide	97.33	95.51	91.83	91.18
Urban	99.68	98.79	98.03	97.84
Rural	91.76	87.74	77.14	75.37

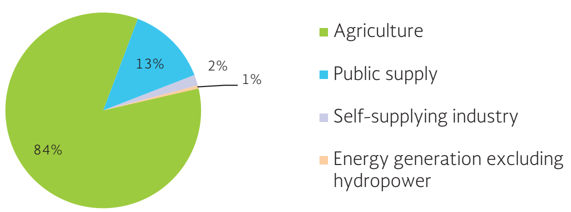
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (CONAGUA) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (CONAGUA) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

11. Guanajuato

Contextual data		Wastewater treatment plants, 2015		
Number of municipalities	46		**Municipal**	**Industrial**
Total population, 2015	5 817 614 inhabitants	Number in operation	76	139
Urban	4 082 389 inhabitants	Installed capacity (m³/s)	7.650	0.803
Rural	1 735 225 inhabitants	Flow processed (m³/s)	5.450	0.733
Total population, 2030	6 361 401 inhabitants			
Normal annual precipitation 1981-2010	605 mm			



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	3 454	1 336	2 118
Public supply	547	94	453
Self-supplying industry	73	<0.5	72
Energy generation excluding hydropower	21	0	21
Total	**4 095**	**1 431**	**2 664**
Instream uses			
Hydropower (volume allocated)	800		

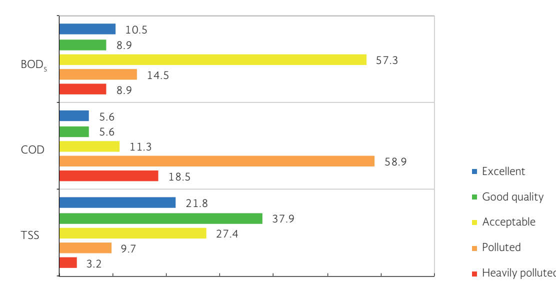
Municipal water treatment plants, 2015

Number in operation	30
Installed capacity (m³/s)	0.680
Flow processed (m³/s)	0.493

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	124
COD	124
TSS	124

Distribution of sites by indicator and classification (%)



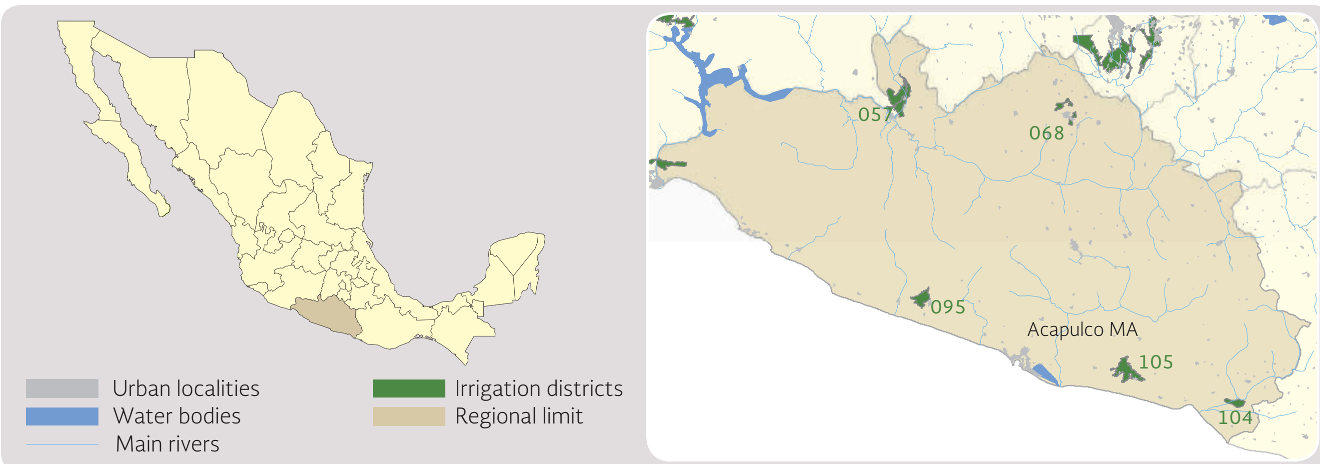
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
State-wide	96.65	94.48	93.90	92.69
Urban	97.92	96.25	98.06	97.38
Rural	93.52	90.15	83.69	81.22

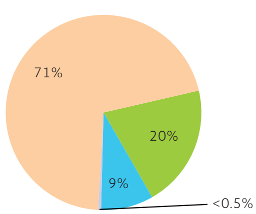
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

12. Guerrero

Contextual data		Wastewater treatment plants, 2015		
Number of municipalities	81		Municipal	Industrial
Total population, 2015	3 568 139 inhabitants	Number in operation	61	7
Urban	2 108 097 inhabitants	Installed capacity (m³/s)	4.404	0.030
Rural	1 460 042 inhabitants	Flow processed (m³/s)	3.721	0.019
Total population, 2030	3 772 110 inhabitants			
Normal annual precipitation 1981-2010	1 160 mm			



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	900	780	121
Public supply	384	212	172
Self-supplying industry	22	<0.5	21
Energy generation excluding hydropower	3 122	3 122	0
Total	**4 429**	**4 114**	**314**
Instream uses			
Hydropower (volume allocated)	15 799		

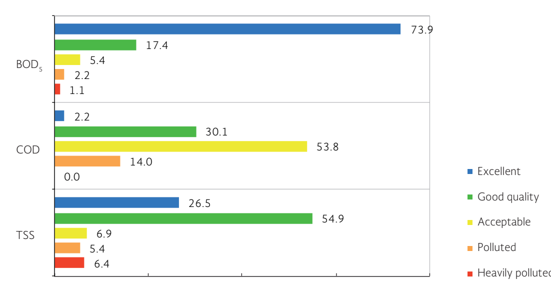
Municipal water treatment plants, 2015

Number in operation	13
Installed capacity (m³/s)	3.548
Flow processed (m³/s)	3.186

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	92
COD	93
TSS	204

Distribution of sites by indicator and classification (%)



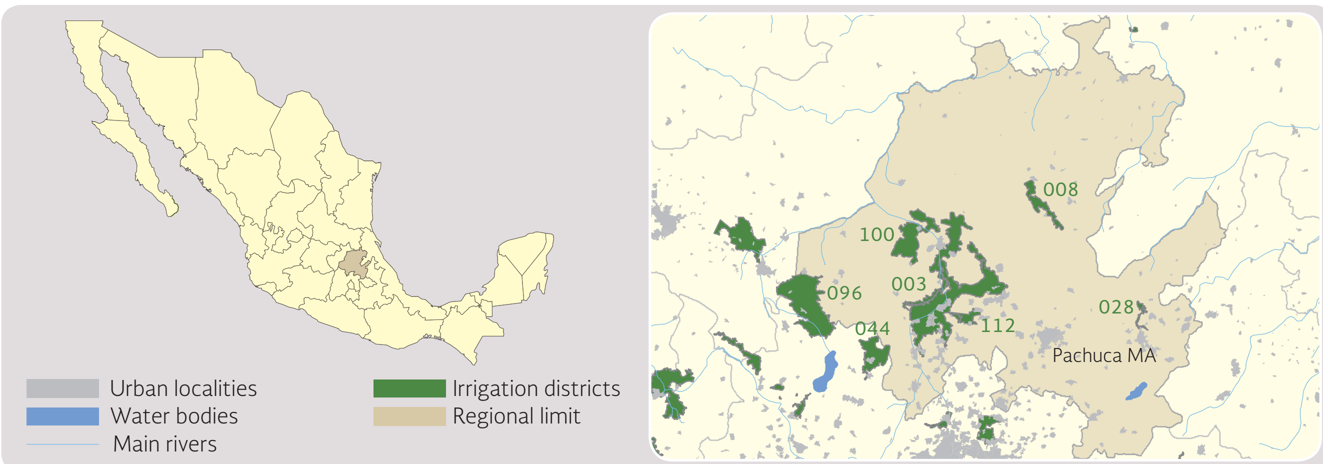
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
State-wide	86.29	80.71	81.74	77.12
Urban	90.41	85.79	94.32	91.71
Rural	80.25	73.25	63.28	55.71

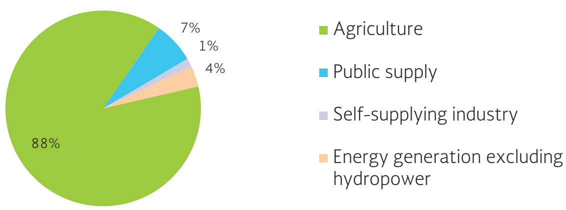
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

13. Hidalgo

Contextual data		Wastewater treatment plants, 2015		
Number of municipalities	84		Municipal	Industrial
Total population, 2015	2 878 369 inhabitants	Number in operation	38	46
Urban	1 577 300 inhabitants	Installed capacity (m³/s)	23.779	1.841
Rural	1 301 069 inhabitants	Flow processed (m³/s)	9.441	1.377
Total population, 2030	3 329 765 inhabitants			
Normal annual precipitation 1981-2010	725 mm			



Uses of water, 2015 (hm³/year)



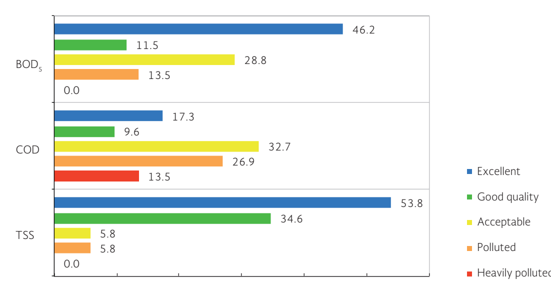
Offstream uses	Total	Surface water	Groundwater
Agriculture	2 093	1 895	199
Public supply	163	39	124
Self-supplying industry	32	14	19
Energy generation excluding hydropower	83	22	61
Total	**2 371**	**1 969**	**402**
Instream uses			
Hydropower (volume allocated)	1 215		

Municipal water treatment plants, 2015	
Number in operation	20
Installed capacity (m³/s)	0.393
Flow processed (m³/s)	0.358

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	52
COD	52
TSS	52

Distribution of sites by indicator and classification (%)



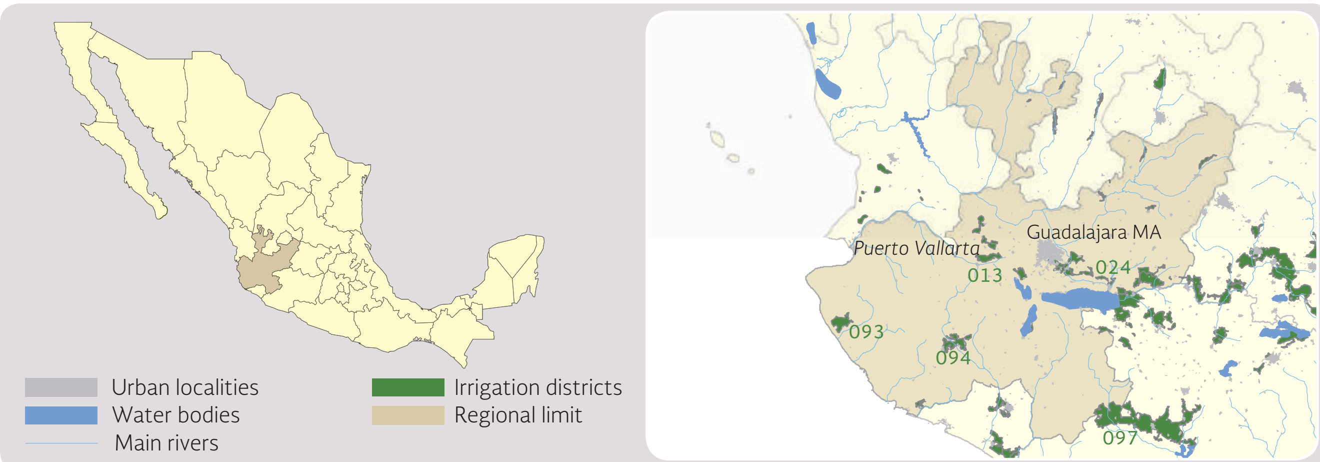
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
State-wide	95.23	91.98	91.09	89.41
Urban	98.52	96.34	97.93	97.08
Rural	91.61	87.19	83.56	80.99

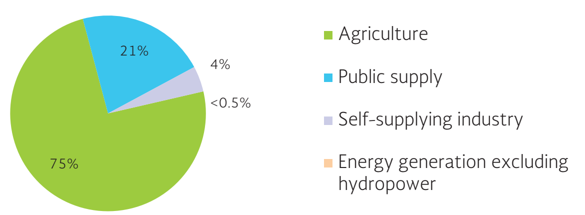
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. “Access to drinking water services” corresponds to the “Drinking water coverage” employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. “Access to sewerage and basic sanitation services” corresponds to the “Sanitation coverage” employed in previous editions of Statistics on Water in Mexico.

14. Jalisco

Contextual data		Wastewater treatment plants, 2015		
Number of municipalities	125		**Municipal**	**Industrial**
Total population, 2015	7 931 267 inhabitants	Number in operation	142	93
Urban	6 906 289 inhabitants	Installed capacity (m³/s)	15.194	1.838
Rural	1 024 978 inhabitants	Flow processed (m³/s)	11.704	1.734
Total population, 2030	9 102 259 inhabitants			
Normal annual precipitation 1981-2010	844 mm			



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	3 712	1 729	1 983
Public supply	1 062	699	363
Self-supplying industry	211	8	203
Energy generation excluding hydropower	<0.5	<0.5	0
Total	**4 985**	**2 436**	**2 549**
Instream uses			
Hydropower (volume allocated)	8 943		

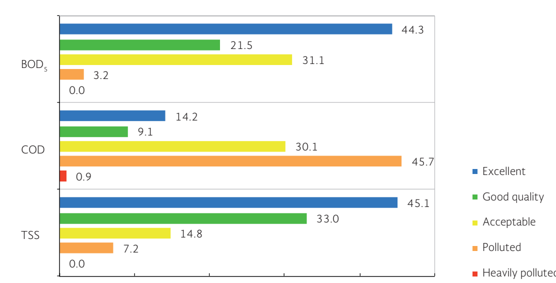
Municipal water treatment plants, 2015

Number in operation	42
Installed capacity (m³/s)	16.281
Flow processed (m³/s)	12.281

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	219
COD	219
TSS	264

Distribution of sites by indicator and classification (%)



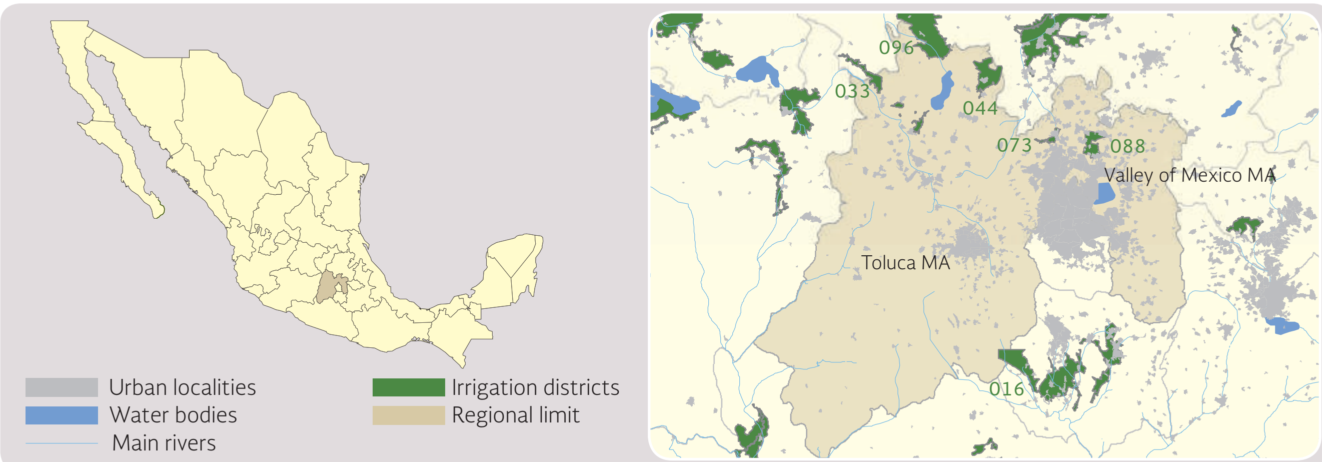
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
State-wide	98.59	96.64	98.17	97.37
Urban	99.11	97.45	99.01	98.68
Rural	95.30	91.39	92.79	89.01

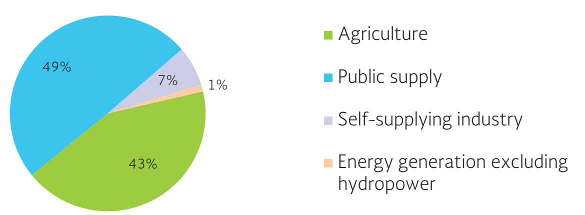
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. “Access to drinking water services” corresponds to the “Drinking water coverage” employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. “Access to sewerage and basic sanitation services” corresponds to the “Sanitation coverage” employed in previous editions of Statistics on Water in Mexico.

15. Mexico

Contextual data		Wastewater treatment plants, 2015		
Number of municipalities	125		**Municipal**	**Industrial**
Total population, 2015	16 870 388 inhabitants	Number in operation	180	262
Urban	14 814 274 inhabitants	Installed capacity (m^3/s)	10.977	3.072
Rural	2 056 115 inhabitants	Flow processed (m^3/s)	7.593	2.200
Total population, 2030	20 167 433 inhabitants			
Normal annual precipitation 1981-2010	900 mm			



Uses of water, 2015 (hm^3/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	1 173	811	363
Public supply	1 358	334	1 024
Self-supplying industry	182	38	144
Energy generation excluding hydropower	31	24	7
Total	**2 744**	**1 206**	**1 538**

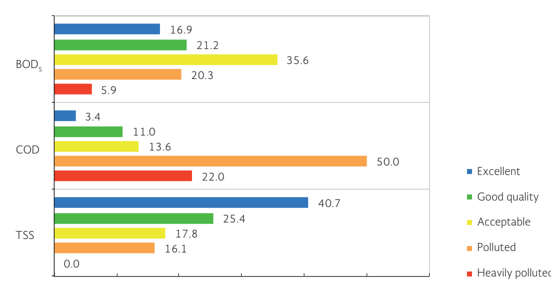
Instream uses	
Hydropower (volume allocated)	2 064

Municipal water treatment plants, 2015	
Number in operation	12
Installed capacity (m^3/s)	22.171
Flow processed (m^3/s)	16.744

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	118
COD	118
TSS	118

Distribution of sites by indicator and classification (%)



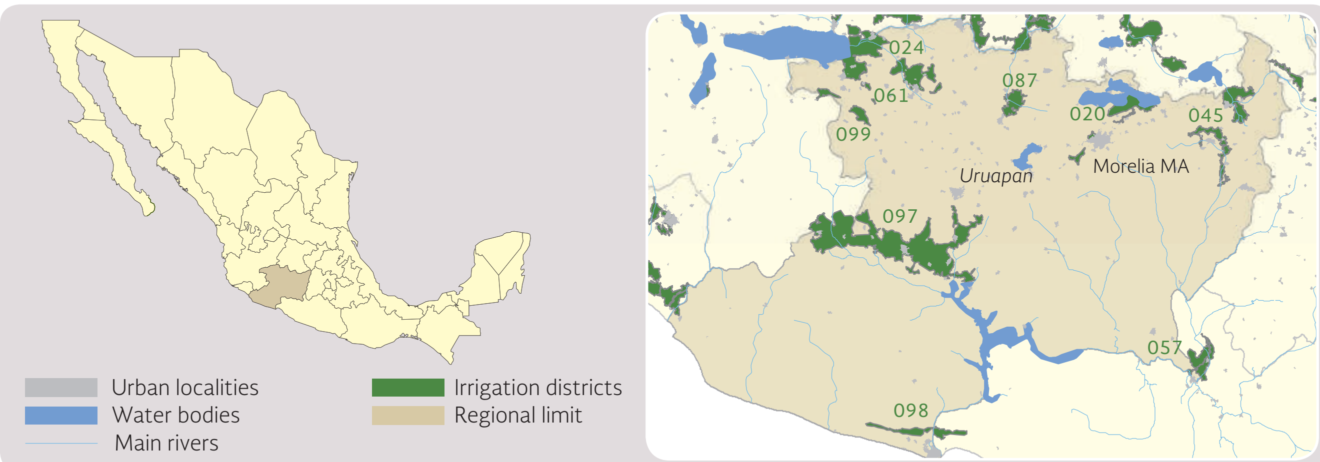
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
State-wide	96.30	93.64	95.54	93.65
Urban	97.51	95.31	97.70	96.54
Rural	88.83	83.24	82.20	75.77

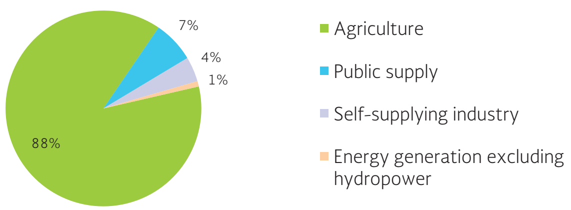
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

16. Michoacan de Ocampo

Contextual data		Wastewater treatment plants, 2015		
Number of municipalities	113		Municipal	Industrial
Total population, 2015	4 596 499 inhabitants	Number in operation	37	104
Urban	3 149 935 inhabitants	Installed capacity (m³/s)	4.090	5.683
Rural	1 446 564 inhabitants	Flow processed (m³/s)	3.342	5.240
Total population, 2030	4 960 773 inhabitants			
Normal annual precipitation 1981-2010	848 mm			



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	4 792	3 717	1 075
Public supply	373	208	165
Self-supplying industry	224	186	38
Energy generation excluding hydropower	48	0	48
Total	**5 437**	**4 111**	**1 325**

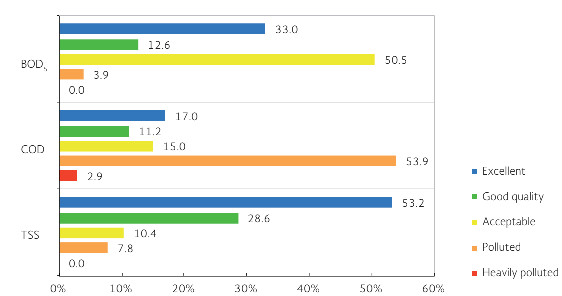
Instream uses	
Hydropower (volume allocated)	26 241

Municipal water treatment plants, 2015	
Number in operation	4
Installed capacity (m³/s)	2.690
Flow processed (m³/s)	2.060

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	206
COD	206
TSS	231

Distribution of sites by indicator and classification (%)



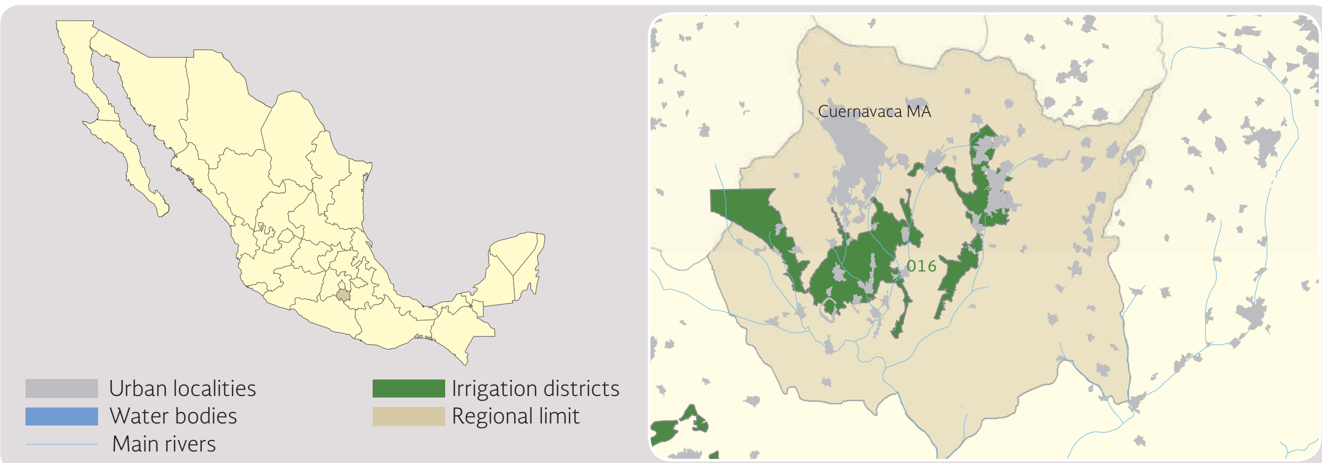
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (CONAGUA)	Access to sewerage and basic sanitation services	Sanitation coverage (CONAGUA)
State-wide	96.84	93.63	92.20	89.32
Urban	98.04	95.83	95.79	94.08
Rural	94.23	88.81	84.33	78.87

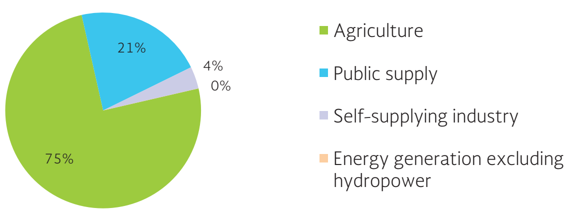
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (CONAGUA) for tap water from the public network, community or private well or public faucet. “Access to drinking water services” corresponds to the “Drinking water coverage” employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (CONAGUA) to distinguish the population that has sewerage through a public network or septic tank. “Access to sewerage and basic sanitation services” corresponds to the “Sanitation coverage” employed in previous editions of Statistics on Water in Mexico.

17. Morelos

Contextual data		Wastewater treatment plants, 2015		
Number of municipalities	33		**Municipal**	**Industrial**
Total population, 2015	1 920 350 inhabitants	Number in operation	49	97
Urban	1 600 046 inhabitants	Installed capacity (m³/s)	2.838	2.127
Rural	320 304 inhabitants	Flow processed (m³/s)	1.538	2.094
Total population, 2030	2 222 863 inhabitants			
Normal annual precipitation 1981-2010	1 000 mm			



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	986	877	109
Public supply	279	36	243
Self-supplying industry	48	25	23
Energy generation excluding hydropower	0	0	0
Total	**1 314**	**938**	**376**
Instream uses			
Hydropower (volume allocated)	0		

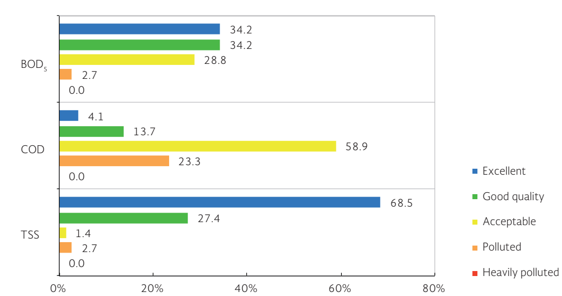
Municipal water treatment plants, 2015

Number in operation	3
Installed capacity (m³/s)	0.006
Flow processed (m³/s)	0.003

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	73
COD	73
TSS	73

Distribution of sites by indicator and classification (%)



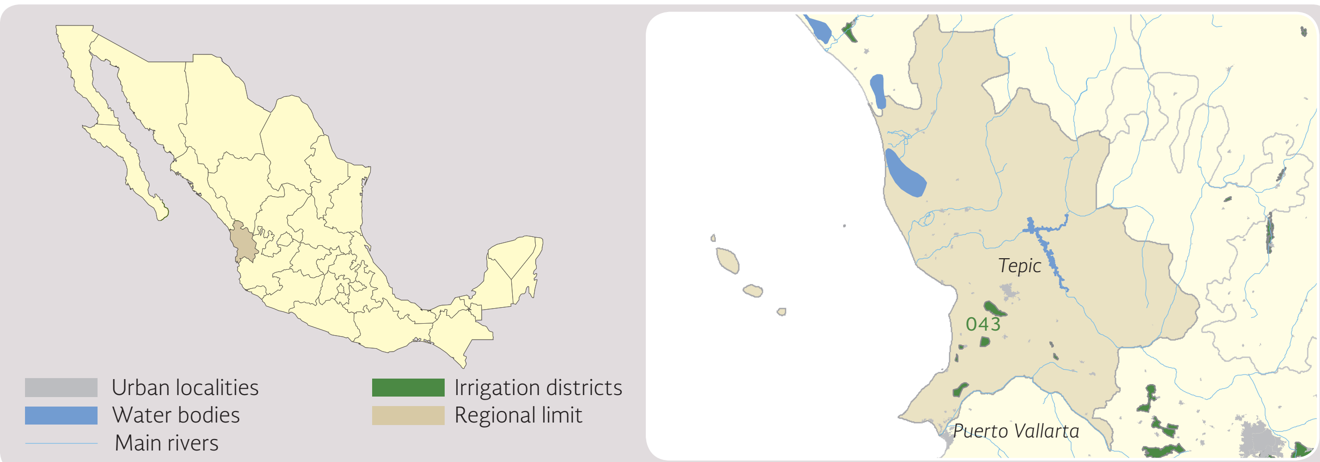
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (CONAGUA)	Access to sewerage and basic sanitation services	Sanitation coverage (CONAGUA)
State-wide	95.46	90.52	97.34	95.75
Urban	98.04	94.44	98.46	96.91
Rural	83.19	71.87	91.99	90.19

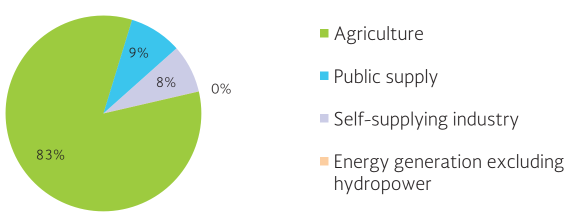
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (CONAGUA) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (CONAGUA) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

18. Nayarit

Contextual data		Wastewater treatment plants, 2015		
Number of municipalities	20		**Municipal**	**Industrial**
Total population, 2015	1 223 797 inhabitants	Number in operation	70	16
Urban	857 219 inhabitants	Installed capacity (m³/s)	3.467	0.803
Rural	366 578 inhabitants	Flow processed (m³/s)	2.506	0.803
Total population, 2030	1 544 709 inhabitants			
Normal annual precipitation 1981-2010	1 227 mm			



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	1 111	984	127
Public supply	116	20	95
Self-supplying industry	106	22	84
Energy generation excluding hydropower	0	0	0
Total	**1 333**	**1 027**	**306**

Instream uses	
Hydropower (volume allocated)	15 301

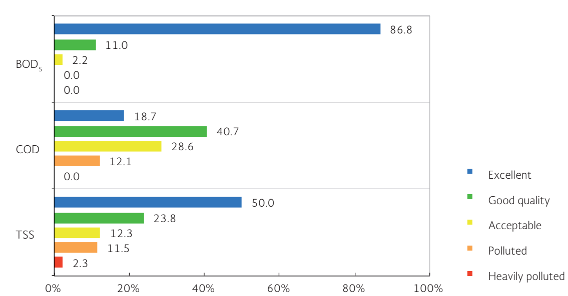
Municipal water treatment plants, 2015

Number in operation	0
Installed capacity (m³/s)	0.000
Flow processed (m³/s)	0.000

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	91
COD	91
TSS	130

Distribution of sites by indicator and classification (%)



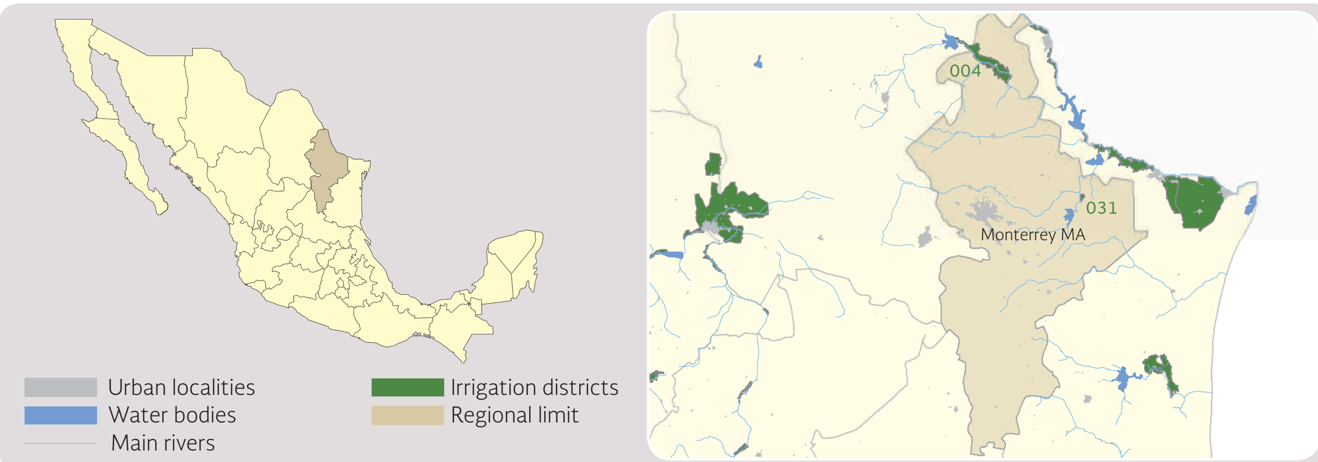
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (CONAGUA)	Access to sewerage and basic sanitation services	Sanitation coverage (CONAGUA)
State-wide	96.66	94.39	94.04	93.44
Urban	99.39	98.26	98.67	98.43
Rural	90.46	85.65	83.57	82.18

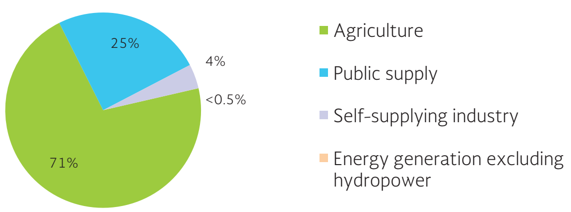
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (CONAGUA) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (CONAGUA) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

19. Nuevo Leon

Contextual data		Wastewater treatment plants, 2015		
Number of municipalities	51		**Municipal**	**Industrial**
Total population, 2015	5 085 848 inhabitants	Number in operation	52	187
Urban	4 809 752 inhabitants	Installed capacity (m³/s)	14.610	4.092
Rural	276 096 inhabitants	Flow processed (m³/s)	11.231	2.957
Total population, 2030	6 097 769 inhabitants			
Normal annual precipitation 1981-2010	542 mm			



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	1 473	828	645
Public supply	512	356	156
Self-supplying industry	83	0	83
Energy generation excluding hydropower	<0.5	0	<0.5
Total	**2 069**	**1 184**	**885**
Instream uses			
Hydropower (volume allocated)		0	

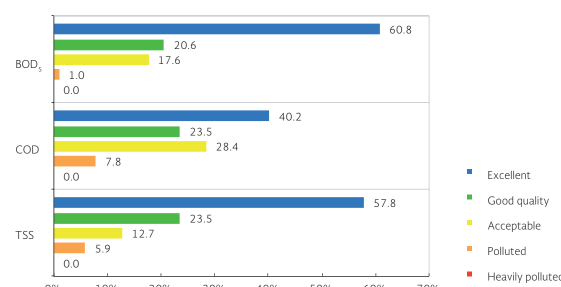
Municipal water treatment plants, 2015

Number in operation	13
Installed capacity (m³/s)	15.348
Flow processed (m³/s)	6.082

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	102
COD	102
TSS	102

Distribution of sites by indicator and classification (%)

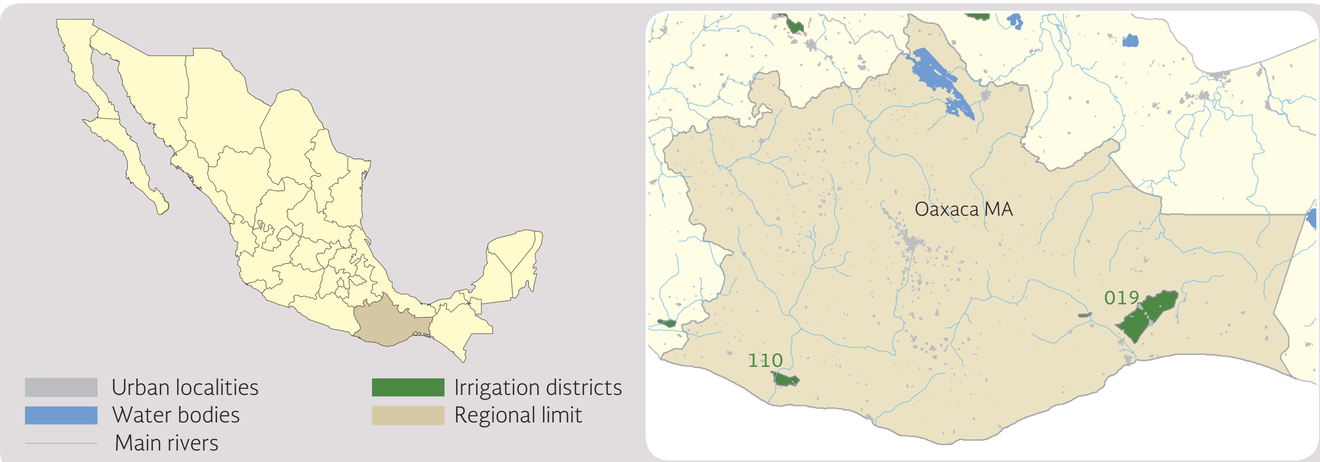


Coverage, 2015 (%)

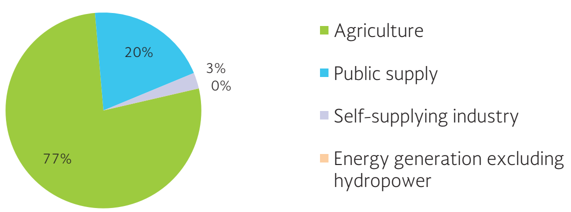
	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
State-wide	98.80	97.32	97.64	97.55
Urban	99.36	98.10	98.75	98.67
Rural	90.31	85.48	80.85	80.54

Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

20. Oaxaca				
Contextual data		**Wastewater treatment plants, 2015**		
Number of municipalities	570		**Municipal**	**Industrial**
Total population, 2015	4 012 295 inhabitants	Number in operation	70	19
Urban	1 926 358 inhabitants	Installed capacity (m^3/s)	1.531	5.701
Rural	2 085 937 inhabitants	Flow processed (m^3/s)	1.005	5.382
Total population, 2030	4 293 423 inhabitants			
Normal annual precipitation 1981-2010	977 mm			



Uses of water, 2015 (hm^3/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	1 021	774	247
Public supply	266	140	126
Self-supplying industry	35	8	26
Energy generation excluding hydropower	0	0	0
Total	**1 322**	**923**	**400**
Instream uses			
Hydropower (volume allocated)	16 869		

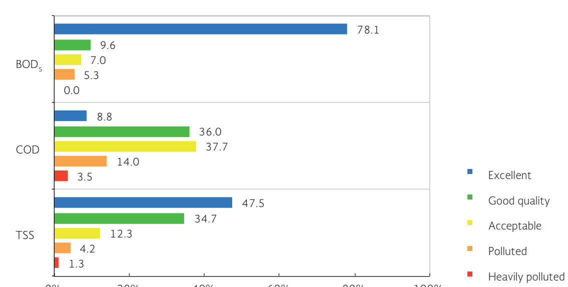
Municipal water treatment plants, 2015

Number in operation	16
Installed capacity (m^3/s)	1.516
Flow processed (m^3/s)	0.949

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	114
COD	114
TSS	236

Distribution of sites by indicator and classification (%)



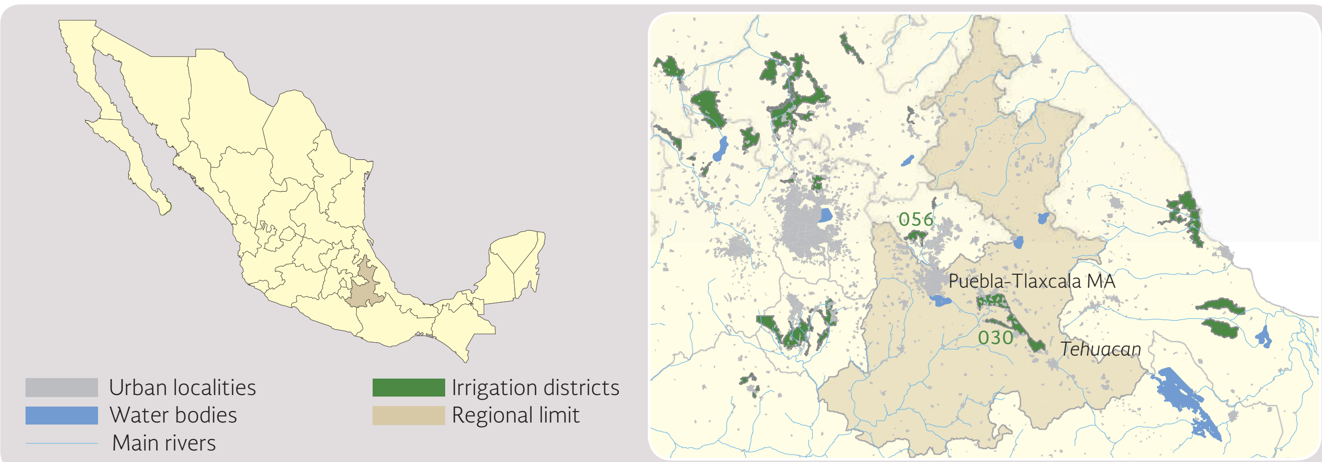
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (CONAGUA)	Access to sewerage and basic sanitation services	Sanitation coverage (CONAGUA)
State-wide	86.88	82.46	73.38	71.76
Urban	91.64	88.46	89.51	88.36
Rural	82.42	76.83	58.24	56.18

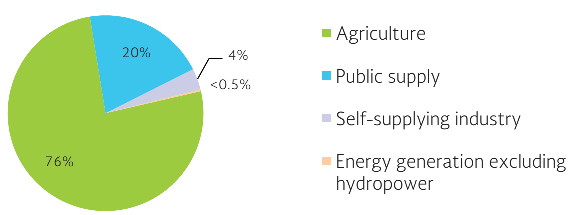
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (CONAGUA) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (CONAGUA) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

21. Puebla

Contextual data		Wastewater treatment plants, 2015		
Number of municipalities	217		**Municipal**	**Industrial**
Total population, 2015	6 193 836 inhabitants	Number in operation	78	216
Urban	4 495 490 inhabitants	Installed capacity (m^3/s)	3.420	0.936
Rural	1 698 346 inhabitants	Flow processed (m^3/s)	3.532	0.759
Total population, 2030	6 942 481 inhabitants			
Normal annual precipitation 1981-2010	947 mm			



Uses of water, 2015 (hm^3/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	1 614	1 000	614
Public supply	428	178	250
Self-supplying industry	74	31	43
Energy generation excluding hydropower	6	0	6
Total	**2 123**	**1 208**	**914**
Instream uses			
Hydropower (volume allocated)	4 960		

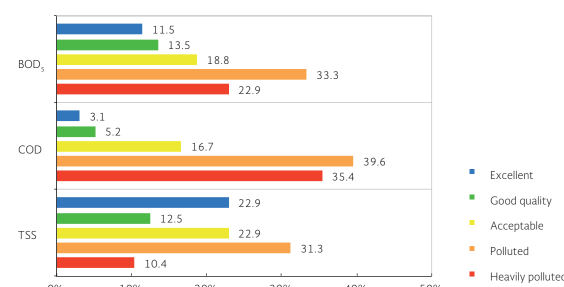
Municipal water treatment plants, 2015

Number in operation	5
Installed capacity (m^3/s)	0.815
Flow processed (m^3/s)	0.515

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	96
COD	96
TSS	96

Distribution of sites by indicator and classification (%)



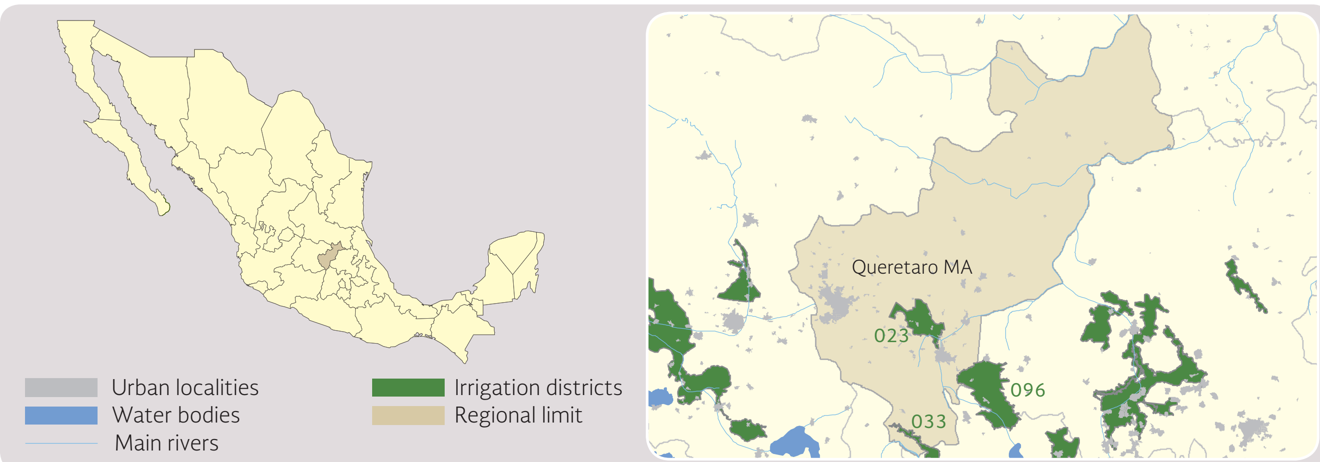
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
State-wide	93.87	89.39	90.83	88.79
Urban	96.24	91.93	95.90	94.40
Rural	87.75	82.86	77.77	74.31

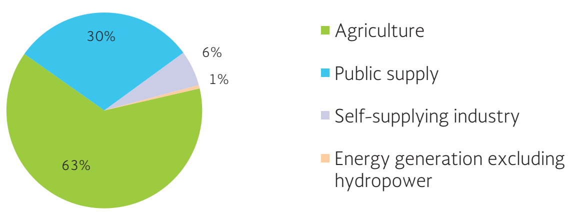
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

22. Queretaro

Contextual data		Wastewater treatment plants, 2015		
Number of municipalities	18		Municipal	Industrial
Total population, 2015	2 004 472 inhabitants	Number in operation	51	156
Urban	1 423 204 inhabitants	Installed capacity (m³/s)	2.449	1.246
Rural	581 268 inhabitants	Flow processed (m³/s)	1.732	0.662
Total population, 2030	2 403 016 inhabitants			
Normal annual precipitation 1981-2010	609 mm			



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	640	172	469
Public supply	305	152	153
Self-supplying industry	59	1	58
Energy generation excluding hydropower	6	0	6
Total	**1 010**	**324**	**686**
Instream uses			
Hydropower (volume allocated)	18		

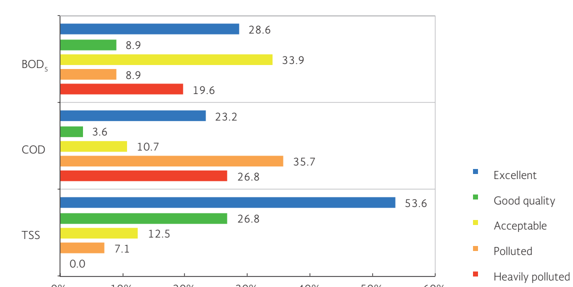
Municipal water treatment plants, 2015

Number in operation	5
Installed capacity (m³/s)	1.602
Flow processed (m³/s)	1.592

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	56
COD	56
TSS	56

Distribution of sites by indicator and classification (%)



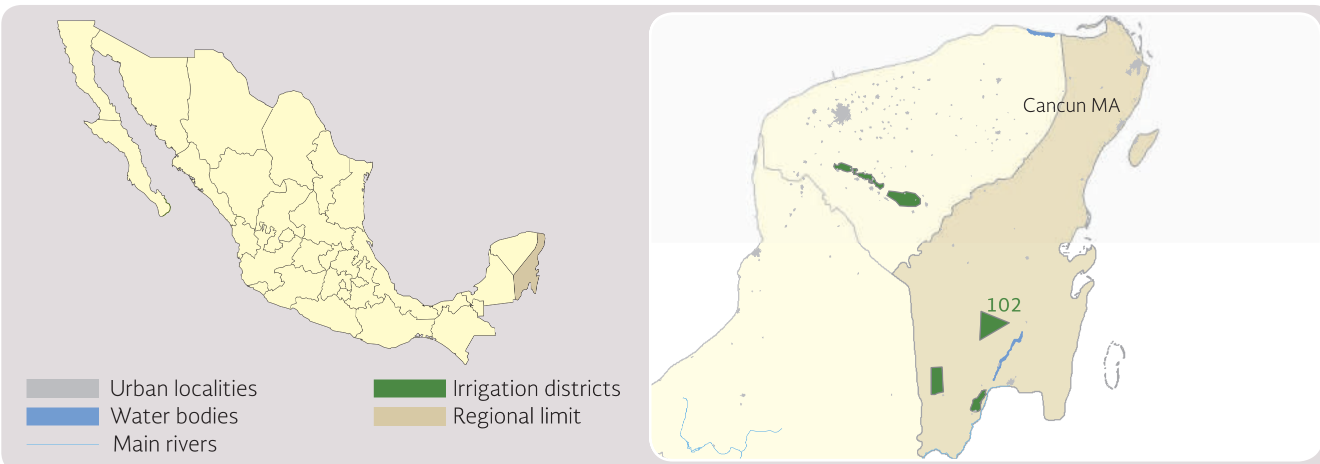
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
State-wide	97.62	95.10	95.08	94.64
Urban	99.25	97.81	98.34	98.25
Rural	94.04	89.12	87.91	86.67

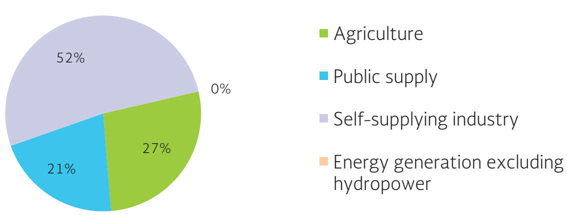
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

23. Quintana Roo

Contextual data		Wastewater treatment plants, 2015		
Number of municipalities	10		Municipal	Industrial
Total population, 2015	1 574 824 inhabitants	Number in operation	36	4
Urban	1 388 781 inhabitants	Installed capacity (m³/s)	2.581	0.060
Rural	186 043 inhabitants	Flow processed (m³/s)	1.774	0.055
Total population, 2030	2 232 702 inhabitants			
Normal annual precipitation 1981-2010	1 267 mm			



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	277	1	276
Public supply	212	<0.5	212
Self-supplying industry	525	<0.5	525
Energy generation excluding hydropower	0	0	0
Total	**1 015**	**1**	**1 014**
Instream uses			
Hydropower (volume allocated)		0	

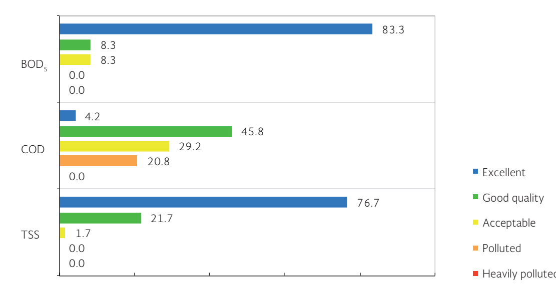
Municipal water treatment plants, 2015

Number in operation	0
Installed capacity (m³/s)	0.000
Flow processed (m³/s)	0.000

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	24
COD	24
TSS	120

Distribution of sites by indicator and classification (%)



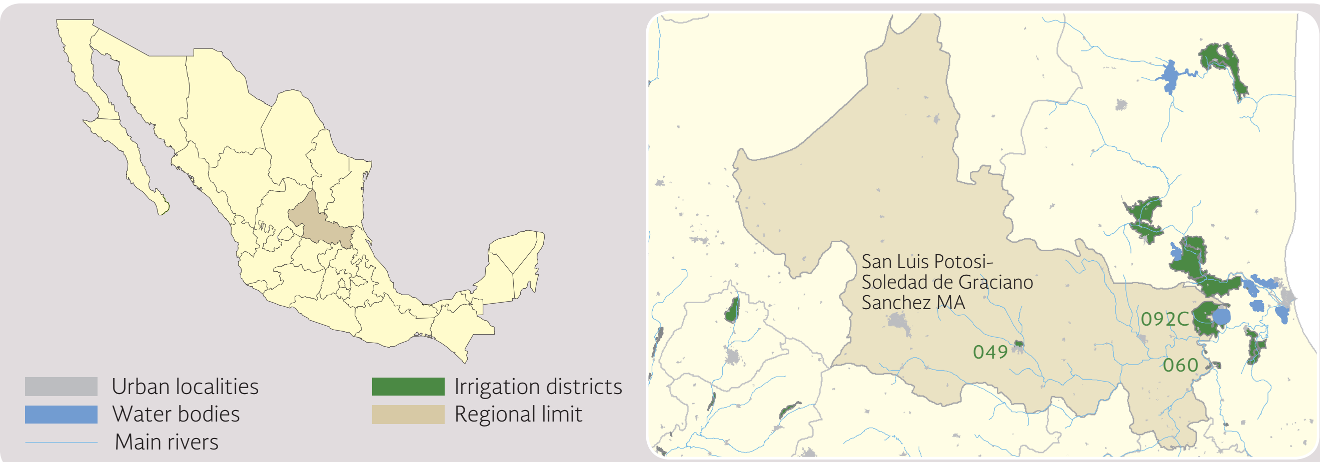
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
State-wide	98.13	96.15	96.69	95.88
Urban	98.30	96.39	98.80	97.98
Rural	96.75	94.24	79.79	79.05

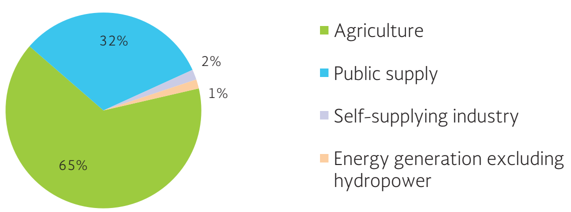
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

24. San Luis Potosi

Contextual data		Wastewater treatment plants, 2015		
Number of municipalities	58		**Municipal**	**Industrial**
Total population, 2015	2 753 478 inhabitants	Number in operation	43	63
Urban	1 790 013 inhabitants	Installed capacity (m³/s)	2.579	0.987
Rural	963 465 inhabitants	Flow processed (m³/s)	2.143	0.592
Total population, 2030	3 055 130 inhabitants			
Normal annual precipitation 1981-2010	853 mm			



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	1 338	774	564
Public supply	655	504	151
Self-supplying industry	35	12	22
Energy generation excluding hydropower	31	14	17
Total	**2 059**	**1 304**	**754**
Instream uses			
Hydropower (volume allocated)		390	

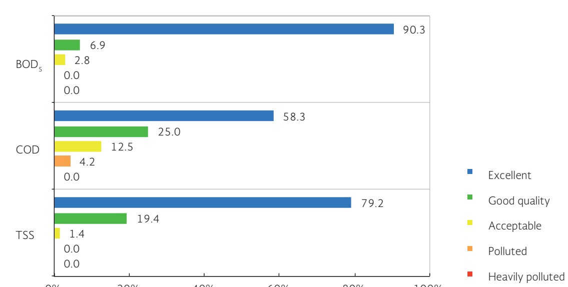
Municipal water treatment plants, 2015

Number in operation	15
Installed capacity (m³/s)	2.315
Flow processed (m³/s)	1.307

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	72
COD	72
TSS	72

Distribution of sites by indicator and classification (%)



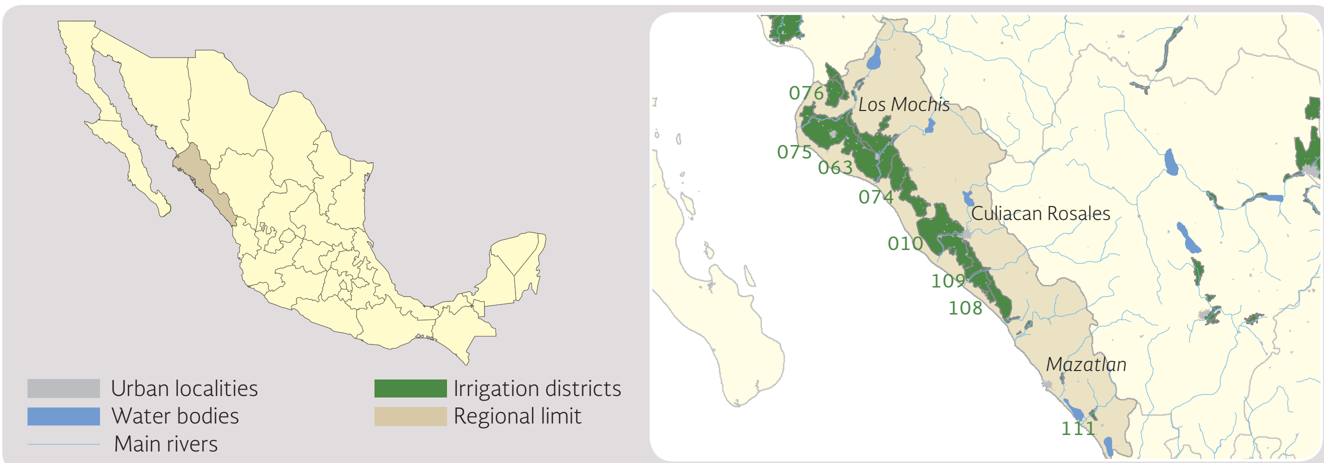
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
State-wide	90.72	87.49	86.01	85.25
Urban	98.08	95.85	97.06	96.89
Rural	77.10	72.04	65.56	63.71

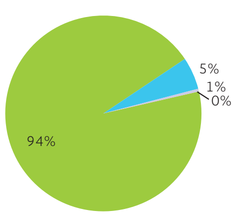
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. “Access to drinking water services” corresponds to the “Drinking water coverage” employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. “Access to sewerage and basic sanitation services” corresponds to the “Sanitation coverage” employed in previous editions of Statistics on Water in Mexico.

25. Sinaloa

Contextual data		Wastewater treatment plants, 2015		
Number of municipalities	18		**Municipal**	**Industrial**
Total population, 2015	2 984 571 inhabitants	Number in operation	256	96
Urban	2 216 210 inhabitants	Installed capacity (m³/s)	6.697	8.370
Rural	768 362 inhabitants	Flow processed (m³/s)	5.360	5.066
Total population, 2030	3 302 931 inhabitants			
Normal annual precipitation 1981-2010	728 mm			



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	8 990	8 152	838
Public supply	509	280	229
Self-supplying industry	43	35	8
Energy generation excluding hydropower	0	0	0
Total	**9 542**	**8 467**	**1 075**
Instream uses			
Hydropower (volume allocated)	10 982		

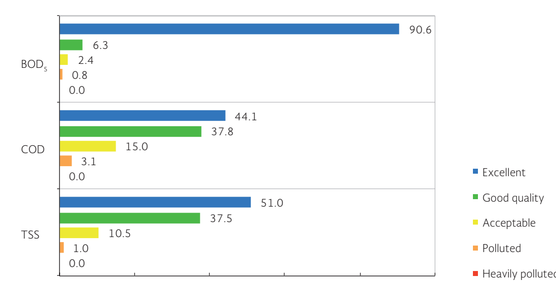
Municipal water treatment plants, 2015

Number in operation	143
Installed capacity (m³/s)	9.364
Flow processed (m³/s)	8.332

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	127
COD	127
TSS	200

Distribution of sites by indicator and classification (%)



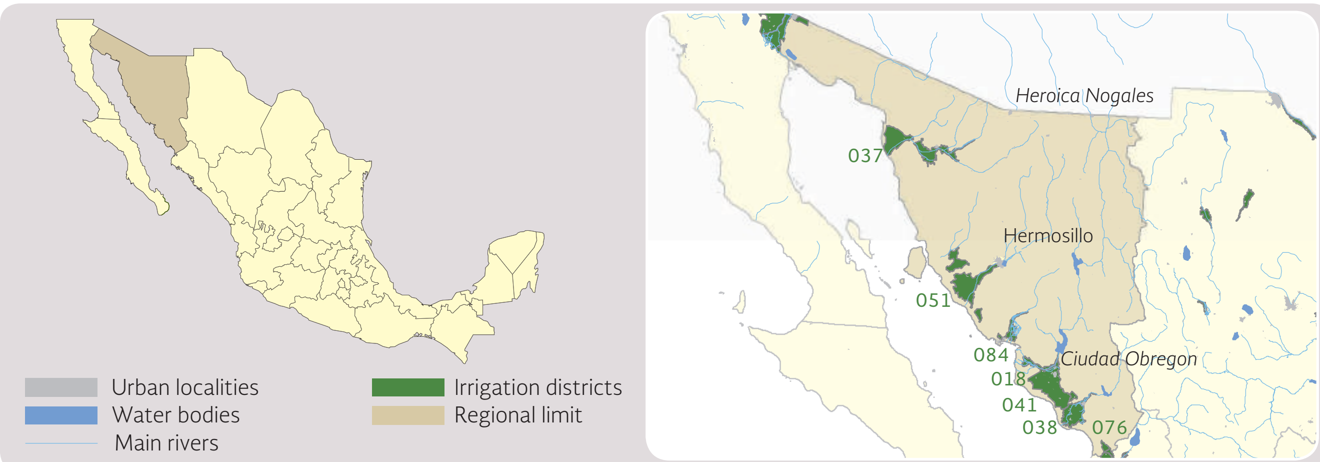
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (CONAGUA)	Access to sewerage and basic sanitation services	Sanitation coverage (CONAGUA)
State-wide	98.17	95.68	93.96	92.85
Urban	99.54	97.73	97.73	97.01
Rural	94.15	89.67	82.97	80.70

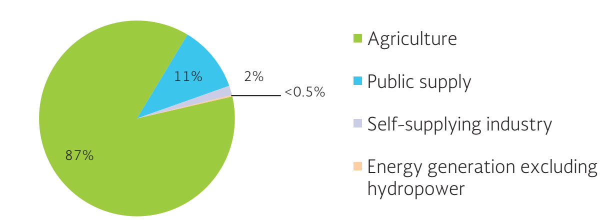
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (CONAGUA) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (CONAGUA) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

26. Sonora

Contextual data		Wastewater treatment plants, 2015		
Number of municipalities	72		**Municipal**	**Industrial**
Total population, 2015	2 932 821 inhabitants	Number in operation	82	236
Urban	2 525 775 inhabitants	Installed capacity (m³/s)	5.408	6.463
Rural	407 046 inhabitants	Flow processed (m³/s)	3.651	6.260
Total population, 2030	3 476 930 inhabitants			
Normal annual precipitation 1981-2010	465 mm			



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	6 131	3 950	2 180
Public supply	770	277	493
Self-supplying industry	110	4	106
Energy generation excluding hydropower	16	7	9
Total	**7 027**	**4 239**	**2 789**
Instream uses			
Hydropower (volume allocated)	5 214		

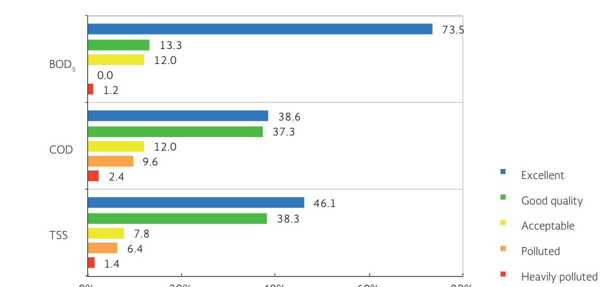
Municipal water treatment plants, 2015

Number in operation	24
Installed capacity (m³/s)	5.577
Flow processed (m³/s)	2.293

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	83
COD	83
TSS	141

Distribution of sites by indicator and classification (%)



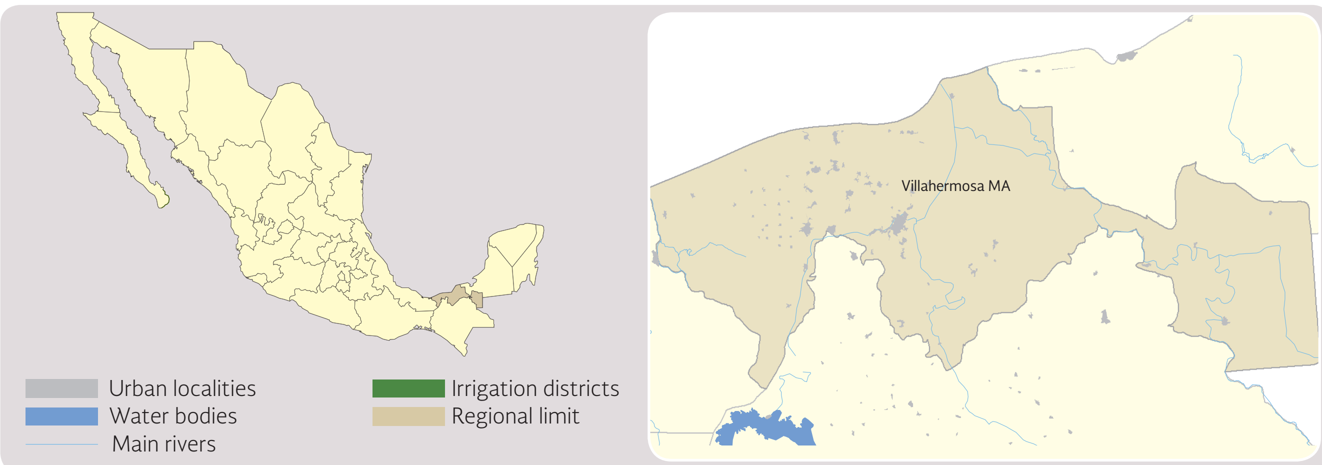
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
State-wide	97.56	95.50	91.93	91.72
Urban	97.98	96.21	95.88	95.79
Rural	94.58	90.54	64.51	63.40

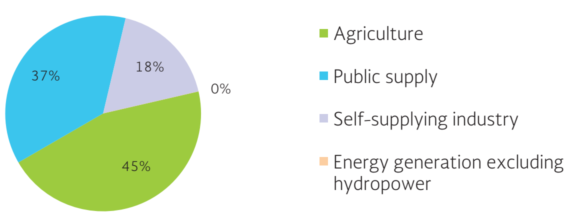
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

27. Tabasco

Contextual data		Wastewater treatment plants, 2015		
Number of municipalities	17		**Municipal**	**Industrial**
Total population, 2015	2 383 900 inhabitants	Number in operation	80	118
Urban	1 392 200 inhabitants	Installed capacity (m³/s)	2.816	0.934
Rural	991 700 inhabitants	Flow processed (m³/s)	1.765	0.919
Total population, 2030	2 687 426 inhabitants			
Normal annual precipitation 1981-2010	2 184 mm			



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	225	101	124
Public supply	184	107	77
Self-supplying industry	88	59	29
Energy generation excluding hydropower	0	0	0
Total	**496**	**267**	**230**
Instream uses			
Hydropower (volume allocated)	0		

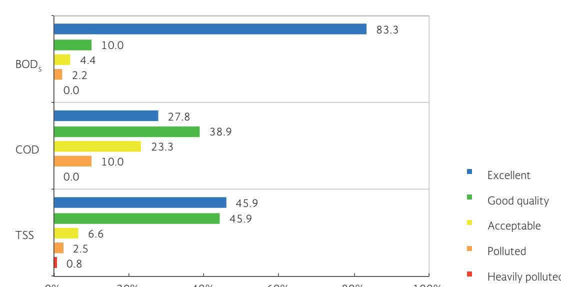
Municipal water treatment plants, 2015

Number in operation	39
Installed capacity (m³/s)	9.960
Flow processed (m³/s)	8.465

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	90
COD	90
TSS	122

Distribution of sites by indicator and classification (%)



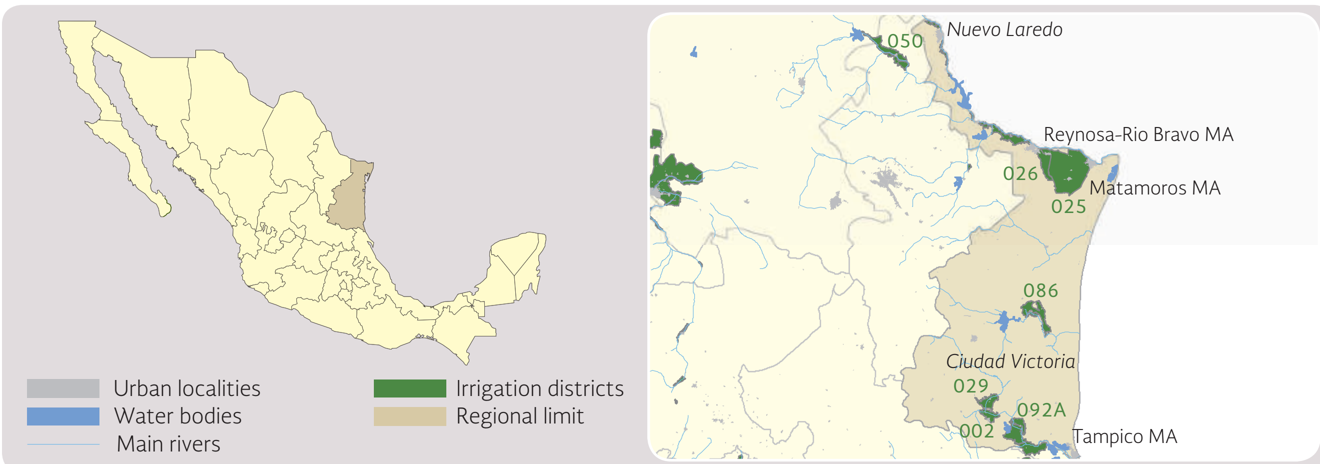
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
State-wide	91.44	88.86	97.27	95.50
Urban	96.87	94.89	98.42	97.13
Rural	83.57	80.11	95.61	93.14

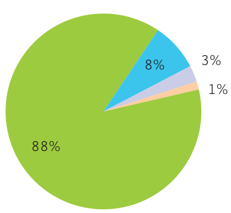
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

28. Tamaulipas

Contextual data		Wastewater treatment plants, 2015		
Number of municipalities	43		**Municipal**	**Industrial**
Total population, 2015	3 543 366 inhabitants	Number in operation	40	109
Urban	3 103 421 inhabitants	Installed capacity (m³/s)	7.840	8.468
Rural	439 944 inhabitants	Flow processed (m³/s)	5.392	7.879
Total population, 2030	4 069 115 inhabitants			
Normal annual precipitation 1981-2010	783 mm			



Uses of water, 2015 (hm³/year)



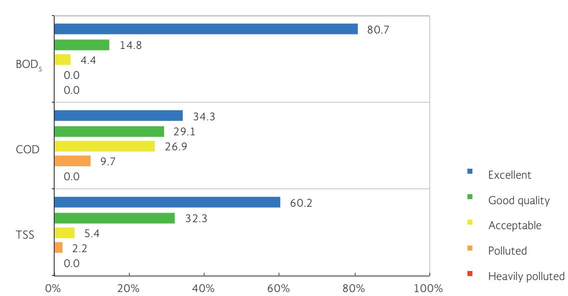
Offstream uses	Total	Surface water	Groundwater
Agriculture	3 710	3 309	401
Public supply	335	293	42
Self-supplying industry	115	100	15
Energy generation excluding hydropower	55	52	3
Total	**4 215**	**3 754**	**461**
Instream uses			
Hydropower (volume allocated)	2 181		

Municipal water treatment plants, 2015	
Number in operation	54
Installed capacity (m³/s)	15.091
Flow processed (m³/s)	11.899

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	135
COD	134
TSS	186

Distribution of sites by indicator and classification (%)



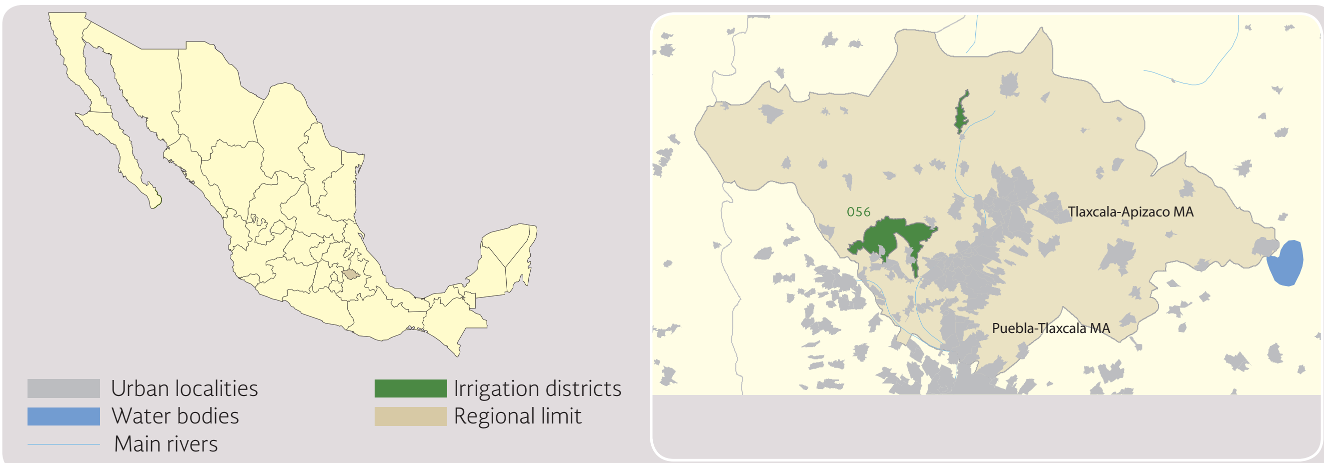
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
State-wide	98.02	96.21	91.21	91.06
Urban	99.30	97.88	96.21	96.10
Rural	87.76	82.76	50.87	50.40

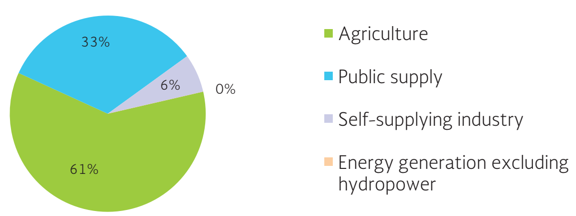
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

29. Tlaxcala

Contextual data		Wastewater treatment plants, 2015		
Number of municipalities	60		Municipal	Industrial
Total population, 2015	1 278 308 inhabitants	Number in operation	56	72
Urban	1 032 031 inhabitants	Installed capacity (m³/s)	1.122	0.703
Rural	246 277 inhabitants	Flow processed (m³/s)	0.614	0.372
Total population, 2030	1 516 712 inhabitants			
Normal annual precipitation 1981-2010	703 mm			



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	163	59	104
Public supply	90	8	81
Self-supplying industry	17	<0.5	17
Energy generation excluding hydropower	0	0	0
Total	**270**	**67**	**203**
Instream uses			
Hydropower (volume allocated)	0		

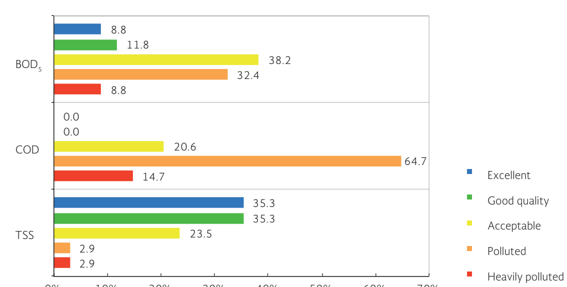
Municipal water treatment plants, 2015

Number in operation	0
Installed capacity (m³/s)	0.000
Flow processed (m³/s)	0.000

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	34
COD	34
TSS	34

Distribution of sites by indicator and classification (%)



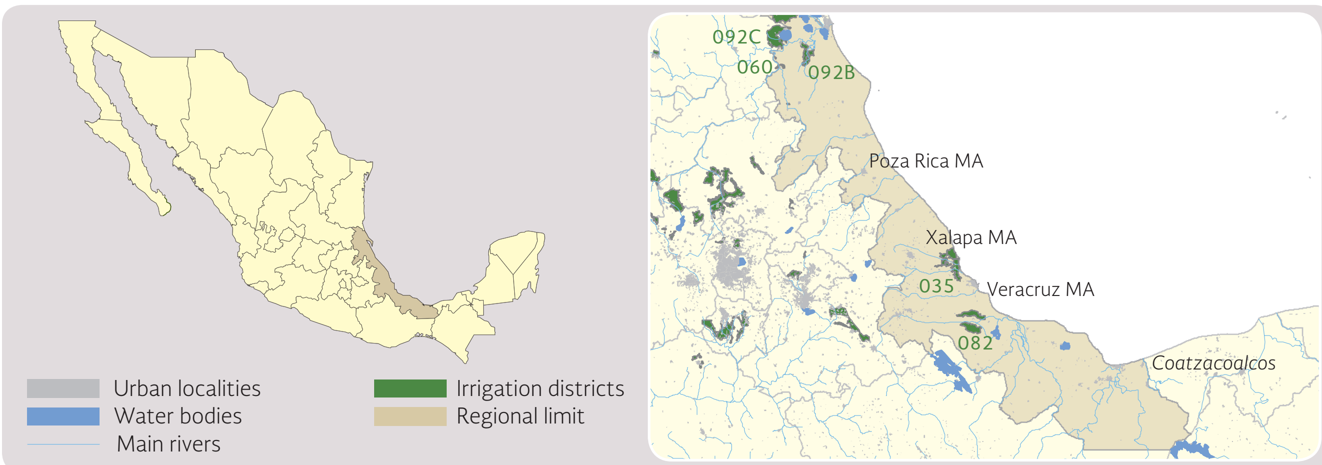
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
State-wide	99.26	97.85	96.69	95.54
Urban	99.40	98.23	97.72	96.80
Rural	98.72	96.36	92.63	90.54

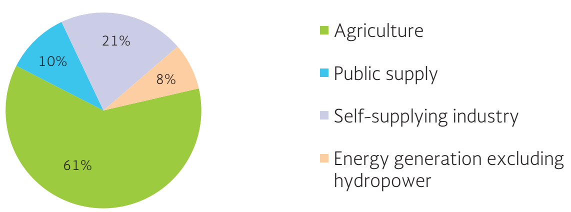
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

30. Veracruz de Ignacio de la Llave

Contextual data		Wastewater treatment plants, 2015		
Number of municipalities	212		**Municipal**	**Industrial**
Total population, 2015	8 046 828 inhabitants	Number in operation	118	156
Urban	4 960 760 inhabitants	Installed capacity (m^3/s)	7.422	12.751
Rural	3 086 068 inhabitants	Flow processed (m^3/s)	5.754	9.404
Total population, 2030	8 781 620 inhabitants			
Normal annual precipitation 1981-2010	1 544 mm			



Uses of water, 2015 (hm^3/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	3 233	2 425	807
Public supply	551	320	231
Self-supplying industry	1 095	974	121
Energy generation excluding hydropower	408	406	1
Total	**5 287**	**4 126**	**1 161**
Instream uses			
Hydropower (volume allocated)	4 185		

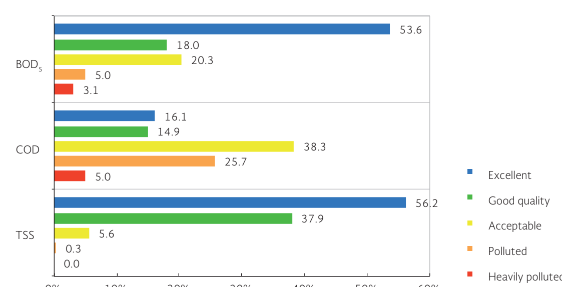
Municipal water treatment plants, 2015

Number in operation	16
Installed capacity (m^3/s)	7.580
Flow processed (m^3/s)	5.281

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	261
COD	261
TSS	340

Distribution of sites by indicator and classification (%)



Coverage, 2015 (%)

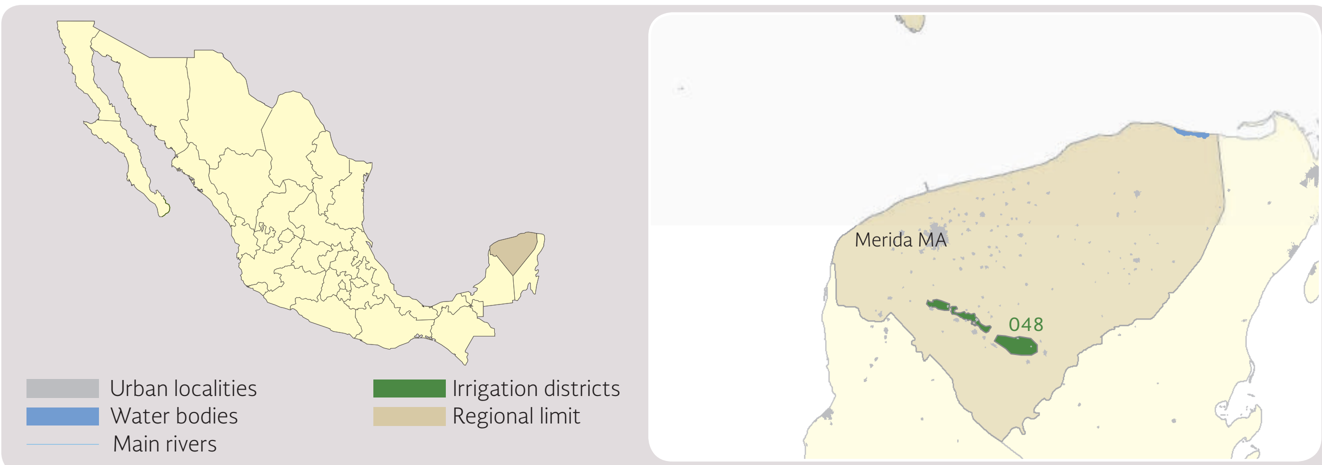
	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
State-wide	88.10	84.05	87.56	84.34
Urban	95.19	92.90	97.16	94.70
Rural	76.95	70.11	72.44	68.05

Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

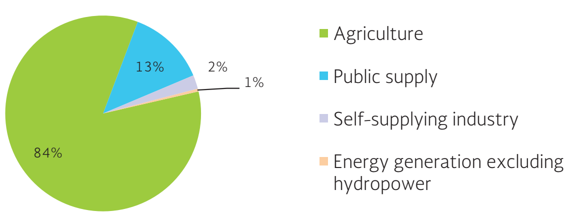
31. Yucatan

Contextual data	
Number of municipalities	106
Total population, 2015	2 118 762 inhabitants
Urban	1 805 663 inhabitants
Rural	313 099 inhabitants
Total population, 2030	2 503 132 inhabitants
Normal annual precipitation 1981-2010	1 056 mm

Wastewater treatment plants, 2015	Municipal	Industrial
Number in operation	26	80
Installed capacity (m³/s)	0.416	0.327
Flow processed (m³/s)	0.184	0.206



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	1 673	0	1 673
Public supply	256	0	256
Self-supplying industry	45	0	45
Energy generation excluding hydropower	9	0	9
Total	**1 983**	**0**	**1 983**
Instream uses			
Hydropower (volume allocated)		0	

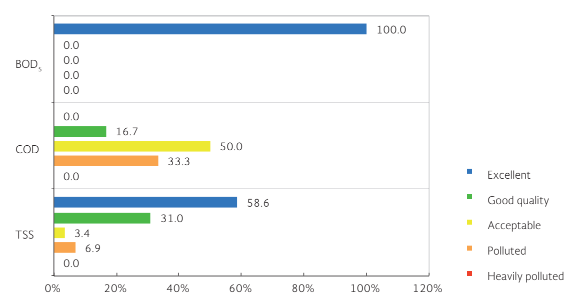
Municipal water treatment plants, 2015

Number in operation	0
Installed capacity (m³/s)	0.000
Flow processed (m³/s)	0.000

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	6
COD	6
TSS	29

Distribution of sites by indicator and classification (%)



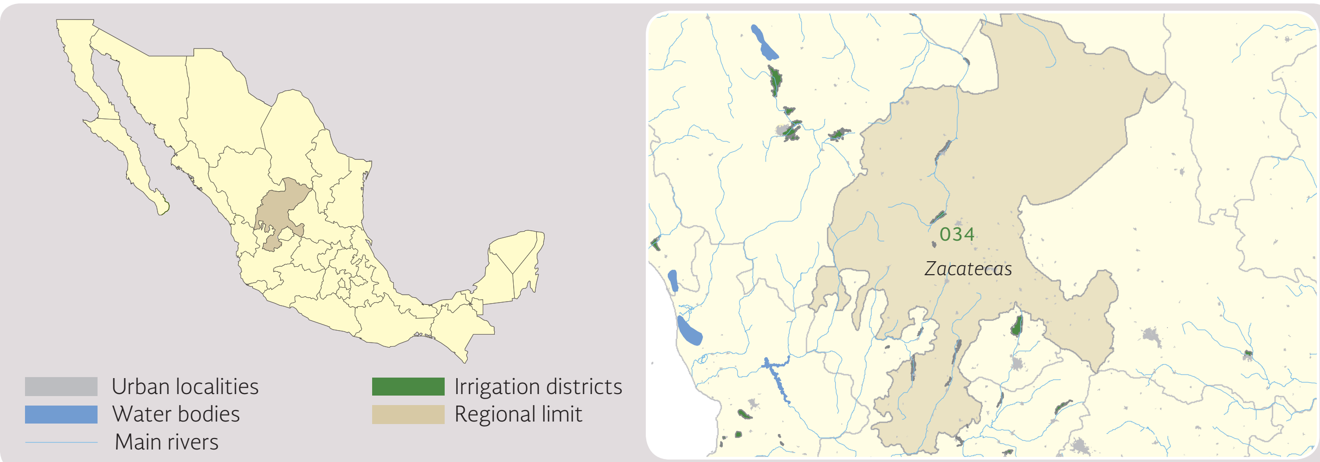
Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
State-wide	99.29	97.63	86.82	86.50
Urban	99.44	97.86	89.41	89.13
Rural	98.47	96.40	72.63	72.14

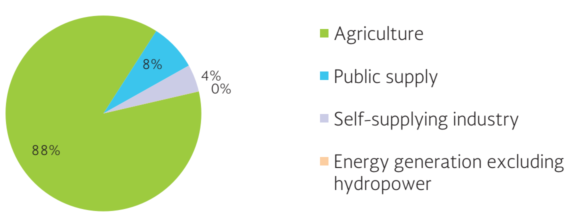
Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

32. Zacatecas

Contextual data		Wastewater treatment plants, 2015		
Number of municipalities	58		**Municipal**	**Industrial**
Total population, 2015	1 576 068 inhabitants	Number in operation	71	20
Urban	953 692 inhabitants	Installed capacity (m³/s)	1.970	0.199
Rural	622 376 inhabitants	Flow processed (m³/s)	1.611	0.168
Total population, 2030	1 726 347 inhabitants			
Normal annual precipitation 1981-2010	496 mm			



Uses of water, 2015 (hm³/year)



Offstream uses	Total	Surface water	Groundwater
Agriculture	1 397	341	1 056
Public supply	124	11	113
Self-supplying industry	72	1	71
Energy generation excluding hydropower	0	0	0
Total	**1 594**	**353**	**1 241**
Instream uses			
Hydropower (volume allocated)		0	

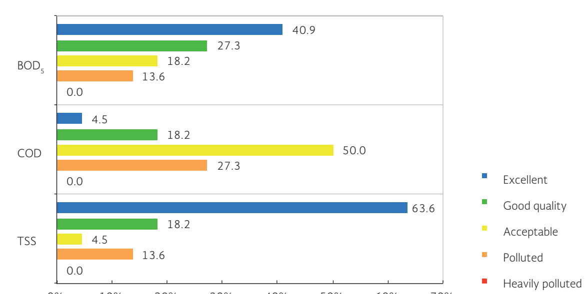
Municipal water treatment plants, 2015

Number in operation	93
Installed capacity (m³/s)	0.164
Flow processed (m³/s)	0.139

Surface water quality, 2015

Number of monitoring sites by water quality indicator	
BOD_5	22
COD	22
TSS	22

Distribution of sites by indicator and classification (%)



Coverage, 2015 (%)

	Water		Sanitation	
	Access to sewerage and basic sanitation services	Drinking water coverage (Conagua)	Access to sewerage and basic sanitation services	Sanitation coverage (Conagua)
State-wide	97.60	95.58	93.14	92.44
Urban	99.04	97.31	98.33	98.12
Rural	95.32	92.86	84.93	83.46

Note: The projection considers the population at the mid-point of the indicated year. The coverage is calculated based on the 2015 Inter-Censal Survey. For water there is: Access to tap water services for the population with tap water in their household or plot, from a public faucet or hydrant or another house, as well as Drinking water (Conagua) for tap water from the public network, community or private well or public faucet. "Access to drinking water services" corresponds to the "Drinking water coverage" employed in previous editions of Statistics on Water in Mexico. Similarly, for sanitation there is Access to sewerage and basic sanitation services for the population in private housing with drainage connected to the public network, a septic tank, the ground, a ravine, crack, river, lake or sea; there is also Sanitation (Conagua) to distinguish the population that has sewerage through a public network or septic tank. "Access to sewerage and basic sanitation services" corresponds to the "Sanitation coverage" employed in previous editions of Statistics on Water in Mexico.

Annex C. Characteristics of the hydrological regions, 2015

Code	Hydrological region	Mainland extension (km²)	Normal annual precipitation 1981-2010 (mm)	Mean natural internal surface runoff (hm³/year)	Inflows (+) or outflows (-) from/to other countries (hm³/year)	Total mean natural surface runoff (hm³/year)	Number of watersheds
1	B.C. Northwest	28 492	209	337		337	16
2	B.C. Central-West	44 314	116	251		251	16
3	B.C. Southwest	29 722	200	362		362	15
4	B.C. Northeast	14 418	151	122		122	8
5	B.C. Central-East	13 626	132	101		101	15
6	B.C. South-East	11 558	291	200		200	14
7	Colorado River	6 911	98	78	1 850	1 928	4
8	Sonora North	61 429	297	132		132	5
9	Sonora South	139 370	483	4 934		4 934	16
10	Sinaloa	103 483	747	14 319		14 319	23
11	Presidio-San Pedro	51 717	819	8 201		8 201	23
12	Lerma-Santiago	132 916	717	13 180		13 180	58
13	Huicicila River	5 225	1 400	1 279		1 279	6
14	Ameca River	12 255	1 063	2 205		2 205	9
15	Jalisco Coast	12 967	1 144	3 606		3 606	11
16	Armeria-Coahuayana	17 628	866	3 537		3 537	10
17	Michoacan Coast	9 205	944	1 617		1 617	6
18	Balsas	118 268	947	16 805		16 805	15
19	Greater Guerrero Coast	12 132	1 215	5 113		5 113	28
20	Lower Guerrero Coast	39 936	1 282	18 170		18 170	32
21	Oaxaca Coast	10 514	951	2 892		2 892	19
22	Tehuantepec	16 363	884	2 453		2 453	15
23	Chiapas Coast	12 293	2 220	12 617	1 586	14 203	25
24	Bravo-Conchos	229 740	399	5 588	- 432	5 156	37
25	San Fernando-Soto la Marina	54 961	703	4 864		4 864	45
26	Panuco	96 989	855	19 673		19 673	77
27	North of Veracruz (Tuxpan-Nautla)	26 592	1 422	14 155		14 155	12
28	Papaloapan	57 355	1 440	48 181		48 181	18
29	Coatzacoalcos	30 217	2 211	34 700		34 700	15
30	Grijalva-Usumacinta	102 465	1 703	59 297	44 080	103 378	83
31	Yucatan West	25 443	1 175	707		707	2
32	Yucatan North	58 135	1 143	0		0	0
33	Yucatan East	38 308	1 210	576	864	1 441	1
34	Closed Catchments of the North	90 829	298	1 261		1 261	22
35	Mapimi	62 639	292	568		568	6
36	Nazas-Aguanaval	93 032	393	2 085		2 085	16
37	El Salado	87 801	393	2 876		2 876	8
Total		**1 959 248**	**740**	**307 041**	**47 949**	**354 990**	**731**

Source: CONAGUA (2016b).

Annex D. Glossary

Alkalinization. Also known as salinization. It represents an increase of the salt content in the surface soil that causes, among other impacts, a decrease in crop yield. Its possible causes include saltwater intrusion and the use of irrigation systems that use water with a high sodium concentration. Salinization or alkalinization mainly occurs in arid regions, in closed catchments and in coastal areas that have naturally saline soils.[v]

Allocation. A deed granted by the Federal Executive Branch to municipalities, states or the Federal District in order to use the nation's water resources, destined for public-urban or domestic water services, in which case it is termed in Spanish an "asignación", or for the use of the nation's water resources and public inherent assets to individuals or companies, be they private or public, in which case they are termed a "concesión".[a]

Aquifer. A geological formation or group of hydrologically interconnected geological formations, through which subsoil water flows or is stored that may be extracted for different uses, and whose lateral and vertical limits are conventionally defined for the purpose of the evaluation, management and administration of the nation's subsoil water.[a]

Artificial recharge. A set of hydrogeological techniques applied to introduce water to an aquifer, through purpose-built infrastructure.[q]

Availability zone. For the purpose of the payment of water duties, the municipalities in the Mexican Republic have been classified into nine availability zones. This classification is contained in the Federal Duties Law.

Blue water. The quantity of water withdrawn from the country's rivers, lakes, streams and aquifers for various uses, both offstream and instream.

Brackish water. Water with a concentration of total dissolved solids equal to or greater than 2 000 and less than 10 000 mg/l.[aa]

Channel of a current. A natural or artificial channel that has the necessary capacity for the waters of the maximum ordinary flow to run through it without overflowing. When currents are subject to overflowing, the natural channel is considered a riverbed, while no channeling infrastructure is built. At the origins of any current, is it considered a channel strictly speaking, when the runoff is concentrated towards a topographic depression and it forms an erosion gully or channel, as a result of the action of water flowing over the ground.[a]

Climate contingency. In terms of declarations related to extreme hydro-meteorological phenomena, this recognizes the risk of impacts on the productive capacity of economic activities.

Climate station. A given area or zone of open-air ground, with the particular climate conditions of the area, meant for measuring climate parameters. Equipped with instruments and sensors exposed to the open air, for the measurement of precipitation, temperature, evaporation and the direction and speed of the wind.

Connate water. Connate or formation water is saltwater that is found inside rock, associated with the presence of hydrocarbons. It contains dissolved salts, such as calcium and sodium chlorides, sodium carbonates, potassium chlorides, calcium or barium sulfates, among others; it may even include some metals. The concentration of these components may lead to negative impacts on the environment when they are not appropriately managed and disposed of.[r]

Coverage of access to water services. Percentage of the population that lives in private housing and that has tap water within the household or on the grounds, or that has supply from a public faucet or another household. It is determined by means of the censuses or inter-censal surveys carried out by Inegi.

Cyclone. Atmospheric instability associated with an area of low pressure, which causes convergent surface winds which flow anti-clockwise in the northern hemisphere. It originates over tropical or subtropical waters and is classified according to the wind intensity as a tropical depression, tropical storm or a hurricane.[m]

Reservoir. Infrastructure that serves to capture, store and control the water of a natural catchment and which includes a contention wall and an overflow spillway.[c]

Degree of water stress. A percentage indicator of the stress placed on water resources, calculated by the quotient between the total volume of water allocated and the natural mean availability of water.

Demand. For the drinking water, sewerage and sanitation subsector, the demand is the total volume of water required in order for a population to meet all types of consumption (domestic, commercial, industrial and public), including losses in the system.[e]

Demographic conciliation. Indirect method to establish the volume and structure of the population, in order to carry out new population projections. It is carried out by reconstructing the demographic dynamic of the recent past.[w]

Disaster. In terms of extreme hydro-meteorological phenomena, the disaster declaration allows resources from the state and society to be focused on the reconstruction of affected areas.

Discharge permit. A deed granted by the Federal Executive Branch through the Conagua or the corresponding river basin organization, in conformity with their respective areas of competence, for discharging wastewater into receiving bodies that are the property of the nation, for individuals or organizations, be they public or private.[a]

Discharge. The action of emptying, infiltrating, depositing or injecting wastewater into a receiving body.[a]

Drainage. Natural or artificial conducts that are an outlet or vent for water.

Drinking water and sanitation system. A series of works and actions that allow public drinking water and sanitation services to be provided, including sanitation, which contemplates the piping, treatment, removal and discharge of wastewater.[a]

Drinking water coverage. Percentage of the population living in private homes with running water within their house, on the grounds, or from a public water faucet or from another household. It is determined by means of censuses and inter-censal surveys carried out by Inegi.

Drinking water treatment plant. Infrastructure designed to remove elements that are dangerous to human health from water, prior to its distribution for water supply to population centers.

Drinking water. Literally, water that can be drunk. The Mexican standard (NOM-127-SSA1-1994) defines water for human use and consumption as that which does not contain noxious pollutants, be they chemical or infections agents, and which does not have a negative effect on human beings.[d]

Drought. Atypical drought, according to the operating rules of the Natural Disaster Fund, refers to a prolonged period (a season, a year or several consecutive years), with a deficit of precipitation as compared to the mean statistical value from various years (generally 30 years or more). Drought is a normal and recurring property of the climate and it will be considered that a drought is atypical when the deficit of precipitation has a probability of occurrence equal to or less than 10% (meaning that the aforementioned deficit occurs in one or less of every ten years) and that furthermore that situation has not occurred five time or more over the last ten years.m

Duty collection. In terms of the water sector, the amount charged to rates payers for the use of the nation's water resources, as well as wastewater discharges and for the use of inherent water-related assets.

Emergency. In terms of declarations related to extreme hydro-meteorological phenomena, this recognizes the risk of impacts on the life and health of the population.

Environmental services. The benefits of social interest that are generated by or derived from watersheds and their components, such as climate regulation, conservation of hydrological cycles, erosion control, flood control, aquifer recharge, maintenance of runoff in quality and quantity, soil formation, carbon capture, purification of water bodies, as well as the conservation and protection of biodiversity; for the application of this concept in the National Water Law, water resources and their link with forest resources are considered first and foremost.[a]

Eutrophication. Also known as eutrofization. The excess of soil nutrients which adversely affects the development of vegetation and may be due to the excessive application of chemical fertilizers.[x]

Evaporite rocks. Evaporite rocks are the main chemical rocks, meaning that they are formed through direct chemical solidification of mineral components. They are often formed from seawater, although there are also continental evaporite rocks, formed in saltwater lakes, or in desert regions which are sporadically flooded. They thus originate as a result of the evaporation of waters containing abundant dissolved salts. When the saturation level of the corresponding salts is reached, as a result of evaporation, the precipitation of the mineral that forms this composite takes place. Successive precipitations often takes place: at an initial stage the least soluble salts fall as rain, and when the evaporation increases, the more soluble salts then fall.[s]

Exploitation. Application of water in activities aiming to extract chemical or organic elements dissolved in it, after which it is returned to its original source without significant consumption.[a]

Extraction index. The result of dividing the volume of groundwater extraction by the volume of mean total annual recharge.

Federal zone. A ten-meter wide strip adjacent to channels, currents or reservoirs which belong to the nation, measured horizontally from the normal pool elevation. The width of the bank or federal zone is five meters in channels with a width of less than five meters.[a]

Flood. An atypical flood, according to the operating rules of the Natural Disaster Fund, consists of the overflow of water beyond the normal limits of a channel or a stretch of water, or an accumulation of water as a result of an excess in areas that are not normally submerged.[m]

Freshwater. Water which has a concentration of total dissolved solids of under 1 000 mg/l.[aa]

Green water. The quantity of water that is part of the soil humidity and that is used for rainfed crops and vegetation in general.

Gross Domestic Product (GDP). The total value of goods and services produced in the territory of a country in a given period, free from duplication.[h]

Groundwater extraction. The volume of water that is extracted artificially from a hydrogeological unit for different uses.[b]

Groundwater. Water that is completely saturated into the pores or interstices of the subsoil.

Grouped use for agriculture. In this document, it includes agriculture, livestock and aquaculture uses, in conformity with the definitions in the National Water Law.

Grouped use for public supply. In this document, it is the volume of water employed for public-urban and domestic uses, in conformity with the definitions in the National Water Law.

Grouped use for self-supplying industry. In this document, it is the volume of water employed in industrial, agro-industry, services and trade uses, in conformity with the definitions in the National Water Law.

Housing. A place surrounded by walls and covered with a roof, with an independent entrance, in which people generally eat, prepare food, sleep and shelter from the environment.[k]

Human system. Any system in which human organizations play a predominant role. Often, but not always, the term is a synonym of 'society' or 'social system' (for example, agricultural system, political system, technological system or economic system).[y]

Hurricane. A tropical cyclone in which the maximum sustained wind reaches or surpasses 119 km/h. The corresponding cloudy area covers an extension between 500 and 900 km in diameter producing intense rainfall. The center of the hurricane, known as the "eye", normally reaches a diameter that varies between 20 and 40 km, however it may even reach 100 km. At that stage it is classified according to the Saffir-Simpson scale.[m]

Hydrogeological units. A combination of inter-connected geological layers, the lateral and vertical limits of which are conventionally defined for the purpose of the evaluation, management and administration of the nation's groundwater resources.[b]

Hydrological region. A territorial area shaped according to its morphological, orographical and hydrological features, in which the watershed is considered as the basic unit for water management, and the finality of which is to group and systematize information, analysis, diagnoses, programs and actions with regard to the occurrence of water in quantity and quality, as well as its use. Normally a hydrological region is made up of one or several watersheds. As a result, the limits of the hydrological region are generally speaking different from those of the political division of states, Mexico City and municipalities. One or several hydrological regions make up a Hydrological-Administrative Region.[a]

Hydrological-administrative region (HAR). A territorial area defined according to hydrological criteria, made up of one or several hydrological regions, in which the watershed is considered the basic unit for water resources management. The municipality, as in other legal instruments, represents the minimal unit of administrative management in the country.[a]

Hydro-meteorological phenomenon. An unsettling occurrence that is generated as a result of atmospheric agents such as: tropical cyclones, extreme rainfall, rain-related, coastal and lake flooding; snow, hail, dust and electricity storms; frost; droughts; heatwaves and ice fronts; and tornadoes.[ac]

Hydropower dams. Infrastructure that generates electricity through dynamos or alternators, in which the energy is obtained through turbines propelled by water.

Incidental recharge. A recharge that is the result of some sort of human activity and that does not have specific infrastructure for artificial recharge.[q]

Inflow. Volume of water that is received in a watershed or hydrogeological unit from other watersheds, towards which it does not naturally drain.[b]

Inherent public assets. The national assets listed in Article 113 of the Political Constitution of the United Mexican States: the beaches and federal zones, in the part that corresponds to the riverbeds according to the terms of the NWL; the grounds occupied by the reservoirs of lakes, lagoons, estuaries or natural deposits, the waters of which are the property of the nation; riverbeds that are of the nation's water resources; riverbanks or federal zones that are adjacent to riverbeds and the reservoirs or deposits which are the property of the nation, according to the terms of the NWL; the grounds of riverbeds and those of reservoirs of lakes, lagoons or estuaries that are the property of the nation, uncovered by natural causes or by artificial works; the islands that exist or that are formed in the reservoirs of lakes, lagoons, estuaries, dams and deposits or in the riverbeds that are the property of the nation, except those that are formed when a stream dissects grounds that are private or community property, and the water infrastructure works funded by the federal government, such as dams, dykes, reservoirs, canals, drains, water retention berms, trenches, aqueducts, irrigation districts or units and others built for the use of water, flood control and management of the nation's water resources, including the grounds they occupy and the protection areas, in the extension that is defined by the Conagua in each case.[a]

Irrigation district. A geographical area where irrigation services are provided by means of hydro-agricultural infrastructure works.

Irrigation sheet. The quantity of water, measured in longitudinal units, which is applied to a crop so that it may meet its physiological needs during the entire growth cycle, in addition to soil evaporation (offstream use = evapotranspiration + water in the fabric of the plant).

Irrigation surface. An area with irrigation infrastructure.

Irrigation unit. An agricultural area which has irrigation infrastructure and systems, different from an irrigation district and commonly of a more reduced area; it may be made up of user associations or other figures of organized farmers who are freely associated in order to provide irrigation services with autonomous management systems and operate water infrastructure works in order to capture, divert, conduct, regulate, distribute and remove the nation's water resources that are destined for agricultural irrigation.[a]

Irrigation. Application of water to crops through infrastructure, in comparison with crops that only receive precipitation, which are known as rainfed crops.

Lake, lagoon or marsh bed. The natural deposit of the nation's water resources outlined by the elevation of the maximum ordinary surge.[a]

Lake. A continental water body of considerable extension, surrounded by freshwater or saltwater.[c]

Large dams. Dams whose height above the bed is greater than 15 m or with a maximum capacity of more than 3 million m^3 at the surcharge pool elevation.[p]

Lentic. Water bodies whose liquid content moves basically within the depression they are located in, mainly with convective movements with a more or less limited replacement of water. A concept applied to stagnant water, such as swamps, ponds, lakes and wetlands, which are shallow water bodies.[x]

Locality. Any place occupied by one or more households, which may or may not be inhabited; this place is recognized by either law or custom. According to their characteristics and for statistical purposes, they may be classified into urban and rural.

Lotic. Water bodies which move in a more or less defined direction, and in which the liquid is replaced by nimble flow. A term related to flowing water, such as a stream or river.[x]

Marsh. Swampy lowlands which are often filled with rainwater or from the overflow of a current, a nearby lagoon or the sea.[a]

Marshy. Belonging to or related to a lagoon or a swamp.[t]

Mean annual availability of groundwater. The mean annual volume of groundwater that may be allocated in order to be extracted from a hydrogeological unit or aquifer for different uses, in addition to the already allocated extraction and the natural discharge that has been committed, without jeopardizing the balance of the ecosystems.[a]

Mean annual availability of surface water. The value that results from the difference between the mean annual volume of runoff from a watershed to downstream areas, and the current mean annual volume committed downstream.[a]

Mean annual precipitation. Precipitation calculated for any period of at least ten years, which starts on January 1 of the first year and ends on December 31 of the final year.

Mean aquifer recharge. The mean annual volume of water that feeds into an aquifer.

Mean natural availability. The total volume of renewable surface water and groundwater that occurs naturally in a region.

Mean natural internal surface runoff. In a given territory, this is the volume of precipitation minus the volume of evapotranspiration minus the mean aquifer recharge. It represents the surface runoff in channels and currents without considering volumes of inflows or outflows from the territory to neighboring territories.

Mean natural surface runoff. The part of mean historical precipitation that occurs in the form of flows into a watercourse.

Meteorological station. A given area or zone of open-air ground, used for the measurement of surface meteorological parameters. It is equipped with instruments to measure precipitation, temperature, wind speed and direction, relative humidity, atmospheric pressure and solar radiation.

Mexican Standard (NMX). A standard produced by a national standardization body, or the Ministry of the Economy, which foresees, for a common and repeated use, rules, specifications, attributes, testing methods, guidelines, characteristics or previsions applicable to a product, process, installation, system, activity, service or production or operating method, as well as those related to terminology, symbology, packaging, marking or labelling. These Mexican standards are voluntarily applied, except for those cases where private parties state that their products, processes or services comply with the standards, notwithstanding the agencies requiring their observance of an Official Mexican Standard for any given purpose.[l]

Mexico's System of National Accounts. A scheme to organize statistical information on macro-economic aspects of the country: production, consumption, saving, investment in sectors of economic activity and primary and secondary distributions of income; as well as the financial transactions and the economic relationship with the outside, through institutional sectors, during a given period of time. Its information is derived from censuses, surveys and administrative registers, as well as following theoretical-methodological models of international validity and comparability.[ae]

Mine tailing dam. One of the systems for the final disposal of solid waste generated, for the benefit of minerals, which should comply with conditions of maximum security, in order to guarantee the protection of the population, economic and social activities, and in general, ecological balance.

Municipality. A basic political entity of territorial division and of the political and administrative organization of the states of the Republic.

National catalogue of indicators. A set of key indicators with their corresponding metadata and statistical series, which have the objective of providing the Mexican State and society-at-large with information that is necessary for the design, follow up and evaluation of public policies of national scope; similarly indicators can be integrated that allow the Mexican State to attend information commitments as requested by international organizations. It is part of the National System of Statistics and Geography.[af]

Natural recharge. The recharge generated by direct infiltration from precipitation, from surface water runoff into channels or from water stored in water bodies.[q]

Normal pool elevation (NPE). For reservoirs, this is the equivalent of the elevation of the weir crest in the case of a freely-flowing structure; if it has floodgates, this refers to their highest level.

Normal precipitation. Precipitation measured for a uniform and relatively long period, which should have at least 30 years of data, which is considered a minimum representative climate period, and which starts on January 1 of a year ending in one, and ends on December 31 of a year ending in zero.

Official Mexican Standard (NOM). The obligatorily-observed technical regulation, issued by the competent authorities, which establishes rules, specifications, attributes, guidelines, characteristics or provisions applicable to a product, process, installation, system, activity, service or method of production or operation, as well as those related to terminology, symbology, packaging, marking or labelling and which refer to its compliance or application.[l]

Offstream use. The volume of water of a given quality that is consumed when implementing a specific activity, which is determined as the difference in the volume of a given quality that is extracted, minus the volume of an also given quality that is discharged, and which is indicated in the respective deed.[a]

Outflow. Volume of surface water that is transferred from one watershed or hydrogeological unit to another or others.[b]

Overdrafted aquifer. One in which the groundwater extraction is greater than the volume of the mean annual recharge, in such a way that the persistence of this condition over prolonged periods of time brings about some of the following environmental impacts: depletion or disappearance of springs, lakes or wetlands; reduction or disappearance of base river flow; indefinite depletion of the groundwater level; formation of cracks; differential ground settlement; saltwater intrusion in coastal aquifers; and migration of poor quality water. These impacts may bring about economic losses for users and society-at-large.

Particular discharge conditions. The series of physical, chemical and biological parameters, and of their maximum permitted levels in wastewater discharges, determined by the Conagua or by the corresponding river basin organization, for each user, for a specific use or user group of a specific receiver body, with the purpose of conserving and controlling the water quality, in accordance with the National Water Law and the By-Laws derived from that Law.[a]

Perennial crops. Crops whose maturation cycle is more than one year long.

Permits. Granted by the Federal Executive Branch through the Conagua or the corresponding river basin organization, for the use of the nation's water resources, as well as for the construction of hydraulic works and others of a diverse nature related with water and national assets, as referred to in Article 113 of the 2004 National Water Law.[a]

Phenology. The study of the relationship of biological phenomena with the weather, particularly seasonal changes.[t]

Physically irrigated surface. Surface which receives at least some irrigation within a given time period.

Pollution. Incorporation of foreign agents in water, which may modify its physical and chemical composition and quality.[c]

Population center. A group of one or more municipalities in which the population is concentrated mainly in urban localities. Metropolitan areas are considered population centers.

Precipitation. Water that falls from the atmosphere in liquid or solid form, onto the earth's surface; it includes dew, drizzle, rain, hail, sleet and snow.[c]

Private inhabited housing. Of interest for the calculation of coverage based on different types of censuses (called respectively "Censos" and "Conteos" in Spanish), it is an independent house, apartment in a building or a house in a neighborhood which at the time of the census was occupied by people that make up one or more homes.[k]

Productivity of water in irrigation districts. The quantity of agricultural produce from all crops in irrigation districts, divided by the quantity of water applied to them. It is presented in kg/m^3.

Prohibition zone. Those specific areas of hydrological regions, watersheds or aquifers, in which no use of water is authorized apart from those legally established, the latter being controlled through specific regulations, as a result of the deterioration in the quantity or quality of water, due to the impact on the sustainability of water resources, or the damage to surface and groundwater bodies.[a]

Protection zone. The strip of ground immediately surrounding reservoirs, hydraulic structures and other infrastructure and related installations, when the aforementioned infrastructure is the property of the nation, of the extension that in each case is established by the Conagua or the corresponding river basin organization, in conformity with their respective competencies, for their protection and appropriate operation, conservation and surveillance.[a]

Public Registry of Water Rights (Repda). A Registry that provides information and legal certainty to the users of the nation's water resources and inherent assets through the registration of concession or allocation deeds or discharge permits, as well as the modifications that are made to their characteristics.

Receiving body. The current or natural water deposit, reservoir, channel, salt-water zone or national asset into which wastewater is discharged, as well as the grounds into which this water is filtered or injected, when it may pollute the soil, subsoil or aquifers.[a]

Reclamation. An act issued by the Federal Executive Branch for the purpose of public utility or interest, through the corresponding declaration, to eliminate concessions or allocations for the use of the nation's water resources and their inherent public assets; or concessions to build, equip, operate, conserve, maintain, rehabilitate and extend federal water infrastructure and the provision of the related services.[a]

Regulated zone. Those specific areas of aquifers, watersheds, or hydrological regions, which due to their characteristics of deterioration, hydrological imbalance, risks or damage to water bodies or the environment, fragility of vital ecosystems, overdrafting, as well as for their reorganization and restoration, require a specific water management in order to guarantee hydrological sustainability.[a]

Renewable water resources. The total amount of water that can feasibly be used every year. Renewable water resources are calculated as the annual unaltered surface runoff, plus the mean annual aquifer recharge, plus inflows from other regions or countries, minus the outflows to other regions or countries.

Reserve zone. Those specific areas of aquifers, watersheds or hydrological regions, in which limits are established in the use of a proportion or all of the available water, with the aim of providing a public service, implementing a restoration, conservation or preservation program, or when the State resolves to use those water resources for public utility.[a]

Reuse. The use of wastewater with or without prior treatment.[a]

River basin commission. A collegiate body of mixed membership, not subordinate to the Conagua or the river basin organizations. An auxiliary body of the river basin council at the sub-basin level.[a]

River basin council. Collegiate bodies of mixed membership, which carry out coordination and consultation, support and advice, between the Conagua, including the corresponding river basin organization, the agencies and bodies at the federal, state and municipal levels, and the representatives of water users and civil society organizations, from the respective watershed or hydrological region. They have the vocation of formulating and implementing programs and actions to improve water management, the development of water infrastructure and the respective services and the preservation of the watershed's resources.[a]

River basin organization. A specialized technical, administrative and legal unit, autonomous in nature, which directly reports to the Head of the Conagua, the attributions of which are established in the National Water Law and its By-Laws, and whose specific resources and budget are determined by the Conagua. Prior to the 2004 reform, they were known as regional offices.[a]

River. A natural current of water, either permanent or intermittent, which flows into other currents, into a natural or artificial reservoir, or the sea.[a]

Rural locality. A locality with a population of less than 2 500 inhabitants, and which is not a municipal seat.

Saltwater intrusion. A phenomenon in which saltwater filters into the subsoil towards the inner land mass, causing groundwater salinization; this occurs when the extraction of water causes a drop in the groundwater level below sea level, altering the natural dynamic balance between seawater and freshwater.

Saltwater. Water with a concentration of total dissolved solids greater than 10 000 mg/l.[aa]

Sanitation coverage. Percentage of the population that lives in private housing, whose housing has an outlet connected to the public sewerage network or a septic tank. Determined by means of the different types of census and inter-censal surveys carried out by Inegi and estimations from the Conagua for intermediate years.

Sanitation. Collection and transportation of wastewater and the treatment of both wastewater and the sub-products generated in the course of these activities, in such a way that its disposal produces the smallest possible impact on the environment.[i]

Sewerage. System of pipes that conduct wastewater to the site of its final disposal.[e]

Sink. Any process, activity or mechanism which withdraws a greenhouse gas, an aerosol, or a precursor of greenhouse gas from the atmosphere.[y]

Slightly brackish water. Water with a concentration of total dissolved solids equal to or greater than 1 000 and less than 2 000 mg/l.[aa]

Source. Site from which water is taken for its supply.

State. The 31 states and the Federal District, which together make up the Federation.[f]

Storage. Volume or quantity of water that can be captured, in millions of cubic meters.[c]

Stream gage. A place in which volumes of water are measures and recorded by means of different instruments and/or apparatuses.[c]

Stream. Channel of a current of water with a limited flow occupied over periods of time.[c]

Supply. Water supply.

Surcharge pool elevation (SPE). The highest level that water should reach in a reservoir under any condition.

Surface water extraction. Volume of water that is artificially extracted from surface water channels and reservoirs for different uses.[b]

Surface water. Water which flows over or is stored on the surface of the earth's crust in the form of rivers, lakes or artificial reservoirs such as dams, berms or canals.[c]

Sustainable development. As regards water resources, this is the process that may be evaluated through criteria and indicators related to water, the economy, social and environmental aspects, which aims to improve the quality of life and the productivity of people, supported by the necessary measures for the preservation of hydrological balance and the use and protection of water resources, in such a way that the needs for future generations are not compromised.

Tariff. The unit price established by the competent authorities for the provision of public drinking water, sewerage and sanitation services.[j]

Technical groundwater committee (Cotas). Collegiate bodies of mixed membership and which are not subordinate to the Conagua or the river basin organizations. They carry out their activities on a given aquifer or group of aquifers.[a]

Technified rainfed district. Geographical area intended for agricultural activities without but which lacks irrigation infrastructure, and in which, through the use of certain techniques and infrastructure, the damage to production caused by periods of strong and prolonged rainfall is reduced – in which case they are also referred to as drainage districts – or in conditions of drought, when rain or agricultural soil humidity is used with greater efficiency; the technified rainfed district is made up of rainfed units.[a]

The nation's water. Water resources that are the property of the Nation, according to the terms of paragraph 5 of article 27 of the Political Constitution of the United Mexican States, the preservation of which in both quantity and quality and its sustainability is a fundamental task of the State and Society, as well as a priority and a matter of national security.[a]

Thermoelectric plant. Infrastructure that generates electricity through dynamos or alternators, in which the power is obtained from steam-propelled turbines.

Ton of oil equivalent. Accounting unit employed to measure the use of energy. The IEA defines it as the net calorific value of 10 Gcal (Giga calories).[z]

Total capacity of a reservoir. The volume of water that a reservoir can store at the Normal Pool Elevation (NPE).

Total mean natural surface runoff. The mean natural internal surface runoff of a territory, plus the volumes of inflows from neighboring territories, minus the volumes of outflows to neighboring territories. It represents the total surface runoff in channels and currents.

Total recharge. The volume of water that enters a hydrogeological unit, in a given time period.[q]

Torrential rain. Rainfall with an intensity of more than 60 mm/h.[ab]

Urban locality. A locality with a population equal to or more than 2 500 inhabitants, or which is a municipal seat, regardless of the number of inhabitants it had at the time of the most recent census.

Use. Application of water in activities that do not imply its total or partial consumption.[a]

Virtual water. The sum of the quantity of water employed in the productive process of a product.

Vulnerability. The degree of exposure or propensity of a component of the social or natural structure to suffer damage as a result of a threat or danger, of natural or anthropogenic origin, or the lack of resilience to recover subsequently. It corresponds to the physical, economic, political or social predisposition or susceptibility of a community to be affected or to suffer adverse effects as a result of the occurrence of a dangerous phenomenon. Vulnerabilities may be institutional, legal, political or territorial in nature.[ad]

Wastewater treatment plant. Infrastructure designed to receive wastewater and remove materials that might degrade water quality or place public health at risk when discharged into receiving bodies or channels.[g]

Wastewater. Water of varied composition coming from discharges from public urban, domestic, industrial, commercial, service, agricultural, livestock, from treatment plants and in general from any other use, as well as any combination of them.[a]

Water footprint. The sum of the quantity of water used by each person for his or her different activities and which is necessary to produce the goods and services that he or she consumes. It includes both blue and green water.

Water infrastructure. A combination of structures built with the objective of water management, whatever its origin may be, with the purpose of exploitation, removal, treatment or defense, such as dams, dykes, reservoirs, canals, drains, water retention berms, trenches, aqueducts, irrigation districts and units and others built for the use of water, flood control and the management of the nation's water resources.[aa]

Water utility. A body in charge of supplying drinking water and sanitation services in a given locality.[n]

Watershed. A territorial unit, differentiated from other units, normally outlined by a continental divide between waters – through the polygonal line formed by the points of highest elevation of that unit – in which water appears in different forms, and is stored or flows to an exit point, which may be the sea or another inland receiving body, through a hydrographic network of channels which converge into one main one, or the territory in which waters form an autonomous unit or one that is differentiated from others, without flowing out into the sea. In that space that is outlined by a topographic diversity, water resources, soils, flora, fauna, other natural resources related with the latter and the environment co-exist. Watersheds together with aquifers constitute the management unit of water resources.[a]

Wetlands. Transition zones between aquatic and terrestrial systems that constitute temporary or permanent flood zones, subject or not to the influence of tides, such as swamps, marshes and mudflats, the limits of which are made up by the type of moisture-absorbing vegetation, either permanent or seasonal; areas in which the soil is predominantly water-based; and lake areas or areas of permanently humid soils due to natural aquifer discharge.[a]

Note: The glossary is a compilation from different sources, with the aim of illustrating the diverse concepts employed in this document. They thus do not constitute legally binding definitions.

Source:

a	National Water Law (Ley de Aguas Nacionales).
b	NOM-011-CONAGUA-2000.
c	Inegi (2000).
d	NOM-127-SSA1-1994.
e	Conagua (2003).
f	Political Constitution of the United Mexican States.
g	USGS (2016c).
h	CEFP (2012).
i	Trillo (1995).
j	NMX-AA-147-SCFI-2008.
k	Inegi (2011).
l	Federal Law on Metrology and Standardization (Ley Federal sobre Metrología y Normalización).
m	Specific operating guidelines of the Fonden.
n	NOM-002-CNA-1995.
p	Arreguín et al. (2009).
q	NOM-014-CONAGUA-2003.
r	NOM-143-SEMARNAT-2003.
s	Higueras and Oyarzun (2013).
t	RAE (2015).
u	Conagua (2012).
v	Semarnat (2008).
w	Conapo (2012).
x	Sanchez et al. (2010).
y	IPCC (2007).
z	WB (1996).
aa	Conagua (2016b).
ab	AEMET (2015).
ac	General Law of Civil Defense.
ad	2014-2018 Program for national security.
ae	Inegi (2013e).
af	Inegi (2016m).

Annex E. Abbreviations and acronyms

Apazu	Drinking water and sanitation in urban zones
Banobras	National Bank of Works and Services
Banxico	Bank of Mexico
BOD_5	Five-day Biochemical Oxygen Demand
Capaseg	Drinking Water, Sewerage and Sanitation Commission of the State of Guerrero
Cdi	National Commission for the Development of Indigenous Peoples
CEC	Commission for Environmental Cooperation
CFE	Federal Electricity Commission
CMAS	Municipal Drinking Water and Sanitation Commission
COD	Chemical Oxygen Demand
CODIA	Conference of Ibero-American Water Directors
Cofepris	Federal Commission for Protection against Health Risks
Conafor	National Forestry Commission
Conagua	National Water Commission
Conanp	National Commission for Protected Areas
Conapo	National Population Council
Conavi	National Housing Commission
Coneval	National Council for the Evaluation of the Social Development Policy
COP	Conference of Parties
Cosae	Commission of Water Services of the State of Baja California
DOF	Official Government Gazette
EEP	External Energy Producer (also known as IPP: Independent Power Producer)
EEZ	Exclusive Economic Zone
ENSO	El Niño - Southern Oscillation
FAO	Food and Agriculture Organization
FDL	Federal Duties Law
GDP	Gross Domestic Product
GWI	Global Water Intelligence
HAR	Hydrological-Administrative Region
IBRD	International Bank for Reconstruction and Development
IBWC	International Boundary and Water Commission
Icold	International Commission on Large Dams
ID	Irrigation district
IDB	Inter-American Development Bank
IEA	International Energy Agency

IFRC	International Federation of the Red Cross and Red Crescent Societies
Inai	National Institute of Access to Information
Inegi	National Institute of Statistics and Geography
IPCC	Intergovernmental Panel on Climate Change
IU	Irrigation Unit
Landsat	Land Satellite
LO	Local office
MA	Metropolitan Area
MAVM	Metropolitan Area of the Valley of Mexico
MDGs	Millennium Development Goals
MLN	Most likely number
MW	Megawatt
NA	Not applicable
NADM	North American Drought Monitor
NAICS	North American Industry Classification System
NASA	National Aeronautics and Space Administration
NDP	National Development Plan
NIW	National Inventory of Wetlands
NMX	Mexican Standard
NOAA	National Oceanic and Atmospheric Administration
NOM	Official Mexican Standard
NPE	Normal Pool Elevation
NVWI	Net virtual water import
NWL	National Water Law
NWP	National Water Program
PA	Protected Area
PAENT	Percentage of the population with tap water in their household or plot
PAP	Population with access to tap water services
PAS	Population with access to sewerage and basic sanitation services
PIAE	Protection for Infrastructure and Emergency Attention
Prodder	Program for Reimbursing Duties
Profepa	Attorney General's Office for Environmental Protection
Promagua	Water Utility Modernization Project
Prome	Program for the improvement of efficiency in the drinking water and sanitation sector
Pronacose	National Drought Prevention Program
Prossapys	Program for the Construction and Rehabilitation of Drinking Water and Sanitation Systems in Rural Areas

Protar	Wastewater Treatment Program
RBO	River basin organization
REAC	Regional Emergency Attention Center
Repda	Public Registry of Water Duties
RWR	Renewable water resources
SCFI	Ministry of Trade and Industrial Development (obsolete, employed in the names of NOMs)
SDGs	Sustainable Development Goals
Sectur	Ministry of Tourism
Sedesol	Ministry of Social Development
SEEA	System for Environmental-Economic Accounting
Semar	Ministry of the Navy
Semarnat	Ministry of the Environment and Natural Resources
Sener	Ministry of Energy
SGT	Deputy Director General's Office for Technical Affairs
SHCP	Ministry of Finances and Public Credit
SIAP	Agro-Food and Fishing Information Service
Siapa	Inter-Municipal System for Drinking Water and Sanitation Services (Guadalajara MA)
Sina	National information system on water quality, quantity, uses and conservation
SST	Sea Surface Temperature
TD	Tropical depression
TEO	Eastern Drainage Tunnel
TRD	Technified rainfed district
TS	Tropical storm
TSS	Total Suspended Solids
UN	United Nations
UNAM	National Autonomous University of Mexico
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
Unstats	United Nations Statistics Division
USGS	United States Geological Service
VAT	Valued added tax
VWE	Virtual water export
VWI	Virtual water import
WB	World Bank
WFN	Water Footprint Network
WHO	World Health Organization
WMO	World Meteorological Organization
WQI	Water Quality Index
WSP	Water and Sanitation Program
WWAP	World Water Assessment Programme

Annex F. Measurement units and notes

Renewable water resources: The calculation of renewable water resources is carried out through spatial analysis, intersecting the layers of municipalities, watersheds and aquifers in order to make up minimal spatial units (municipality-watershed-aquifer). Assuming an equal distribution throughout the area of the relevant and most up-to-date values, the renewable water resources for each minimal spatial unit are calculated. This calculation allows the value of renewable water resources to be represented through the aggregation of minimal units both in municipalities, watersheds and aquifers and in groups of municipalities: states and hydrological-administrative regions.

Closing: The closing date of the data is generally speaking December 31, 2015, except for specific cases, when the latest information available is not at the closing date, such as the state GDP (see the respective note).

Population: The population projection employed by Conapo (2012), at the mid-year point, is used for the 2010-2030 period. According to that projection, in 2015 there were 121.01 million inhabitants of Mexico. It should be mentioned that the latest data from a census, a product of the 2015 Inter-censal Survey (one of the objectives of which was to maintain the comparability of national censuses), found that in 2015 there were 119.53 million inhabitants in Mexico. The use of data from the Conapo population projection (2012) is continued until it is eventually replaced by a projection based on the 2015 Inter-censal Survey. The Conapo projection considers 137.48 million inhabitants by 2030.

Precipitation: The values reported by the National Meteorological Service (total, regional and state-wide) are employed for both the normal 1981-2010 precipitation and the 2015 annual precipitation.

Gross Domestic Product (GDP): For the present document the national GDP available was calculated for the year 2015. The calculation by state and by hydrological-administrative region is based on the GDP per state, the latest data on which available for this edition was for 2014.

Rounding up or down: Because of rounding up or down, the sums in the tables both in values and percentages do not necessarily add up to the totals.

Bibliographic references: The Harvard System or author-date system is used. In the text, when the reference document is quoted, a particle is included with the format "Author (date)", for example "Conagua (2003)". The list of bibliographical references is included in annex G. For the previous example, the corresponding entry in the annex is "Conagua. 2003. Manual de Drinking water, Sanitation y saneamiento - MAPAS." Specific formats are used for printed documents, institutional authors and sources consulted online. In order to identify the works from one author from the same year, the years are differentiated by a progressive literal: "Conagua (2016a)", "Conagua (2016b)". Using this system results in space saving and allows the sources used to be rigorously quoted.

System of units: The units used in this document are expressed in conformity with NOM-008-SCFI-2002 "General System of Measurement Units" considering its modification on September 24, 2009, which establishes that the decimal point may be a comma or a period.

Mainland area: In Inegi's Information Bank, the "Mainland area" item (Inegi 2016o), there is information up to 2005 on the mainland area for each one of the 2 454 municipalities existing at that time, and consistent with the totals of mainland area present in Inegi's statistical almanac. Considering that the new municipalities are made up of fractions of existing municipalities, the Conagua, based on the analysis of the information in the geographical layer "Marco geoestadístico municipal" (Municipal geostatistical framework), 2005 and 2014 versions, assigned areas to each of the 2 457 municipalities existing in 2015, conserving the same totals. It is of interest to the Conagua to have the mainland areas and totals at the municipal level, since with that it is possible to calculate consistently the mainland and total area both of states and hydrological-administrative regions, which are the aggregation of municipalities.

Baseline units, derived or conserved for their use from NOM-008-SCFI-2002		
Symbol	**Unit**	**Equivalents**
cm	centimeter	1 cm = 0.01 m
ha	hectare	1 ha = 10 000 m² = 2.47 acres
hm³	cubic hectometer	1 hm³ = 1 000 000 m³
kg	kilogram	1 kg = 1 000 g
km/h	kilometer per hour	1 km/h = 0.2778 m/s
km²	kilometer per hour	1 km² = 1 000 000 m²
km³	square kilometer	1 km³ = 1 000 000 000 m³
L, l	liter	1 L = 0.2642 gal
L/s, l/s	liter per second	1 L/s = 0.001 m³/s
m	meter	1 m = 3.281 ft
m³	cubic meter	1 m³ = 0.000810 AF
m³/s	cubic meter per second	1 m³/s = 35.3 cfs
mm	millimeter	1 mm = 0.001 m
mm	millimeter	1 mm = 0.0394 in
t	ton	1 t = 1 000 kg
W	watt	1 W = 1 m² kg/s³

Units not included in NOM-008-SCFI-2002		
Symbol	**Unit**	**Equivalents**
AF	acre-foot	1 AF = 1 233 m^3
cfs	cubic feet per second	1 cfs = 0.0283 m^3/s
ft	foot	1 foot = 0.3048 m
gal	gallon	1 gal = 3.785 L
hab.	inhabitants	Not applicable
in	inch	1 in = 25.4 mm
MAF	million acre-feet	1 MAF = 1.23 km^3
MASL	meters above sea level	Not applicable
pesos	Mexican pesos	1 Mexican peso = 0.05798 United States dollars
ppm	parts per million	1 ppm = 0.001 g/L
USD	United States dollar	1 United States dollar = 17.2487 Mexican pesos *
* The FIX exchange rate as of December 31, 2015 was considered (Banxico 2016b).		

Examples of measurement:
1 m^3 = 1 000 liters
1 hm^3 = 1 000 000 m^3
1 km^3 = 1 000 hm^3 = 1 000 000 000 m^3
1 TWh = 1 000 GWh = 1 000 000 MWh

Prefixes to form multiples					
Symbol	**Name**	**Value**	**Symbol**	**Name**	**Value**
T	tera	10^{12}	h	hecto	10^{2}
G	giga	10^{9}	c	centi	10^{-2}
M	mega	10^{6}	m	mili	10^{-3}
k	kilo	10^{3}			

Annex G. Bibliographical references

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Annex H. Analytical index

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