Technical Note on the Water Accounts of Mexico

National Institute of Statistics and Geography (INEGI) of Mexico

Content

1 Introduction

The natural water cycle makes available essential supplies necessary for the survival of ecosystems and economic activities. The resource is taken, among other uses, for irrigation, for power generation, for household consumption; in addition, it can be considered a natural resource, a product, or simply a type of flow.

Mexico has implemented since 2007 Water Accounts under the water thematic group, corresponding to the National Institute of Statistics and Geography (INEGI) the construction of the project, with the collaboration of the National Water Commission (CONAGUA, Spanish acronym)).

Mexico Current advances in this topic include the development of Chapters III "Supply and Use Tables of physical water" and V "Economic and hybrid Accounts of activities and products related to water" SEEA Water. Additionally, it has been developed a diagram of the physical flows of water, which is an additional presentation proposal to physical supply and use tables (PSUT). Finally, it has been developed a proposal for economic valuation of water resources.

This paper describes how it has been made the SUT, the manner in which diffuse; sources of information used and, the technical issues remain to be addressed.

2 Development of the calculus

The progress made so far in Mexico, provide information on water resources in the form of COU physical units (plus a diagram of the physical flows) and COU hybrids.

2a. Physical supply and use tables (PSUT)

In the case of Mexico, the National Accounts uses the Industrial Classification System of North America 2007 (NAICS), matching the previous structure for our country.

2a.1 Physical use table

The following algorithm describes how it has been calculated and integrated information in conjunction with CONAGUA, estimating each of the required variables.

Table 2a1.1. Algorithm for calculating the physical use table

		ISIC 1-3	ISIC 5-33, 38-99	ISIC 35		ISIC 36	ISIC 37		
		Agricultura, Ganadería, Silvicultura, Caza y Pesca	Industria y Servicios	Termoeléctricas	Hidroeléctricas	Redes de distribución municipal	Alcantarillado	Doméstico	
Del medio ambiente	**1. Extracciones totales**	**Total (1.a + 1.b = 1.i +1.ii)**	**Total (1.a + 1.b = 1.i +1.ii)**	**Total (1.a + 1.b = 1.i +1.ii)**	**Total (1.a + 1.b = 1.i +1.ii)**	**Total (1.a + 1.b = 1.i +1.ii)**	**Total (1.a + 1.b = 1.i +1.ii)**	**Total (1.a + 1.b = 1.i +1.ii)**	**Total 1**
	1.a Extracción para uso propio								Subtot 1.a
	1.b Extracción para distribución								Subtot 1.b
	1.i De otros recursos del agua	**Subtot 1.i (ExtSup1+Extsub1)**	**Subtot 1.i (ExtSup2+Extsub2**	**Subtot 1.i (ExtSup3+Extsub3**	**Subtot 1.i (ExtSup4+Extsub4**	**Subtot 1.i (ExtSup5+Extsub5**	**Subtot 1.i (ExtSup6+Extsub6**	**Subtot 1.i (ExtSup7+Extsub7**	**Subtot 1.i**
	1.i.1 Agua superficial	ExtSup1	ExtSup2	ExtSup3	ExtSup4	ExtSup5A	ExtSup6	ExtSup7	SubtotExtSup
	1.i.2 Agua subterránea	ExtSub1	ExtSub2	ExtSub3	ExtSub4	ExtSub5A	ExtSub6	ExtSub7	SubtotExtSub
	1.ii. De otras fuentes	**Subtot 1.ii (1.ii.1+1.ii.2)**	**Subtot 1.ii (1.ii.1+1.ii.2)**	**Subtot 1.ii (1.ii.1+1.ii.2)**	**Subtot 1.ii (1.ii.1+1.ii.2)**	**Subtot 1.ii (1.ii.1+1.ii.2)**	**Subtot 1.ii (1.ii.1+1.ii.2)**	**Subtot 1.ii (1.ii.1+1.ii.2)**	**Subtot 1.ii**
	1.ii.1 Agua de lluvia						Inf-Esc		**SubtotInf-Esc**
	1.ii.2 Extracción de agua de mar								
Dentro de la economía	**2. Uso de agua recibida de otras unidades económicas**	**Reuso1+Reuso2**	**Reuso3+Abast1**	**Reuso4**			**Desc1+Desc2**	**Abast2**	**Total 2**
3. Uso total del agua	**(= 1+2)**	**1+2**	**1+2**	**1+2**	**1+2**	**1+2**	**1+2**	**1+2**	**TOTAL**

Source: Joint development, CONAGUA and INEGI.

Cuadro 2a1.2. Description of variables of Physical use table

VARIABLE	SOURCE	DESTINATION	DESCRIPCTION
ExtSub1	Groundwater	Agriculture	Extraction of groundwater for agricultural use (Use A + Use D + Use G + Use I + Use L)
ExtSub2	Groundwater	Industry	Extraction of groundwater for industrial use (Use B + Use E + Use F1 + Use K)
ExtSub3	Groundwater	Electric Power Generation (Thermoelectric)	Extraction of groundwater for thermoelectric use
ExtSub4	Groundwater	Electric Power Generation (Hydropower)	Extraction of groundwater for Hydropower use
ExtSub5	Groundwater	Urban use	Extraction of groundwater for Urban use
ExtSub5A	Groundwater	Municipal distribution	Extraction of groundwater for Municipal distribution use
ExtSub6	Groundwater	Sewer	Extraction of groundwater for Municipal sewer use
ExtSub7	Groundwater	Domestic	Extraction of groundwater for Domestic use
ExtSup1	Surface water	Agriculture	Extraction of surface water for agricultural use
ExtSup2	Surface water	Industry	Extraction of surface water for industrial use
ExtSup3	Surface water	Electric Power Generation (Thermoelectric)	Extraction of surface water for thermoelectric use
ExtSup4	Surface water	Electric Power Generation (Hydropower)	Extraction of surface water for Hydropower use
ExtSup5	Surface water	Urban use	Extraction of surface water for Urban use
ExtSup5A	Surface water	Municipal distribution	Extraction of surface water for Municipal distribution use
ExtSup6	Surface water	Sewer	Extraction of surface water for sewer use
ExtSup7	Surface water	Domestic	Extraction of surface water Domestic use
Reuso1	Sewer	Agriculture	Wastewater reuse
Reuso2	Industry	Agriculture	Wastewater reuse
Reuso3	Sewer	Industry	Municipal Wastewater reuse for industrial and utilities use
Reuso4	Sewer	Electric Power Generation	
Abast1	Municipal distribution	Industry	Drinking water supply
Abast2	Municipal distribution	Domestic	Drinking water supply
Desc1	Industry	Sewer	Discharge of No Municipal Wastewater
Desc2	Domestic	Sewer	Discharge of Municipal Wastewater to sewer

Source: Joint development, CONAGUA and INEGI.

2a.2 Physical supply table

The following algorithm describes how it was calculated and integrated the information for each cell of the physical supply table.

Table 3a2.1. Algorithm for calculating the physical supply table

		ISIC 1-3	ISIC 5-33, 38-99	ISIC 35		ISIC 36	ISIC 37		
		Agricultura, Ganadería, Silvicultura, Caza y Pesca	Industria y Servicios	Termoeléctricas	Hidroeléctricas	Redes de distribución municipal	Alcantarillado	Doméstico	Total
Dentro de la economía	4. Oferta de agua a otras unidades económicas		Desc1+Reuso2			Abast1+Abast2	Reuso1+Reuso3 +Reuso4	Desc2	Total 4
	4.a Agua de reúso		Reuso2				Reuso1+Reuso3+ Reuso4		Subtot 4.a
	4.b Agua residual que descarga al alcantarillado		Desc1					Desc2	Subtot 4.b
	4.c Agua desalinizada								
Al medio ambiente	5. Retornos totales	Pérdida1 + Retorno1	Retorno 2	Retorno 3	Retorno 4	Pérdida2	Retorno6	Retorno5	Total 5
	Pérdidas en distribución por fugas	Pérdida1				Pérdida2			Subtot
	Aguas residual tratada		Dato directo del PTAR				Dato directo del PTAR		Subtot
	Agua residual no tratada	Retorno1	Retorno 2-Dato directo del PTAR	Retorno3			Retorno 6-Dato directo del PTAR		Subtot
6. Oferta total	(=4+5)	4+5	4+5	4+5	4+5	4+5	4+5	4+5	Total 6
7. Consumo	(=3-6)	3-6	3-6	3-6	3-6	3-6	3-6	3-6	Total 7
Coeficiente de consumo		7/3*100	7/3*100	7/3*100	7/3*100	7/3*100	7/3*100	7/3*100	7/3*100

Source: Joint development, CONAGUA and INEGI.

Cuadro 2a2.2. Description of variables of Physical use table

VARIABLE	SOURCE	DESTINATION	DESCRIPCTION
Pérdida1	Agriculture	Ground/Surface Water	Losses to the environment from leaks in driving
Pérdida2	Municipal distribution	Ground/Surface Water	Losses to the environment from leaks in driving
Retorno1	Agriculture	Ground/Surface Water	Return to the Environment
Retorno2	Industry	Ground/Surface Water	Return to the Environment
Retorno3	Electric Power Generation (Thermoelectric)	Ground/Surface Water	Return to the Environment
Retorno4	Electric Power Generation (Hydropower)	Ground/Surface Water	Return to the Environment
Retorno5	Domestic	Ground/Surface Water	Return the Environment for losses in the sewer
Retorno6	Sewer	Ground/Surface Water	Return to the Environment
Dato directo del PTAR	Industry and Sewer	-	Treated wastewater

NOTE: Some variables are already included in the table integrated description of physical use table.

Source: Joint development, CONAGUA and INEGI.

2a.3 Matrix transfers within the economy

Additionally, an array structure that describes transfer water flows into the economy.

Table 2a3.1. Algorithm for calculating Matrix transfers within the economy

Usuarios / Ofertantes	ISIC 1-3	ISIC 5-33, 38-99	ISIC 35		ISIC 36	ISIC 37		
	Agricultura, Ganadería, Silvicultura, Caza y Pesca	Industria y Servicios	Termoeléctricas	Hidroeléctricas	Redes de distribución municipal	Alcantarillado	Doméstico	Total de agua ofertada
Agricultura, Ganadería, Silvicultura, Caza y Pesca								**TOTAL**
Industria y servicios	Reuso2					Desc1		
Termoeléctricas								**TOTAL**
Hidroeléctricas								**TOTAL**
Redes de distribución municipal		Abast1					Abast2	**TOTAL**
Alcantarillado	Reuso1	Reuso3	Reuso4					
Doméstico						Desc2		**TOTAL**
8. Total de agua recibida de otras unidades económicas (uso)	**TOTAL**	**TOTAL**	**TOTAL**	**TOTAL**	**TOTAL**	**TOTAL**	**TOTAL**	**TOTAL**

Source: Joint development, CONAGUA and INEGI.

It is noteworthy that the equality between supply and use are seen in water flows within the economy, reflected in the transfer matrix.

2b. Diagram of physical flows of water

The diagram of the physical flows of water is an additional proposal for submission of physical SUT, developed by INEGI. With physical information obtained it generates this tool that is an important element for an alternative perspective of the water in three key areas: the environment to the economy, in the economy and the economy to the environment.

2c. Hybrid tables of supply and use

The starting point in the hybrid tables is the National Accounts System of Mexico along with physical information on the extraction of water, i.e., the supply and use within the economy, the discharge of sewage and pollutants into the environment.

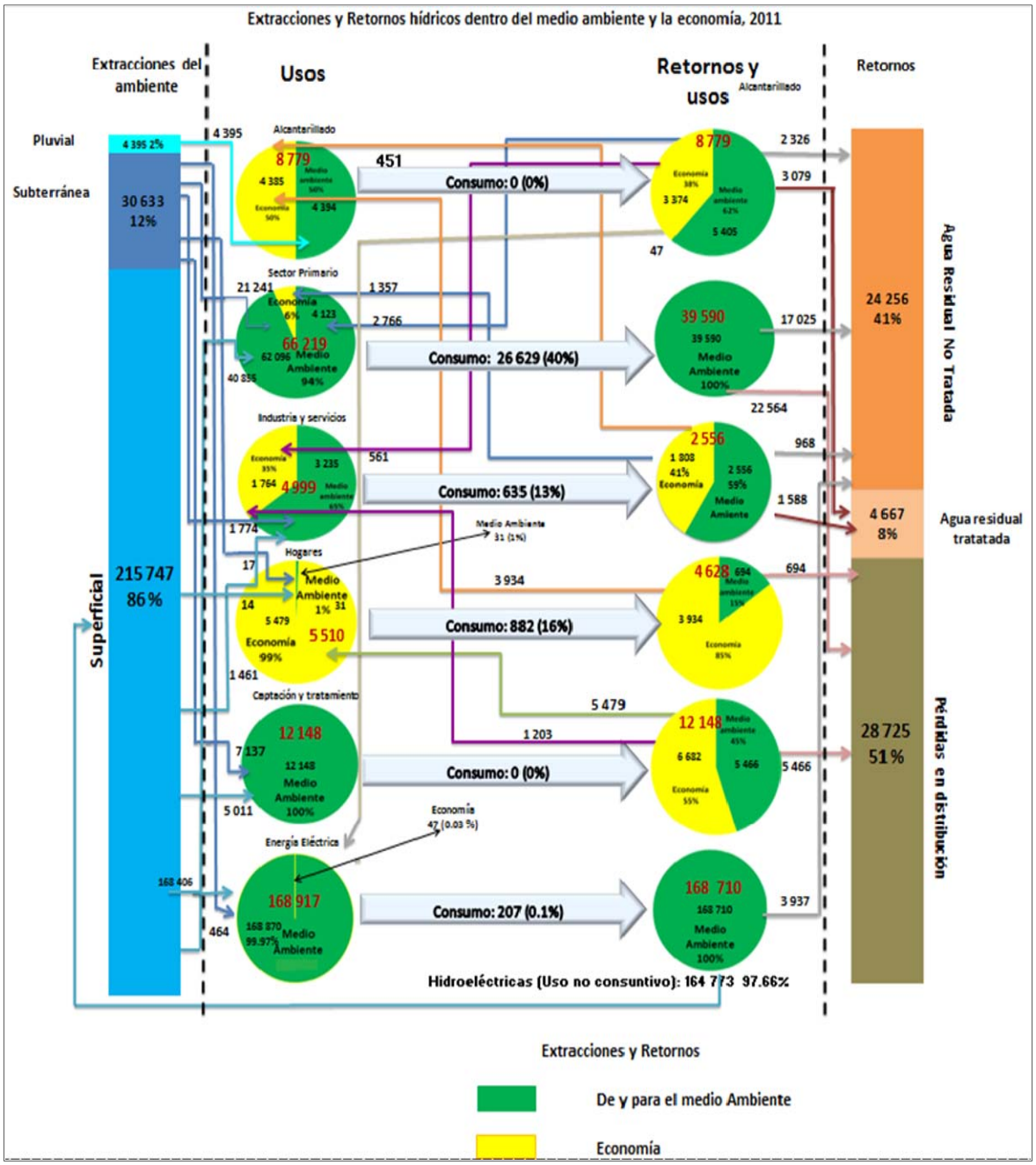
3 Tables of results

Below are shown the results for 2011, resultant from the methodology described above.

3a. Diagram of physical flows of water

Diagram 3a.1. physical flows of water, 2011

Million cubic meters



Source: Own elaboration with information of the PSUT.

The physical flow diagram illustrates the flow of resource in its transit environment to the economy, between economic units and finally his return to the environment.

In the first point, we can see the total volumes of water extracted from the environment by source type. Water from rain represents 2% of the total supplied to the economy, groundwater contributes with 12% and finally surface water 86 percent.

Subsequently, it shows the total amount of water used for each economic sector and corresponds to natural sources provision and/or from other economic units: e.g. the 66 219 million cubic meters (Mmm^3) of water used the primary sector, 94% is environmental extractions and the remaining 6% of the returns are only sewage and industry.

Additionally, it shows the water consumption of each sector and subsequently recorded total returns, i.e. the volume of water being returned to the environment or other economic units.

The following describes, as an example, the flow of water resources for industry and services.

The industry uses 4 999 Mmm^3, of which 65% come from the environment (1 774 Mmm^3 of groundwater and 1 461 Mmm^3 surface extraction) and the remaining 35% comes from other economic units (561 Mmm^3 of sewage and 1 203 Mmm^3 uptake municipal water networks). Moreover, the industrial sector registered a water resource consumption of 635 Mmm^3, which corresponds to water that entered the economy but does not return to the environment since it evaporates or is incorporated into the final products equivalent to 13% of the volume of water used in this sector.

Finally, the industry returns 2 556 Mmm^3 of water resources, of which 41% (1808 million m3) are recirculated to other economic units as the sewer and the primary sector, the remaining 59% goes directly to the environment in different ways, i.e. industry download 968 Mmm^3 of untreated waste water and 1 588 Mmm^3 treated wastewater.

The final part of the diagram shows how the economy returns to the environment the water used; so we can see that 51% of total returns were losses in the distribution, either by leakage or evaporation, the other 8% represents the treated wastewater and 41% as untreated wastewater.

For the electricity sector there is a non-consumptive use, i.e. water used in an economic process (generation of electricity through hydroelectric plants), but is returned to the environment without significant physical or chemical alteration.

3b. Physical supply and use tables

3b.1 Physical use table

Table 3b.1. Physical use table, 2011

Million cubic meters

		Uso físico (por categoría SCIAN, 2007)							Hogares	Total
		11	21, 2222, 23,31-33, 43-93	221			2221			
					Del cual					
		Agricultura, Cría y Explotación de Animales, Aprovechamiento Forestal, Pesca y Caza	Generación, transmisión y distribución de energía eléctrica, suministro de agua y de gas por ductos al consumidor final	Generación, transmisión y suministro de Energía Eléctrica	Termoeléctricas	Hidroeléctricas	Captación, tratamiento y suministro de agua	Alcantarillado y Saneamiento		
Del medio ambiente	1. Extracciones totales	62 096	3 235	168 870	4 097	164 773	12 148	4 395	31	250 775
	1.a Extracción para uso propio	62 096	3 235	168 870	4 097	164 773		0	31	234 232
	1.b Extracción para distribución						12 148			12 148
	1.i De otros recursos del agua	62 096	3 235	168 870	4 097	164 773	12 148	0	31	246 380
	1.i.1 Agua superficial	40 855	1 461	168 406	3 633	164 773	5 011	0	14	215 747
	1.i.2 Agua subterránea	21 241	1 774	464	464	0	7 137	0	17	30 633
	1.i.i. De otras fuentes	0	0	0	0	0	0	4 395	0	4 395
	1.i.i.1 Agua de lluvia							4 395		4 395
	1.i.i.2 Extracción de agua de mar									
Dentro de la economía	2. Uso de agua recibida de otras unidades económicas	4 123	1 764	47	47	0	0	4 384	5 479	15 797
3. Uso total del agua	(=1+2)	66 219	4 999	168 917	4 144	164 773	12 148	8 779	5 510	266 572

Source: Joint development, CONAGUA and INEGI.

3b.2 Supply use table

Table 3b.2. Supply use table, 2011

Million cubic meters

		Oferta física (por categoría SCIAN, 2007)							Hogares	Total
		11	21, 2222, 23,31-33, 43-93	221			2221			
					Del cual					
		Agricultura, Cría y Explotación de Animales, Aprovechamiento Forestal, Pesca y Caza	Generación, transmisión y distribución de energía eléctrica, suministro de agua y de gas por ductos al consumidor final	Generación, transmisión y suministro de Energía Eléctrica	Termoeléctricas	Hidroeléctricas	Captación, tratamiento y suministro de agua	Alcantarillado y Saneamiento		
Dentro de la economía	**4. Oferta de agua a otras unidades económicas De la cual:**	**0**	**1 808**	**0**	0	0	**6 682**	**3 374**	**3 934**	**15 797**
	4.a Agua de reúso	0	1 357	**0**	0	0	0	3 374	0	**4 731**
	4.b Agua residual que descarga al alcantarillado	0	451	**0**	0	0	0	0	3 934	**4 384**
	4.c Agua desalinizada	0	0	**0**	0	0	0	0	0	**0**
Al medio ambiente	**5. Retornos totales**	**39 590**	**2 556**	**168 710**	3 937	164 773	**5 467**	**5 405**	**694**	**222 422**
	Pérdidas en distribución por fugas	22 564	0	**0**	0	0	5 467	0	694	**28 725**
	Aguas residual tratada	0	1 588	**0**	0	0	0	3 079	0	**4 667**
	Agua residual no tratada	17 025	968	**3 937**	3 937	0	0	2 326	0	**24 256**
6. Oferta total	**(=4+5)**	**39 590**	**4 363**	**168 710**	3 937	164 773	**12 148**	**8 779**	**4 628**	**238 219**
7. Consumo	**(=3-6)**	**26 629**	**635**	**207**	207	0	**0**	**0**	**882**	**28 353**
Coeficiente de consumo	CONSUMO/USO TOTAL DEL AGUA *100	**40.2**	**12.7**	**0.1**	5.0	0.0	**0.0**	**0.0**	**16.0**	**10.6**

Source: Joint development, CONAGUA and INEGI.

3b.3 Matrix transfers within the economy

Table 3a.3. Matrix transfers within the economy, 2011

Million cubic meters

Usuarios / Oferentes	Por categoría SCIAN, 2007							Hogares	Total de agua ofertada
	11	21, 2222, 23,31-33, 43-93	221			2221			
				Del cual					
	Agricultura, Cría y Explotación de Animales, Aprovechamiento Forestal, Pesca y Caza	Generación, transmisión y distribución de energía eléctrica, suministro de agua y de gas por ductos al consumidor final	Generación, transmisión y suministro de Energía Eléctrica	Termoeléctricas	Hidroeléctricas	Captación, tratamiento y suministro de agua	Alcantarrillado y Saneamiento		
Agricultura, Ganadería, Silvicultura, Caza y Pesca									0
Minería,Construcción, Industria Manufacturera y Servicios; suministro de gas por ductos	1 357						451		1 808
Termoeléctricas									0
Hidroeléctricas									0
Captación, tratamiento y suministro de agua		1 203						5 479	6 682
Alcantarrillado y Saneamiento	2 766	561		47					3 374
Hogares							3 934		3 934
8. Total de agua recibida de otras unidades económicas (uso)	**4 123**	**1 764**	**0**	**47**	**0**	**0**	**4 384**	**5 479**	**15 797**

Source: Joint development, CONAGUA and INEGI.

3c. Hybrid tables of supply and use

Regarding to the SUT at current values, presents figures to 2011 and whose records are added to the accounts prepared in water.

An example of the way we have interpreted the hybrid SUT seen in Sector 11 (Agriculture, animal breeding and production, forestry, fishing and hunting) that generated in 2011 a gross production of 709 393 million pesos; of which 262 522 million pesos were for intermediate consumption, thus generating an added value of 446 871 million pesos.

Meanwhile, the Sector extracted from the environment 62 096 Mmm^3 of water to carry out their productive activities; additionally received 4 123 Mmm^3 from other economic units as they were: 1 357 Mmm^3 of industry and services, and from 2 766 Mmm^3 sewer.

Moreover, the agricultural sector returned to the environment a volume of 39 590 Mmm^3. The above resulted in the sector experiences water consumption of 26 629 Mmm^3 of vital fluid in the course of the year.

Below are presented the hybrid SUT for 2011.

Table 3c.1. Hybrid table of supply, 2011

Million pesos, million cubic meters

	PRODUCCIÓN TOTAL POR INDUSTRIA (CATEGORÍA SCIAN 2007)														
	11	21, 2222, 23,31-33, 43-93	221			2221									
				Del cual:											
	Agricultura, cría y explotación de animales, aprovechamiento forestal, pesca y caza	Minería, Construcción, Industria manufacturera y servicios; Suministro de gas por ductos	Generación, transmisión y suministro de energía eléctrica	Termoeléctricas	Hidroeléctricas	Captación, tratamiento y suministro de agua	Alcantarillado y saneamiento	PRODUCCIÓN TOTAL A PRECIOS BÁSICOS	Hogares (uso doméstico)	Oferta total de agua	Importaciones	Oferta total a precios básicos	Impuestos menos subsidios a la producción	Margen de comercio y distribución	Oferta total a precios de comprador
1. Producción y oferta total (Milllones de pesos corrientes)	709 393	23 115 349	409 343	317 241	92 102	39 023	39 023	24 312 132			4 728 326	29 040 457	506 080		29 546 538
De la cual:															
1.a Agua potable (CPC 1800)						39 023		39 023				39 023			39 023
1.b Servicio de alcantarillado y saneamiento (CPC 941)							39 023	39 023				39 023			39 023
2. Oferta total de agua (Millones de m^3)	39 590	4 363	168 710	3 937	164 773	12 148	8 779	233 591	4 628	238 219					238 219
2.a Oferta de agua a otras unidades económicas	0	1 808	0	0	0	6 682	3 374	11 864	3 934	15 797					15 797
2.b Retornos totales	39 590	2 556	168 710	3 937	164 773	5 467	5 405	221 727	694	222 422					222 422
3. Emisiones totales de DBO (Millones de toneladas)		6					1	7							7

Source: Joint development, CONAGUA and INEGI.

Table 3c.2. Hybrid table of use, 2011

Million pesos, million cubic meters

	Consumo Intermedio de las industrias (por categoría SCIAN 2007)								Consumo final actual									
	11	21,2222, 23,31-33, 43-93	221			2221			Hogares (Doméstico)									
				Del cual														
	Agricultura, cría y explotación de animales, aprovechamiento forestal, pesca y caza	Mineria, Construcción, Industria manufacturera y servicios; Suministro de gas por ductos	Generación, transmisión y suministro de energía eléctrica	Termoeléctricas	Hidroeléctricas	Captación, tratamiento y suministro de agua	Alcantarrillado y saneamiento	CONSUMO INTERMEDIO TOTAL	Gasto de consumo final	Transferencias sociales del gobierno	Total	Gobierno	Total	Formacion bruta de capital fijo	Variación de existencias	Exportaciones	Discrepancias estadísticas	Usos totales a precios de comprador
1. Consumo intermedio y uso total (Millones de pesos corrientes)	262 522	9 814 868	181 096	140 349	40 747	11 402	11 402	10 281 289	9 639 862	945	9 640 807	1 692 827	11 333 634	3 165 020	73 542	4 545 385	147 667	29 546 538
Del cual:																		
1.a Agua potable (CPC 1800)	510	20 722	25	3	21	122		21 379	0	0	0		0					21 379
1.b Servicio de alcantarillado y saneamiento (CPC 941)	68	265	0					333										333
2. Valor agregado total (Millones de pesos corrientes)	446 871	13 298 332	228 247	176 892	51 356	27 622	27 622	14 028 694										14 028 694
3.Uso total de agua (Millones de m^3)	66 219	4 999	168 917	4 144	164 773	0	4 384	244 519			239 711		239 711					484 230
3.a Extracción total	62 096	3 235	168 870	4 097	164 773	0	0	234 201			234 232		234 232					468 433
De la cual: 3.a.1- Extracción para uso propio	62 096	3 235	168 870	4 097	164 773	0	0	234 201			234 232		234 232					468 433
3.b - Uso de agua recibida de otras unidades económicas	4 123	1 764	47	47	0	0	4 384	10 318			5 479		5 479					15 797
CIIU 36 Captación, tratamiento y distribución de agua		6 682						6 682			5 479		5 479					12 161
7. Consumo	26 629	635	207	207	0	0	0	10 929			235 083		235 083					246 011

Source: Joint development, CONAGUA and INEGI.

4 Sources of information

VARIABLE	SOURCE
- Physical flows of water from the environment to the economy (by water source type) **- Physical flows of water between economic units** **- Physical flows of water from the economy to the environment**	CONAGUA
- Economic variables	INEGI. *Sistema de Cuentas Nacionales de México. Cuentas de Bienes y Servicios*.

5 Technical issues to be addressed

- **Asset accounts**

Currently, measure water reserves are complex; because it is necessary to have bathymetry studies main bodies of water, including other specific investigations.

It is necessary to direct more efforts to have this kind of information because it is extremely important for society to know the amount of water that we have, to develop policies for the protection, management and resource management based on comprehensive and robust statistics.

- **Economic valuation**

In the framework of satellite accounts and particularly into Mexico environmental accounts, we have worked on developing a proposal for economic valuation to two issues:

Depletion of groundwater and wastewater discharges untreated.

Groundwater

From the calculation in physical units of groundwater overexploited, considering the recharge and extraction variables for each registered in Mexico aquifers. In cases in which the difference between the two variables is negative, the aquifer is considered as exploited:

$$Overexploited = Recharge - Extraction$$

Furthermore, the economic assessment is carried out according to the recommendations of SEEAW described in Chapter 8, "Assessment of Water Resources". In this methodology indicates that well water has economic value when users are willing to pay for the availability of the resource.

In the absence of a water market or when the function of the market is limited, you can use valuation techniques that allow for an economic value to water resources without considering market failures.

This method is known as the residual value or shadow prices and is associated with two methods that apply to the use of water as an intermediate input for production. These are, firstly, changes in net income, and on the other the approximation of the production function, are based on the premise that a company maximizes its profits from the sale of water to the extent that net income marginal costs are equal to marginal. The assessment process requires that the water market is not competitive, so that the total value of production is exactly equal to the opportunity costs of all inputs.

This also, is summarized in the following equation:

$$VMP_W = \frac{TVP - \sum p_i\, q_i}{q_W}$$

Donde:

VMP_W = The value of the marginal product of water

TVP = Total value of the commodity produced

$p_i q_i$ = The opportunity costs of non-water inputs into production

q_W = The cubic metres of water used in production.

The total value of goods produced is the value of the water produced by the utility over income connection rights, sewage, treated water sales and other income derived from the activity, as well as fixed assets produced for own use, in other words is the production value.

For its part, the opportunity costs of inputs of production water not refer to intermediate costs not directly related to the water resource itself.

Finally, the term used in the production water to the sum of all the water collection and supply sources, whether ground or surface water, more water volume acquired block.

When the opportunity cost of inputs no water is given by their market prices, shadow prices of water are equal to the difference between the value of production and the costs of all non-water inputs.

In this context the calculation of shadow prices was based on information derived from the Economic Census, the following variables:

a) Gross Value of Production of utilities (pesos)
b) Physical and chemical agents, reagents and supplies related (pesos)
c) Supplies and materials (pesos)
d) Payments for staffing (pesos)
e) Honorary and commissions paid (pesos)
f) Fuels, lubricants (pesos)
g) Advertising (pesos)
h) Electricity (pesos)
i) Other (pesos)
j) Payments for bulk water (pesos)
k) Surface water (cubic meters)
l) Groundwater (cubic meters)
m) Bulk water (cubic meters)

Intermediate consumption in the sector leading in two parts: water no intermediate consumption [subparagraphs *b* to *i*)] and intermediate water consumption (*j*). The manner in which developed the calculation of shadow prices is to subtract the value of production the amount of water consumption and not divided by the volume of water used in production (sum of *k*, *l*, *m*):

$$\boldsymbol{Shadow\ price} = \frac{\boldsymbol{a} - (\boldsymbol{b} + \boldsymbol{c} + \boldsymbol{d} + \boldsymbol{e} + \boldsymbol{f} + \boldsymbol{g} + \boldsymbol{h} + \boldsymbol{i})}{(\boldsymbol{k} + \boldsymbol{l} + \boldsymbol{m})}$$

Finally, it multiplies the volume of ground water by the shadow price overused derivative described method.

When data allows, it is possible to obtain economic values by economic sector. In the case of Mexico, have data for agriculture, industry and households

Wastewater discharges untreated

It starts of the calculation in physical units of discharge of untreated wastewater, considering the variables "total downloads" and "treatment":

$$Wastewater\ untreated = Total\ discharges - Treated\ discharges$$

Furthermore, the economic assessment is also done according to the recommendations of SEEAW described in Chapter 8, "Assessment of Water Resources", particularly on the basis of technical "waste assimilation"; and costs for water treatment residual are estimated.

The calculation of treatment costs was based on information derived from the Economic Census, considering the following variables:

a) Capital (gross fixed capital formation and changes in inventories) (pesos)
b) Expenditures (Compensation of employees) (pesos)
c) Inputs (reagents, materials and supplies, electricity, payment for bulk water, other) (pesos)
d) Volume of water (supply, disinfection, purification and treatment) (cubic meters)

The treatment costs are estimated as follows:

$$\boldsymbol{Treatment\ costs} = \frac{(\boldsymbol{a} + \boldsymbol{b} + \boldsymbol{c})}{\boldsymbol{d}}$$

Finally, multiply the volume of untreated wastewater treatment for the cost estimate.

Similarly, when information allows economic values are possible economic sector. In the case of Mexico, have data for agricultural, industrial and municipal.