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SANITATION IN LATIN AMERICA AND THE CARIBBEAN: THE ACHIEVEMENTS OF THE INTERNATIONAL DRINKING WATER SUPPLY AND SANITATION DECADE

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Contents

1. Introduction

In 1980, at the beginning of the International Drinking Water Supply and Sanitation Decade, Latin America and the Caribbean were relatively well provided with both water supply and sanitation facilities compared with the other regions of the developing world. Nevertheless, many millions of the citizens of the countries of the region remained without a protected source of drinking water, and even more suffered the absence of safe and decent facilities for the disposition of excreta. This was especially true for the low-income population in both urban and rural areas.

It can justifiably be claimed that the programmes developed under the Alliance for Progress and continued in the 1970s and largely directed towards the provision of urban drinking water supply had served the region well. The reduction in the expansion of service in more recent years in most countries of the region raises questions, however, about the nature of the policies being applied. There is a need to reconsider the approach being taken and perhaps to introduce innovations in the means of delivery of drinking water supply and excreta disposal.

This paper critically examines the recent development of the sector within the context of the International Drinking Water Supply and Sanitation Decade (IDWSSD). Consideration is given specifically to the achievements of the sector in the provision of sanitation. Attention is also drawn to the needs of the poor peri-urban and rural populations. The performance of the sector is discussed with particular reference to the wider social and economic problems facing the region, particularly the recession and the accompanying problem of capital shortage.

a) The situation at the beginning of the decade

Relatively well organized water supply and sanitation institutions were operating in most of the countries of the region by the end of the 1970s. Usually these institutions have been organized within the central government and had responsibility for both drinking water supply and sanitation. There were exceptions, as in Brazil, where the institutions were organized within the states, and in Colombia, where the municipalities continue to be the most important providers of water supply and sanitation services. More recently, there has been a tendency to increasing decentralization of water supply and sanitation administrations, as for example in Argentina where responsibility has been delegated to the provinces and in Chile where regional companies are being created. There has even been some consideration to increasing the role of private enterprise in the sector.

In the urban areas of most countries of the region, high levels of service had been achieved, particularly in water supply where 71% of the population were served with house connections in 1980 (table 1). The situation was not, however, so satisfactory in the provision of sewerage, only 59% of the urban population being served, although perhaps the data understate the real existence of adequate individual excreta disposal systems. In rural areas less progress had been made although, here again, in the larger rural settlements in many parts of the region piped drinking water supply systems were being installed. There were still, however, many rural people without a safe source of drinking water or sanitary excreta disposal facilities. Moreover, very few countries had any institutional support for providing services to this part of their population.

The provision of service in 1980 varied considerably among the countries of the region, with the highest levels in the smaller countries of Central America and the Caribbean. Not surprisingly, access to a safe source of drinking water and adequate sanitation remained lowest in those countries with a higher proportion of rural population and lower incomes --Haiti, Paraguay, Bolivia and Nicaragua.

Table 1

LATIN AMERICA AND THE CARIBBEAN, PROVISION OF WATER SUPPLY & SANITATION,1990

	WATER SUPPLY															SEWERAGE AND SANITATION					
	Total Population served*					Urban Population						Rural Population									
Country	Total Population	House Connection	Easy Access	Total Served	%	Total Population	House Connection	%	Easy Access	%	Total Served	%	Total Population	Total Served	%	Total Served	%	Urban Served	%	Rural Served	%
Argentina	27.94	13.38	1.44	14.82	53	23.19	13.38	58	0.65	3	14.03	61	4.75	0.79	17	20.21	72	18.56	80	1.65	35
Bahamas	0.22	0.11	0.02	0.13	59	0.14	0.11	79	0.02	14	0.13	93	0.08	-	0	0.12	55	0.12	86	-	-
Barbados	0.24	0.08	0.16	0.24	100	0.08	0.08	100	0.00	0	0.08	100	0.17	0.16	94	-	100	-	-	-	-
Belize	0.15	0.05	0.05	0.10	67	0.07	0.05	71	0.03	43	0.08	114	0.07	0.03	43	0.10	67	0.05	71	0.06	86
Bolivia	5.60	0.60	1.45	2.05	37	2.49	0.60	24	1.13	45	1.73	69	3.11	0.32	10	1.04	19	0.92	37	0.12	4
Brazil	119.10	64.81	22.00	86.61	73	80.48	64.61	80	2.40	3	67.01	83	38.62	19.60	51	26.30	22	25.91	32	0.39	1
Colombia	27.00	11.84	11.27	23.11	86	17.28	11.84	69	4.16	24	16.00	93	9.72	7.11	73	16.37	61	16.00	93	0.37	4
Costa Rica	2.22	1.30	0.76	2.06	93	1.33	1.30	98	0.03	2	1.33	100	0.89	0.73	82	2.07	93	1.32	99	0.75	84
Chile	11.20	8.42	1.01	9.43	84	9.07	8.42	93	0.65	7	9.07	100	2.13	0.36	17	9.24	83	9.03	100	0.21	10
Dominican Rep	5.43	1.64	1.59	3.23	59	2.75	1.64	60	0.69	25	2.33	85	2.68	0.90	34	0.80	15	0.69	25	0.11	4
Ecuador	8.12	2.77	1.10	3.87	48	3.82	2.77	73	0.25	7	3.02	79	4.30	0.85	20	3.54	44	2.80	73	0.74	17
El Salvador	4.54	1.17	1.16	2.33	51	1.90	1.17	62	0.11	6	1.28	67	2.64	1.05	40	1.60	35	0.91	48	0.69	26
Guatemala	7.26	1.38	1.86	3.24	45	2.69	1.38	51	1.03	38	2.41	90	4.57	0.83	18	2.14	29	1.22	45	0.92	20
Guyana	0.79	0.35	0.28	0.63	80	0.39	0.35	90	0.04	10	0.39	100	0.40	0.24	60	0.61	77	0.28	72	0.32	80
Haiti	4.91	0.33	0.56	0.89	18	1.20	0.33	28	0.28	23	0.61	51	3.71	0.28	8	0.87	18	0.50	42	0.37	10
Honduras	3.75	0.70	1.52	2.22	59	1.36	0.70	51	0.56	41	1.26	93	2.39	0.96	40	1.29	34	0.67	49	0.62	26
Jamaica	2.25	0.62	0.51	1.13	50	1.13	0.62	55	0.00	0	0.62	55	1.12	0.51	46	0.15	7	0.13	12	0.02	2
Mexico	70.12	28.39	22.76	51.15	73	45.79	28.39	62	13.03	28	41.42	90	24.33	9.73	40	38.37	55	35.45	77	2.92	12
Nicaragua	2.73	0.97	0.08	1.05	38	1.46	0.97	66	0.01	1	0.98	67	1.27	0.07	6	0.50	18	0.50	34	-	-
Panama	1.92	0.84	0.72	1.56	81	0.94	0.84	89	0.11	12	0.95	101	0.98	0.61	62	1.36	71	0.78	83	0.58	59
Paraguay	3.06	0.45	0.17	0.62	20	1.15	0.45	39	0.00	0	0.45	39	1.91	0.17	9	2.61	85	1.09	95	1.52	80
Peru	16.82	5.82	2.31	8.13	48	10.21	5.82	57	1.10	11	6.92	68	6.61	1.21	18	5.86	35	5.86	57	0.02	0
Suriname	0.35	0.09	0.22	0.31	89	0.10	0.09	90	0.01	10	0.10	100	0.25	0.20	80	0.30	86	0.10	100	0.20	80
Trinidad	1.10	0.55	0.52	1.07	97	0.70	0.55	79	0.15	21	0.70	100	0.40	0.37	93	1.02	93	0.67	96	0.35	88
Uruguay	2.94	2.19	0.17	2.36	80	2.44	2.19	90	0.16	7	2.35	96	0.50	0.01	2	1.47	50	1.44	59	0.03	6
Venezuela	15.02	9.80	2.87	12.67	84	11.89	9.80	82	1.20	10	11.00	93	3.13	1.67	53	7.47	50	7.09	60	0.38	12
TOTAL	344.76	158.45	76.56	235.01	68	224.05	158.45	71	27.80	12	186.25	83	120.73	48.76	40	145.43	42	132.09	59	13.34	11

Source:PAHO *Population in millions

Moreover, the quality of service leaves much to be desired in many cases. Only in the island countries of the Caribbean were high levels of service to be found for the rural population.

One aspect of service which was little developed anywhere, however, was waste water treatment. In most urban areas sewered wastes were discharged into the nearest water body with no treatment and in many cases with little consideration of even the most elementary concept of preserving water quality. For example, in Chile only some 2% of sewered wastes were treated in 1980.1/ Where treatment of sewage did occur it was usually in smaller towns. In fact, the expansion of sewerage has been one of the major and increasing causes of contamination of both fresh water bodies and coastal seas.

b) The targets of the Decade

By 1980, the majority of the countries of the region had set national targets for expanding the provision of drinking water supply and sanitation services during the Decade. These targets have been adjusted since then, generally downwards reflecting the impact of the generally negative overall economic climate. The targets remain ambitious, however, even if they fall short of the original goal set at the time of the Mar del Plata Conference,

"to provide all people with water of safe quality in adequate quantity and basic sanitary facilities by 1990 according priority to the poor and less privileged".2/

The prevailing targets for expansion of coverage during the Decade adopted by the countries of Latin America and the Caribbean can be summarized as follows:

i) The provision of safe drinking water to 91% of the urban population --85% to be served through house connections;

ii) The provision of safe drinking water to 56% of the rural population;

iii) The provision of sewerage or other excreta disposal services to 69% of the urban population;

iv) The provision of means for the sanitary disposition of excreta to 31% of the rural population.3/

The Pan-American Health Organization (PAHO) has estimated that the achievement of these targets implies the need to provide by 1990 in the region water supplies to 99 million people in urban areas and 21 million in rural areas. Some 85 million urban dwellers and 26 million rural dwellers must be provided with sanitation.4/ No targets were considered for waste treatment.

It was estimated in 1985, again by PAHO, that the total investment required during the remainder of the Decade in order to reach the national targets would be some 30 billion United States dollars. In addition, however, considerable sums will be required for the maintenance of the existing systems. The cost of maintenance of existing systems is difficult to estimate, but probably lies between US$ 2 billion and US$ 8 billion a year. If new investment and maintenance requirements are taken together, there was in 1985 an additional need to invest between US$ 40 to US$ 70 billion in water supply and sanitation in the second half of the Decade.

c) The financial restraint

At the beginning of the Decade, it was already obvious that for many countries in the region, the achievement of the goals of the Decade and even of the specific national targets would be very dependent on the financial resources made available. The very existence of the Decade implied increasing the priority given to water supply and sanitation investments even beyond that already given during the 1960s and 1970s.

In the 1960s and 1970s large investments were made in Latin America and the Caribbean in sanitation, particularly in the provision of urban water supply (table 2). In 1960 some US$ 17 billion at 1985 per capita unit costs had been invested historically in water supply and sewerage facilities.5/ In the following twenty years between US$ 20 to US$ 24 billion was invested and a considerable expansion of service achieved. Of this investment approximately 60% was spent in the construction of urban water supply systems. The remainder was largely invested in urban sanitation. The available information does not permit any more detailed analysis. The relative costs of the provision of a water supply connection and of a sewerage connection

are such that the distribution of investment shows a considerable imbalance unfavourable to urban sewerage in particular and to sanitation in general.

It was estimated that for the region as a whole, the level of investment required, to achieve the targets set for the Decade by the countries in 1980, using conventional technology, would be some one and a half to two and a half times the level achieved between 1970 and 1979.6/ In some countries, plainly the poorer ones, the coefficient would be very much higher. Such increases in the amount of investment, it was hazarded, could be achieved in most countries of the region less than complete coverage was targeted.7/ There would be exceptions, however, particularly among the smaller and poorer countries.

Moreover, it was concluded that the bulk of the required financing would have to be found within the countries themselves. External sources of finance could not be expected to provide more than a small amount of the capital required. During the 1970s the external contribution to investment in the sector was equivalent to 26% of the total, but was declining. This external financing was largely provided by the multilateral banks and was heavily concentrated in the larger countries of the region and in urban areas. Most countries of the region have only very limited aid from bi-lateral sources.

During the 1980s, however, the countries of Latin America and the Caribbean have almost without exception suffered from an economic recession unparalleled since the 1930s. The water supply and sanitation sector was not immune from the effects of the crisis. Levels of capital investment fell dramatically in most countries. This fall affected the levels of investment in water supply and sanitation which fell short of the targets established at the beginning of the Decade in many countries although it did increase for the region as a whole over the levels achieved in the 1970s. The extent of the increase depends on which estimates of investment are used (table 2). It is clear, however, that the investments made fell short of those required to meet the targets set.

Table 2

LATIN AMERICA AND THE CARIBBEAN: ESTIMATED INVESTMENTS IN DRINKING WATER SUPPLY, SEWERAGE OR EXCRETA DISPOSAL SERVICES
(US dollars at 1985 per capita unit costs or in constant 1985 prices)

Sub-sector	Before 1960 (million)	1960s (million)	1970s (million)	1981/85 (million)	1986/90 (billion)	Estimated cost of reaching national goals of IDWSSD (million)
Urban drinking water supply						
- ECLAC	7 649.6	4 716.9	9 829.4	5 261.0	4.9/6.1/5.4	13 866.2
- PAHO	..	..	..	..	..	15 704.3
Rural drinking water supply						
- ECLAC	1 524.0	358.1	1 960.3	810.6	0.6/0.9/0.7	1 930.8
- PAHO	..	..	..	..	..	1 888.6
Sub-total for water supply						
- ECLAC	9 173.6	5 075.0	11 789.7	6 071.6	5.6/6.9/6.0	15 797.0
- PAHO	..	..	..	..	..	17 593.0
Urban sanitation						
- ECLAC	7 880.6	1 616.7	5 844.4	5 821.9	3.6/4.5/4.0	11 561.4
- PAHO	..	..	..	..	..	11 324.4
Rural sanitation						
- ECLAC	72.3	91.8	..	448.0	0.2/0.6/0.2	1 198.7
- PAHO	..	..	..	..	..	1 195.9
Sub-total for sanitation						
- ECLAC	7 952.9	1 708.6	5 844.4	6 269.9	3.8/5.1/4.2	12 760.1
- PAHO	..	..	..	..	..	12 520.3
TOTAL						
- ECLAC	17 126.4	6 783.5	17 634.0	12 341.5	9.4/12.1/10.3	28 557.0
- PAHO	..	6 063.3	14 915.1- -18 123.7	7 735.7	22.5	30 113.3

Source: - All ECLAC estimates have been made on the basis of the number of population provided with drinking water supply, sewerage or excreta disposal services during the period in question and unit per capita costs corresponding to 1985. The definition of coverage and/or the types of services and/or the number of countries or sub-sectors considered may not coincide between various periods. In the cases where information has not been available either its estimate or information for the nearest year were used. Information on unit per capita costs and coverage have been taken from various PAHO, WHO and other publications.

- All PAHO estimates have been taken from PAHO/WHO, Environmental Health Program, International Drinking Water Supply and Sanitation Decade, Regional Progress Report, Environmental Series No. 6; and various other publications. These estimates were recalculated into constant 1985 US dollars. For this purpose they have been inflated by the United States Capital Equipment Price Index. In the cases where information has not been available estimates were used.
- Estimates corresponding to the 1986/90 period are ECLAC estimates of probable investments during this period (three different alternatives have been analyzed); in the case of PAHO, this is the estimated cost of reaching national IDWSSD goals during the last five years of the Decade (this estimate is not in constant US dollars).
- Estimated cost of reaching national goals of IDWSSD corresponds to the 1981/90 period.

Note: Small differences in totals/sub-totals are due to rounding.

2. The achievements so far

The progress made in increased coverage and investments in other aspects of water supply and sanitation for the region as a whole, although substantial in a few countries, was less during the first half of the Decade than had been expected (table 3). The increases in coverage that have been obtained are far from sufficient to meet the targets set for 1990. This is particularly true in the expansion of sanitation both urban (figure 1), and rural (figure 2).

There has been an imbalance in the provision of water supply and the provision of sanitation in Latin America and the Caribbean for many years. The difference between the levels of service has widened during the Decade from 20.2% to 26.7% in the first five years and has probably continued to widen since then. Among the explanations that can be found for this difference, is the fact that a conventional sewerage connection is a more expensive installation than a water supply connection. In addition, external funds have been predominantly directed towards water supply perhaps because the construction of sanitation facilities requires a much lower amount of imported goods and services. Given the prevailing economic situation it is to be expected that the slower progress in the installation of sanitation facilities will continue unless the cost of connections can be lowered.

The expansion in the provision of sewerage is obviously beneficial to the state of the environmental quality around the home and elsewhere where people congregate. The overall impact on the environment is not, however, so favourable. Even with the prevailing relatively low levels of provision of sewerage, human wastes are the major source of water pollution in the region. ECLAC has estimated the total flows of domestic wastes for large urban centres as well as their impact on the water resource (Annex 1).

a) The reasons for the lack of progress

There are various reasons for the relative lackluster performance of the sector during the Decade and for the failure to meet the targets set in 1980. Some are specific to the particular circumstances of the 1980s while others are longer-term weaknesses in

Table 3

LATIN AMERICA AND THE CARIBBEAN, PROVISION OF WATER SUPPLY & SANITATION, 1985

	WATER SUPPLY															SEWERAGE AND SANITATION					
	Total Population served*					Urban *					Rural *										
Country	Total Population	House Connection	Easy Access	Total Served	%	Urban Population	House Connection		Easy Access	%	Total Served	%	Rural Population	Total Served	%	Total Served	%	Urban Served	%	Rural Served	%
Argentina	30.57	15.60	1.26	16.86	55	25.57	15.60	61	0.40	2	16.00	63	5.00	0.86	17	21.05	69	19.30	75	1.75	35
Bahamas	0.23	0.12	0.03	0.15	65	0.15	0.12	80	0.03	20	0.15	100	0.08	-	0	0.15	65	0.15	100	-	-
Barbados	0.25	0.08	0.17	0.25	100	0.09	0.09	100	0.00	0	0.09	100	0.16	0.16	100	0.10	100	0.10	111	-	-
Belice	0.16	0.06	0.05	0.11	69	0.07	0.06	86	0.02	29	0.08	-	0.09	0.02	22	0.10	63	0.06	86	0.04	44
Bolivia	6.43	2.11	0.64	2.75	43	3.07	2.11	69	0.20	7	2.31	75	3.36	0.44	13	1.34	21	1.02	33	0.32	10
Brazil	134.48	79.90	23.54	103.44	77	97.40	79.90	82	2.91	3	82.81	85	37.08	20.63	56	32.50	24	32.10	33	0.40	1
Colombia	27.50	13.97	11.22	25.19	92	18.10	13.97	77	4.11	23	18.08	100	9.40	7.11	76	16.59	68	17.34	96	1.25	13
Costa Rica	2.46	1.45	0.84	2.29	93	1.48	1.45	98	0.03	2	1.48	100	0.98	0.81	83	2.34	95	1.47	99	0.87	89
Chile	12.17	9.54	0.99	10.53	87	10.19	9.54	94	0.41	4	9.95	98	1.98	0.58	29	10.27	84	10.19	100	0.08	4
Dominican Rep	5.96	1.82	1.85	3.67	62	3.28	1.82	55	0.96	29	2.78	85	2.68	0.89	33	1.60	27	1.34	41	0.26	10
Ecuador	9.38	3.71	1.63	5.34	57	4.88	3.71	76	0.22	5	3.93	81	4.50	1.41	31	6.06	65	4.78	98	1.32	29
El Salvador	4.77	1.51	1.07	2.58	54	2.38	1.51	63	0.11	5	1.62	68	2.39	0.96	40	2.97	62	1.94	82	1.03	43
Guatemala	7.96	1.83	1.04	2.87	36	2.98	1.83	61	0.33	11	2.16	72	4.98	0.71	14	1.82	23	1.22	41	0.60	12
Guyana	0.82	0.37	0.31	0.68	83	0.40	0.37	93	0.04	10	0.41	103	0.42	0.27	64	0.73	89	0.40	100	0.33	79
Haiti	5.27	0.45	1.55	2.00	38	1.41	0.45	32	0.38	27	0.83	59	3.86	1.17	30	1.10	21	0.59	42	0.51	13
Honduras	4.07	0.55	1.45	2.00	49	1.44	0.55	38	0.26	18	0.81	56	2.63	1.19	45	1.25	31	0.35	24	0.90	34
Jamaica	2.10	0.99	1.03	2.02	96	1.10	0.99	90	0.10	9	1.09	99	1.00	0.93	93	1.91	91	1.01	92	0.90	90
Mexico	79.24	37.45	28.08	65.53	83	54.24	37.45	69	16.23	30	53.68	99	25.00	11.85	47	44.86	57	41.70	77	3.16	13
Nicaragua	3.27	1.30	0.27	1.57	48	1.87	1.30	70	0.12	6	1.42	76	1.40	0.15	11	0.88	27	0.65	35	0.23	16
Panama	2.14	1.04	0.72	1.76	82	1.09	1.04	95	0.05	5	1.09	100	1.05	0.67	64	0.72	34	1.08	99	0.64	61
Paraguay	3.35	0.59	0.21	0.80	24	1.18	0.59	50	0.03	3	0.62	53	2.17	0.18	8	2.85	85	1.05	89	1.80	83
Peru	19.70	7.62	2.73	10.35	53	12.55	7.62	61	1.53	12	9.15	73	7.15	1.20	17	9.29	47	8.40	67	0.89	12
Suriname	0.50	0.24	0.15	0.39	78	0.34	0.24	71	0.00	0	0.24	71	0.16	0.15	94	0.28	56	0.27	79	0.08	50
Trinidad	1.76	0.67	0.48	1.15	65	0.80	0.67	84	0.13	16	0.80	100	0.38	0.36	95	1.16	66	0.80	100	0.36	95
Uruguay	2.97	2.19	0.28	2.47	83	2.46	2.19	89	0.14	6	2.33	95	0.51	0.14	27	1.74	59	1.44	59	0.30	59
Venezuela	16.47	11.25	3.09	14.34	87	12.75	11.25	88	0.66	5	11.91	93	3.72	2.43	65	7.47	45	7.27	57	0.20	5
TOTAL	383.98	196.41	84.68	281.09	73	261.27	196.42	75	29.40	11	225.82	86	122.13	55.27	45	173.15	45	156.00	60	18.22	15

Source: PAHO *Population in Millions

Figure 1

CHANGE IN URBAN SANITATION, 1980-1985

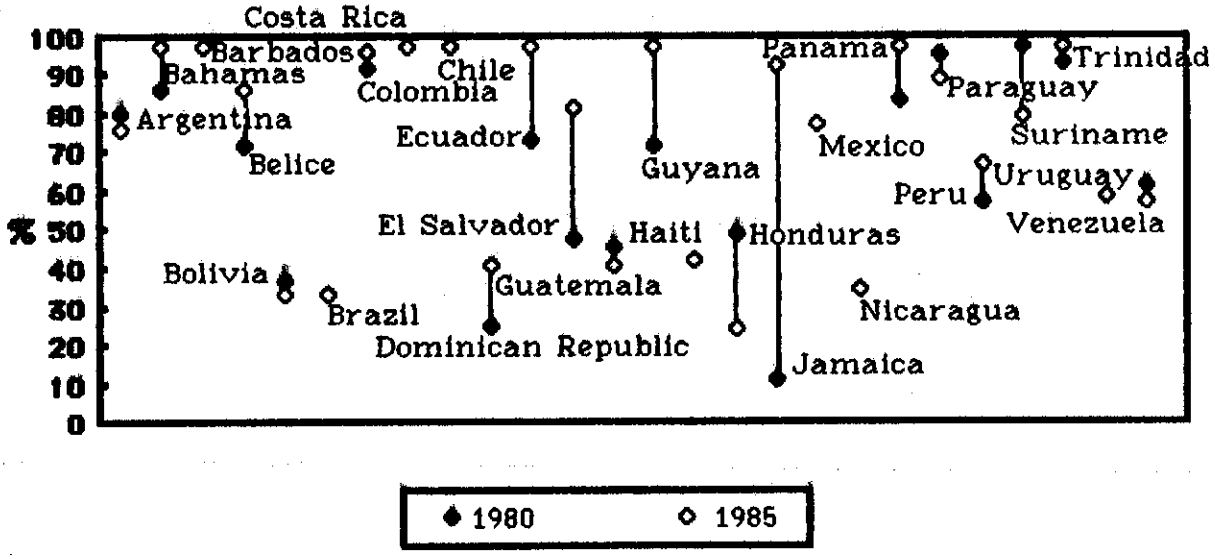
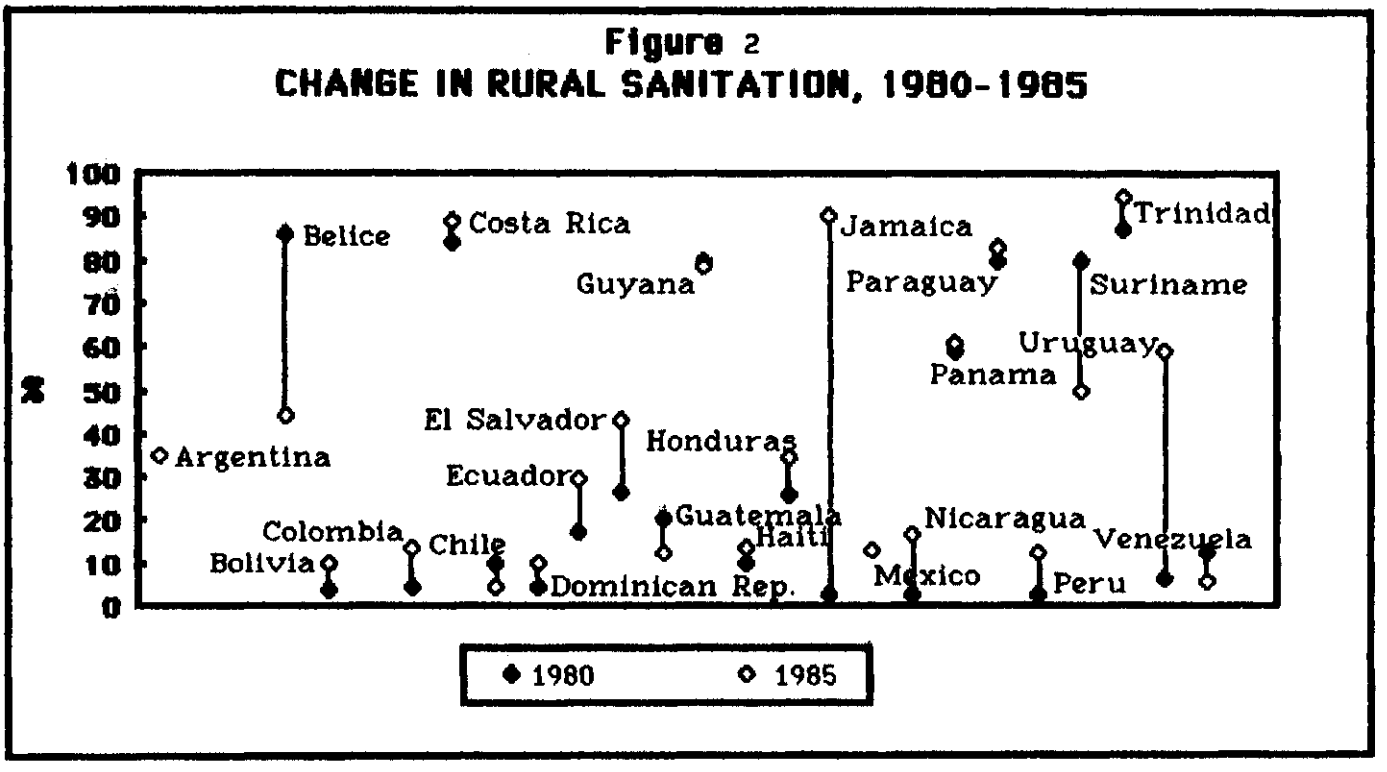


Figure 2
CHANGE IN RURAL SANITATION, 1980-1985



the organization of the provision of water supply and sanitation in the region. For example, it has long been recognized that there is a dearth of properly trained personnel and a need to strengthen the institutions of the sector. At the same time the financing of water supply and sanitation remains too dependent on sources external to the sector itself. It is clear that the bulk of financing will have to be met from the proceeds from the provision of services. Unfortunately, few water supply and sanitation utilities have adequate tariff structures.

The impact of the failure of the provision of services to expand in line with the targets established at the beginning of the Decade has been compounded by the fact that full use is not made of existing facilities. There are too many examples in the region of a serious neglect of maintenance, which leads to poor functioning and repeated breakdowns. Particularly important in this respect is the widespread failure to control losses from water distribution systems and the poor operation of sewage treatment plants where these exist.

b) The significance of the negative economic climate

The 1980s began well for Latin America. Incomes reached their highest levels ever in 1980 and 1981. These peaks were followed by severe falls in economic activity and, in consequence, in levels of income (table 4). Many countries of the region have yet to recuperate from this recession. A serious effect of the recession has been the reduction of the rates of investment in most countries. Levels of investment have experienced a decline which is more than proportionate with the drop in gross domestic product at the beginning of the decade. Moreover, coefficients of gross domestic investment have remained low in many countries. This decline in capital investment is one of the consequences of the large transfers of resources involved in the payment of interest on the external debt.

The fall in the overall level of investment --by up to half in many countries to what it was at its peak in the years at the beginning of the 1980s-- will continue to be felt in the water supply and sanitation sector. Moreover, it can be presumed that the drop in capital investment has affected not only the expansion of water supply and sewerage networks but also the maintenance of existing systems.

Table 4

PER CAPITA GROSS DOMESTIC PRODUCT, AT CONSTANT MARKET PRICES a/

	Dollars at 1980 prices									
Country	1970	1975	1980	1981	1982	1983	1984	1985	1986	1988b/
Argentina	2694	2848	2951	2700	2519	2542	2565	2412	2523	2523
Barbados	2726	2697	3340	3249	3057	3033	3120	3123	3275	3307
Bolivia	686	785	766	749	708	645	622	595	562	554
Brazil	1312	1639	2056	1941	1915	1827	1889	2001	2119	2091
Colombia	925	1090	1265	1266	1251	1248	1268	1288	1335	1402
Costa Rica	1205	1409	1557	1476	1328	1324	1388	1362	1383	1392
Chile	2129	1777	2324	2405	2055	2010	2095	2110	2187	2368
Dominican R	756	1021	1141	1158	1145	1174	1150	1098	1093	1128
Ecuador	758	1206	1421	1432	1407	1350	1375	1401	1404	1389
El Salvador	722	824	775	702	656	654	663	666	661	659
Guatemala	856	978	1128	1107	1040	984	957	925	900	901
Guyana	658	713	616	600	524	461	479	479	...	...
Haití	180	196	235	225	213	211	208	205	203	188
Honduras	548	561	667	650	615	592	584	575	566	571
Jamaica	1601	1567	1216	1226	1207	1205	1188	1112	1120	1175
México	1807	2099	2538	2694	2612	2443	2473	2478	2327	2260
Nicaragua	977	1068	750	702	656	654	663	666	661	571
Panamá	1378	1498	1766	1797	1844	1804	1758	1791	1806	1319
Paraguay	767	951	1318	1388	1333	1253	1253	1263	1222	1275
Perú	1066	1181	1190	1210	1182	1016	1038	1035	1090	1027
Trinidad	3392	4175	5390	5349	5320	4757	4398	4099	3874	3661
Uruguay	1790	1990	2415	2434	2174	2028	1989	1970	2085	2170
Venezuela	4695	3598	3377	3243	3112	2861	2742	2648	2716	2748
Average	1518	1761	2045	2012	1944	1852	1878	1901	1928	1908

Source: ECLAC

a/ Figures in outline indicate lowest levels of per capita income .

b/ Preliminary estimate

Unfortunately, precise information on the effects of the recession on the levels of investment in maintenance is not available. The impact of the economic crisis can be seen in a weakening of the impetus of expansion achieved in the 1970s in the population served and a shortfall on targets resulting in a failure to provide 13.9 million persons with water supply and 25.7 million with sanitation. On the basis of the provision of counterpart funds to the loans of the Inter-American Development Bank and the World Bank, PAHO has estimated that the overall investment in the first half of the Decade fell short of the original national targets by some US$ 4.5 billion.8/

The drop in levels of investment can be compared to the steady increase achieved in the two previous decades under the impetus of the commitments made under the Alliance for Progress and with a generally favourable overall economic climate.

3. Lower-income groups and the Decade

It is to be feared, in the absence of direct information, that the lower income groups of the population have borne the brunt of the relatively poor performance of the sector. They form a large proportion of the population of the majority of the countries of the region and have in general been the major sufferers from the recession of the 1980s.

a) Who are the poor?

Estimating the number of poor people is not easy. It is obvious that large numbers of the population of Latin America and the Caribbean are poor, even destitute. To go from this qualitative statement to a more precise estimate of the size and distribution of the poor has, however, rarely been attempted. There is in fact only one regional study based on comparative data and it provides information only for the period around 1970.9/ In this study it is estimated that approximately 40% of the population of Latin America is poor in an absolute sense (table 5). The people in this proportion of

Table 5

ESTIMATES OF THE INCIDENCE
OF POVERTY IN SELECTED COUNTRIES AROUND 1970

	% of households below the poverty line			% of households below the destitution line		
	Urban	Rural	Total	Urban	Rural	Total
Argentina	5	19	8	1	1	1
Brazil	35	73	49	15	42	25
Colombia	38	54	45	14	23	18
Costa Rica	15	30	24	5	7	6
Chile	12	25	17	3	11	6
Honduras	40	75	65	15	57	45
Mexico	20	49	34	6	18	12
Peru	28	68	50	8	39	25
Uruguay	10	-----	-----	4	-----	-----
Venezuela	20	36	25	6	19	10
Latin America	26	62	40	10	34	19

Source: Oscar Altimir, "The extent of poverty in Latin America", World Bank Staff Working Papers, No.522, Washington, 1982.

the population are incapable of satisfying their basic needs for food, shelter, clothing, health, education, etc.10/ Some 20% of the population were estimated to be destitute, that is unable even to buy a minimum basket of food.

Does this situation still exist now, almost 20 years after the study was carried out? Unfortunately, the answer would seem to be "yes". It may even be worse as there are indications that the distribution of income has worsened with the recession of the 1980s since per capita incomes have declined and unemployment has increased. In many countries per capita incomes are little or no higher than they were in the 1970s (table 4). In Argentina, Bolivia, El Salvador, Guyana, Jamaica, Nicaragua and Venezuela, per capita incomes in 1986 were actually below the level at which they stood in 1970.

There is, in addition, more direct evidence that the distribution of income generally worsened during the 1970s and that the subsequent recession would only have strengthened this trend. For example, in Argentina the share of the poorest half of the population declined from 25.1% to 21% of total income between 1970 and 1981. In none of the six countries for which such data is available for the two periods was there any improvement in the distribution of income over the last decade.

Moreover, in many countries the adjustment process is far from complete. It can be expected that with any increase in the levels of unemployment due to adjustment policies leading to changes in economic structure will cause incomes to decline further and its distribution to become more regressive.

b) Where do the poor live?

There is a lack of specific information for the region as a whole on the rural-urban distribution of poverty. In general, however, it can be stated that although the majority of the lowest income groups is made up of urban dwellers, the poorest people are to be found living in the countryside. This assertion is supported by various partial studies. Two recent studies in Central America, for example, illustrate one of the major differences between rural and urban levels of living, even in poorer countries.11/ In Guatemala, 85% of the population with the highest rates of infant mortality --more than 120

deaths per 1 000 children under 2 years old-- lives in rural areas, compared with 15% in urban areas and none in Guatemala City. In Honduras, a higher proportion of the urban population in a region not only is associated with a lower rate of infant mortality but was also accompanied by a more rapid decline in the death rate between 1960 and 1980.

In Latin America and the Caribbean, traditionally the poor have, in general, been more highly concentrated in rural areas. Not only has the rural population been poorer than the urban population, but income has been distributed more unequally.12/ The rise in unemployment accompanying the recession has largely been an urban phenomenon and has increased the numbers of urban poor to an unknown degree. The poorest groups within the population are still found in rural areas. One caveat must be made: in those countries with a lower incidence of overall poverty, the lot of the rural poor may be considerably ameliorated thanks to their own food production.

c) Have the poor benefitted from the Decade so far?

It is not readily evident that the poor have benefitted in any general or particular way from the water supply and sanitation programmes executed during the Decade so far. The statistics on the growth of coverage show only a marginal increase in the provision of services --even in drinking water supply-- to the rural population. Moreover, much of that increase has benefitted the portion of the rural population living in larger villages. Statistics specifically relating to the provision of water supply and sewerage to the urban poor are not available, but the small expansion in the number of urban households with house connections for either water supply or sewerage would suggest that the poor have not clearly been provided with improved facilities.

There is much sporadic and indirect evidence that would support such a conclusion. The continuance of very high rates of infant mortality, although dramatic reductions have been achieved in a few countries, such as Chile, Costa Rica and Cuba;13/ the few and isolated examples that can be cited of innovative supply practices for either

drinking water or sanitation;14/ the absence of significant change in the sector in recent years and other evidence all suggest a failure to reach out to the poorer sections of the population.

Moreover, it is generally reasonable to assume that in countries where half or more than half of the population lives in poverty, it is the poor households that are without drinking water and sanitation services. The higher income groups, given their levels of absolute income, can satisfy their own needs should the public services fail to do so, but when such failure occurs the poor are left without service.

4. What can be done?

It is clear that if the trends noted during the first half of the Decade continue then the targets will not be met. There is a need to give serious consideration to what can be done both to increase the rhythm of expansion of service, especially that provided to the lower income groups and to put the sector in a situation where it is less dependent on the ups and downs of the economy as a whole and of the public sector in particular.

There appear to be five areas --sector administration, system management, tariffs, technology and the provision of adequate excreta disposal-- where innovation is needed. It is not meant to imply that it is possible to arrive at definitive proposals for the reform in such a short review. Rather, the proposals made here are intended to represent factors that need to be taken into account in any effort to improve the provision of service. The specific requirements for change in each area are beyond the scope of this paper, but it would seem that there is a general need for the following changes:

i) Greater administrative decentralization;

ii) More businesslike system management;

iii) The adoption of a tariff structure to permit the generation of enough revenue to cover capital costs as well as operation and maintenance costs;

iv) The wider use of cost-minimizing technology;

v) A greater emphasis of the construction of sanitation facilities, including the control of the final deposition of wastes to minimize pollution.

It is not suggested that any of these proposals are new. Such recommendations have been made before and there are examples of their application in various countries. They are, however, proposed again here as a reminder that the achievement of change is a complex process and requires multiple innovations. At the same time, if universal provision of water supply and sanitation is to be achieved and maintained then it will be essential to renew and extend the commitment to the sector entered into at the beginning of the International Drinking Water Supply and Sanitation Decade.

5. Conclusions

The conclusions that can be drawn from this short review of the current state of drinking water supply and sanitation sector halfway through the International Drinking Water Supply and Sanitation Decade are the following:

i) Investment in drinking water supply and sanitation in most countries of the region has been seriously reduced by the general economic recession prevailing in Latin America and the Caribbean since 1981;

ii) There is a serious imbalance in the pattern of investment in the sector unfavourable to the provision of sanitation and an even more serious neglect of the impact of the final deposition of wastes;

iii) The effect of the reduced resources available to the sector has been to curtail both the expansion of services and the maintenance of existing systems;

iv) The impact of the reduction of resources has been felt most severely by lower income groups.

v) There is, therefore, an urgent need to extend the commitments entered into at the beginning of the Decade and to consider the development of specific programmes to improve both sanitation and the provision of services to lower income groups.

Notes

1/ Corporación de Fomento, Instituto de Fomento Pesquero, Diagnóstico de la contaminación marina en Chile, Santiago, February, 1986, p. 5.

2/ United Nations, Report on the United Nations Conference on Water (Mar del Plata, 14-25 March 1977), New York.

3/ Pan-American Health Organization, Environmental Health Programme, International Drinking Water Supply and Sanitation Decade: Regional progress report, Environmental Health Series No. 6, Washington, 1987, p. 5.

4/ Ibid.

5/ ECLAC estimates.

6/ United Nations, Economic Commission for Latin America and the Caribbean, Drinking water supply and sanitation in Latin America 1981-1990, Estudios e Informes de la CEPAL No. 25, p. 91.

7/ Ibid.

8/ Pan-American Health Organization, op. cit., p. 7.

9/ Oscar Altimir, "The Extent of Poverty in Latin America", World Bank Staff Working Paper, Number 522, Washington, 1982.

10/ The definition of poverty used was based on the ability to purchase a minimum basket of food. A separate basket was defined for each country included in the study. That proportion of the population whose income did not permit the purchase of two baskets was defined as poor. People who could not purchase even one basket were defined as destitute.

11/ United Nations, Latin American Demographic Centre, Guatemala: Diferencias socioeconómicas de la mortalidad de los menores de dos años, 1968-1976, Santiago, Chile, 1984, and United Nations, Latin American Demographic Centre, Mortalidad infantil: Los riesgos de muerte infantil en diferentes contextos sociales y geográficos, 1955-1985, Encuesta Demográfica Nacional de Honduras, Vol. 5, Serie A.1047/V, San José, Costa Rica, January 1988.

12/ Altimir, op. cit., p. 85.

13/ For an analysis of the reductions achieved see José Miguel Guzmán and Hernán Orellana, "Mortalidad infantil, neonatal y posneonatal en algunos países de América Latina" Notas de Población, No. 44, August 1987, pp. 31-66.

14/ See for example the discussion in, Tim Campbell, "Water supply and waste disposal to low-income urban settlements in Latin America and the Caribbean", paper presented at the Regional Symposium on Drinking Water Supply and Sanitary Disposal of Excreta in Urban Slum Areas, held in Santiago, Chile, from 5 to 9 November 1984.

Annex 1

LATIN AMERICA AND THE CARIBBEAN: ESTIMATES OF DOMESTIC SEWAGE OUTFLOW, ITS COMPOSITION AND FLOW REQUIRED FOR ITS DILUTION FOR CITIES WITH 100 000 INHABITANTS OR MORE IN 1980, BY MAJOR HYDROGRAPHIC BASINS AND COUNTRIES a/

a/ The presence or absence of waste water treatment facilities has not been taken into consideration.
These estimates are based on:

i) Population in 1980 (Latin American Center, Statistical Abstract of Latin America, University of California, Los Angeles, various recent years; and other sources).

ii) Sewerage service (house connections) coverage of the urban population for the country as a whole (1980); in the cases where this information has not been available, coverage by sewerage and excreta disposal services was used (WHO, The International Drinking Water Supply and Sanitation Decade - Review of National Baseline Data (as at December 1980), Offset Publication No. 85; PAHO/WHO, Environmental Health Program, International Drinking Water Supply and Sanitation Decade, Regional Progress Report, Environmental series No. 6, p. 18; and Osvaldo Montero Ojeda, Instituto de Hidroeconomía, El Programa cubano para el abastecimiento de agua y saneamiento para poblaciones de bajos ingresos, Seminario Regional sobre Agua Potable y Saneamiento para Grupos de Bajo Ingreso en Comunidades Rurales y Urbano-marginales, Recife, 1988, Documento No. 14, p. 3);

iii) The level of consumption is estimated to be 200 litres per capita per day;

iv) The conversion factor for DBO_5 applied is 19.7 kg/inh./year (United Nations, ECLAC, Desarrollo industrial: generación y manejo de los residuos, (LC/R.602(Sem.41/6), 28 August 1987, p. 52).

v) The dilution factor applied is 1 cubic foot (0.02832 m^3) per second per 1 000 of sewered population).

Latin America and the Caribbean: Estimates of Domestic Sewage Outflow, its Composition and Flow Required for its Dilution for Cities with 100 000 Inhabitants or more in 1980, by Major Hydrographic Basins and Countries

Cities by major hydrographic basins, countries and recipient water bodies		DOMESTIC SEWAGE OUTFLOWS (m3/sec)	DBO (Ton/year)	FLOW REQUIRED FOR DILUTION (m3/sec)
BASIN: Amazon				
Bolivia				
Cochabamba	Rocha	0.14	1 180	1.7
La Paz	Choqueyapu	0.43	3 682	5.3
Santa Cruz	Pirai	0.18	1 534	2.2
	Subtotal	0.75	6 396	9.2
Brazil				
Belem	Marajo Bay	0.56	4 779	6.9
Campo Grande	Aripuana	0.21	1 783	2.6
Manaos	Amazonas	0.45	3 865	5.6
	Subtotal	1.23	10 427	15.0
Peru				
Cuzco	Vilcanota	0.23	2 000	2.9
Huancayo	Negro	0.21	1 787	2.6
Iquitos	Amazonas	0.23	1 937	2.8
	Subtotal	0.67	5 724	8.2
	TOTAL FOR BASIN	2.65	22 546	32.4
BASIN: Brazil, north-east				
Brazil				
Campina Grande	Paraiba	0.16	1 401	2.0
Caruaru	Ipojuca	0.10	868	1.2
Fortaleza	Atlantic Ocean	0.48	4 090	5.9
Joao Pessoa	Atlantic Ocean	0.22	1 831	2.6
Juazeiro do Norte	Salgado	0.09	790	1.1
Maceio	Atlantic Ocean	0.28	2 373	3.4
Natal	Atlantic Ocean	0.28	2 374	3.4
Olinda	Capibaribe	0.20	1 679	2.4
Recife	Atlantic Ocean	0.88	7 465	10.7
Sao Luis	San Marcos Bay	0.14	1 150	1.7
Teresina	Parnaiba	0.25	2 139	3.1
	Subtotal	3.07	26 160	37.6
	TOTAL FOR BASIN	3.07	26 160	37.6
BASIN: California				
Mexico				
Ciudad Obregon	Yaqui	0.21	1 754	2.5
Culiacan	Culiacan	0.37	3 130	4.5
Durango	Mezquital	0.26	2 208	3.2
Ensenada	Pacific Ocean	0.16	1 345	1.9
Hermosillo	Sonora	0.36	3 082	4.4
Mazatlan	Pacific Ocean	0.21	1 798	2.6
Mexicali	Colorado	0.40	3 364	4.8
Tijuana	Tijuana	0.64	5 467	7.9
	Subtotal	2.60	22 148	31.8
	TOTAL FOR BASIN	2.60	22 148	31.8

Annex 1 (cont.)

Cities by major hydrographic basins, countries and recipient water bodies			DOMESTIC SEWAGE OUTFLOWS (m3/sec)	DBO (Ton/year)	FLOW REQUIRED FOR DILUTION (m3/sec)
BASIN: Caribbean					
Colombia					
Armenia	Cauca		0.25	2 166	3.1
Barrancabermeja	Magdalena		0.19	1 651	2.4
Barranquilla	Magdalena		1.27	10 775	15.5
Bogota	Bogota		5.61	47 765	68.7
Bucaramanga	Lebrija		0.48	4 104	5.9
Cali	Cauca		1.87	15 910	22.9
Cartagena	Caribbean Sea		0.69	5 905	8.5
Ibague	Combeina		0.38	3 239	4.7
Manizales	Chinchina		0.39	3 305	4.8
Medellin	Medellin		2.00	17 047	24.5
Monteria	Sinu		0.22	1 892	2.7
Neiva	Magdalena		0.25	2 141	3.1
Palmira	Cauca		0.25	2 105	3.0
Pereira	Otun		0.33	2 803	4.0
Santa Marta	Caribbean Sea		0.25	2 138	3.1
Valledupar	Guatapuri		0.20	1 716	2.5
		Subtotal	14.65	124 662	179.2
Guatemala					
Guatemala City	Las Vacas		0.69	5 900	8.5
		Subtotal	0.69	5 900	8.5
Honduras					
San Pedro Sula	Chamelecon		0.26	2 194	3.2
Tegucigalpa	Grande		0.42	3 607	5.2
		Subtotal	0.68	5 801	8.3
Nicaragua					
Managua	Lake Managua		0.69	5 881	8.5
		Subtotal	0.69	5 881	8.5
		TOTAL FOR BASIN	16.71	142 244	204.5
BASIN: Caribbean Islands					
Cuba					
Bayamo	Bayamo		0.09	726	1.0
Camaguey	San Pedro		0.21	1 770	2.5
Cienfuegos	Cienfuegos Bay		0.09	741	1.1
Guantanamo	Caribbean Sea		0.14	1 206	1.7
Holguin	Holguin		0.16	1 348	1.9
La Habana	Almendares		1.63	13 912	20.0
Matanzas	Yumuri/San Juan		0.09	727	1.0
Santa Clara	Sagua La Grande		0.15	1 250	1.8
Santiago de Cuba	Caribbean Sea		0.30	2 533	3.6
		Subtotal	2.85	24 212	34.8
Dominican Republic					
Santo Domingo	Ozama		0.68	5 765	8.3
Stgo.de Los Caballeros	Yaque del Norte		0.15	1 248	1.8
Dominican Republic					
		Subtotal	0.82	7 012	10.1
Haiti					
Port-Au-Prince (1982)	Bois de Chene		0.68	5 792	8.3
		Subtotal	0.68	5 792	8.3
Jamaica					
Kingston	Caribbean Sea		0.18	1 537	2.2
		Subtotal	0.18	1 537	2.2

Annex 1 (cont.)

Cities by major hydrographic basins, countries and recipient water bodies			DOMESTIC SEWAGE OUTFLOWS (m3/sec)	DBO (Ton/year)	FLOW REQUIRED FOR DILUTION (m3/sec)
BASIN: Caribbean Islands (cont.)					
Puerto Rico					
Bayamon	Cidra		n/a	n/a	n/a
Caguas	Loiza		n/a	n/a	n/a
Ponce	Caribbean Sea		n/a	n/a	n/a
San Juan	San José Lagoon		n/a	n/a	n/a
		Subtotal	n/a	n/a	n/a
		TOTAL FOR BASIN	4.53	38 553	55.4
BASIN: Central Venezuela					
Venezuela					
Barcelona/Pto.La Cruz	Caribbean Sea		0.45	3 799	5.5
Barquisimeto	Yaracuy		0.77	6 550	9.4
Caracas	Guaires		3.67	31 205	44.9
Cumana	Gulf of Cariaco		0.26	2 203	3.2
Departamento Vargas	Tuy		0.35	3 000	4.3
Maracay	Aragua		0.54	4 582	6.6
Valencia	Cabriales		0.87	7 377	10.6
		Subtotal	6.90	58 716	84.4
		TOTAL FOR BASIN	6.90	58 716	84.4
BASIN: Central system of Chile					
Chile					
Chillan	Itata		0.19	1 606	2.3
Concepcion	Biobio		0.43	3 641	5.2
Rancagua	Cachapoal		0.22	1 902	2.7
Santiago	Mapocho		5.84	49 679	71.4
Talca	Claro		0.21	1 747	2.5
Talcahuano	Pacific Ocean		0.32	2 751	4.0
Valparaiso-Viña del Mar	Pacific Ocean		0.85	7 267	10.4
		Subtotal	8.06	68 594	98.6
		TOTAL FOR BASIN	8.06	68 594	98.6
BASIN: Gulf of Mexico					
Mexico					
Jalapa de Enriquez	Actopan		0.23	1 945	2.8
Mexico City	Lake Texcoco/Tula		16.73	142 384	204.7
Poza Rica de Hidalgo	Purificacion		0.22	1 911	2.7
Tampico	Panuco		0.44	3 764	5.4
Veracruz	Jamapa		0.35	2 962	4.3
		Subtotal	17.97	152 966	219.9
		TOTAL FOR BASIN	17.97	152 966	219.9
BASIN: Interior of Argentina					
Argentina					
Cordoba	Primero		0.73	6 191	8.9
Rio Cuarto	Cuarto		0.08	694	1.0
San Miguel de Tucuman	Sali		0.37	3 133	4.5
San Salvador de Jujuy	San Francisco		0.09	785	1.1
Santiago del Estero	Dulce		0.11	935	1.3
		Subtotal	1.38	11 738	16.9
		TOTAL FOR BASIN	1.38	11 738	16.9

Annex 1 (cont.)

Cities by major hydrographic basins, countries and recipient water bodies		DOMESTIC SEWAGE OUTFLOWS (m3/sec)	DBO (Ton/year)	FLOW REQUIRED FOR DILUTION (m3/sec)
BASIN: Maracaibo				
Colombia				
Cucuta	Zulia	0.50	4 290	6.2
	Subtotal	0.50	4 290	6.2
Venezuela				
Cabimas	Lake Maracaibo	0.24	2 045	2.9
Maracaibo	Lake Maracaibo	1.21	10 331	14.9
	Subtotal	1.45	12 376	17.8
	TOTAL FOR BASIN	1.96	16 666	24.0
BASIN: North Pacific				
Mexico				
Acapulco	Pacific Ocean	0.52	4 461	6.4
Aguascalientes	Verde Grande	0.29	2 483	3.6
Cuernavaca	Apataclo	0.27	2 330	3.3
Guadalajara	Santiago	2.80	23 820	34.2
Irapuato	Turbio	0.18	1 555	2.2
Leon	Turbio	0.71	6 031	8.7
Morelia	Grande	0.28	2 423	3.5
Oaxaca	Atoyac or Verde	0.15	1 309	1.9
Puebla de Zaragoza	Atoyac	0.81	6 862	9.9
Queretaro	Huimilpan	0.21	1 794	2.6
Salamanca	Lerma	0.12	1 019	1.5
Tepic	Mololoa	0.16	1 350	1.9
Toluca de Lerdo	Lerma	0.27	2 335	3.4
Uruapan	Cupatitzio	0.17	1 419	2.0
Zapopan	Santiago	0.12	1 009	1.5
	Subtotal	7.07	60 199	86.5
	TOTAL FOR BASIN	7.07	60 199	86.5
BASIN: Orinoco				
Venezuela				
San Cristóbal	Carapo	0.37	3 120	4.5
	Subtotal	0.37	3 120	4.5
	TOTAL FOR BASIN	0.37	3 120	4.5
BASIN: Pacific: dry climate				
Chile				
Antofagasta	Pacific Ocean	0.30	2 521	3.6
Arica	Pacific Ocean	0.22	1 894	2.7
Iquique	Pacific Ocean	0.18	1 497	2.2
	Subtotal	0.69	5 912	8.5
Peru				
Arequipa	Chili	0.57	4 843	7.0
Chiclayo	Lambayeque	0.36	3 029	4.4
Chimbote	Pacific Ocean	0.28	2 347	3.4
Ica	Pacific Ocean	0.15	1 244	1.8
Lima-Callao	Rimac	5.63	47 882	68.8
Piura	Piura	0.26	2 253	3.2
Trujillo	Pacific Ocean	0.45	3 839	5.5
	Subtotal	7.69	65 435	94.1
	TOTAL FOR BASIN	8.38	71 348	102.6

Annex 1 (cont.)

Cities by major hydrographic basins, countries and recipient water bodies			DOMESTIC SEWAGE OUTFLOWS (m3/sec)	DBO (Ton/year)	FLOW REQUIRED FOR DILUTION (m3/sec)
BASIN: Pacific: tropical climate					
Colombia					
Buenaventura	Pacific Ocean		0.23	1 927	2.8
Pasto	Guevara		0.28	2 372	3.4
		Subtotal	0.51	4 299	6.2
Costa Rica					
San Jose	Torres		0.26	2 195	3.2
		Subtotal	0.26	2 195	3.2
Ecuador					
Guayaquil	Guayas		1.00	8 543	12.3
Quito	Guayllabamba		0.74	6 314	9.1
		Subtotal	1.75	14 857	21.4
El Salvador					
San Salvador	Acelhuate		1.02	8 652	12.4
Santa Ana	n/a		0.46	3 943	5.7
		Subtotal	1.48	12 595	18.1
Panama					
Panama City	Pacific Ocean		0.65	5 521	7.9
		Subtotal	0.65	5 521	7.9
		TOTAL FOR BASIN	4.64	39 467	56.7
BASIN: Pampa					
Argentina					
Bahia Blanca	Atlantic Ocean		0.16	1 392	2.0
Mendoza	Mendoza		0.44	3 762	5.4
San Juan	San Juan		0.22	1 831	2.6
		Subtotal	0.82	6 985	10.0
		TOTAL FOR BASIN	0.82	6 985	10.0
BASIN: Plata					
Argentina					
Corrientes	Parana		0.13	1 132	1.6
Gran Buenos Aires	La Plata		7.35	62 582	90.0
Gran La Plata	La Plata		0.42	3 532	5.1
Mar del Plata	Atlantic Ocean		0.30	2 566	3.7
Parana	Parana		0.12	1 006	1.4
Posadas	Parana		0.10	882	1.3
Resistencia	Parana		0.16	1 377	2.0
Rosario	Parana		0.71	6 018	8.7
Salta	San Francisco		0.19	1 641	2.4
Santa Fe	Salado		0.21	1 811	2.6
		Subtotal	9.70	82 548	118.7
Brazil					
Americana	Piracicaba		0.09	768	1.1
Anapolis	Meia Ponte		0.12	1 012	1.5
Aracatuba	Tiete		0.08	715	1.0
Araraquara	Jacare Guacu		0.10	826	1.2
Bauru	Bauru		0.13	1 128	1.6
Brasilia	Paranua Sta Maria		0.30	2 593	3.7
Campinas	Capivari		0.42	3 571	5.1
Carapicuiba	Tiete		0.14	1 171	1.7
Cuiaba	Cuiaba		0.12	1 058	1.5
Curitiba	Belem		0.62	5 319	7.6
Diadema	Tiete		0.17	1 441	2.1
Franca	Grande		0.11	905	1.3

Annex 1 (cont.)

Cities by major hydrographic basins, countries and recipient water bodies			DOMESTIC SEWAGE OUTFLOWS (m3/sec)	DBO (Ton/year)	FLOW REQUIRED FOR DILUTION (m3/sec)
BASIN: Plata (cont.)					
Brazil (cont.)					
Goiania	Meia Ponte		0.52	4 433	6.4
Guarulhos	Cabuu Cima		0.29	2 491	3.6
Jundiai	Guapeva		0.16	1 324	1.9
Lajes	Caveiras		0.08	686	1.0
Limeira	Piracicaba		0.10	869	1.2
Londrina	Tibaji		0.19	1 627	2.3
Marilia	Do Peixe		0.08	703	1.0
Maringa	Ivai		0.12	996	1.4
Maua	Tiete		0.15	1 297	1.9
Mogi das Cruzes	Paraitinga		0.09	771	1.1
Osasco	Tiete		0.35	2 987	4.3
Piracicaba	Piracicaba		0.13	1 131	1.6
Ponta Grossa	Tibaji		0.13	1 079	1.6
Presidente Prudente	Santo Anastacio		0.09	805	1.2
Ribeirao Preto	Pardo		0.22	1 896	2.7
Santo Andre	Tiete		0.41	3 463	5.0
Sao Caetano do Sul	Tiete		0.12	1 028	1.5
Sao Carlos	Jacare Guacu		0.08	689	1.0
Sao Jose do Rio Preto	Preto		0.13	1 084	1.6
Sao Paulo	Tiete		5.21	44 339	63.7
Sorocaba	Sorocaba		0.19	1 606	2.3
Uberaba	Grande		0.13	1 137	1.6
Uberlandia	Uberarinha		0.17	1 452	2.1
		Subtotal	11.56	98 399	141.5
Paraguay					
Asuncion	Paraguay		0.32	2 692	3.9
		Subtotal	0.32	2 692	3.9
Uruguay					
Montevideo	Atlantic Ocean		0.43	3 688	5.3
		Subtotal	0.43	3 688	5.3
		TOTAL FOR BASIN	22.01	187 326	269.3
BASIN: Rio Bravo					
Mexico					
Chihuahua	Chuviscar		0.44	3 726	5.4
Ciudad Juarez	Bravo		0.71	6 034	8.7
Matamoros	Bravo		0.22	1 866	2.7
Monterrey	Pesqueria		2.29	19 486	28.0
Nuevo Laredo	Bravo		0.25	2 158	3.1
Reynosa	Bravo		0.26	2 231	3.2
Saltillo	Pesqueria		0.29	2 495	3.6
		Subtotal	4.46	37 995	54.6
		TOTAL FOR BASIN	4.46	37 995	54.6
BASIN: San Francisco					
Brazil					
Belo Horizonte	Das Velhas		1.07	9 093	13.1
Divinopolis	Para		0.08	683	1.0
Montes Claros	Verde		0.11	957	1.4
		Subtotal	1.26	10 734	15.4
		TOTAL FOR BASIN	1.26	10 734	15.4

Annex 1 (cont.)

Cities by major hydrographic basins, countries and recipient water bodies			DOMESTIC SEWAGE OUTFLOWS (m3/sec)	DBO (Ton/year)	FLOW REQUIRED FOR DILUTION (m3/sec)
BASIN: South Atlantic					
Brazil					
Aracaju	Atlantic Ocean		0.21	1 816	2.6
Barra Mansa	Paraiba do Sul		0.09	778	1.1
Blumenau	Itajai		0.11	913	1.3
Campos	Paraiba do Sul		0.13	1 098	1.6
Canoas	Dos Sinos		0.16	1 350	1.9
Caxias do Sul	Piauhi		0.15	1 253	1.8
Duque de Caxias	Niteroi		0.23	1 929	2.8
Feira de Santana	Jacuipe		0.17	1 418	2.0
Florianopolis	Atlantic Ocean		0.11	968	1.4
Governador Valadares	Doce		0.13	1 095	1.6
Itabuna	Colonia		0.10	819	1.2
Joinvile	Sao Francisco Bay		0.16	1 368	2.0
Juiz de Fora	Paraibuna		0.22	1 889	2.7
Nilopolis	Atlantic Ocean		0.12	1 060	1.5
Niteroi	Atlantic Ocean		0.29	2 435	3.5
Nova Iguacu	Atlantic Ocean		0.36	3 100	4.5
Novo Hamburgo	Dos Sinos		0.10	833	1.2
Pelotas	Lagoa dos Patos		0.15	1 242	1.8
Petropolis	Piabanha		0.11	942	1.4
Porto Alegre	Guaiba		0.82	6 990	10.0
Rio Grande	Lagoa dos Patos		0.09	786	1.1
Rio de Janeiro	Guanabara Bay		3.77	32 108	46.2
Salvador	Atlantic Ocean		1.11	9 433	13.6
Santa Maria	Bagu		0.11	953	1.4
Santos	Atlantic Ocean		0.30	2 591	3.7
Sao Bernardo do Campo	Cubatao		0.28	2 403	3.5
Sao Goncalo	Atlantic Ocean		0.16	1 395	2.0
Sao Joao de Meriti	Atlantic Ocean		0.16	1 327	1.9
Sao Jose dos Campos	Paraiba do Sul		0.20	1 690	2.4
Sao Vicente	Atlantic Ocean		0.14	1 215	1.7
Taubate	Paraiba do Sul		0.12	979	1.4
Vitoria	Atlantic Ocean		0.11	909	1.3
Vitoria da Conquista	Pardo		0.09	793	1.1
Volta Redonda	Paraiba do Sul		0.13	1 121	1.6
		Subtotal	10.69	91 002	130.8
		TOTAL FOR BASIN	10.69	91 002	130.8
BASIN: South Pacific					
Chile					
Temuco	Imperial		0.25	2 143	3.1
		Subtotal	0.25	2 143	3.1
		TOTAL FOR BASIN	0.25	2 143	3.1
BASIN: Southern Interior					
Mexico					
Gomez Palacio	Nazas		0.12	994	1.4
San Luis Potosi	n/a		0.37	3 160	4.5
Torreon	Nazas		0.46	3 931	5.7
		Subtotal	0.95	8 085	11.6
		TOTAL FOR BASIN	0.95	8 085	11.6
BASIN: Titicaca					
Bolivia					
Oruro	Tagarete		0.08	690	1.0
		Subtotal	0.08	690	1.0
		TOTAL FOR BASIN	0.08	690	1.0

Annex 1 (concl.)

Cities by major hydrographic basins, countries and recipient water bodies		DOMESTIC SEWAGE OUTFLOWS (m3/sec)	DBO (Ton/year)	FLOW REQUIRED FOR DILUTION (m3/sec)
BASIN: Yucatan				
Mexico				
Merida	Gulf of Mexico	0.31	2 602	3.7
	Subtotal	0.31	2 602	3.7
	TOTAL FOR BASIN	0.31	2 602	3.7
G R A N D T O T A L		127.14	1 082 028	1 555.5

n/a - information has not been available.
Small differences in totals/subtotals are due to rounding.