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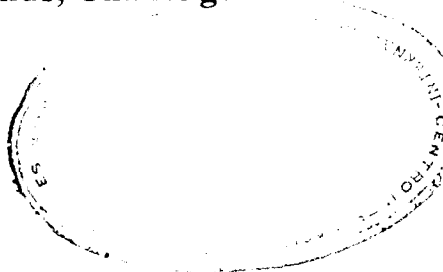
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Municipal Wastewater Management In Latin America and the Caribbean

A Discussion Paper on Trends, Challenges and the Market



Prepared For:

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1.0 Introduction

One only needs to recall the dramatic impact of the cholera epidemic in the early 1990's to understand the critical importance of clean water and effective wastewater management. During the epidemic between 1991 and 1995, there were approximately 1.3 million cases of cholera in Latin America and the Caribbean that resulted in 11,300 deaths (Idelovitch & Ringskog, 1997). The economic losses in Peru alone was estimated to be between \$US 180 - 500 million which is equivalent to approximately 1.5 percent of Peru's gross domestic product at that time. There is clear documented evidence to demonstrate that those areas that had direct access to clean water and effective wastewater management were able to avoid the tragic impact of this epidemic. During this period, investment in the Peru water/sanitation sector was only 0.15 percent of GDP, which indicates that investment in the sector can save lives and reduce detrimental long term economic impacts.

1.1 Scope of This Paper

This paper has been prepared for the Organization of American States and the International Development Research Centre in support of a series of Round Table discussions organized under the Inter-American Program for Environment Technology Cooperation in Key Industry Sectors (see <http://www.idrc.ca/industry/index-e.html>). The program consists of a series of sectoral Round Tables designed to exchange information on clean technologies and sound environmental management practices. This paper provides an overview of the municipal wastewater management sector in Latin American and the Caribbean in support of the Round Table on Municipal Water held in Vancouver, Canada on March 15-17, 1998.

The main objective of the presentation was to provide background information on the sector and to provide an overview of environmental challenges and the market in order to stimulate discussion on these topics during the Round Table. The paper is not intended to be a comprehensive review of the sector but simply an overview document to stimulate discussion and reflect on the key issues of concern in the region. Some effort has been made by the author to focus the attention of the paper on small to medium sized communities. However, it is difficult to focus strictly on small and medium sized communities since the detailed information is not generally available for communities of this size. Also, although wastewater management is the key focus, the information provided is also relevant to the water supply sector.

1.2 Format of the Paper

The paper first provides a summary of water and wastewater coverage in the region, and a summary of a number of trends in the sector. Section 3.0 provides a review of some of the key environmental challenges to wastewater management in the region. Key factors affecting decision making by small and medium sized communities are then summarized. A review of the market for water and wastewater services and equipment is provided in Section 5.0. This is followed by a review of financial options to meet the growing demand for municipal wastewater infrastructure in

Latin America and the Caribbean in Section 6.0. The privatization of water and sewage systems is a key trend in the sector and is therefore given significant attention throughout the paper and in Section 7.0 in particular. Finally, the paper provides a summary of the principle challenges facing the sector. Throughout the paper, reference is made to web sites on the Internet that provide additional information on specific organizations or projects.

2.0 Overview - Coverage and Trends

This section provides a summary of the number of people with access to drinking water and domestic wastewater systems in Latin America and the Caribbean. It also provides a summary of key trends in the sector.

2.1 Water Supply and Sewerage Coverage

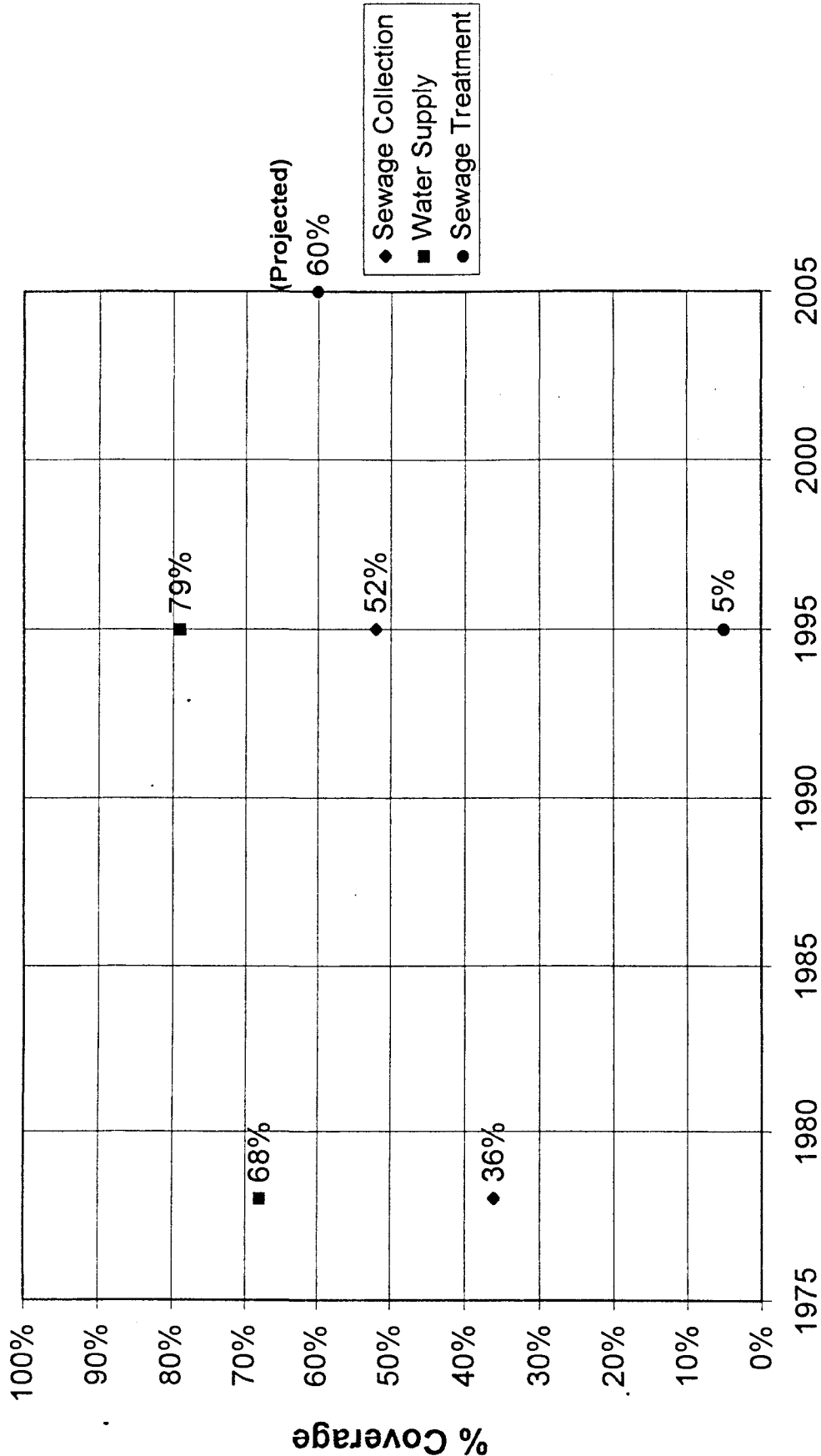
Figure 1 shows the degree of coverage for water supply, sewage collection, and sewage treatment in Latin America and the Caribbean covering the period from the late 1970's to 1995. The figures correspond to water supply and sewage collection for urban areas only.

As shown in Figure 1, the number of households connected to drinking water supply systems in Latin America and the Caribbean has increased to approximately 80 percent in 1995 from under 70 percent in the late 1970's. What this figure does not provide is the degree of treatment, or level of drinking water quality for those households connected to a municipal water supply. It is well known that many of the systems that have been installed are not meeting established drinking water criteria.

There was a significant increase in the percentage of households connected to urban sewage collection systems over the same period, but the demand is still great. In the late 1970's, approximately 36 percent of households in the region were connected to a sewage collection systems, whereas in 1995 still only about 50 percent of the households were connected. The vast majority of these sewage collection systems discharge to water bodies without any form of treatment.

It is estimated that only five percent of households in Latin America and the Caribbean are connected to sewage *treatment* systems. There is significant variation of sewage treatment coverage within the countries of the region but even those countries with more extensive treatment, such as Chile and Mexico, have still not achieved values greater than 15 percent. Some estimates have projected that the degree of sewage treatment will increase to 60 percent of all households by the year 2005. Clearly this is a very ambitious goal and will be a challenge to meet.

Figure 1
Water and Sewage Urban Coverage in Latin America and the Caribbean



(Source: "Wastewater Treatment in Latin America: Old and New Options", World Bank, Idelovitch and Ringskoy, 1997)

There is a significant variation in the degree of coverage for water supply and sewerage as a function of income level. It is estimated that urban areas with higher incomes generally have coverage levels of four times the degree of coverage encountered in the lower income area. (Idelovitch & Ringskog, 1997).

Table 1 provides a detailed summary of the degree of water supply and sewage coverage in urban and rural areas in Latin America and the Caribbean.

Table 1
Population Served with Public Water Supply and Sanitation in Latin America
and the Caribbean, by Country, 1995

Country	Population (millions, rounded)		Drinking Water (percentage of houses connected)		Public Sanitation (percentage of houses connected)	
	Urban	Rural	Urban	Rural	Urban	Rural
Argentina	30.3	4.1	68	24	39	42
Bahamas	0.3	**	88	86	16	100
Barbados	0.1	0.2	98	98	4	98
Belize	0.1	0.1	89	51	44	21
Bolivia	4.2	3.0	74	42	41	39
Brazil	124.5	37.2	74	28	35	43
Chile	12.2	2.0	99	47	79	7
Colombia	26.4	10.3	86	32	65	27
Costa Rica	1.5	1.6	100	99	55	95
Dominican	5.2	2.9	56	55	28	68
Ecuador	6.5	4.7	79	10	61	26
El Salvador	2.7	3.4	78	24	60	65
Guatemala	4.2	6.1	84	48	70	50
Guyana	0.3	0.5	77	69	27	28
Haiti	2.2	4.9	29	39	---	16
Honduras	2.8	3.1	77	66	50	71
Jamaica	1.4	1.1	57	53	34	65
Mexico	68.1	22.7	93	57	81	29
Nicaragua	2.5	1.6	86	28	34	28
Panama	1.6	1.4	98	73	64	81
Paraguay	2.6	2.4	59	6	20	44
Peru	16.8	6.6	63	31	59	23
Suriname	0.3	0.1	95	70	2	36
Trinidad and	0.9	0.4	90	88	32	92
Uruguay	2.7	0.3	90	---	56	---
Venezuela	19.8	1.7	73	79	62	60
Total	340.2	122.4	79%	39%	52%	39%

— Not Available ** Negligible

Source: Wastewater Treatment in Latin America - Old and New Options, E. Edlovitch & Klas Ringshog, 1997.

Trends in the Sector

Key Trends

There are a number of trends that have a significant impact on the municipal water and wastewater sector in Latin America and the Caribbean. These include (not necessarily in order of importance):

- increased migration to urban areas, and rapidly growing urban areas
- increased attention to sewage treatment
- growing public awareness of environmental issues in general, and environmental impacts associated with municipal sewage in particular, on the part of governments and the public
- stricter environmental regulations and in some cases, better enforcement
- increased emphasis on pre-treatment of industrial wastewaters prior to discharge to municipal sewage collection systems
- greater role being played municipalities in all aspects of water supply and wastewater management
- greater degree of participation by all stakeholders
- greater coordination between government agencies at all levels, and between the private sector and non- governmental organizations (NGO's)
- trend to implement river basin authorities or watershed management systems
- better project preparation on the part of governments, funding agencies, and the private sector
- optimization of existing wastewater systems to maximize cost effectiveness
- privatization of water supply and wastewater systems.

Urban Migration

Latin America and the Caribbean is the most urbanized region in the developing world. It is well known that there is significant migration from rural areas to the urban areas in Latin America and the Caribbean including migration to small and medium-sized urban centres. Based on 1994 figures, it is estimated that 74 percent of the region's population live in urban areas and that urban migration is increasing at a rapid rate. This has resulted in many instances of uncontrolled growth of peri-urban areas which has made planning and expansion of water and sewage systems difficult and expensive to carry out. What exacerbates the problem is that the majority of those moving to the urban areas have low incomes and therefore are generally not able to fully pay for the water and sewer upgrades that are required.

Sewage Treatment

As shown in Figure 1 above, investments in the water and sanitation sector have focussed strictly on drinking water supply and sewage *collection*. Very little investment has been made in the past on sewage *treatment* facilities. Sewage treatment is now an area that is receiving greater attention from the World Bank and Inter-American Development Bank as well as government regulatory bodies throughout the region. This is partly the result of a growing awareness in Latin

America and the Caribbean of the impact of sewage contamination on rivers and lakes, and the knowledge that continued contamination of these water sources is unsustainable. One only needs to look at the experience that Canada has had with the eutrophication of its Great Lakes to understand the importance of sewage treatment in sustaining a country's water resources. With the "information revolution" (news media, television, Internet) and democratization, members of the public in the region are better informed on environmental issues and are pushing for stricter environmental regulations. These regulations include the development and enforcement of sewage treatment regulations.

Governments in the region are also beginning to recognize that good environmental management is a competitive asset in certain sectors. This is particularly noticeable in the agriculture and tourism sectors. A poor image with regard to environmental control and sewage treatment can have a serious detrimental impact on agricultural exports as well as the national tourism industry.

Legislation

Although there has been a clear trend towards stricter legislation throughout the region, it is acknowledged that in most countries, and within most districts in each of those countries, that there is poor enforcement of the regulations. This is particularly prevalent with regard to sewage discharges to surface waters.

One area however within which enforcement of regulations is changing is in the control of industrial discharges to the sewage collection systems, and a trend to stricter industrial pre-treatment requirements and the enforcement of those requirements. Canada, and the province of Ontario in particular, has had extensive experience in the implementation and development of industrial pretreatment standards. There may be an opportunity for countries in Latin America and the Caribbean to take advantage of this experience in developing and implementing their own pretreatment standards. Care needs to be taken however to ensure that the pretreatment regulations that are adopted are adjusted to address local issues, concerns and capabilities. In some cases, environmental regulations have been directly "imported" from developed countries such as the United States and Canada too quickly for national officials to be properly trained in the interpretation and enforcement of the regulations. This can result in regulations that may not be appropriate for the local environment and the need for more careful planning to phase in regulations and develop local capacities.

Municipal Downloading

Perhaps the most important trend in recent years has been the greater responsibility put on municipalities to provide water and sewage services, i.e. "municipal downloading". This trend has been particularly demanding on the capacities and resources of small and medium sized municipalities. Many municipalities in the region are now legally required to provide these services either directly or through specialized public or private companies. The problem is that most of these municipalities have not had the time to adjust to these new responsibilities particularly with regard to wastewater treatment needs.

Wastewater treatment often is more complex and requires more skilled operators, and resources, than is required for water supply systems or sewage collection systems. There are significant financial difficulties for small to medium sized municipalities to handle the costs of the construction of capital works as well as the ongoing operation and maintenance costs.

Substantial institutional strengthening is usually required to assist small to medium-sized municipalities to deal with the new administrative and financial management responsibilities passed on to them. Smaller municipalities generally have greater difficulties in overcoming the potential and logistical hurdles associated with establishing and collecting fair tariffs from the local populations.

Between 1985 and 1995, the percent of government spending by provinces and municipalities grew from 34 to 50 percent of total government spending in Argentina; 33 to 40 percent in Columbia; 3 to 10 percent in Peru; and 4 to 14 percent in Chile, according to a survey conducted by the IDB reported in "Economic and Social Progress in Latin America". On average, the degree of spending at this local level is 15 percent for Latin America, compared to 35 percent for the industrial countries of the Organization for Economic Cooperation and Development (OECD). Columbia, Brazil and Chile have historically given their departments (provinces) considerable spending authority.

One program that has been developed to address the problems associated with decentralization, or "municipal downloading" is RIADEL (Local Development Research and Action Network {www.netline.cl/riadel}). RIADEL is a network for interchange of information about local community development in Latin America. Its work includes investigations about decentralization, training of social leaders and civil servants, and intervention in projects for local development such as participatory municipal budgets. RIADEL is being developed by the Bolivian Centre for Interdisciplinary Studies (CCEBEM) in La Paz and the Centre for Social Studies and Education (SUR) from Santiago, Chile with support from the International Development Research Centre (IDRC) in Montevideo.

Local Participation

An important and positive trend in recent years has been the increase in recognition of the importance of local participation in decision making and project execution. The World Bank itself recognized this by releasing its Participation Sourcebook in February 1996 which includes a series of case studies specifically dealing with the water and sanitation sector¹.

Historically, water/sanitation projects involved a simple two-way communication between the lending institution and a public agency. Now there is also a trend in the water/wastewater sector to include a wider circle of stakeholders in a more complicated set of technical, economic, political and social considerations. Previously, the central government simply obtained or provided the

¹ Available from the World Bank web site: www.worldbank.org

financing for water/wastewater systems and constructed them with little thought put into these important considerations involving other stakeholders.

One example of the successful use of community participation in a water/sanitation project is the Prosanear Program in Brazil. The program is set up in a demand oriented approach that includes low cost water and sanitation for low income areas in 11 cities. The key aspect of this program is the strong participation by the beneficiaries in all aspects of the program. As a result of the implementation of this program, a number of conclusions have been drawn concerning community participation:

- i) Participation must be tailored to the local population to meet particular local needs.
- ii) There is a need for agreement on key issues between design engineers and beneficiaries early on in the project.
- iii) It is recognized that conflicts can indeed be resolved through negotiation.
- iv) It is necessary for engineers to adapt to the participation model. This may require the need to work with non-governmental organizations.
- v) The donor needs to provide more extensive supervision in this type of project than is normally required on projects without the same degree of participation.
- vi) Extensive local participation can ultimately reduce capital costs. The beneficiaries often have valid ideas for cost savings that can be implemented into the project.

The Inter-American Development Bank has also recognized the importance of participation in development projects. The IDB had a two day seminar in March 1998 entitled "Social Programs, Poverty and Citizen Involvement", in which government officials, researchers and leaders from the private sector and public sector examined and discussed a series of projects in which local organizations played a key role in developing programs. One of the main conclusions of the seminar was as follows: *"Citizen participation properly channelled generates savings, mobilizes financial and human resources, promotes equity and makes a decisive contribution to the strengthening of society and the democratic system"*. Interest in the concept of community participation in development projects was demonstrated by the strong attendance at the seminar - there were more than 600 participants. The seminar included 32 case studies of participation projects. According to experts participating in the seminar, community associations can greatly assist in making precise identification of social needs which can result in innovative proposals and can improve the efficiency of programs.

Another example of a successful water and sanitation project in which participation has played a key role is one carried out in Peru by the Canadian non-governmental organization WUSC (see Internet website: <http://headwaters.com/burnside/peru.html> for details). This four year project, which is now coming to a close, has focussed on supplying water services to peri-urban areas of Lima as well as water and sanitation services to small communities near Nasca in southern Peru. The program has been extremely successful due in part to the strong involvement by beneficiaries at all stages of project development and implementation. The program includes extensive training of men, women and children in the communities in various aspects of hygiene, water supply and wastewater management. Also stressed is the role of women in the decision making process. There

is a strong sense of ownership by members of the community in each of these projects which helps to ensure the sustainability of the water supply and sanitation systems that have been installed. A secondary benefit of the extensive participation in these projects is the confidence the communities have once a project is completed. This confidence makes beneficiaries feel that they can indeed work together to solve problems in their community. This confidence and the accompanying skill sets acquired during project planning and implementation, leads these communities to take on other challenges including the accessing of financing for other infrastructure projects.

Coordination Between IFI's

An important trend in recent years has been the increased level of coordination between the World Bank and the Inter-American Development Bank and other international financial institutions, particularly in the water/wastewater sector. There are now a number of water/wastewater projects that are co-funded by both institutions. One example is the co-funding by the IDB and the World Bank and collaborative planning on the National Regional Development Fund (FNDR in Spanish) in Bolivia. This project is focussed on communities with populations in the 10,000 to 50,000 range. Included are projects in the water/wastewater sector. Communities submit requests for funding of projects to FNDR. If the project is approved, FNDR then administers the tender call for prequalifying consultants and contractors. The community then selects the consultant and/or contractor with input from FNDR after reviewing the proposals that are submitted. Frequently, the teams that win the contracts are joint ventures between Bolivian firms and foreign firms. Contracts are awarded for feasibility studies, detailed design, construction and construction supervision.

One problem that has occurred with the FNDR program is the lack of sufficient funds for extensive community participation in the decision making process, and for the provision of specialized professional consulting services. There have also been extensive delays in the selection of consultants. Nonetheless, there have been efficiencies and economies of scale in having the IDB and World Bank collaborate on this type of project, and additional benefits have accrued from using a consistent approach to implement projects of this sort. Access to central funds of this sort helps individual communities that would likely have difficulty accessing capital on their own. There is a similar World Bank funded program in Bolivia for communities of less than 5,000 people called the Social Investment Fund (FIS).

There is acknowledgement in the reports and documents of both the IDB and the World Bank that there is a need to work closer together throughout the region in the water and sanitation sector in the future.

Collaboration of Private Sector and NGO's

There is also a trend for more extensive collaboration between the private sector (ie. consulting firms and equipment suppliers) and non-government organizations. This is particularly true for Canada's aid program in which the Canadian International Development Agency is strongly encouraging collaboration between the private sector and NGO's in providing services in the water/sanitation sectors, particularly in Latin America and the Caribbean.

Better Project Preparation

The World Bank and the Inter-American Development Bank have recognized in recent years the importance of carrying out better project preparation in the water/sanitation sector. It is recognized that increasing investments in the sector without more careful quality control at the beginning of the project cycle is not worthwhile. Although this results in a longer "project cycle", it leads to better formulated projects with more participation by stakeholders, and more innovation in project planning. The needs are more carefully assessed including the need for institutional strengthening.

River Basin/Watershed Management Approach

Another trend that has had an impact on not only large communities but also small and medium sized communities is the river basin approach or watershed management approach. A number of river basin/watershed programs have been implemented in Latin America including examples in Brazil, Chile and Mexico but there have been mixed results. In the Brazilian example, work was carried out in five urbanized basins in which water pollution control was based on water basin management and assimilative capacity studies. The program covered all activities including planning and management, and took advantage of economies of scale for wastewater treatment. One important aspect of the Brazilian example was the water use and pricing policy that reflected specific local characteristics and planning goals. There was also a regulatory framework that covered the entire basin and reflected the local environmental, political and economic conditions.

There are intrinsic advantages to this approach from an environmental management point of view given that a watershed is a natural environmental zone within which to manage wastewater impacts. However, results have been mixed because of the difficulty in addressing the myriad of needs and concerns of all stakeholders in the watershed.

Optimization of Existing Systems

Another trend that addresses the concern of high capital costs of wastewater treatment systems is the optimization of existing sewage treatment facilities. Environment Canada, through contracts to Canadian consulting firms, is assisting local authorities responsible for the operation of wastewater treatment plants in the State of São Paulo in Brazil by carrying out optimization studies of existing plants. Recommendations are provided with regard to areas such as bio-solids management, industrial source control, phosphorus removal and, automation and process control.

Collaboration Between Cities

There is a more recent trend for more collaboration between cities in Latin America through Mercosur. Mercosur is a trade block made up of Argentina, Brazil, Paraguay and Uruguay. Bolivia and Chile have negotiated special agreements with Mercosur. In six years, trade between Mercosur countries has more than quadrupled, from \$US 4.1 billion in 1990 to \$US 16.9 billion in 1996. This makes Mercosur the world's fourth largest market (after NAFTA, the European Union and Japan) (reference IDB America, November 1997).

The network of cities of Mercosur "Merco ciudades" was created in 1995 (<http://poa.procompa.com.br/mercociudades>). A total of 30 of the Mercosur's largest cities are members. Its goals include: developing a political forum for more collaboration between the cities, elaborating effective means for internal and external communication, and defining plans of cooperation and interchange of information between the cities. This forum will likely allow for interchange of information on the successes and lessons learned on water/wastewater implementation. Unfortunately, it appears to be focussed on only the larger cities in these countries.

Privatization

The trend towards increased privatization and development of public/private systems is also a key trend in the sector and will be addressed later on in this paper in the Section 7.0.

3.0 Key Environmental Challenges

"The greatest challenge in the water and sanitation sector over the next two decades will be the implementation of low cost sewage treatment that will at the same time permit selective reuse of treated effluents for agricultural and industrial purposes".²

Less than five percent of all wastewater collected in Latin America and the Caribbean receives any form of treatment. The vast majority of wastewater treatment systems in place in the region are solely primary treatment systems (i.e. settling for removal of suspended solids without biological treatment). Of the few wastewater treatment plants that have been built, few are in fact operating satisfactorily. One source estimates that in Mexico only five percent of the sewage treatment plants are operating effectively (Idelovitch & Ringskog, 1997).

The lack of sufficient numbers of sewage treatment facilities and the poor operation of many existing collection and treatment systems are not the only environmental challenges. Perhaps it is best to reflect on past trends and anticipated future trends with regard to technology in the wastewater sector to put the current environmental challenges into perspective.

In the past, there has been a focus on sewage collection only, if that, and very little focus on sewage treatment. There has also been a common practice of discharging untreated sewage and sewage sludge directly into oceans and other water bodies. Unstabilized wastewater is often put on agricultural land which poses significant health risks as well as potential economic risks if consumers are made aware of this practice.

² Source: World Bank Publication "Meeting the Infrastructure Challenge in Latin America and the Caribbean", 1995

Another common problem is the poor condition of existing sewage collection systems. Many systems of older materials have corroded iron pipes and other leaking piping components. This leads to infiltration of surface and ground waters into the system resulting in an increase in the size of required sewage treatment systems. More importantly, some older systems were installed above water distribution lines or even in the same trench with water supply lines posing considerable health risks by cross-contamination of drinking water supplies. This problem is particularly acute in earthquake-prone areas, such as many areas of Peru.

It is anticipated that future trends with regard to technologies and approaches for wastewater management will include:

- more careful planning and design of collection and treatment facilities
- steps to reduce infiltration into collection systems so as to minimize treatment requirements
- more extensive use of local suppliers as they become more capable to meeting the demand
- integrated water basin management
- optimization of existing facilities
- continued research and development of alternative lagoon designs to reduce land requirements for treatment systems
- restricted irrigation of low quality effluents for specific crops but more irrigation with higher quality effluents that would have less restrictions on crop types
- more application of stabilized sewage sludge on agricultural land with implementation of strict regulations for this practice.

Based on the extensive successful experience in Canada and elsewhere on cost effective and environmentally sound practices of sludge application on agricultural land there is tremendous potential for the safe disposal of sewage sludge on agricultural land in the region . Over 50 percent of the municipal sewage sludge in the province of Ontario in Canada is placed on agricultural land. Ontario has a population of approximately ten million people.

One key area of improvement that could offset the enormous costs involved in water and wastewater systems is the reduction of water losses in distribution systems. A study by the World Bank and a Brazilian research institute concluded that illegal connections and leaks in distribution networks amount to approximately 45 percent. Even SABESP, (Sao Paulo State Sanitation Company) the largest and most profitable sanitation company in Brazil, (1996 Revenues of \$US 2.4 billion) has water losses of around 25 percent. The National Bank for Economic and Social Development (BNDES) in Brazil reports that the decrease of water losses from 45 percent to a level of 25 percent would alone represent savings of approximately \$US 2 billion per year for the sanitation sector in Brazil (Rose, 1997).

Another important environmental challenge in the area of wastewater management in the future, even in the smaller and medium sized communities, is how to deal with industrial discharges to sewage systems. To minimize environmental impacts, it is necessary that pretreatment standards be developed and enforced, and that appropriate tariffs be developed for volume and mass loadings for those contaminants that can be treated at the central sewage treatment works. It is important to keep in mind the economic impact of industrial discharges to sewage treatment plants when one looks at the impact of these discharges on the quality of sludge produced in the municipal sewage treatment plant. This is particularly of concern when there are heavy metals present in the sewage sludge which makes it unsafe for application on agricultural lands.

One of the key challenges for small and medium-sized municipalities is how to select cost-effective and appropriate technologies from the large variety of wastewater treatment technologies that are available. Rural areas tend to have access to technical information through support from non-governmental organizations (NGOs) such as CARE, UNICEF and World Vision, as well as national NGOs. Large municipalities tend to have access to technical information through journals, access to universities, the Internet, etc. and can more likely afford or obtain financing for the services of consultants, while small to medium-sized municipalities do not have this luxury. The Internet is becoming a cost-effective means of accessing technical information that will likely be used more and more by these smaller municipalities (through such centres as Volunteers in Technical Assistance (VITA), UNDP, and the International Water and Sanitation Centre in the Netherlands). Perhaps there is a need for more technical centres to be established that would service strictly the needs of small and medium-sized communities with information and advise on water supply and wastewater projects.

Round Table discussions such as the one in Vancouver, are another means to exchange technical, administrative and financial information on water/wastewater system implementation in the Region.

4.0 Factors Affecting Decision Making

The following factors affect decision making by small and medium sized communities in Latin America and the Caribbean when evaluating options to address water supply and wastewater management problems:

- condition of existing infrastructure
- the degree of participation by all stakeholders, including the communities' beneficiaries
- level of fiscal strength, financial management, and the ability to obtain local bank guarantees for loans
- per capita water demand
- local topography and other technical considerations

- existing, feasible water sources and wastewater discharge points
- access to information on appropriate technologies
- access to funds for feasibility studies
- access to funds for capital works and funds for operation and maintenance
- prioritization of needs for water/sanitation versus other needs (eg. housing, transportation, etc.)
- degree to which women are involved in decision making and project implementation
- capability of regional and national governments to provide technical support and financing of projects
- energy availability, and cost considerations
- availability of human resources for the operation and maintenance of new facilities including those with existing skills and those with the aptitude for acquiring new skills
- degree of political will by local government officials to see a water or wastewater system improved
- access to political influence is still a key factor.

5.0 The Market

Overview

"Ignoring the Latin American water/wastewater market is economic suicide".

Vice President of Black and Veatch (a large US Environmental engineering firm),
Latin Trade Magazine, May 1997

"Water and wastewater management accounts for 51 percent of the environmental services market in Latin America".

US Environmental Business Journal, 1997

Figure 2 provides a graph showing the degree of infrastructure investment in Latin America and the Caribbean in the 1980's in four different sectors: the power sector, transportation sector, telecommunication sector, and the water/sanitation sector. The graph shows the degree of investment as a percentage of the annual gross domestic product of the region. The graph clearly shows that the water and sanitation sector received much less investment than the other three sectors during the 1980's. One of the main reasons for this is the perception that the water/wastewater sector does not hold as high a profit making potential as the other sectors. This makes it more difficult to encourage private investments to be combined with the investments and loans provided by local governments and international financial institutions.

Figure 3 provides a graph showing the total annual investment in the water supply and sewage sectors in Latin America and the Caribbean in \$US billions of investment required per year from the 1970's to the present, as well as an estimate of the projected investment required for the future. There was significant investment in the sector in the late 1960's and the 1970's with an average investment of \$US 4.4 billion per year (1993 dollars). There was then a decrease investment in the sector in the 1980's which created a backlog for new works and for rehabilitation of existing systems. In the early 1990's (from 1990 to 1995), investment increased to \$US 4 billion per year. It is estimated that investments in the order of \$US 12 billion per year are needed for the period from 1995 to the year 2005. This estimate is based on wastewater being treated for 60 percent of the population with sewage collection at an average cost of \$US 70 per capita (Ref: Idelovitch & Ringskog, 1997).

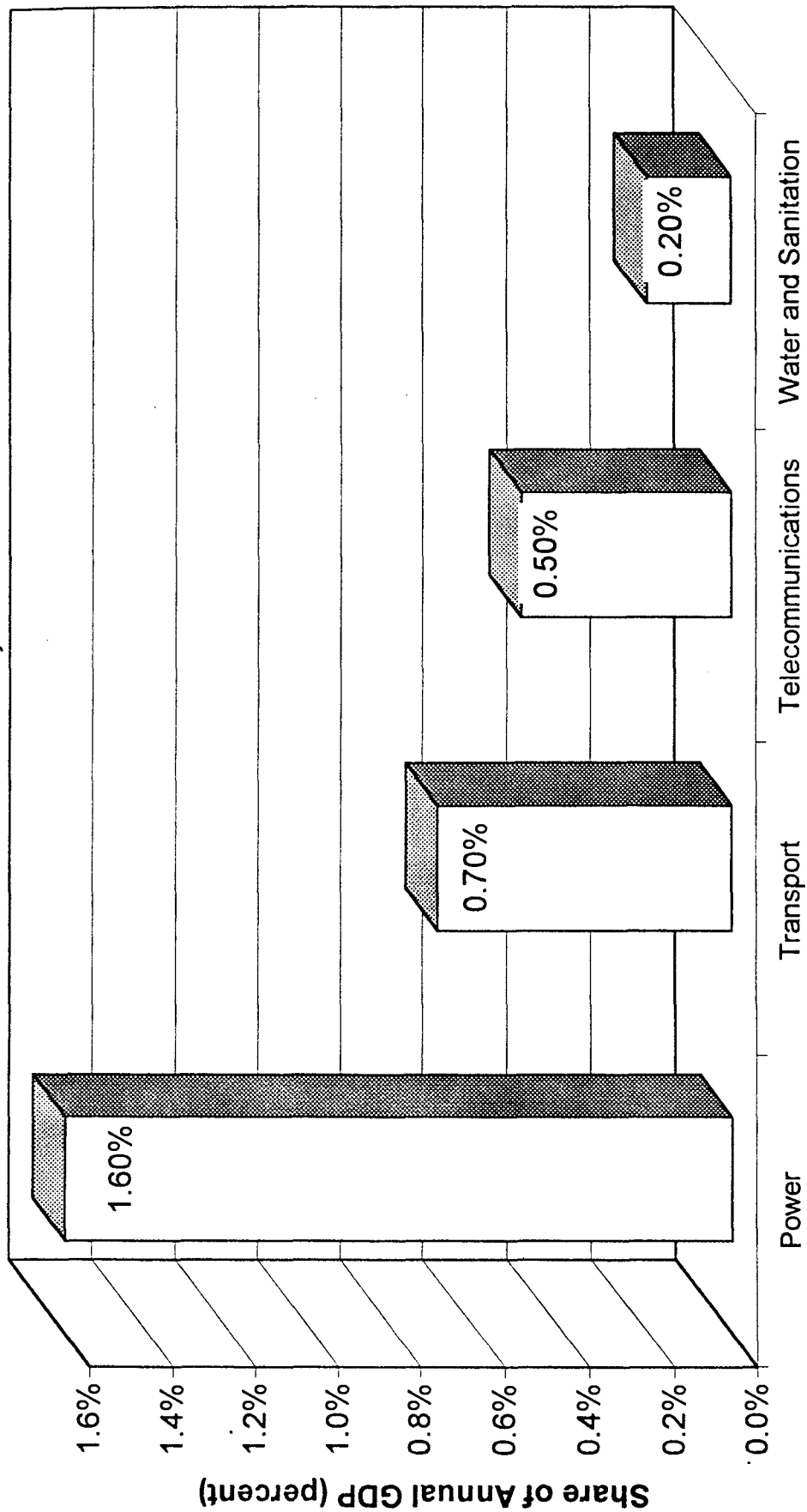
Figure 4 is a pie chart showing the percentage of investment required in the different water and sewer infrastructure sub-sectors in Latin America and the Caribbean for the ten year period from 1995 to the year 2005. Of note are the large investments required for sewage collection (37 percent) and sewage treatment (10 percent) which together account for close to half of the total investment required (Idelovitch & Ringskog, 1997).

Brazil and Mexico are anticipated to provide the largest portions of the investments required in the water/sanitation sector based on these World Bank estimates. The following are the estimated figures for required annual investment in the "environmental market" for the countries that require the highest degree of investment (ESSA & Others, 1996):

- Brazil \$US 2.5 billion
- Mexico \$2 billion
- Argentina \$700 million
- Chile \$300 million
- Venezuela \$300 million
- Columbia \$300 million
- Peru \$200 million

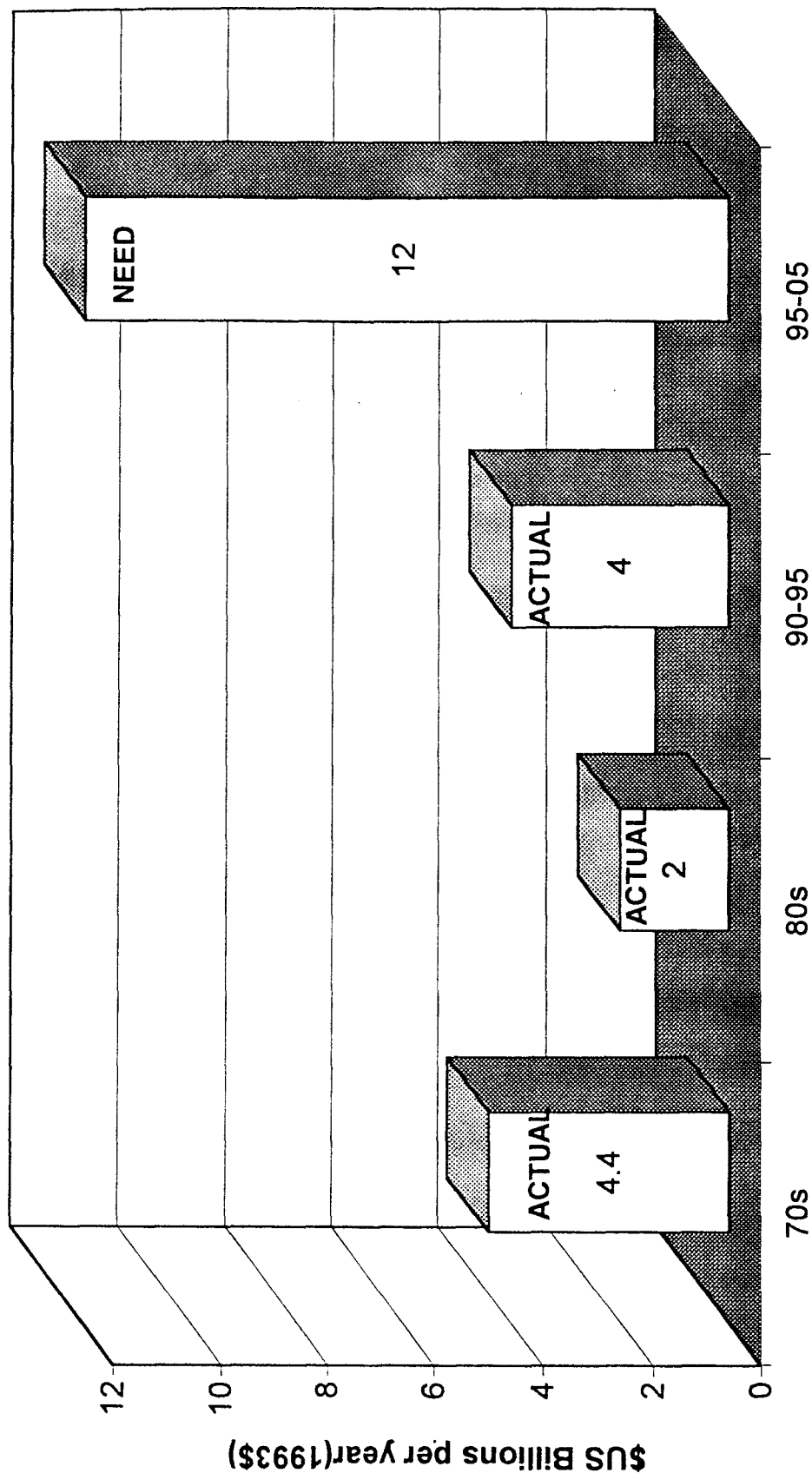
Included in these figures are investments in environmental sectors other than water supply and municipal wastewater management (e.g. industrial wastewater and hazardous waste management, groundwater contamination and remediation, etc.). However, at least half of the amounts shown above would be for water supply and municipal wastewater management given that \$US 1.6 billion was invested in the water/sanitation sector in Brazil in 1996 (Rose, 1997). This includes sewage and water treatment projects including civil works, hydraulic equipment, electrical equipment, control equipment and consulting services.

Figure 2
Infrastructure Investment in Latin America
and the Caribbean, 1980s

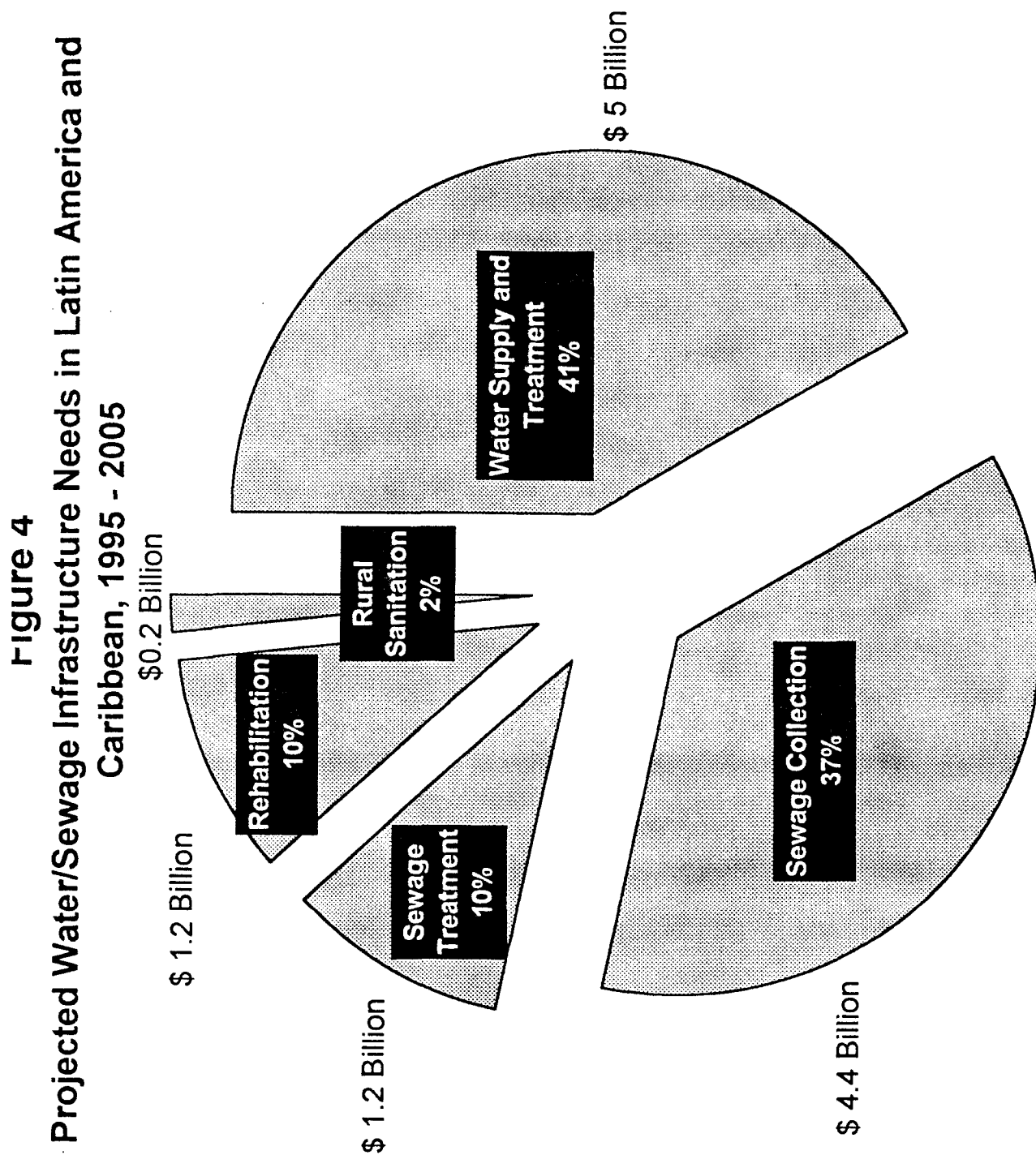


(Source: "Meeting the Infrastructure Challenge in Latin America and the Caribbean", World Bank, July 1995)

Figure 3
Total Annual Investment in Water Supply and Sewage
Latin America and the Caribbean



(Source: "Wastewater Treatment in Latin America: Old and New Options", World Bank, Idelovitch and Ringskoy, 1997)



(Source: "Wastewater Treatment in Latin America: Old and New Options", World Bank, Idelovitch and Ringskoy, 1996)

With certain notable exceptions, particularly Brazil and Chile, most wastewater collection and treatment equipment is provided by foreign suppliers. The concentration of suppliers from certain countries varies from country to country in the region. For example, Canadian water and wastewater consultants have a large share of the Caribbean market whereas US consultants and equipment suppliers are very strong in Brazil, constituting approximately 30 percent of the import market for pollution control equipment in 1996 (Rose, 1997).

Two sources of financing for water and wastewater projects in Latin America and the Caribbean are the Inter-American Development Bank (www.iadb.org) and the World Bank (www.worldbank.org). They also play a key “catalytic” role in financing technical studies that lead to projects that are then financed or co-financed by others.

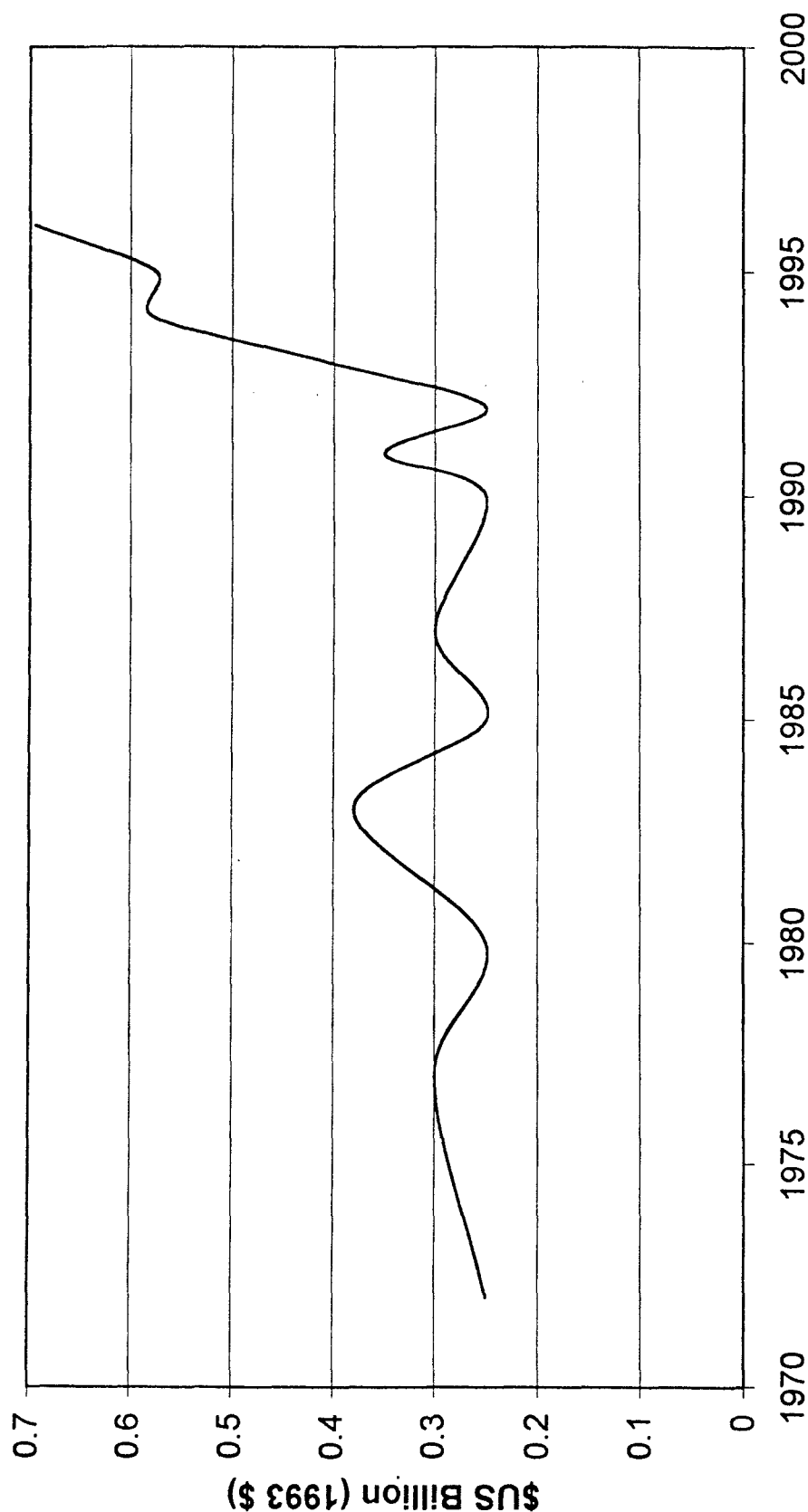
The Inter-American Development Bank

Figure 5 shows the annual investment by the Inter-American Development Bank in the water supply and sanitation sector in Latin America and the Caribbean over the period from the early 1970's to 1997. The annual investment has fluctuated between approximately \$250 million per year to as much as \$695 million per year. As Figure 5 shows, there has been a significant increase in investment in recent years. The IDB reports that it will be committing \$US 3 billion to water and wastewater projects in Latin America and the Caribbean over the next two years, which would be equivalent to approximately 20 percent of its total lending budget. This is clearly a large increase over past spending by the IDB in sector.

There are currently 12 projects in Latin America and the Caribbean that are in the IDB pipeline (ie. in the preparation stage). This includes five projects in Brazil and one project in each of the following countries: Argentina; Bahamas; Barbados; Ecuador; El Salvador; Haiti; and Mexico. The total amount of possible IDB financing is \$US 1.4 billion and of this total, projects in Brazil account for \$784 million or 56 percent. This IDB financing is helping to leverage other financing for many of these projects. The total estimated project costs for these projects including the IDB contribution is \$US 3.83 billion.

In 1997, the IDB continued to put emphasis on the strengthening of legal and regulatory frameworks as well as environmental management initiatives in improving the urban environment. It also developed a detailed strategy for integrative water resource management that was submitted to the Board of Executive Directors. The IDB has indicated that it considers its lending to play a catalytic role by using its resources to attract private capital through co-financing, insurance and loan guarantees. The IDB's 1997 Annual Report says that it has increased its catalytic (ie. leveraging) ratio that facilitates the flow of private debt capital to development projects without itself having to commit a significant percentage in total financing. The IDB's Private Sector Department targets projects where the Bank's size, experience, special relationship with governments and high credit rating provide more confidence to private sector investors.

Figure 5
Inter-American Development Bank
Annual Investment in Water Supply and Sanitation
Latin America and the Caribbean



(Source: 1970-1992 data: "Meeting the Infrastructure Challenge in Latin America and the Caribbean", World Bank, July 1995; 1993-1997 data: provided by Canadian Executive Director's office of the IDB which includes urban drainage projects)

Since the IDB began its private sector lending program in 1995, 16 projects for a total of \$US 615 million in direct lending have been approved. Two of these 16 projects are in the water and sanitation sector (in Columbia and Argentina). This sector has proved to be more difficult to finance given that the regulatory frameworks in most countries are less developed than other sectors such as the energy sector. The water/wastewater sector is not a sector in which private investments have a long standing tradition compared to other sectors. The Bank is working to increase the number of water and wastewater projects in its portfolio including the development of approaches for public and private partnerships which makes such projects more viable for private sector participation.

The World Bank

The World Bank Group consists of a number of organizations. The primary World Bank organizations that provide loans to the public sector are the International Bank for Reconstruction and Development (IBRD) and the International Development Association (IDA). IBRD makes loans to governments in developing countries with relatively high per capita incomes whereas IDA provides concession loans to governments with lower per capita incomes.

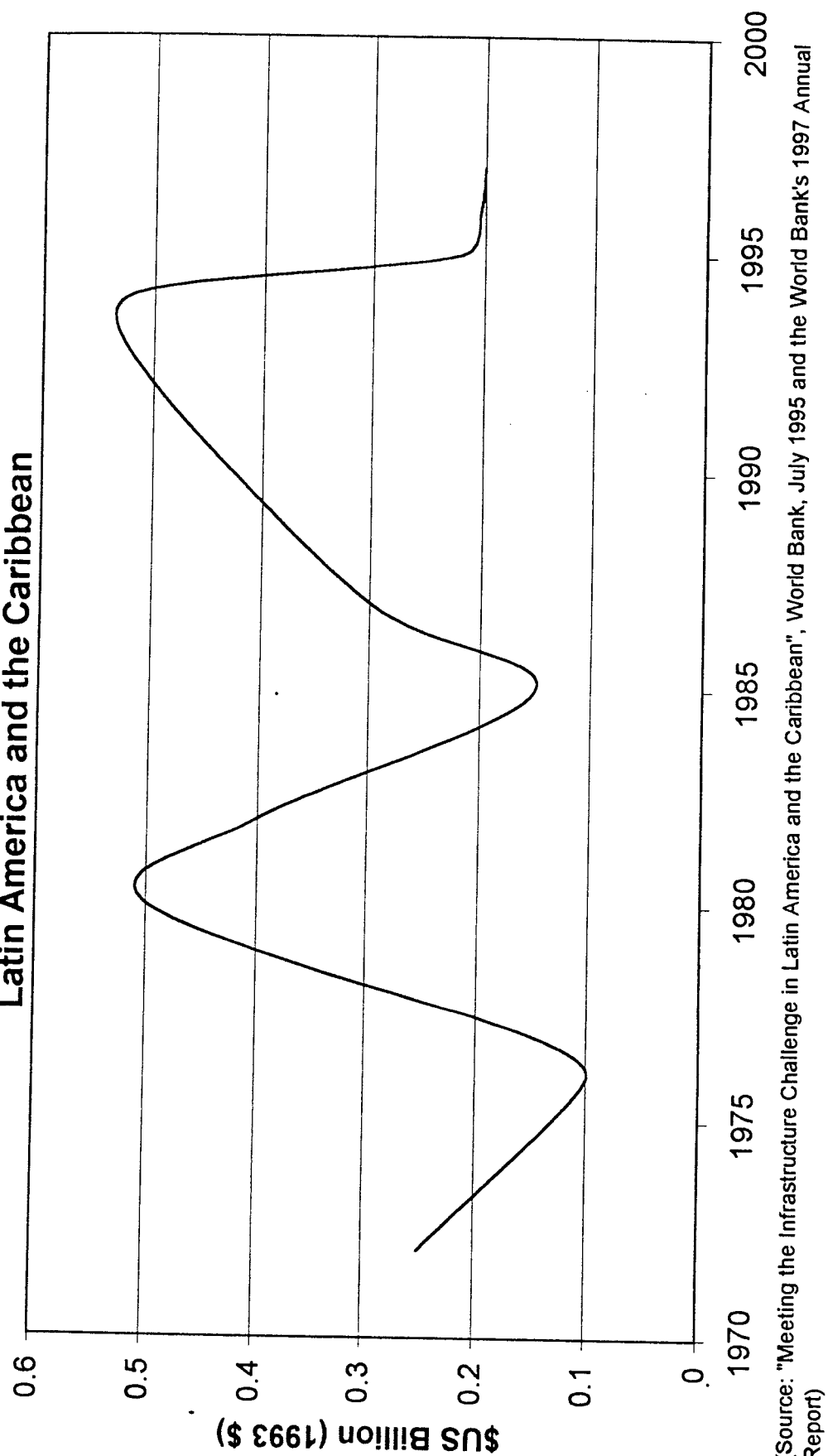
IDA and IBRD have 15 projects in the "pipeline" in the water sanitation sector according to its January 1998 monthly operational summary. This "pipeline" includes five projects from Brazil, two in Trinidad and Tobago, two in Venezuela and one in each of the following countries: Argentina, Columbia, Ecuador, Paraguay, Peru and Uruguay. The total possible World Bank financing totals \$961 million. Of this total, \$441 million pertains to projects in Brazil, ie. 46 percent.

Figure 6 shows the fluctuating amount of annual investment provided by the World Bank in the water supply and sanitation sector from the early 1970's to mid to late 1990's. There has been significant variation in the annual investment by the World Bank in this sector varying from approximately \$100 million to \$530 million per year. World Bank documentation says that it plans to expand assistance for rehabilitating water institutions; finance more systems with the private sector; provide more loans for wastewater treatment systems; and extend connection rates for water supply and sewage for the urban poor. According to the World Bank's 1997 Annual Report, it spent an average of 4.2 percent of its total loans on water supply and sanitation projects for the fiscal years 1995, 1996 and 1997.

The Caribbean Development Bank

The Caribbean Development Bank (www.cdbank.org) usually has in the order of \$US 25 million in loans for the water/sanitation sector in its pipeline.

Figure 6
World Bank
Annual Investment in Water Supply and Sanitation
Latin America and the Caribbean



6.0 Financial Options

6.1 Overview

As mentioned previously, it is estimated that \$12 billion per year will be required over the 1995-2005 period in to meet the needs of the water/sanitation sector. Based on planned investment levels, the World Bank and the IDB will only be able to provide a small fraction of the overall investment required. Today, 15 percent of all infrastructure spending in Latin America and the Caribbean is reported to be financed by the private sector. Around 10 percent comes from multilateral development banks (i.e. IDB, World Bank) with the remainder still provided by the region's governments (Ref: IDB America, March 1998)³. There is also a recognition that part of the investment will need to be made by the beneficiaries themselves in each of the individual projects.

One way to reduce the capital costs of treatment works is to reduce the volume of wastewater to be treated. One way to do this is to apply appropriate tariffs since this will often have a direct impact on the amount of wastewater produced by the beneficiaries. One example of a tariff structure that is of interest is that developed by Chile's Superintendency of Sanitary Services (SSS) which is adopting a new approach to the pricing of water and sewer services. The rates are calculated by SSS based on the replacement value of existing installations, expected service levels and a 15 year investment program. Maximum rates are fixed for a period of five years and they are applied gradually, slowly increasing tariffs over a period of five years so that the tariffs eventually cover the full cost of service. An interesting component of this program are subsidies provided to low income consumers. Representatives from Chile that were present at the Round Table confirmed that this program is in fact in place and is becoming an effective means of meeting the financial requirements of water and sewer infrastructure development in the country.

Apart from the IDB, the World Bank's IDA and IBRD, and the Caribbean Development Bank, there are a number of other institutions that play a key role in the financing of water and sewer works in the region and the provision of related financial services. These include: the IDB's Multi-Lateral Investment Fund (MIF) and Inter-American Investment Corporation (IIC), and the World Bank's International Financial Corporation (IFC) and Multi-Lateral Investment Guarantee Agency (MIGA). Other organizations such as the Canadian Export Development Corporation (EDC) and the Canadian Commercial Corporation (CCC) also provide important financial services.

6.2 The Multi-Lateral Investment Fund

The Multi-Lateral Investment Fund (www.iadb.org/mig/mifeng.htm) promotes private sector development and private investment in Latin America and the Caribbean. It was established in 1993. By early 1997, 118 projects that had been approved worth more than \$224 million. During 1997,

³ Missing from IDB America's estimate is the contributions made through bilateral aid, which is substantial.

47 projects were approved for a total of \$US 62 million. Its emphasis has been in the development of small enterprises. It also concentrates on technical cooperation to encourage private investment and human resources development.

MIF offers assistance primarily in the form of grants. It also acts as a catalyst for the formation of partnerships and other activities that encourage private sector growth in the region. It promotes investment in infrastructure, including the water and sanitation sector. A special focus is planned on investments that assist in the diffusion of appropriate technology and substantiate environmental development.

MIF has teamed up with the Environmental Enterprises Assistance Fund (EEAF) which is an investment fund that supplies venture capital to entrepreneurs in the environmental industry in developing countries. MIF has joined with other partners to establish an environmental fund, Corporación Financiera Ambiental that supports small private companies in Central America that adopt clean technologies, solutions and/or processes.

MIF has supported 27 projects in 17 Latin American and Caribbean countries to encourage private sector participation in the water/wastewater sector and the energy, transportation and telecommunications sector. It supports legal institutional and regulatory changes that are necessary to encourage private sector growth in these sectors. In addition to financing of projects, MIF also has taken some innovative steps to be involved in other ways such as helping employees to buy shares in their (new) company through employee stock ownership plans and tapping employee pension funds.

In addition to the IDB's Multi-Lateral Investment Fund, the IDB also has a new Private Sector Department that lends directly to private firms for infrastructure projects and catalyzes other sources of investment capital. Enrique Iglesias was recently re-elected to a five year mandate as President of the IDB starting April 1, 1998. It is reported that he will continue his efforts to put the private sector at the centre of IDB's efforts to spur economic growth in the region.

In April 1997, the IDB approved its first partial risk guarantee for private investors for a wastewater treatment plant in Bogotá, Columbia. The IDB guaranteed \$US 30 million to senior debt note holders investing in the project to reduce long term contract and currency risks associated with operating the plant.

According to Antonio Vives, deputy manager of the IDB's Sustainable Development Department, the best way to overcome the limited supply of foreign capital is to improve the region's own capital markets and attract local investors. (Ref. IDB America, March 1998).

6.3 The Inter-American Investment Corporation

The Inter-American Investment Corporation (IIC) began operations in 1989 as a member of the Inter-American Development Bank group to promote the economic development of its Latin American and Caribbean member countries by providing financing for small and medium sized private enterprises in the region (see www.iadb.org). The IIC finances projects proposed by small and medium-sized private companies that do not have access to other suitable sources of equity capital and long term loans. To be eligible for IIC funding, projects must contribute to economic and development goals such as job creation, burdening capital ownership, generating net foreign currency income, facilitating the transfer of resources and technology, fostering local savings or promoting the economic integration of Latin America and the Caribbean.

The IIC has played an important role in investments in small scale investment projects in the region. Since 1989, IIC has lent \$US 51.9 million to 14 projects in transportation, warehousing, water supply, telecommunications and power generation. According to the IIC's 1997 Annual Report, 40 percent of funds approved were for equity investments and 60 percent for loans. The IIC could be an appropriate source of financing for local equipment supplies for the water and sanitation sector in Latin America and the Caribbean.

6.4 The International Finance Corporation

The International Finance Corporation (IFC) (www.ifc.org) is a member of the World Bank Group and is the largest multilateral source of loan and equity financing for private sector projects in the developing world. It finances and provides advice for private sector projects in developing countries in partnership with private investors. Like MIF, IFC plays a catalytic role through its stimulation of private sector investment by helping to demonstrate that specific investments can be profitable. IFC was founded in 1956, and since that time it has provided over \$US 19 billion in financing to over 1,700 companies in 125 developing countries. In recent years, private sector participation in infrastructure projects have become a primary focus of the IFC. These projects now account for close to 25 percent of its investments.

IFC's 1996 Annual Report indicates that it has been working to facilitate development of private sector infrastructure in high risk markets. The IFC is rapidly expanding its investment in lending to infrastructure sectors in Latin America and the Caribbean. It has supported water and sewer projects in the past although they have focussed primarily on large systems such as the following:

- Buenos Aires, Argentina - \$US 4 billion, 30 year water/wastewater concession (IFC lent \$US 93 million, invested \$US 10.5 million and mobilized \$US 382.5 million from banks)
- Puerto Vallarta, Mexico - \$US 33 million, 15 year build-own-transfer wastewater treatment plant project
- Aguas de Limeira, Brazil - \$US 60 million, 30 year water/wastewater concession (IFC loan \$US 10 million; \$US 1 million in equity).

IFC is also involved in a number of advisory roles including a water supply BOT project in Brazil for \$250 million, and a 15 year wastewater collection and treatment BOT (build-own-transfer) project in Ribeirão Preto in Brazil with a total cost of \$30 million. The IFC is also involved at present in the development of additional water and wastewater concession projects in Mexico, Columbia and Bolivia. A representative of IFC gave a presentation at the Vancouver Round Table which provided more details on specific case studies.

6.5 The Multi-Lateral Investment Guarantee Agency

The Multi-Lateral Investment Guarantee Agency (MIGA) - (see www.worldbank.org) has a mandate to encourage flow of foreign investment in developing countries. It provides insurance to private investors against non commercial risks (eg. political risk). MIGA expects continued growth and guarantees for Latin America and the Caribbean infrastructure in the future. During 1997, MIGA issued 70 guarantee contracts totalling \$614 million in coverage for projects in 25 countries. The projects helped to facilitate close to \$5 billion in foreign direct investment. Latin America and the Caribbean accounts for the largest share of MIGA's portfolio (44 percent). Of the 26 projects in the region, seven of these covered infrastructure investments which were primarily in the power sector. Brazil currently is the highest beneficiary of MIGA's investment guarantees. However, up to now, MIGA has had little involvement in providing guarantees to the privatization of water or wastewater utilities in Latin America or other parts of the world. Nonetheless, it should be considered as one of the institutions to consider for financial services.

6.6 The Export Development Corporation

The Export Development Corporation (EDC) is a Canadian financial services organization that supports Canadian businesses to compete in foreign markets (www.edc.ca). The United States and some European countries have similar organizations. The financial services provided include export insurance against commercial and non-commercial risks, financing of projects and guarantees. In financing projects, certain restrictions apply to the degree of Canadian content to be included in the goods and services for the project. EDC has set up a number of Lines of Credit in Latin America which provide a streamlined form of financing in which EDC lends money to a foreign bank, institution or purchaser, which then on-lends the necessary funds to foreign purchases of Canadian goods and services. EDC has supported a total of \$US 120 billion in exports over the past 53 years.

6.7 The Canadian Commercial Corporation

The Canadian Commercial Corporation (www.ccc.ca) is a Canadian Crown Corporation established in 1946 that acts as a prime contractor and guarantor for sales by Canadian exporters to foreign governments and international organizations, as well as private sector buyers. In 1996-97, CCC facilitated sales valued at \$CAN 859 million (~\$US 600 million) in 43 countries. Over 70 percent of the 1,500 new contracts placed through CCC in 1996-1997 were valued at under \$100,000 so it is not only interested in large projects.

7.0 Privatization

7.1 Overview

An important trend in recent years has been the move towards privatization of infrastructure throughout the world and in Latin America and the Caribbean in particular. Compared to other sectors such as the telecommunications, power and transportation sectors, the water/sanitation sector is viewed to be more difficult to privatize because water and sewage services are considered by many to be social services. As mentioned previously, the regulatory framework is less well established than the energy, telecommunications, or transportation sectors and the water/wastewater sector is still viewed by many investors as having higher risks and lower profit margins than these other sectors. However, there has been significant experience with privatization in the sector in the region particularly with regard to the privatization of water supply systems. There has been limited experience with the privatization of sewage systems. The privatization of sewage system is even relatively new in North America.

There are various options for the roles of the public sector and their involvement in privatization projects, including but not limited to (Idelovitch & Ringskog, 1995):

Under Public Ownership

- service contracts
- management contracts
- lease arrangements
- concessions

Under Partial Private Ownership

- BOOT (Build-Own-Operate-Transfer) and its variations such as BOT (Build-Own-Operate)
- Reverse BOOT (public sector finances and builds plant then contracts a private firm to operate it over a set time period and pay an annual fee to cover rest of investment)
- Joint ownership or mixed companies
- outright sale

The focus to date with regard to privatization of water and sewage systems has been on large systems. However, there is a trend toward privatization of the smaller systems for municipalities in the region. The question is whether or not these smaller systems provide the economies of scale to make it economically viable to privatize these smaller systems.

Based on the experience to date in the privatization of water and sewage systems, there are a number of conclusions that have been arrived at including the following:

- political commitment at the highest levels is needed
- there is a need for consensus building among all stakeholders
- it is important that all risks be carefully assessed, including: political risks; economic risks; commercial risks; technical risks; legal risks; etc.
- the assets in a privatization program do not necessarily need to be privatized
- clearly it takes a lot of time for a privatization program to be developed and implemented
- a strong regulatory framework must be developed and it must be extremely clear to all involved
- experiences indicates that hiring a single multi-disciplinary firm is preferable to hiring a number of firms during a transfer to the private sector
- the sensitive issue of reductions in staff are usually inevitable but are achievable if handled carefully
- rate increases need to be carefully justified
- the private sector may not be willing to invest in some cases but often may be willing to borrow to become involved in privatization of water and sewer works
- privatization is clearly not a universal panacea - there have been mixed results to date.

There is growing interest from the private sector in investing in the water/sanitation sector in Latin America. One example that demonstrates this interest has been Emerging Markets Partnership (EMP) which teamed up with American International Group and GE capital to invest in infrastructure industries in Latin America. So far, the fund has raised \$US 1 billion, 10 to 15 percent of which will be devoted to water/wastewater projects. The Chief Executive Officer of EMP's Latin America Group says "*We are very interested in water since its returns are interesting and the benefits to society are great*".

7.2 Privatization in Brazil⁴

During the 1980's, the Brazilian government faced a financial crisis caused by high inflation and a lack of international financing resources and foreign investment. It significantly impacted on infrastructure investment. One of the sectors that was most seriously affected by this financial crisis and the lack of public resources was the water and sewage sector.

In an attempt to generate a solution to infrastructure shortcomings and attract capital investment, the federal government of Brazil created in 1995 the Concession Law for Public Services. This law grants municipalities the right to transfer to the private sector the operation of public services including water and sewage services. Based on the law, the municipalities can create

⁴ Much of the material from this subsection is from Rose, 1997.

their own municipal regulations for implementing the concession of such services. The framework for the privatization is such that through international bids, Brazilian and foreign and private companies or consortia can finance, construct and operate the water and sewage services. The investments are then later recovered through fees that are charged to the municipality during a period that generally ranges from 15 to 30 years.

The Ministry of Planning in Brazil has designated the sanitation sector within the national plan for privatization. A model is being prepared for the privatization of the Brazilian sanitation sector providing financial support for the municipalities that are interested in implementing concession projects. BNDES has a budget of \$US 13 billion for 1997 and has created a department to coordinate financing projects in the sanitation sector. BNDES plans to invest \$US 280 million, specifically for water projects. The major objectives of BNDES for this program are:

- to increase efficiency of sanitation services
- reduce water losses in the distribution networks
- modernize the operation of water treatment plants
- introduce more efficient management techniques
- implement new technologies.

Most sources report that the major impediment to speedy implementation of these concession projects is a lack of financing resources. Although BNDES' financial participation is important, it is recognized that to cover all of the financial needs for the sector there is a need for foreign partners with expertise in financial engineering and knowledge of alternative financing sources.

Of the 6,500 municipalities in Brazil, about 5,200 are served by state-owned companies. The services for the remaining 1,300 municipalities are provided by municipally owned companies. The 1,300 municipalities that operate their own sanitation companies are in their majority small sized cities with populations ranging from 30,000 to 100,000 inhabitants. Most of the medium-sized cities that have independent water and wastewater systems are located in the state of San Paulo. Of the 1,300 municipalities that operate their own water and sewage treatment facilities, a total of 30 are in different stages of implementation of projects, most of which are concessions for sewage treatment services as of mid-1997. The vast majority of these are in the Sao Paulo area. These privatization are for communities that vary in size from 4,400 inhabitants up to 436,000 inhabitants. Most trade sources report that a major impediment to the speedy implementation of concession projects is a lack of financing resources.

During a seminar in Brazil for private and public entities held in 1997 to consider various options for water and sewage concessions, the following financing options were proposed as the most viable financing approaches to expand and implement water and wastewater concessions:

- participation of local and foreign shareholders in sanitation companies
- participation of Brazilian and foreign financing entities
- participation of local and foreign pensions and securitization funds

- implementation of BOT models and its variants
- long term financing for equipment.

Brazil's privatized its first wastewater system just last year. The concession was awarded to a US/Brazil partnership to design, construct, own and operate a wastewater collection and treatment system in Rebeiro Preto.

Brazil is not the only country with a progressive privatization program in the sector. Chile is planning the privatization of 13 water supply and wastewater treatment companies. (Ref.: WET, January, 1998).

8.0 Principal Challenges

In summary, the following are the principal challenges facing the sector in the coming years:

- meeting the growing demand for municipal wastewater treatment
- how to address the public's willingness to pay for water and wastewater services
- the challenge of controlling industrial discharges to sewage collection systems (i.e. indirect discharges)
- sewage sludge management
- developing viable private/public sector partnerships and viable privatization schemes, particularly for small to medium sized urban centers
- adequate technology transfer and training of municipal authorities
- selection and implementation of cost-effective, appropriate technologies from the plethora of options available
- meeting the large financial demand, both in terms of capital costs and for operation and maintenance of water and wastewater systems in the region.

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OVERHEADS

Municipal Wastewater in
in Latin America and the Caribbean -
A Discussion Paper on
the Market and Technologies
March 16, 1998

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OUTLINE

- Overview - Coverage and Trends
- Key environmental challenges
- Market - Past and Future
- Financial Options
- Principal Challenges

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Overview

- cholera map

CHOLERA

- '91-'95: 1.3 million cases; **11,300 deaths**
- **economic losses** Peru alone:
\$US 180 - \$500 million - say 1.5 % of GDP
- investment in Peru water/sanitation was
= 0.15% of GDP (ie. 10% of losses)
- **spread** to all countries in the continent
except Canada and Uruguay

coverage graph

COVERAGE

- **52%** had sewer connections in '95
- **< 5%** of all sewage collected was **treated**
- treatment coverage **varies by country** - eg. Chile ~15% treated ... others lower
- water/sewerage coverage also **function of income level** - estimate 4 times higher coverage for high income level

TRENDS

- **Move to urban areas** - growing peri-urban areas
- Latin America and Caribbean **most urbanized region** in developing world (1994 - 74%) and increasing
- In the past potable water and sewage collection prevailed ... sewage **treatment deferred** ... now changing

TRENDS

- **Growing awareness** in L.A. and Caribbean that contamination of rivers/lakes is unsustainable...Canadian experience with eutrophication of Great Lakes
- **More informed population** re: environmental issues

TRENDS

- Good environmental management becoming recognised as a **competitive asset** in certain sectors (eg. agriculture, tourism)
- **Stricter legislation** ... but poor enforcement generally
- Increased emphasis on **industrial pre-treatment**

TRENDS

- **Greater role for municipalities** ... legally obliged to provide water/sewer services directly or through specialised public or private companies
- **BUT** problem with **time to adjust** for many municipalities especially for wastewater treatment ... more complex, skilled operators relatively scarce ... financing difficult

CART BEFORE THE HORSE

TRENDS

World Bank reports two main negative trends in the past decade (1985-95):

- (1) decentralisation to unprepared municipalities and provinces
- (2) neglect of continuous maintenance and efficient operations

TRENDS

- **Participation** in decision making increasing ... World Bank released Participation Handbook with case studies
- Participation example: **Brazils' PROSANEAR** program

BRAZIL PARTICIPATION EXAMPLE

- demand oriented planning for low-cost water/sanitation for low income areas in **11 cities ... strong participation** by beneficiaries
- conclusions:
 - (i) participation **must be tailored** to the population
 - (ii) agreement between design engineers and beneficiaries needed

BRAZIL PARTICIPATION EXAMPLE

- conclusions (cont'd):
 - (iii) conflicts can be resolved through **negotiation**
 - (iv) engineers need to adapt ... eg. work with **NGOs**
 - (v) donor needs to provide more extensive **supervision** to work out details
 - (vi) participatory projects can **reduce capital costs** ... beneficiaries have good ideas

PERU PARTICIPATION EXAMPLE

- peri-urban areas of **Lima**
- Canadian NGO - **WUSC**; funded by **CIDA**
- very **successful** ... involvement by beneficiaries at all stages
- combined with **training**
- role of **women important**
- sense of ownership

MORE TRENDS

- **More co-ordination** between multilateral agencies ... eg. WB and IDB
- Starting to have more collaboration between **private sector and non-governmental organisations** ... for example its becoming popular with Canadian government aid programs (CIDA)

TRENDS

- trend to implement **River Basin authorities** based on European models .. Brazil, Chile and Mexico ..mixed results
- Brazilian example
- carried out in at least **5 urbanized basins**

BASIN APPROACH EXAMPLE

- water pollution control based on water basin management & assimilative capacity
- **covered all activities** including planning and management
- takes advantage of **economies of scale** for wastewater treatment

BASIN APPROACH EXAMPLE

- water use and **pricing policy** reflect basin characteristics and planning goals
- **regulatory framework** basin wide
- others underway in Argentina and Chile

TRENDS

- Trend in IDB and WB for **better project preparation** ... recognition that increasing investment without quality control is not worthwhile
- **Optimisation** of existing systems
- **Privatisation**... public/private systems ... many options ... challenge ... more on that later

OUTLINE

- Overview - Coverage and Trends
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- Principal Challenges

KEY ENVIRONMENTAL CHALLENGES

"The greatest challenge in the water & sanitation sector over the next two decades will be the implementation of low- cost sewage treatment that will at the same time permit selective reuse of treated effluents for agricultural and industrial purposes"

World Bank: "Meeting the Infrastructure Challenge in Latin America and the Caribbean", 1995

KEY ENVIRONMENTAL CHALLENGES

- of the few wastewater treatment plants built, **few are operating properly** - one Mexican estimate was 5 %
- how to meet **costly demand**
- how to select the **appropriate technologies**

TECHNOLOGIES

- Past:
 - » collection only (if that)
 - » sludge to ocean
 - » unstabilized wastewater to agricultural land
 - » foreign suppliers
 - » poor O&M
 - » few cases of secondary and tertiary treatment

TECHNOLOGIES

- Future:
 - » integrated basin management
 - » **optimisation** of existing facilities
 - » more **careful planning/design**
 - » steps to **reduce incoming flow** for treatment
 - » **local suppliers** becoming more adapt at meeting demand

TECHNOLOGIES

- Future (cont'd):
 - » **treatment ponds** - effective treatment without chlorination if detention time is sufficient and O&M costs are low but large land areas req'd ... **alternative lagoon designs** to reduce land requirements
 - » restricted **irrigation** of low-quality effluents for specific crops ... fewer restrictions for higher quality effluent .. can be a safe and economic practice...controls

KEY ENVIRONMENTAL CHALLENGES

- role of **industry discharges** to sewer key ... pre-treatment standards and enforcement, tariffs for volume and mass loadings .. industry discharges have economic impact on sludge disposal practices

KEY ENVIRONMENTAL CHALLENGES

- appropriate **sludge** standards required ... especially heavy metals
- potential for disposal on agricultural land ... common, cost-effective and environmentally sound practices in Canada

OUTLINE

- Overview - Coverage and Trends
- Key environmental challenges
- **Market - Past and Future**
- Financial Options
- Principal Challenges

MARKET

"Ignoring the Latin American (water/wastewater) market is economic suicide"

VP Black & Veatch, May/97 Latin Trade.

MARKET

"Water and wastewater management account for 51 % of the environmental services market in Latin America"

US Environmental Business Journal, 1997

MARKET

- GRAPH of infrastructure investment in 1980s....water sanit. much less than other sectors

MARKET

- Investment and rehabilitation backlog created in the 1980s
- Need to **raise service levels**
- Increase investment needed in **sewage treatment** ... recall only 5 % of wastewater treated now

- GRAPH past/future investment in water/sanitation...70s...80s...90s

- GRAPH of projected needs...pie

MARKET

- World Bank estimates \$11.5-12 billion per year in water/sanitation req'd for next 10 yrs:
- Brazil - \$2.5Billion
- Mexico - \$2 Billion
- Argentina - \$700 M
- Chile - \$300 M
- Venezuela - \$300 M
- Columbia \$300 M
- Peru - \$200 M

- GRAPH historical IDB investment

IDB Pipeline (January 1998 MOS)

- 12 projects: Argentina (1); Bahamas (1); Barbados (1); Brazil (5); Ecuador (1); El Salvador (1); Haiti (1); Mexico (1)
- Possible IDB financing: **\$US1.4 Billion** (Brasil \$US 784 Million)
- Total cost: **\$US 3.83 Billion**

- GRAPH historical WB investment

World Bank Pipeline (January 1998 MOS)

- 15 Projects: Argentina (1); Brazil (5); Columbia (1); Ecuador (1); Paraguay (1); Peru (1); Trinidad & Tobago(2); Uruguay (1); Venezuela (2)
- Possible WB Financing: **\$961 Million** (Brazil \$441 Million)
- << IDB's \$3.8 Billion

Caribbean Development Bank Pipeline (April 1997)

- \$6 M Sewage Project - Dominica
- \$7.7M Third Water Project - Grenada
- \$6 M Second Sewerage Project - St. Lucia
- \$5 M Kingston Sewerage - St. Vincent
- Total: **\$US 24.7 Million**

- GRAPH req'd investment vs. planned investment...IDB and WB not enough

World Bank Financing

"Meeting the Infrastructure Challenge in Latin America and the Caribbean"(World Bank Publication, July/95):

"The World Bank plans to expand assistance for rehabilitating water institutions and systems with the private sector, to fund the treatment of wastewater ... and extend connection rates for water supply and sewerage ... for the urban poor."

IDB Financing

Latin Trade, May/97:

"The IDB ... is committing \$3 billion (\$US) to water and wastewater projects in the (Latin American) region over the next two years, or 20 % of its total lending budget"

Outline

- Overview - Coverage and Trends
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- **Financial Options**
- Principal Challenges

Some Financial Options

- reduce volume requiring treatment (eg. w/w flow to be treated can be reduced by appropriate tariffs)
- Chile's Superintendency of Sanitary Services (SSS) adopting a new approach to pricing water and sewage services

Chile-Tariffs

- Rates calculated by SSS based on replacement value of existing installations, expected service levels, and 15 year investment program. Max. rates fixed for 5 yr..... applied gradually over 5 years ...eventually tariffs will cover full cost of service ...alongside program of subsidies for low-income consumers

Some Financial Options

- IDB's **Multilateral Investment Fund (MIF)** has \$1.2 B/yr for grants to assist the private sector, including technical assistance for privatisation, regulatory and legal reforms, and capital market development.

Some Financial Options

- The World Bank Group's **IFC** is rapidly expanding its investments and lending to the infrastructure sectors in Latin America and the Caribbean
- IFC has supported water and sewer projects in the past.

Some Financial Options

- **Multilateral Investment Guarantee Agency (MIGA)** mandate is to encourage flow of foreign investment into developing countries. ..provides insurance to private investors against non-commercial risks ... MIGA expects continued growth in guarantees for Latin American and Caribbean infrastructure projects

PRIVATISATION

- various options for roles of public sector
- focus to date has been on large systems... is it economically viable at a smaller scale?
- privatisation of sewage systems new... even in N. America
- compared to other sectors (telecom, power, and transportation) water and sanitation difficult to privatise... water/sewer considered "social service"

Some Conclusions Re: Privatisation

- political commitment to privatise req'd at high level
- consensus building among stakeholder critical
- all risks must be assessed (political, economic, commercial, technical, legal, etc.)
- assets do not necessarily have to be privatised
- takes time
- regulatory framework must be clear

Some Conclusions Re: Privatisation

- hiring single multidisciplinary firm preferable
- reduction of staff achievable...but sensitive
- rate increases must be justified
- private sector may not be willing to invest but may be willing to borrow
- privatisation is not a universal panacea ... mixed results to date

Outline




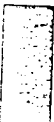
- Overview - Coverage and Trends
- Key environmental challenges
- Market - Past and Future
- Financial Options
- **Principal Challenges**

PRINCIPAL CHALLENGES

- Public's willingness to pay
- Controlling industrial discharges
- Sludge management
- Private/public partnerships
- Technology transfer to municipal authorities
- Cost-effective technologies
- Meeting the financial demand

Cholera Epidemic in the Americas, 1991-95

Legend

-  Initial epidemics, January 1991
-  August 1991
-  February 1992
-  November 1994

As of December 31, 1995:

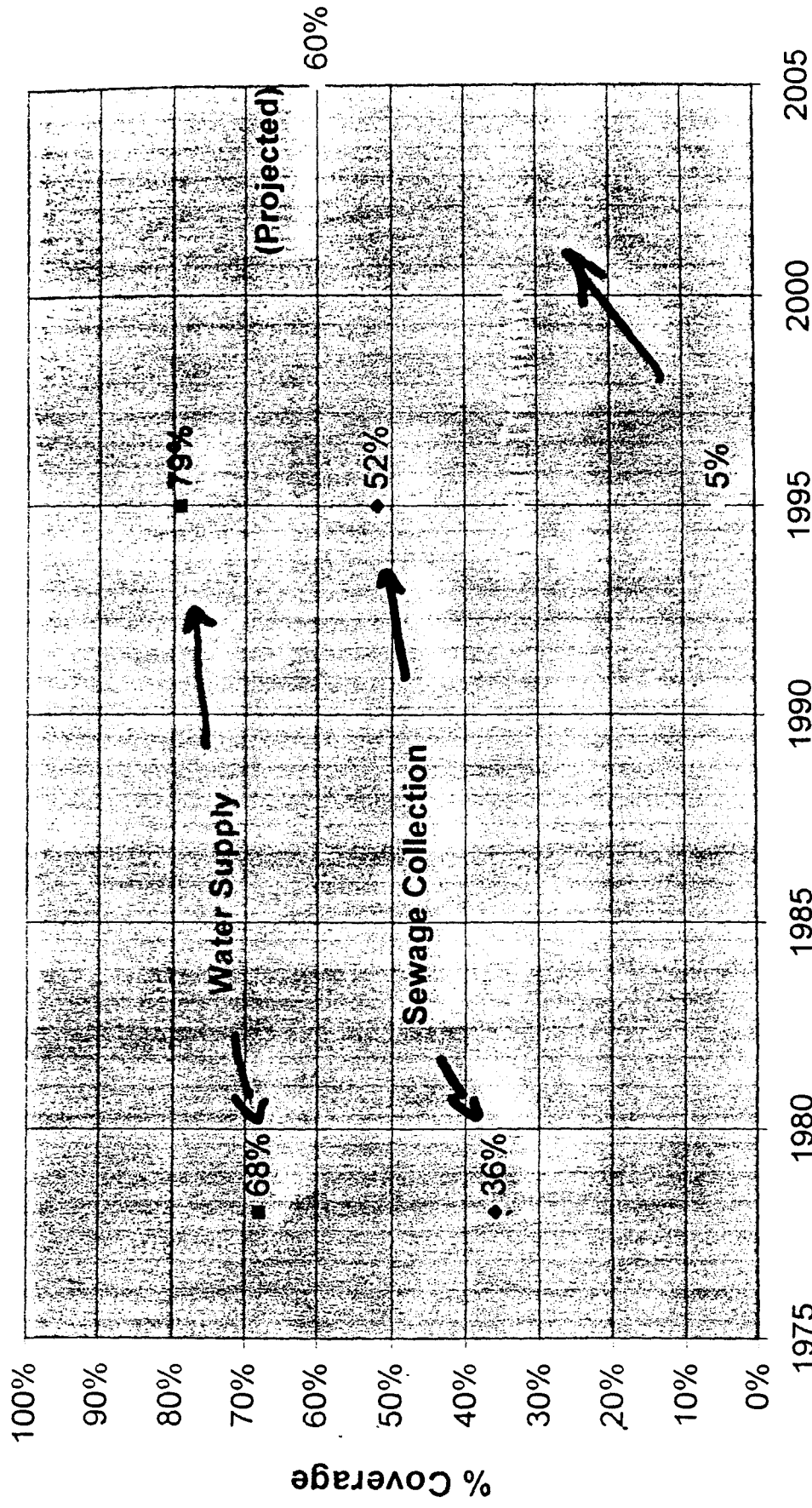
Number of cases: 1,340,000

Number of deaths: 11,300



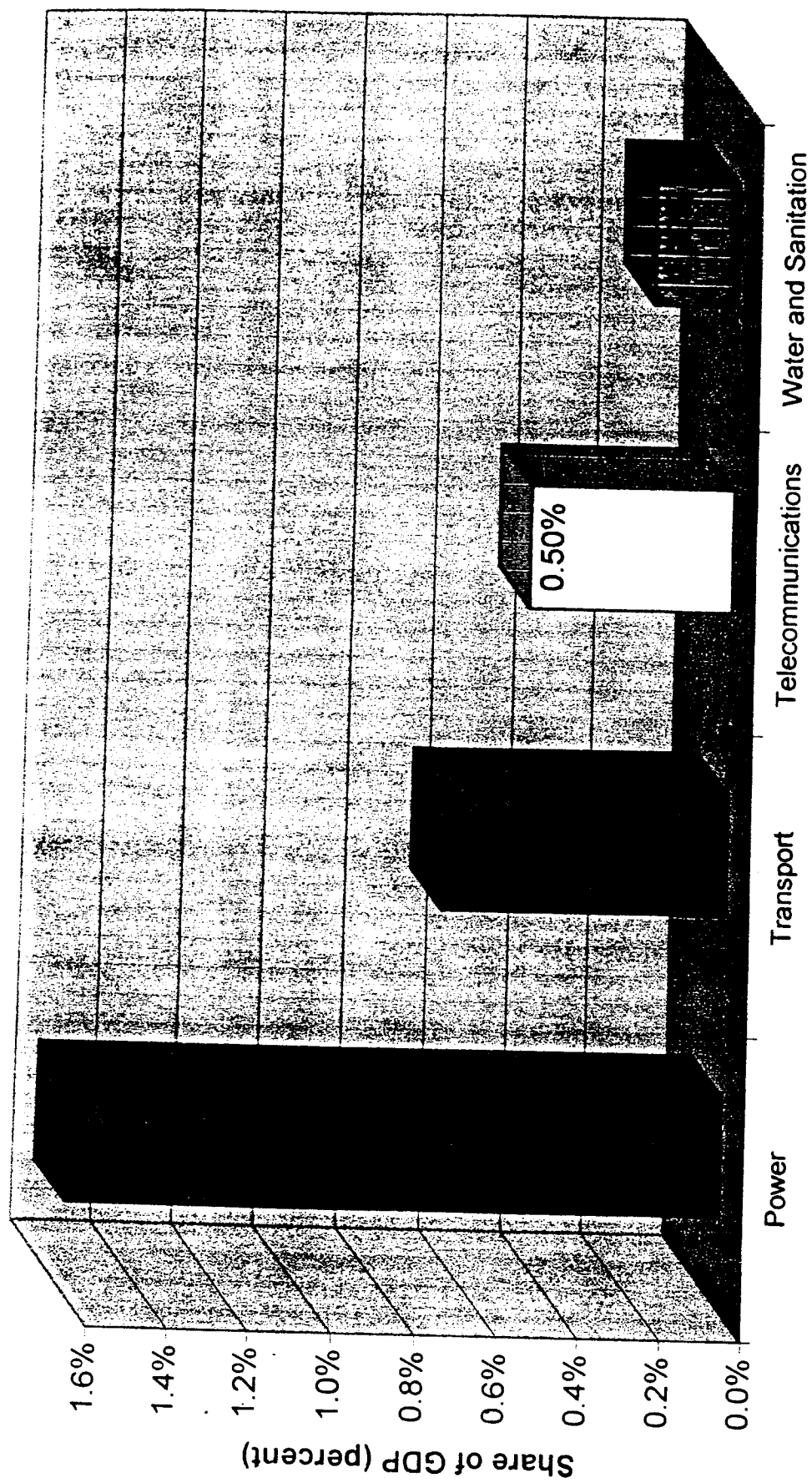
Reference: World Bank Publication
"Wastewater Treatment in Latin America"
By E. Idelovitch & K. Ringskog, 1997

Water and Sewage Urban Coverage



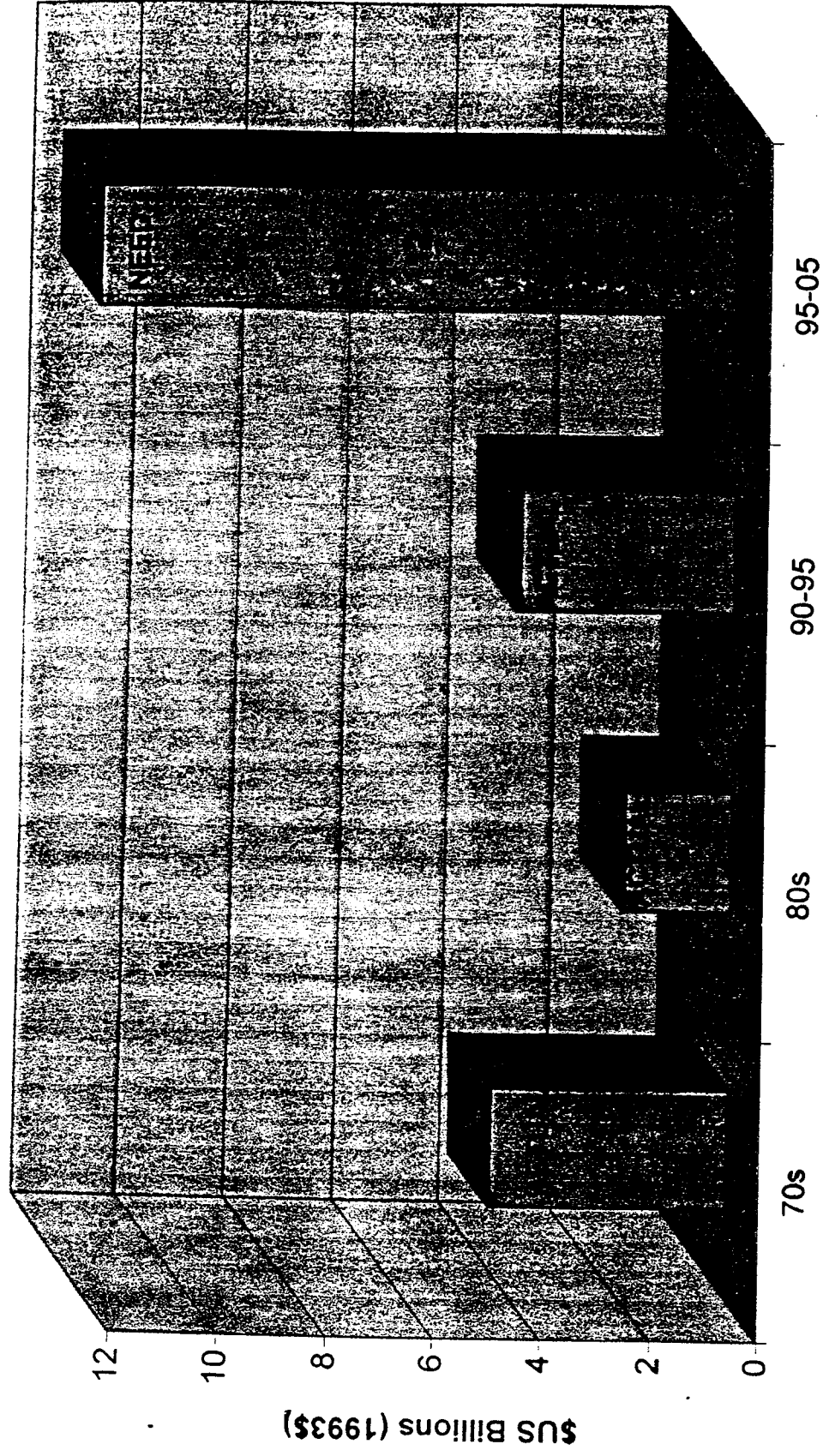
(Source: "Wastewater Treatment in Latin America: Old and New Options", World Bank, Idelovitch and Ringskoy, 1997)

Infrastructure Investment in Latin America and the Caribbean, 1980s



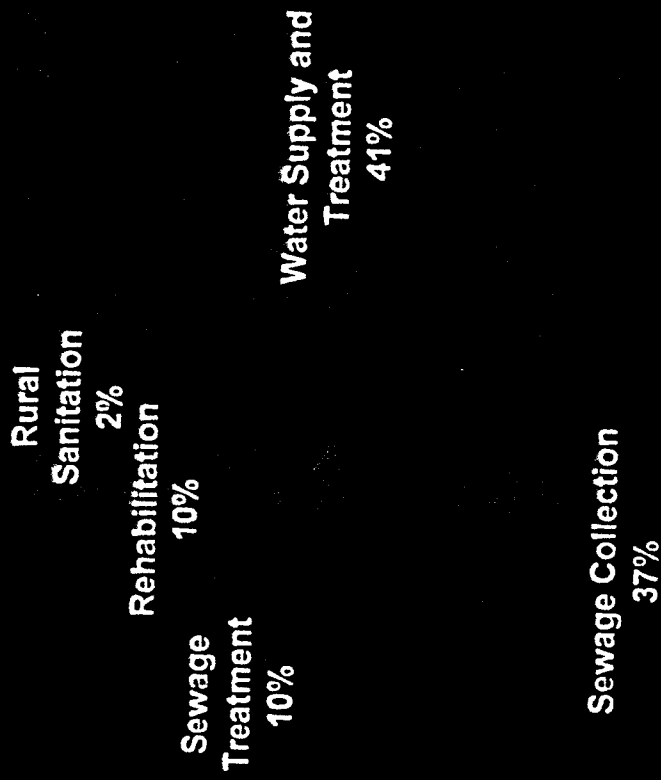
(Source: "Meeting the Infrastructure Challenge in Latin America and the Caribbean", World Bank, July 1995)

Total Annual Investment in Water Supply and Sewage Latin America and the Caribbean

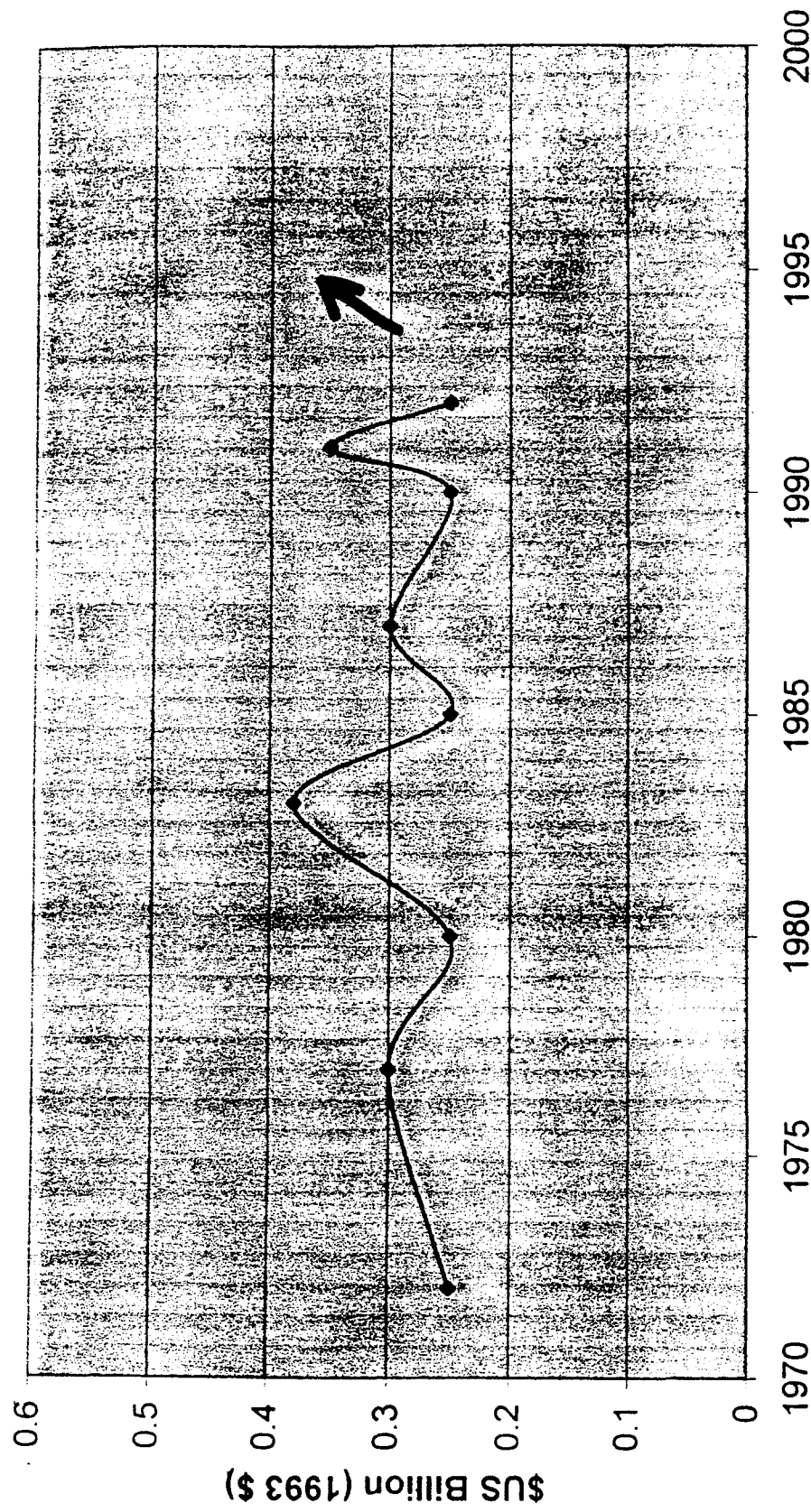


(Source: "Wastewater Treatment in Latin America: Old and New Options", World Bank, Idelovitch and Ringskoy, 1997)

Projected Water/Sewage Infrastructure Needs in Latin America and Caribbean, 1995 - 2005

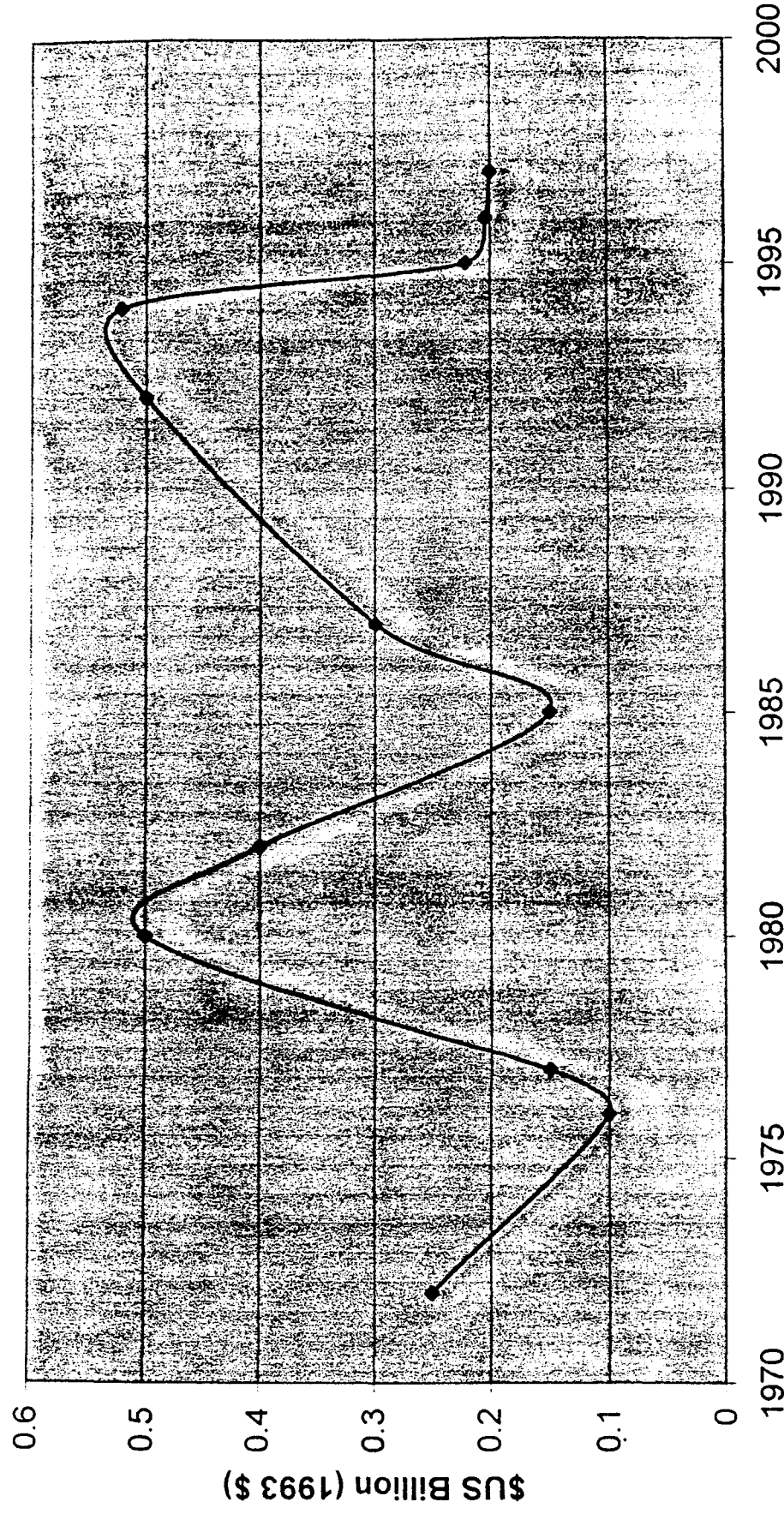


Inter-American Development Bank Annual Investment in Water Supply and Sanitation Latin America and the Caribbean



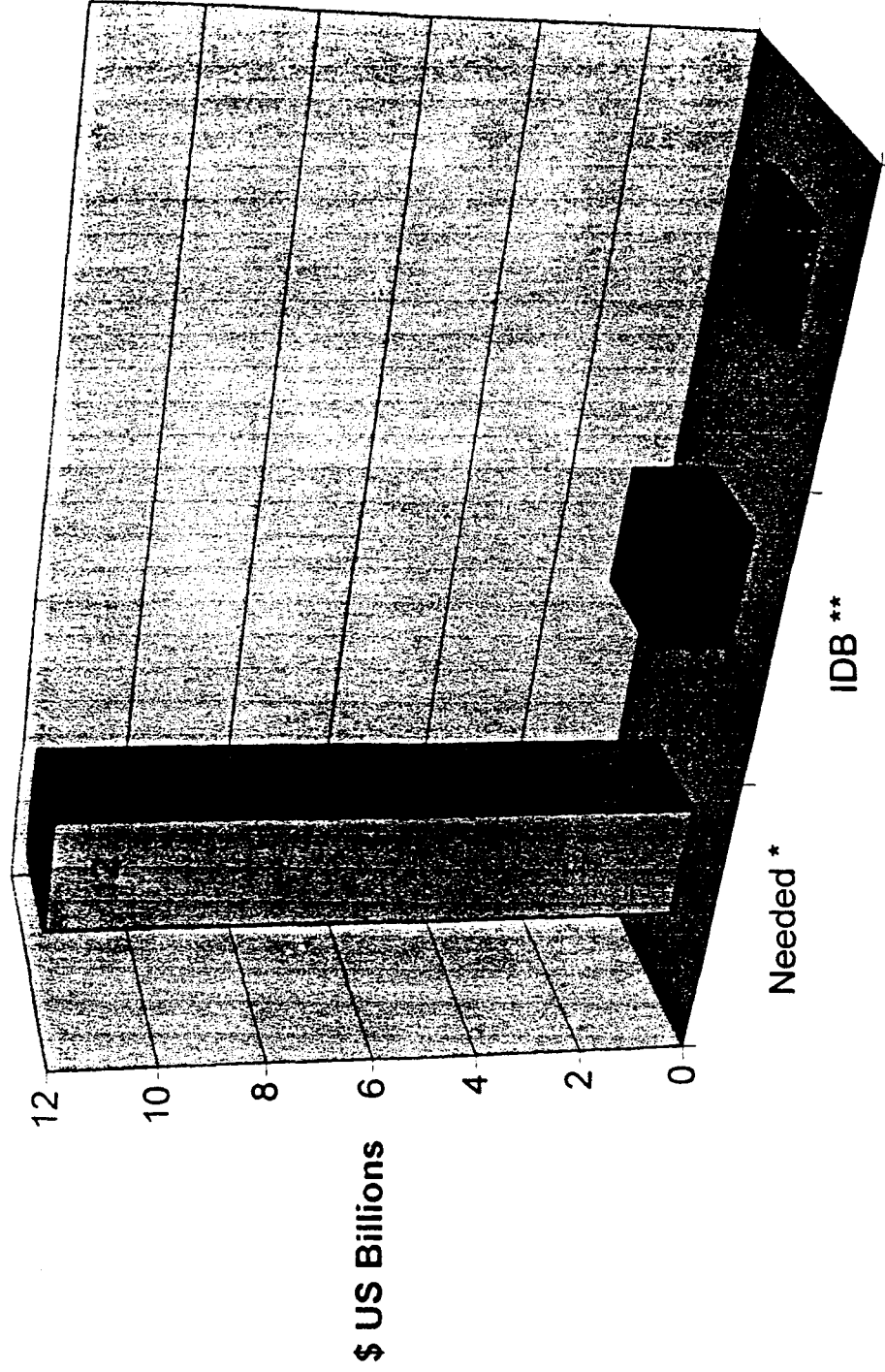
(Source: "Meeting the Infrastructure Challenge in Latin America and the Caribbean", World Bank, July 1995)

World Bank
Annual Investment in Water Supply and Sanitation
Latin America and the Caribbean



(Source: "Meeting the Infrastructure Challenge in Latin America and the Caribbean", World Bank, July 1995)

Required Investment vs. Planned Investment In Water and Sanitation Sector for 1995 - 2005



Source:
 * "Wastewater Treatment in Latin America: Old and New Options", World Bank, Idelovitch and Ringskoy, 1997
 ** "Bridge Over Troubled Waters", Latin Trade, May 1997, by Carol Poole

World Bank *