PN-ABM-187
79146

United States Agency for International Development
Mission in El Salvador

INFRASTRUCTURE SECTOR ASSESSMENT

Final Report

Volume III
Water Supply and Sanitation

Tech International, Inc.
Louis Berger International, Inc.
Edificaciones Choussy, S.A. de C.V.

February 1990

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

MISSION IN EL SALVADOR

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FINAL REPORT

FEBRUARY, 1990

VOLUME III

WATER SUPPLY AND SANITATION

TECH INTERNATIONAL, INC.

LOUIS BERGER INTERNATIONAL, INC.

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INFRASTRUCTURE

SECTOR ASSESSMENT

VOLUMES

VOLUME I	SUMMARY REPORT
VOLUME II	TRANSPORTATION
VOLUME III	WATER SUPPLY & SANITATION
VOLUME IV	ELECTRIC POWER & TELECOMMUNICATIONS

This study is being prepared under contract between USAID/El Salvador and Tech International, Inc. under contract number 519-0177-C-00-9503-01.

The Consultants wish to thank the generous assistance and contributions provided by the staff of USAID/Salvador, the Government of El Salvador, its agencies and private firms. They were extremely helpful in providing data and clear explanations of Salvador and its infrastructure sector. Nevertheless, the Consultants remain solely responsible for all data, opinions, conclusions and recommendations.

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GLOSSARY

ANDA	Administration of Water and Sewage
ANTEL	National Administration for Telecommunications
BCR	Salvadoran Central Reserve Bank
CABEI	Central American Bank for Economic Integration
CE	Economic Committee
CEL	Executive Committee of Hydroelectric Power for the Lempa River
CONARA	National Commission for Agrarian Reform
CONIAPOS	National Committee of Water Supply and Sanitation
DGC	General Directorate for Roads
FENADESAL	National Railway System
FOCEM	Central American Monetary Stabilization Fund
GTZ	German Agency for Technical Cooperation
IBRD	International Bank for Reconstruction and Development (The World Bank)
IDB	Inter-American Development Bank
IRR	Internal Rate of Return
ISA	Infrastructure Sector Assessment
MIPLAN	Ministry of Planning
MOH	Ministry of Health
MSPAS	Ministry of Public Health and Social Assistance
MW	Unit of measure for power, megawatt
MZ	Unit of measure for surface, equivalent to 10,000 square varas (1 vara = 0.84 m)
PLANSABAR	National Basic Rural Sanitation Plan
RASA	Salvadoran Oil Refinery Corporation
REER	Real Effective Fxchange Rate
SCF	Standard Conversion Factor
SRE	Shadow Rate of Exchange
UCA	Central American University

WATER SUPPLY AND SANITATION

SUMMARY AND RECOMMENDATION

1. Economic Evaluation

The economic evaluation of complete modular water supply and sanitation systems, serving typical communities of specific sizes, indicate higher priority for:

- small, rural handpump latrine systems because of their low cost
- large urban systems due to high prices for water from other sources and high per capita demand.

Modular systems serving 1,000 to 5,000 people are marginally feasible.

Recommendation #1

A total of $725.7 million is recommended for investment based on this evaluation.

We also recommend a review of the design standards, as well as construction and contracting procedures with a view toward reducing per capita cost, especially for communities of 1,000 to 5,000 people. With lower costs, higher coverage targets can be set.

2. Rural Water Supply Institutions

The principal institutions in charge of the rural water sector are MOP through ANDA and MOH through PLANSABAR.

Local communities are at the receiving end of decisions taken by the above organizations. Community participation is limited to taking part in the civil works during construction and to paying for maintenance and operation. As a result, systems are poorly maintained and their operation is not always efficient. Communities may also be targeted by more than one institution, adding planning redundancy in a sector with many unfulfilled needs. USAID's Grant agreement 0519-320 clearly defines the need for sector coordination.

International agency experience and recommendations favor maximum community participation, projects without community participation cost between 50 and 100 percent more, even when the cost of contributed labor and materials is fully valued. Not only does participation lower cost, but the community becomes identified with the project, its operation and maintenance.

Recommendation #2

If improved coverage is to be achieved by the year 2000, there is a need to define sector policy for rural project implementation. This should include:

- closer donor coordination
- coordination between existing agencies
- community participation in planning and execution decisions
- and contracting at the municipal and community levels.

Terms of reference should be prepared for a sector policy paper to be reviewed by CONIAPOS or an equivalent coordinating body. Its technical committee could then work with international technical assistance in preparing this paper for GOES consideration.

The ideal result of this review of water policy would be for ANDA and PLANSABAR to decentralize operations gradually, with communities taking the lead role in planning, building, operating and maintaining local water systems. The agencies should progressively reduce their role, limiting it to financial and technical assistance.

Another option would be to delegate small system responsibilities to regional offices. Regardless which option is selected, ANDA's rural program should be administered separately with simplified procedures and as an entirely separate regionalized entity.

PLANSABAR has a number of serious problems including lack of autonomy and insufficient financial controls. Yet, it has several positive aspects. Its experience in rural water supply and sanitation field is too valuable, even within its present limitations, to be lost once its ongoing program with the IDB is completed.

Recommendation #4

These facts need to be carefully reviewed along with alternatives to PLANSABAR's future role, efficiency,

effectiveness and whether it should be relocated within the Ministry of Health or elsewhere in the Government.

3. Urban Water Systems

a. Conditions

The condition of the water systems have been surveyed by a number of studies, and in general it was favored that:

- systems have had little or no maintenance and the design period of a number of them has been over-extended

- in some cases, population served has increased much faster than planned

- electromechanical equipment has suffered from power shortages, lack of spare parts and regular maintenance.

Recommendation #5

ANDA should set up a routine preventive maintenance program that would cover regular oiling, adjustments, changing of gaskets, etc. At present, these operations are carried on an emergency basis only. As a first step, an inventory should be made and computerized, showing present condition and maintenance needs, coinciding with an IDB request.

b. Waste Water

Urban waste water collection and disposal facilities need urgent attention. Waste is currently dumped into rivers, streams and lakes without treatment.

Recommendation #6

Sewage treatment plants for the main discharges should be considered immediately. The San Salvador Metropolitan Area collectors should be considered first. This study should be conducted in tandem with the urban refuse, or solid waste study that is detailed in the electric power sector.

c. Rehabilitation and Expansion

Only 51 percent of the urban population have house connections, whereas others have outdoor latrines. In many towns, there is an imbalance between water supply and sewerage services.

Recommendation #7

In order to meet urban water supply and sanitation needs rehabilitation and/or replacement of existing systems should be given priority. The following programs still require funding:

- Expansion of water supply and sewerage disposal in the cities of Santa Ana, Sonsonate and San Miguel. Feasibility studies were to be completed in December, 1989.

- Sanitation systems (sewers or latrines) to balance services in municipal seats that at present have water supply systems. Most of the urban communities to be served are small. Economic feasibility of the program may require a review of design standards, in terms of consumption per capita and pipe diameters.

III. WATER SUPPLY AND SANITATION

The Consultants have prepared the following report with the cooperation of the National Water and Sewer Authority - ANDA, the Management Unit of the National Plan for Basic Rural Sanitation - PLANSABAR, the Ministry of Planning and other agencies.

A. INSTITUTIONAL ASPECTS

1. National Development Objectives

Salvadoran authorities are aware of the critical water supply and sanitation situation in urban and rural areas and as a result have given it high priority in their development programs. At the United Nations Conference on water held in Argentina in 1977, El Salvador joined other nations in a commitment to bring water and sanitation facilities to urban and rural communities by 1990.

In July 1984, the Ten-Year Plan originally prepared in 1982 was revised in order to prepare the National Plan for the International Water Supply and Sanitation Decade.

Its primary objective is to improve public health by providing urban and rural populations with basic services. Other objectives are to:

- strengthen and improve sector implementation and administrative capacities

- work towards the financial self-sufficiency of the national agencies by means of an adequate tariff structure covering debt service, operating and maintenance costs

- make the communities active participants in the development programs, as well as in the control and quality of water-supply.

The government's goal has been adjusted to achieve 82% coverage by the end of the decade.

The present Administration is aware of environmental deterioration and its causes, which include waste water contamination by excreta, and sewage disposal without prior treatment.

2. Sector Institutions

Two agencies are reviewed in this study. ANDA, an autonomous institution under the Ministry of Public Works with experience mostly in urban systems; and PLANSABAR, a unit of

the Ministry of Health working with rural programs. In addition, many municipalities operate their own urban systems while Save the Children, CONARA, FEDECREDITO and other organizations have smaller programs in the rural areas. This study does not generally review these small, largely disperse programs.

ANDA and PLANSABAR work with the Ministry of Planning, SETEFE, the Accounts Court, the Budget Directorate and the Ministry of Finance in implementing their programs. These key relationships are shown in Figure III.A.1.

3. ANDA

ANDA is responsible for water supply and sewerage services, as well as for the construction and maintenance of sanitary projects for large cities and towns of more than 2,000 inhabitants. It is now expanding to serve smaller towns as well.

a. **Organization**

There has been little change in ANDA's organization, over the last several years. The most recent chart was compiled in January, 1988. (See Figure III.A.2). ANDA's 1988 total personnel (3512) was somewhat excessive. Of this total, 10.5% were professional executives and technicians, 34.61% were in administration and 54.9% in operations and maintenance. In general terms, ANDA's has a logical and consistent organization, and has effectively carried out project implementation.

No significant dysfunction attributable to organizational structure is apparent nor do major organizational structure problems appear to exist. There are, however, two significant organizational issues for ANDA's expansion in rural water supply: The development of ANDA's regional structure and the evolution of the Management Unit (MU) set up for projects financed by AID.

b. **Regional Structure**

The main organizational impact on ANDA of the large expansion of rural water supply systems is the need to develop ANDA's regional structure. To provide hundreds of thousands with new and improved water production facilities to villages and towns with fewer than 2,000 inhabitants will involve community participation in all phases, planning, then construction, community education, operations, and maintenance. Performing and/or coordinating these functions represents a significant role change for ANDA, which have primarily been focused on standard water production,

distribution, and related maintenance operations in towns of over 2,000 inhabitants.

ANDA has recognized the need to strengthen its regional operations to accommodate the anticipated expansion of service responsibility. It is planning for:

- Central office/regional office division of authority over various field functions;

- Establishing and maintaining appropriate staffing in the regions, especially while armed conflict persists; and

- Phasing-in regional growth and functional authority to coincide with the construction and implementation of facilities in the new service sectors.

This decentralization process should deal with the high cost of ANDA's rural water systems, probably due to high design standards, insufficient community participation and contract procedures. See section on construction costs.

c. **The Management Unit**

ANDA has set up a Management Unit (MU) for projects financed by AID. It is in charge of general management, planning, supervision and technical guidance, along with general contract administration. This office has carried out its work efficiently, fulfilling its responsibilities to both ANDA and AID executive management. Other donors and lending agencies establish their management requirements, generally using ANDA's regular organization.

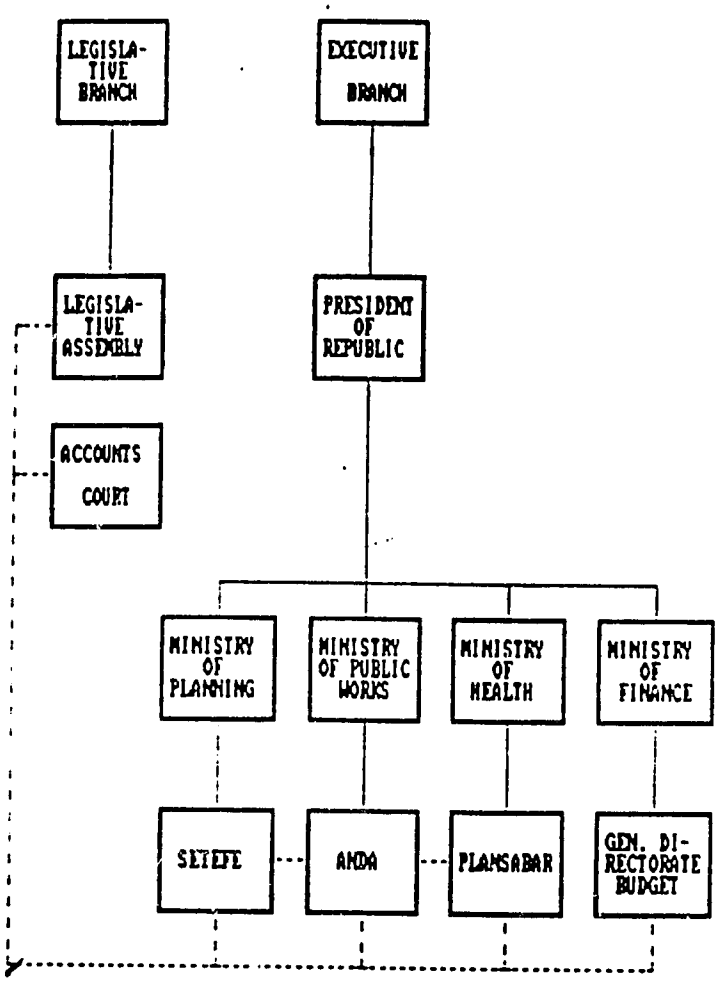
This Unit contracts private firms to design and construct wells and other works, and also undertakes planning and feasibility studies, project design, control and evaluation. It prepares an annual action plan, as well as socio-economic project site evaluations and later bid specifications for a pre-qualified group of contractors. For each contract granted, a project supervisor is appointed.

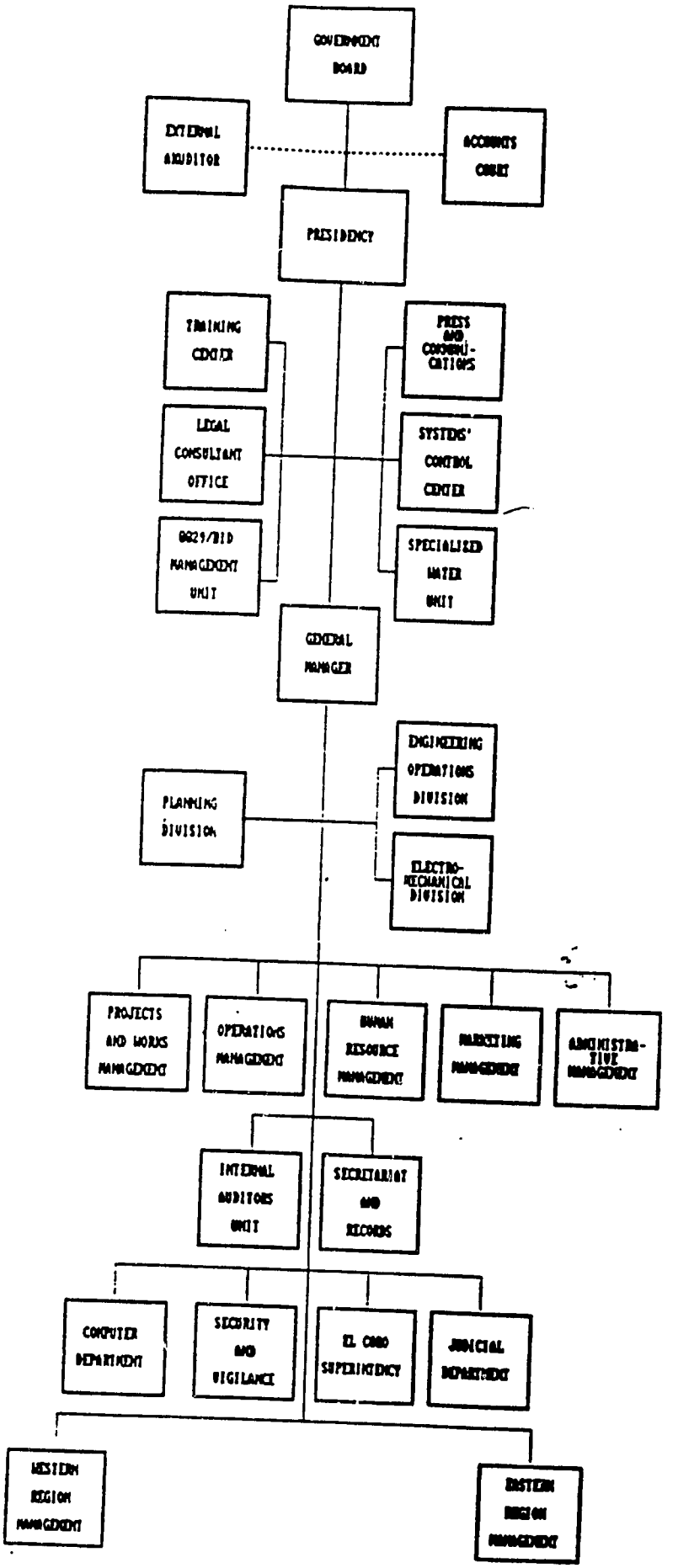
The MU has been successful in its role for several reasons:

- Accountability -- the MU has been accountable to top ANDA management, and to AID, more closely than is the norm for development projects;

- Contracting -- the MU contracts with private engineering and construction firms for the design and construction of the wells, as opposed to performing all the work themselves; and

FIGURE III.A.1




GOVERNMENT BOARD
EXTERNAL AUDITOR
ACCOUNTS COURT
PRESIDENCY
TRAINING CENTER
PRESS AND COMMUNI-CATIONS
LEGAL CONSULTANT OFFICE
SYSTEMS' CONTROL CENTER
BOOS/BID MANAGEMENT UNIT
SPECIALIZED WATER UNIT
GENERAL MANAGER
ENGINEERING OPERATIONS DIVISION
PLANNING DIVISION
ELECTRO-MECHANICAL DIVISION
PROJECTS AND WORKS MANAGEMENT
OPERATIONS MANAGEMENT
HUMAN RESOURCE MANAGEMENT
MARKETING MANAGEMENT
ADMINISTRA-TIVE MANAGEMENT
INTERNAL AUDITORS UNIT
SECRETARIAT AND RECORDS
COMPUTER DEPARTMENT
SECURITY AND VIGILANCE
EL CANO SUPERINTENDENCY
JUDICIAL DEPARTMENT
WESTERN REGION MANAGEMENT
EASTERN REGION MANAGEMENT

- Streamlined Procedures -- Project development procedures, especially review steps, focus on the essentials and minimize redundancy.

Other factors judged to contribute to MU success include the relative simplicity of handpump well construction, and greater productivity attributable to the focused nature of the effort and the "project" environment.

Yet, there is need for a firmer foundation in project design and management. To manage larger projects, the Management Unit's technical and professional personnel should be expanded and given technical assistance or training. Also, ANDA's regional structure would have to be improved to develop and expand projects in small towns and villages.

ANDA also should consider a complete reorientation of its approach to rural water supply, seeking to build greater community participation, simplified contracting procedures and designs, requiring of more of a community development input, along with project design.

The main organizational issues concerning the MU are:

- How it should evolve to accommodate the considerably expanded work load;

- How should it relate to the ANDA regional structure, both in the near and long terms.

The WASH report recommended that the MU be strengthened through additional central and regional staff. Building on the MU's success is the logical organizational strategy for expansion. Continuing to rely on the private sector for design and construction also seems to be a clear choice.

What is less clear, however, is the appropriate MU responsibility for operations and maintenance beyond project implementation. It is our view that ANDA, as an institution, should develop its rural water supply organization as a separate, subordinate entity with a modified, community participatory project approach essential to long-term success in rural areas. It's regional structure for rural programs would be a part of this entity with authority for all on-going operations in each region delegated to the regional director. This is primarily because of potentially lower construction and maintenance costs, overall community responsibility, resource and management efficiencies available to consolidated operations, as well as greater service accountability.

d. Project Finance

ANDA uses two sources of budgetary financing. The ordinary budget comes from ANDA water revenues, which are used to pay for operating costs. The extraordinary budget is made up of foreign aid project funds. This budget is prepared on a project basis. The project management unit, SETEFE, the donors (ie: AID, BID), and the Accounts Court all control the use of funds.

Budgets are often revised, however, when ANDA declares an emergency project. It may receive the total amount of funds at the beginning of the project, allowing for fast action. Plans and programs using national funds are administered by each department and sent to the budget manager. AID funds are administered based on the Management Unit's budgets and calendars.

The AID Management Unit processes financial transactions between SETEFE, Accounts Court, AID and ANDA. Payments are authorized, according to SETEFE funding, by the project supervisor to ANDA's Administration Department. This Department acts as controller and has three divisions designed to handle finance, logistics and properties. The Financial Division prepares and controls ANDA's budget and disbursements, supervising all financial transactions.

Finally, AID financed projects are audited by the management unit. External auditors carry out administrative audits and financial transactions are audited by the delegates of the Accounts Court.

e. Maintenance and Equipment

ANDA's heavy equipment and vehicle fleet need adequate maintenance in order to support the maintenance of its water system. Equipment management is comprised of keeping inventory of equipment and spare parts, doing regular preventive and corrective maintenance regularly, acquiring the necessary equipment and spare parts, and the appropriate training of maintenance personnel.

The maintenance department is divided in two divisions - the electro-mechanical division's auto repair service and the division of electricity and pumps. Even though the two divisions complement each other, they are located at opposite ends of San Salvador. The first one has 76 employees of which only 7 are technical personnel, the second division has 112 employees of which 22 are professional and technical personnel. Thirty percent of ANDA vehicles are inoperable and only 50% of the remainder are in fair or good condition.

The high rate of damaged vehicles requires that the auto repair service be devoted almost entirely to corrective maintenance, to the exclusion of preventive maintenance. Therefore, ANDA is short of vehicles needed for its work. It lacks a computerized inventory of equipment and spare parts. There is also limited personnel training.

f. Purchases

ANDA's purchases follow two separate procedures for the ordinary and extraordinary budget. Ordinary budget purchases under C 25,000 require internal approvals at several levels. Acquisitions over C 25,000 must be made through public or private bids.

Purchases with extraordinary budget funds require numerous approvals. This causes considerable delays. In addition to ANDA's approval of the action plan, bid specifications, pre-qualification, evaluation and hiring of contractors, the Accounts Court Delegation to ANDA, SETEFE, and the Accounts Court of the Republic also must approve the purchases. There are currently no procedures to speed up this process.

4. PLANSABAR

a. Organization

PLANSABAR, was created as an institutional entity by Ministerial Resolution No. 332, of the Ministry of Health, on October 20, 1980. It was established as part of the Rural Aqueducts Department of the Directorate of Health Engineering.

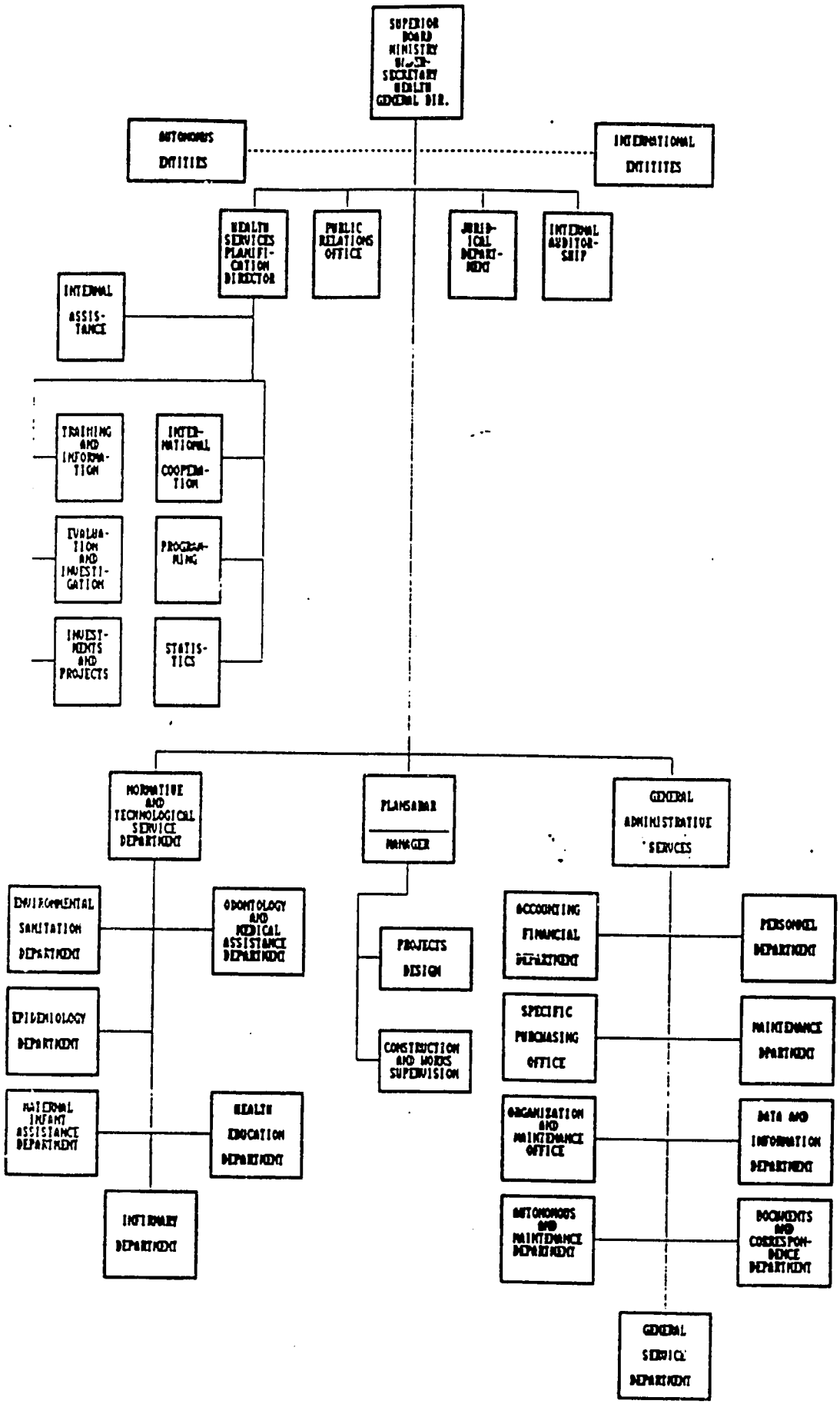
Presently, PLANSABAR has a total staff of 454, including professionals, technicians and skilled workers distributed among the four regions and the Central Office. Four hundred and three staff members work in the Unit, and 51 are located in another MSPAS dependency.

PLANSABAR has gone through two stages development since it's inception. The first stage, in (1980 to 1985) was a period when the programs it was responsible for, financed by IDB loans, were implemented approximately as scheduled. At that time, PLANSABAR operated as a Management Unit of MOH directly under the Minister, with an administrative structure which fitted its needs. (See Figure III.A.3)

However, for administrative and partly political reasons, it became difficult to give sufficient attention to the Management Unit. Funds were also spent without sufficient

FIGURE III.0.3
ORGANIZATIONAL CHART

MINISTRY OF HEALTH AND SOCIAL WELFARE



control.

In the second stage (from 1985 to the present), while continuing as a Management Unit, it was lowered in the hierarchy, from a direct dependency of the MOH to a dependency of the Media Attention Division. From the moment it moved to this level, the ability to make decisions has become more cumbersome. This has severely affected project implementation.

Regarding its Loan 772/SF-ES scheduled to begin in 1991, IDB made observations about this change and the administrative structure which was blocking program implementation, especially purchasing. To date, only some of the proposed changes and corrections have been made with limited improvements.

b. Coordination within the Ministry of Health

PLANSABAR works with the MOH Offices of Environment, Sanitation, Planning and Finance. The latter office handles all requirements of the MSPAS and its dependencies. This causes delays and inefficiencies in purchasing goods and services. Another key program relationship is with the Ministry's community health program, which helps to ensure that water and health education go hand in hand.

c. Future of PLANSABAR

In the event the agency receives more funding it should be done so with autonomy and financial controls. One alternative would be to set it up as an autonomous agency or public company under the Ministry of Health; however, there is no precedent for this under the MOH.

Another would to be transfer its expertise to ANDA. As a part of a separate entity, specializing in rural systems, and using simplified procedures adapted to local needs, with regionalized technical support to allow for low-cost, local construction contracts and greater community participation should also be considered.

5. Municipalities

The ISA Consultants were unable to review the institutional, financial, engineering or operational conditions of the municipal water systems. Such a review is crucial to the decentralization of local water supply systems. The recently increased municipal autonomy will make this survey important to sector planning.

The Salvadoran Municipal Development Institute, in charge of providing technical assistance and support to municipalities was established in March 1987. While it has autonomy, and receives 2% of the municipal budget, it does not consider itself qualified to provide support to municipally-owned water systems. Thus, ANDA may be best qualified to fill this role.

6. Community Participation

The above organizations make the decisions for local communities. At best, community participation is limited to taking part in civil works and to participating in their maintenance and operation. As a result, systems are poorly maintained, and their operation is not always efficient.

This situation contrasts with the WHO and multilateral financial institutions' recommendations which specify community participation from planning through actual operation, with outside institutions preferably being limited to finance and technical support roles. This usually results in:

- Community acceptance of greater responsibility
- lower cost of construction and simplified design
- fuller collection of water fees and greater prospects, for community coverage of total cost.

7. PLANSABAR-ANDA Relations and Comparison

Relations between PLANSABAR and ANDA are fairly harmonious. Occasionally one agency will undertake water-supply projects already planned by the other without prior consultation, provoking some interinstitutional friction. The same thing happens with other social service institutions such as the Ministry of the Interior, CONARA, Youth Community Development and others.

Another source of friction is the difference in community participation policy. While ANDA fully finances construction and hires local unskilled labor, PLANSABAR signs a contract with the community to donate unskilled labor and local materials. Communities thus prefer ANDA projects.

This lack of coordination should be brought to the attention of the National Committee of Water Supply and Sanitation (CONIAPOS). This committee was created in 1982 by Decree 885 of the Revolutionary Governing Junta. It consists of the President of ANDA, Coordinators, representatives of the Ministries of Health (MOH) and Planning (MIPLAN). It has a Technical Advisory Committee made up of representatives of

ANDA, PLANSABAR, Sanitation (Department of MOH) and MIPLAN, with the advice of OPS. It's principal objective is to coordinate and plan water supply and sanitation.

The above Committee, from its creation until 1986, functioned normally at first but gradually lost its coordinating functions because it was not given the necessary support. It has stopped functioning since then.

The recent USAID grant agreement 0519-320 recognizes this issue and establishes steps for meeting coordination objectives between the MOH and ANDA.

In addition to poor control of funds, PLANSABAR has the disadvantage of being a part of a Ministry. Thus it is less flexible than ANDA, and its capacity to carry out projects is much more limited. However, it has the advantages of lower cost per person served, even when community labor and material contributions are valued, and PLANSABAR but not MOH administrative costs are included; intensive community participation, with full payment of water fees and a greater likelihood of effective maintenance;
closer identification with community health programs.

ANDA is improving on these points, especially under project 0519-320, specifically through:

-The strengthening of and delegation to regional offices

-the projects inclusion of the public health program

-further community participation.

B. INVENTORY OF FACILITIES

Extensive surveys by the consultants were carried out at ANDA and PLANSABAR to ascertain the inventory of existing facilities according to the population being served. The inventory covers the location, condition, service area, characteristics, capacity and adequacy of both water and sewerage facilities.

The water systems' inventory, especially for the larger urban systems, included the source of supply, treatment, transmission, distribution, storage, pumping, service connections, and public outlets. For the larger sewerage systems the characteristics taken into consideration include service connections, collectors, interceptors, pumping, treatment, and disposal features.

A general summary of the national coverage of these facilities is provided, followed by detailed inventories,

listed by agency.

1. National Coverage

National Coverage statistics, presented in Tables III. B.1 and 2, indicate that 44.5% of the population have water supply and 60.5% have sanitation facilities, including latrines. Graph III.B.3 illustrates the coverage be agency. All major populated areas and most small communities have sanitation systems with service connections.

a. **Differences in Coverage Data**

The trend in rural water supply facilities (See Table III.B.4) shows an unusually drastic drop of population coverage from year 1986 to 1988, from 41.6% for 1985 to 20.1% for 1986, to 7.4% for 1987 and to 10.1% for 1988. The 1988 WASH Report refers to this drop, and quotes a figure of 13% for rural water coverage. As explained by PLANSABAR and ANDA, this is the result of a close check of systems and figures of rural water supply that began in 1986. The decreasing figures are also a result of the difficult access conditions to the conflict areas, preventing accurate inventories as well as deterioration of the systems for lack of proper maintenance.

In an October 1988 report, the Pan-American Health Organization gives an 18.3% water supply coverage of rural population while the Ministry of Health notes it to be on the order of 21%. The disparity is due to:

-the methods used to gather and classify information

-and the number of organizations working in rural water supply.

The high coverage given to latrines in the rural areas is questionable, although the figures are not easy to verify. In the case of the urban areas, the figures are reasonable. This matter will be solved with the results of the Rural Water Supply & Electricity Services Survey in El Salvador which is being conducted by AID.

ISA will adhere to ANDA's statistics, which we consider as currently the most reliable.

b. **Coverage of Municipalities**

El Salvador has 262 municipalities, 177 of which have water supply provided by ANDA, 72 by the municipal governments and 13 lack water supply systems. See Table III.B.5. Of the 262 municipalities, only 82 have service connections and 180 lack

TABLE III. B. 1

NATIONAL COVERAGE OF

WATER SUPPLY AND SANITATION

FACILITIES, DECEMBER 1988 (%)

SUMMARY

DESCRIPTION	PERCENTAGE OF URBAN POPULATION BEING SERVED	PERCENTAGE OF RURAL POPULATION BEING SERVED	PERCENTAGE OF GLOBAL POPULATION BEING SERVED
WATER SUPPLY	83.40	10.10	44.50
SANITATION	85.60	38.60	60.50

SOURCE : ANDA

TABLE III. B. 1 (a)

NATIONAL COVERAGE OF

WATER SUPPLY AND SANITATION FACILITIES

POPULATION COVERED, DECEMBER 1988

POPULATION	WATER SUPPLY				SEWERAGE		
	URBAN		RURAL		URBAN		RURAL
SERVED BY	HOUSE CONNECTION	EASY ACCESS	HOUSE CONNECTION	EASY ACCESS	HOUSE CONNECTION	LATRINES	LATRINES
ANDA	1,671,972	109,500	57,320	1,800	1,339,614	-	-
PLANSABAR	930	-	202,018	7,600	-	670,863	1,034,470
ALCALDIAS	58,698	-	-	-	-	-	-
COMMUNITIES SELF SERVED	127,470	-	-	-	-	-	-
TOTAL	1,859,070	109,500	259,338	9,400	1,339,614	670,863	1,034,470

SOURCE: ANDA

TABLE III.B.1(b)

NATIONAL COVERAGE OF

WATER SUPPLY AND SANITATION FACILITIES

BY TYPE OF SERVICE AND AGENCY

DECEMBER, 1988

TYPE OF SERVICE	POPULATION ATTENDED BY				POPULATION SERVED	%
	ANDA	%	OTHERS	%		
WATER SUPPLY						
WITH HOUSE CONNECTIONS	1,729,292	34.4	389,116	7.7	2,118,408	42.1
WITH EASY ACCESS	111,300	2.2	7,600	0.2	118,900	2.4
TOTAL	1,840,592	36.6	396,716	7.9	2,237,308	44.5
SEWERAGE AND LATRINES						
WITH HOUSE CONNECTIONS	1,339,614	26.6	-	-	1,339,614	26.6
WITH LATRINES	-	-	1,705,333	33.9	1,705,333	33.9
TOTAL	1,339,614	26.6	1,705,333	33.9	3,044,947	60.5

SOURCE: ANDA

TABLE III. B. 2.

NATIONAL COVERAGE WITH

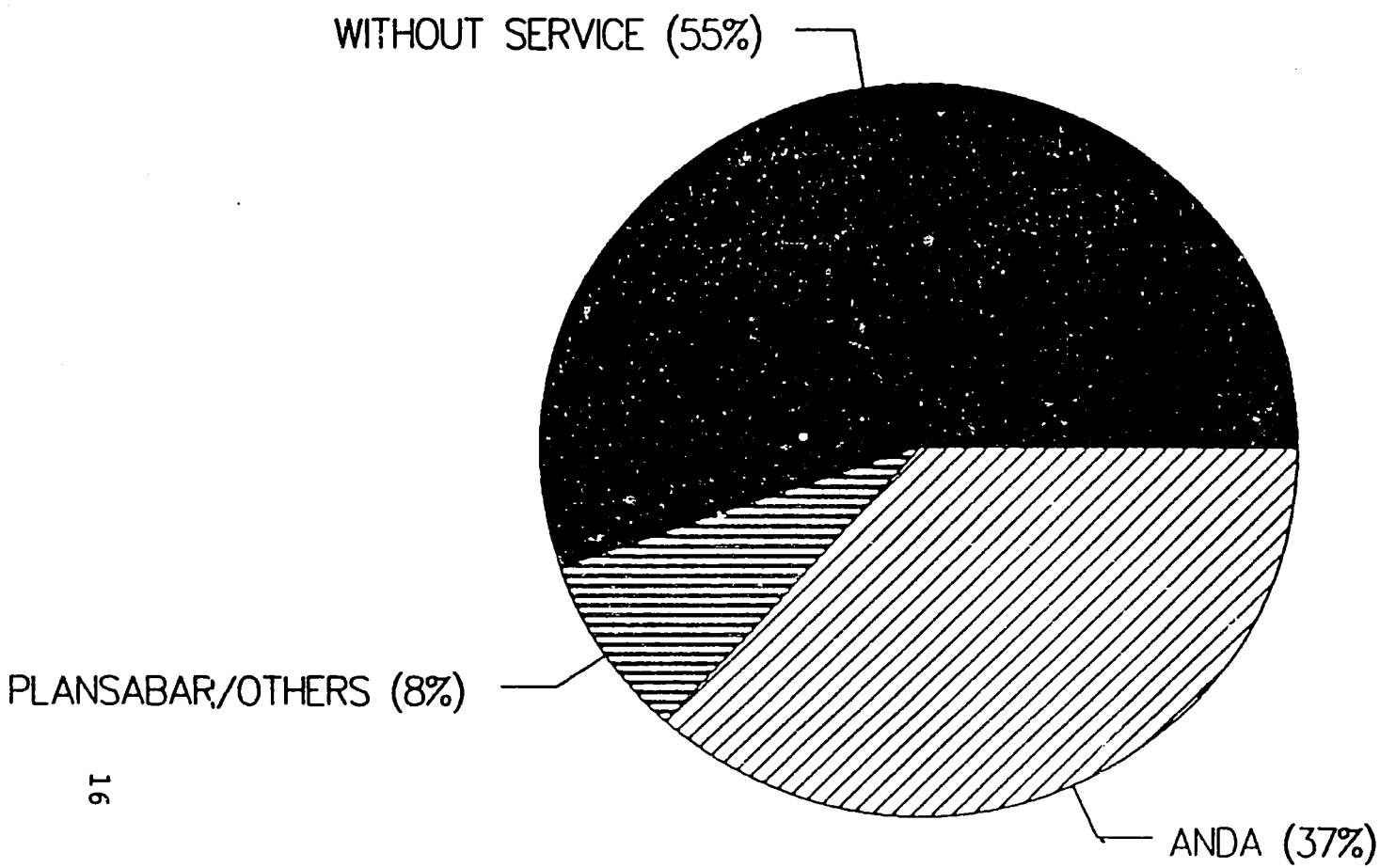
SANITATION SERVICE

TO DECEMBER 1988

CONCEPT	POPULATION COVERAGE (%)					
	1987			1988		
	ANDA	OTHERS	TOTAL	ANDA	OTHERS	TOTAL
URBAN SANITATION	55.3	28.6	83.9	57.0	28.6	85.6
POPULATION WITH SEWER SERVICE	55.3	-	55.3	57.0	-	57.0
POPULATION WITH LATRINE	-	28.6	28.6	-	28.6	28.6
RURAL SANITATION	-	37.4	37.4	-	38.6	38.6
POPULATION WITH LATRINE	-	37.4	37.4	-	38.6	38.6
GLOBAL COVERAGE	25.8	33.5	59.3	26.6	33.9	60.5
POPULATION WITH SEWER SERVICE	25.8	-	25.8	26.6	-	26.6
POPULATION WITH LATRINE	-	33.5	33.5	-	33.9	33.9

SOURCE : ANDA

COVERAGE OF WATER SUPPLY COUNTRY WIDE



SOURCE: ANDA

GRAPH III. B. 3

TABLE III. B. 4.

NATIONAL COVERAGE OF

WATER SUPPLY AND SANITATION

PERIOD 1982 - 1988

CONCEPT	POPULATION COVERAGE %						
	1982	1983	1984	1985	1986	1987	1988
URBAN WATER	69.9	72.6	75.6	77.1	75.8	89.7	83.9
POPULATION WITH HOUSE CONNECTION	64.5	67.3	70.5	72.1	70.5	84.5	79.2
POP. SERVED WITH PUBLIC OUTLETS	5.4	5.3	5.1	5.0	5.3	5.2	4.7
RURAL WATER	41.2	43.7	42.6	41.6	20.1	7.4	10.1
POPULATION WITH HOUSE CONNECTION	7.9	26.6	26.0	25.4	13.1	7.1	4.7
POP. SERVED WITH PUBLIC OUTLETS	33.3	17.1	16.6	16.2	7.0	0.3	5.4
GLOBAL COVERAGE (URBAN AND RURAL)	55.3	55.9	56.5	56.6	43.7	42.5	44.5
URBAN SANITATION	81.3	85.2	87.2	87.7	88.6	92.5	85.6
POP. SERVED W/SEWER CONNECTION	50.1	53.0	55.9	57.3	55.9	60.6	57.0
POPULATION SERVED WITH LATRINES	31.2	32.2	31.3	30.4	32.7	31.9	28.6
RURAL SANITATION							
POPULATION SERVED WITH LATRINES	26.1	34.3	33.4	32.1	35.2	34.8	38.6
GLOBAL COVERAGE (URBAN AND RURAL)	49.4	55.7	56.0	55.7	57.8	59.3	60.5

SOURCE : ANDA AND PLANSABAR

TABLE III. B. 5.

MUNICIPALITIES WITH AND WITHOUT WATER SYSTEMS

AT NATIONAL LEVEL, TO DECEMBER 1988.

DEPARTMENT	NUMBER OF MUNICIPALITIES	MUNICIPALITIES WITH WATER SYSTEMS ATTENDED BY		TOTAL OF MUNICIPALITIES WITH WATER SUPPLY	TOTAL OF MUNICIPALITIES WITHOUT WATER SUPPLY
		ANDA	MUNICIPALITIES		
AHUACHAPAN	12	11	1	12	-
SANTA ANA	13	12	1	13	-
SONSONATE	16	12	3	15	1
CHALATENANGO	33	15	18	33	-
LA LIBERTAD	22	14	7	21	1
SAN SALVADOR	19	17	2	19	-
CUSCATLAN	16	12	1	13	3
LA PAZ	22	19	2	21	1
CABANAS	9	6	3	9	-
SAN VICENTE	13	12	-	12	1
USULUTAN	23	19	1	20	3
SAN MIGUEL	20	13	7	20	-
MORAZAN	26	6	18	24	2
LA UNION	18	9	8	17	1
TOTAL	262	177	72	249	13

SOURCE : ANDA AND PLANSABAR

sewerage facilities and are served by septic tanks and/or latrines.

2. ANDA Water Supply

For the 177 municipalities served by ANDA, the systems are classified according to the size of the population. These are:

- San Salvador Metropolitan Area, covering 10 districts in the departments of San Salvador and La Libertad.

- 5 systems covering towns with a population over 25,000.

- 15 systems covering towns with a population of 25,000 to 10,000.

- 29 systems covering towns with a population of 10,000 to 5,000.

- 118 systems covering towns with a population of under 5,000 persons.

Appendix III.B.1 shows the first three groups of major systems with full detail of their location, existing and served population, system characteristics, operation and maintenance costs, and some information about existing sewerage facilities. Appendix III.B.2 contains details of the remaining systems.

Spot inspections of ANDA systems have led to the following main conclusions.

- In general, the systems were built a number of years ago. Among these visited, the most recent were over ten years old, and most of them are over 25 years old, this meaning their design life is overextended.

- Even with little maintenance, the electro-mechanical equipment, especially the large pumps, function well due to good equipment quality. The pumps tend to overheat, have leaks and show other indications of poor maintenance.

- Some of the water sources visited are produce smaller flows than when the systems were built.

- ANDA urgently needs an extensive detailed equipment inventory program to ascertain their condition and needs for overhaul, replacement and expansion.

3. PLANSABAR Water Supply

Table III.B.6 is a summary of the PLANSABAR systems by department, communities, and population. Appendix III.B.3 contains detailed individual information of each PLANSABAR system.

PLANSABAR is implementing a third program dealing with rural water supply and sanitation that is being financed in part by IDB. In conjunction with a previous Government-financed program, it has already installed 205 water supply systems serving 376 communities throughout the Country. However, 34 of these systems are not effectively serving the population because of the following factors:

- Systems have reached their design life expectancy and have become obsolete

- Community population has increased beyond projections

- There has been little or no maintenance due to their location in areas of conflict.

Of the 205 systems, 139 are gravity systems which have low operation and maintenance requirements. The remaining 66 are pumping systems. The communities are provided with house connections in most of the systems; other systems provide public outlets.

5. ANDA Sanitation

It is of great concern that waste waters from urban sewer systems are discharged from their collectors, without treatment, into rivers and streams. Appendix III.B.4 shows the locations of final waste waters discharge for the main sewerage systems. Taking the figures given in Table III.B.1 for urban population with sewer house connections, and assuming a very low 30 liters per person, per day as a waste water average, 42,000 cubic meters of untreated waste is being dumped daily into water streams, contributing to their pollution and contamination with serious health and environmental consequences.

Inventory analysis indicates the following:

- A number of systems have overextended their period of design.

- Most of the systems do not have the capacity to meet present demands of the communities they serve.

TABLE III. B. 6.

RURAL WATER COVERAGE BY PLANSABAR

TO DECEMBER 1988.

DEPARTMENT	RURAL POPULATION	MUNICIPALITIES SERVED		LOCALITIES SERVED	POPULATION SERVED
SANTA ANA	258,000	10	31	42	37,443
AHUACHAPAN	210,000	8	13	41	32,277
SONSONATE	240,000	5	18	39	31,689
LA LIBERTAD	263,000	10	13	31	25,347
CHALATENANGO	92,000	21	31	48	14,343
SAN SALVADOR	213,000	4	5	8	4,704
LA PAZ	177,000	9	17	37	19,026
SAN VICENTE	116,000	3	5	7	3,360
CABANAS	104,000	5	6	10	3,822
CUSCATLAN	135,000	5	7	13	3,738
USULUTAN	275,000	9	10	35	9,366
SAN MIGUEL	270,000	9	14	25	8,274
MORAZAN	103,000	14	18	22	8,442
LA UNION	227,000	9	17	18	8,169
TOTAL	2,683,000	121	205	376	210,000

SOURCE : PLANSABAR

-The electromechanical equipment is severely taxed due to frequent power cuts and scarcity of spare parts.

ANDA has been repairing and improving their systems using foreign assistance, especially from AID. A nationwide program of replacement and/or rehabilitation of existing systems should be prepared immediately.

6. Rural Community Survey

The AID-financed "Water Resources Inventory and Proposed Solutions in Selected Communities of El Salvador" was completed in May 1989. Of the 319 rural communities visited and studied, 311 have water supply systems of which, 303 are currently operating. The communities range in size from 230 to 11,000 residents. The number of systems by source and type is shown Table III. B.7. below.

TABLE III.B.7

WATER SYSTEMS BY SOURCE AND TYPES

Pressure systems (by pumping)	182
Pumping from springs	111
Pumping from wells	71
Gravity systems (from springs)	129
Total from springs	240
Communities served	311

According to the report, 82% of the communities have deficient water systems. The main problems identified in that study generally affect most of the older systems. They are:

-In most cases, spring and well production does not satisfy present demand. In other cases, a deficit has been caused by an abnormal increase in population (mostly displaced persons).

-Systems are poorly operated. Part of the problem is due to the operating of control valves without the knowledge of system operators, leaving other zones with insufficient water.

-Water is used for purposes not considered in the original design. PLANSABAR designs for domestic use, but it is also

used for brick factories, agriculture and poultry farms, thereby creating a deficit.

- Pumping equipment is in bad condition, lowering operating efficiency. In other cases, the pump capacity is inadequate for current demand.

- Problems are caused by lack of preventive maintenance. Maintenance work is mainly plumbing and electromechanical.

- Water sources are contaminated due to infiltration of effluent.

Graph III.B.8 shows the breakdown of problems the study encountered. The study did not clearly indicate how the communities were selected and whether they represented a reasonable sample of Salvadoran rural communities.

7. Assessment of Infrastructure Damage due to Conflict

Physical damage to infrastructure in the Sanitary Sector, has been relatively minor. In a damage assessment made in April 1986 for the years 1979-1985, its value was C5.83 million, only 2.2% of the total value of physical damages-reported for all sectors. See Table III.B.9.

A new assessment was made in the period 1986-June 1988. Additional physical damages of US$1.82 millions were calculated - Table III.B.10.

The indirect damage cost represented by security installations and services, petroleum products for emergency generation, lost revenues from service interruptions, overtime, indemnization claims, etc. far exceed the direct costs - Tables III.B.11 and III.B.12. These were C87.34 million for the period 1978-1985 and $3.48 million for the period 1986-June 1988.

Since June 1988, physical damages have increased slightly, but indirect damage continues to grow, specially from power cuts which increase petroleum use and equipment damage.

Because of ANDA's continuing deficit, it is impossible to meet the cost of these damages. Donor countries and AID have contributed to finance part of the rehabilitation and ANDA has stopped sending maintenance crews, especially to the areas of guerrilla warfare.

C. PROJECTS UNDERWAY/PLANNED

Both ANDA and PLANSABAR are currently engaged in the implementation of large projects totalling about US$250

GRAPH III.B.8

PROBLEMS OF THE COMMUNITIES INVESTIGATED

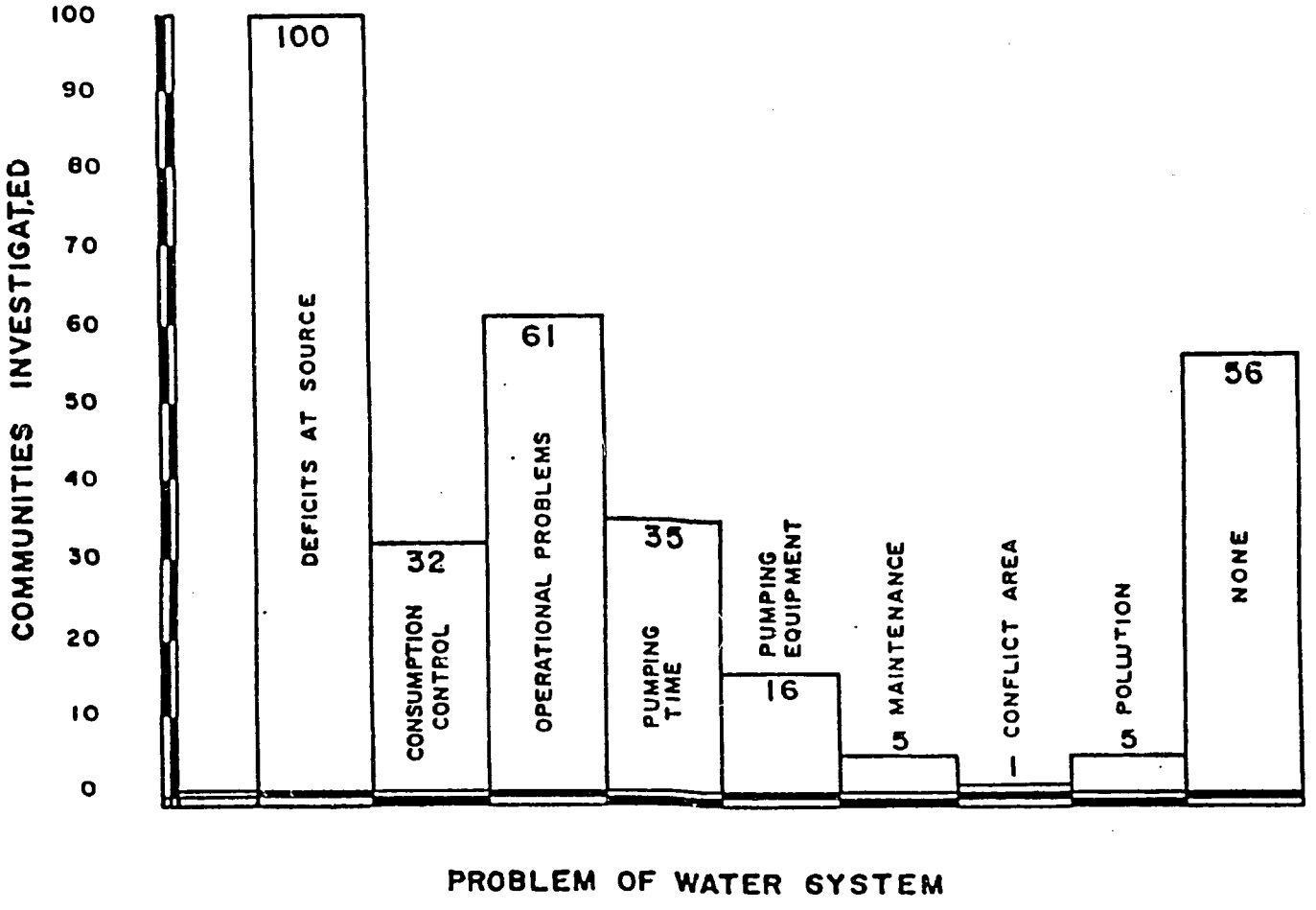


TABLE III. B. 9.

SUMMARY OF DIRECT DAMAGE COSTS TO ANDA INSTALLATIONS FROM 1979 TO 1985
(EXPRESSED IN COLONES)

No	DESCRIPTION	1979	1980	1981	1982	1983	1984	1985	TOTAL
1	BUILDINGS AND INSTALLATIONS	4,402	106,862	255,227	393,141	45,674	66,812	172,560	1,044,678
2	HEAVY EQUIPMENT	840,579	65,000	-	96,000	150,000	-	-	1,151,579
3	LIGHT EQUIPMENT & TOOLS	27,741	1,498,151	364,569	680,160	566,440	216,940	113,745	3,467,746
4	OTHERS	94,920	-	-	-	11,395	-	60,296	166,611
TOTAL		967,642	1,670,013	619,796	1,169,301	773,509	283,752	346,601	5,830,614

SOURCE: EL SALVADOR DAMAGE ASSESSMENT (1986)

TABLE III.B.10

SUMMARY OF DIRECT DAMAGE COSTS TO ANDA INSTALLATIONS FROM 1986 TO JUNE 1988
(EXPRESSED IN US $ '000)

No	DESCRIPTION	1986	1987	TO JUNE	TOTAL FOR
1	BUILDING AND INSTALLATIONS	54.4	253.4	25.6	326
2	HEAVY EQUIPMENT	340.9	491.0	370.6	1,203
3	LIGHT EQUIPMENT AND TOOLS	51.0	50.0	123.8	235
4	OTHERS			48.4	48
TOTAL		446.3	794.4	568.4	1,812

SOURCE: EL SALVADOR DAMAGE ASSESSMENT (1986)

TABLE III.B.11
SUMMARY OF INDIRECT COSTS OF DAMAGES AND LOST REVENUE
(EXPRESSED IN THOUSANDS OF COLONES)

DESCRIPTION	1979	1980	1981	1982	1983	1984	1985	TOTAL
1. REVENUES NOT RECIEVED	1,341.0	2,430.8	3,519.2	4,855.7	4,975.9	6,419.5	10,410.4	33,952.5
2. PERSONAL SECURITY		10.2	28.6	54.1	60.2	62.8	61.9	277.8
3. SECURITY INSTALLATION		21.0	40.3	66.0	494.3	835.8	838.2	2,295.6
4. PERSONNEL INCREASES	88.5	95.0	98.5	96.8	80.1	61.0	9.7	529.6
5. OVERTIME	18.6	71.5	94.8	130.3	199.9	223.5	258.3	996.9
6. ADDITIONAL TRANSP. COST	4.2	49.7	60.0	82.3	87.5	118.5	121.9	524.1
7. ADDITIONAL ENERGY COST	476.8	476.8	1,252.4	1,288.1	1,145.7	1,059.4	1,487.1	7,186.3
8. ADDITIONAL HEAVY EQPT. COST		-	-	-	-	-	500.0	500.0
9. INDEMNIZATIONS-INSURANCE	220.2	332.0	347.4	431.5	584.6	666.0	982.2	3,563.9
10. INDEMNIZATIONS-CLAIMS		9.3	9.7	7.2	-	-	-	26.2
11. OTHERS	53.0	53.0	54.2	54.2	54.2	54.3	55.9	378.8
12. INTEREST FOR LATE PAYMENTS	-	-	-	45.6	875.4	2,872.6	3,180.5	6,974.1
13. SERVICES NOT INVOICED	-	-	7.6	8.7	84.2	122.3	175.1	397.9
14. ADDITIONAL CONSTRUCTION	-	-	-	100.0		-	-	100.0
15. LATE PAYMENT COSTS	964.6	1,564.8	2,074.9	2,966.5	3,152.4	4,119.6	7,119.7	21,962.5
16. PROTECTION CONSTRUCTION	4.0	5.0	6.5	7.5	26.5	10.0	10.0	69.5
17. WORK STOPPAGE SALARIES	16.2	533.8	441.6	424.2	457.3	442.4	5,289.7	7,605.2
TOTAL INDIRECT COST	3,187.1	5,652.9	8,035.7	10,618.7	12,278.2	17,067.7	30,500.6	87,340.9

SOURCE: El Salvador Damage Assessment (1986)

TABLE III.B.12
SUMMARY OF INDIRECT COSTS OF DAMAGES AND LOST REVENUE (IN US$ 000)

D E S C R I P T I O N	1986	1987	1988	TOTAL
1. REVENUES NOT RECEIVED	1,170.9	1,474.1	1,139.6	3,784.6
2. PERSONAL SECURITY	4.5	4.8	4.2	13.5
3. SECURITY-INSTALLATION	10.6	27.5	22.8	60.8
4. PERSONNEL INCREASES	3.7	6.8	4.7	15.3
5. OVERTIME	112.7	146.6	80.2	339.4
6. ADDITIONAL TRANSP. COST	14.5	16.8	7.4	38.7
7. ADDITIONAL ENERGY COST	66.3	394.1	20.0	488.5
8. ADDITIONAL HEAVY EQPT. COST	8.0	12.0	7.0	27.0
9. INDEMNIZATIONS-INSURANCE	37.3	13.1	21.0	71.3
10. INDEMNIZATIONS-CLAIMS	3.3	34.3	9.0	46.6
11. OTHERS	47.0	35.7	20.4	103.1
12. INTEREST FOR LATE PAYMENTS	0.4	0.5	0.4	1.2
13. SERVICES NOT INVOICED	18.4	18.4	18.4	55.2
14. ADDITIONAL CONSTRUCTION	-	-	-	-
15. LATE PAYMENT COSTS	615.6	743.7	623.1	1,982.5
16. PROTECTION CONSTRUCTION	3.6	4.0	2.4	10.0
17. WORK STOPPAGE SALARIES	115.4	79.1	33.7	228.2
TOTAL INDIRECT COST	1,061.3	1,537.4	874.7	3,481.3

Source: Damage Assessment Report (1988)

million. Table III.C.1 shows a summary of all major projects underway, their costs and population coverage.

Both ANDA and PLANSABAR also have regular, internal programs to expand house connections in their water systems to improve financial efficiency. Table III.C.2 shows ANDA's new house connections for the years 1987 and 1988.

1. ANDA Projects Underway

a. **San Salvador Metropolitan Area**

In the urban area, ANDA is implementing the San Salvador Metropolitan Area Water Supply and Sewerage Project, which is partly financed by IDB. This project aims to improve living conditions and health levels of San Salvador and its surrounding areas where water and sewerage disposal deficits are estimated to be in the order of 42.8%. The project covers 97% of the metropolitan area's total water supply demand for 1992.

To reach these objectives, the program has the following goals:

- increase the present mean annual capacity of the metropolitan area system. By 55.3 million cubic meters, by means of two projects, "Tres Pozos" and "Rio Lempa";

- expand the capacity of transmission and distribution pipe lines to increase system capacity;

- improve present operation, maintenance and management of the system by:

- Reducing the presently estimated 40% of unaccounted water supply to a 30% maximum, by detection and control of leaks and the installation of macro and micro measuring devices;

- increasing the number of connections and improve billing and collection procedures;

- providing better measuring and control devices at the water sources for the metropolitan area.

The IDB loan of $166.00 million for this program was approved in December 1987; the total cost of the program is $184.50 million.The program has a five year implementation period and consists of the following projects and components:

TABLE III. C. 1.

PROJECTS UNDERWAY

PROJECT	SOURCE OF FUNDS	POPULATION SERVED		PROJECT COST in thousands of dollars		
		URBAN	RURAL	EXT. FUNDS	GOES	TOTAL
WATER SUPPLY						
SAN SALVADOR METROPOLITAN WS/S	IDB/GOES	410,000	-	166,000	18,500	184,500
PILOT WATER SUPPLY	AID	-	145,000	12,600	-	12,600
PROGRAM ANDA/KFW	K F W	-	110,000	8,500	-	8,500
RURAL WATER SUPPLY, STAGE III	IDB/GOES	-	230,000	21,000	7,000	28,000
SAVE THE CHILDREN (TO 1994)	AID/COMM	-	50,000	1,000	400	1,400
OTHER MINOR	VARIOUS	-	30,000	3,000	-	3,000
TOTAL WATER SUPPLY		410,000	565,000	212,100	25,900	238,000
LATRINIZATION						
RURAL SANITATION	IDB/GOES		450,000			
RURAL SANITATION	UNICEF		360,000			
TOTAL LATRINES			810,000			

SOURCE : ISA CONSULTANTS / FUNDING SOURCES

TABLE III. C. 2

NEW HOUSE CONNECTIONS

WATER SUPPLY & SEWERAGE

BY REGIONS

REGIONS	1987		1988	
	WATER SYSTEMS	SEWERAGE SYSTEMS	WATER SYSTEMS	SEWERAGE SYSTEMS
CENTRAL	3,335	2,224	4,641	2,893
EAST	3,629	2,489	1,495	949
WEST	1,384	1,980	1,415	825
SUB-TOTAL	8,348	6,693	7,551	4,667
METROPOLITAN	16,321	14,652	7,266	6,224
TOTAL	24,669	21,345	14,817	10,891

SOURCE : ANDA

-Tres Pozos Project

This project is made up of the Incorporation of three deep wells to the existing Zona Norte water supply system with a total capacity of 8 million cubic meters/year;installation of 9.1 km of a collector pipe line; construction of a 1,000 cubic meters concrete tank with aeration tower; and construction of a new pumping station at La Toma site, from which the additional supply of water will be integrated into the existing Zona Norte system. In addition to the civil works, all necessary mechanical and electrical equipment will be installed, including telemeasuring and communications equipment and a high voltage transmission line from La Toma to the wells area. Figure III.C.3 shows the Tres Pozos project.

-Lempa River Project

This project consists of new intake works at the Lempa River,in the department of Chalatenango, from which 47.3 million cubic meters/year will be extracted; a nearby treatment plant with an initial capacity of 1,500 liters/sec; three pumping stations along the transmission pipe line with six pumping units and a compensating tank of 3,000 cubic meters at each pumping station; installation of a 42 km impellance 1200 mm diameter pipe line; construction of a 34,000 cubic meters capacity terminal tank at El Carmen; installation of about 41 km of high tension lines; installation of about 77 km of distribution pipe line net with 6" to 36" diam. pipes and interconnection to the existing metropolitan area distribution systems. See Graph III.C.4.

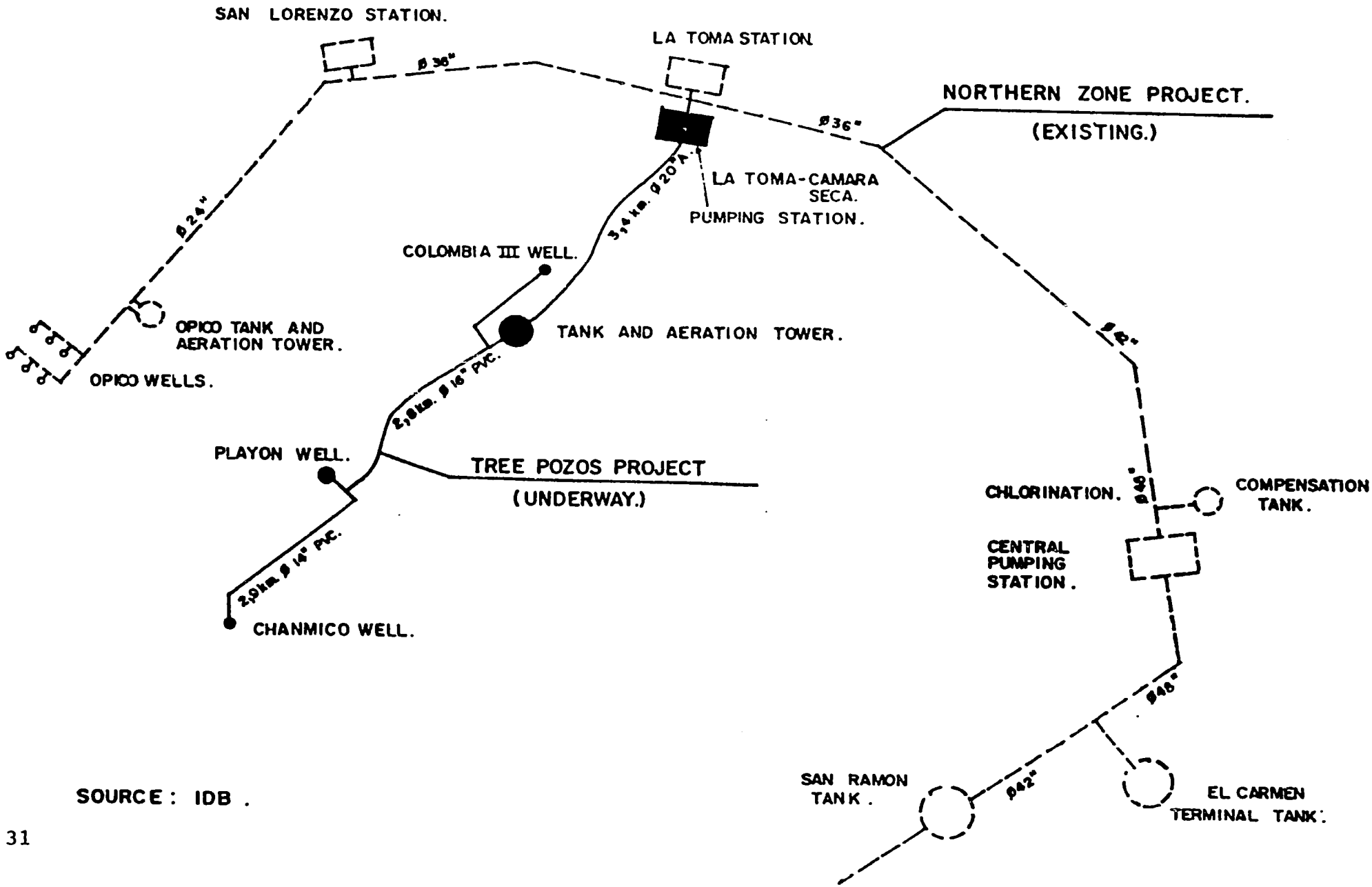
-The installation of a new 30"/32" diameters interconnecting pipe line from the Northern Region to the Eastern system; construction of a 15,000 cubic meters storage tank next to the Bella Vista tank of the Eastern system.

-The installation of large meters along key elements of the project; and 60,000 meters, to reach a goal of 100% metered service connections in the metropolitan area.

-Implementation of the first of a three-stage expansion program of the Primary Sanitation System of the metropolitan area, eliminating the present discharge of sewage within the City limits, and carrying it out to two locations outside the urban area, towards where the sewage treatment plants will be constructed in the second stage of system expansion. This will require: installation of approximately 26 km of collector pipe lines from 18" to 84" diam. pipes; rehabilitation and improvement of the present system;

FIGURE III. C. 3

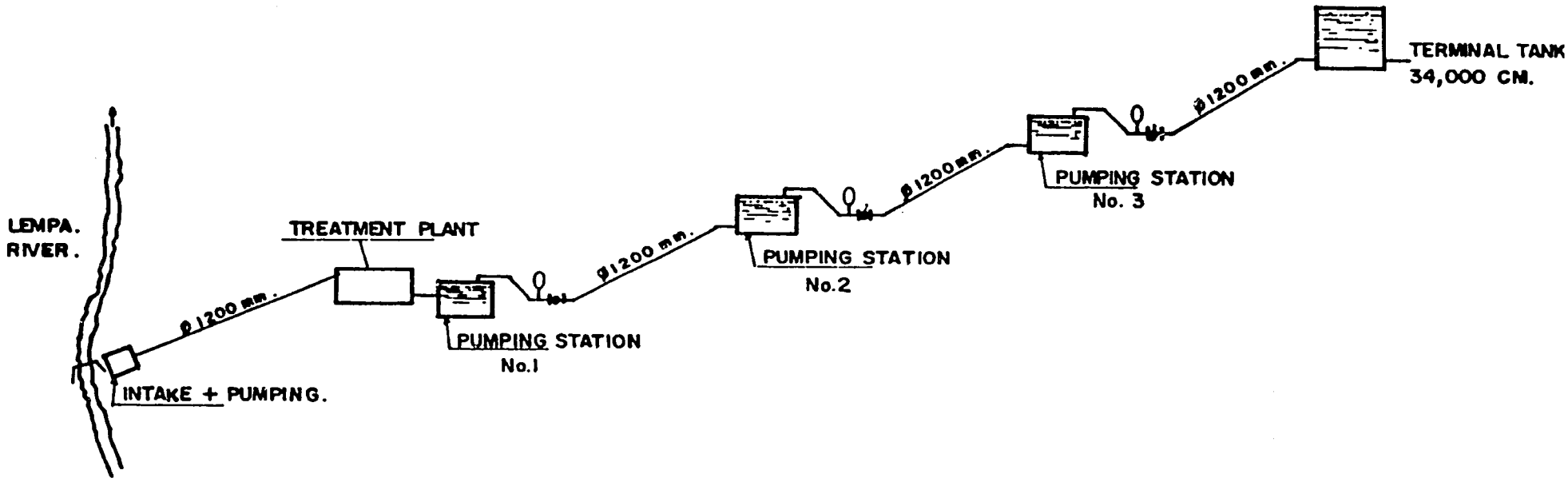
TREE WELLS PROJECT SCHEME.



SOURCE: IDB.

FIGURE III.C.4.

LEMPA RIVER PROJECT SCHEME.



SOURCE : IDB.

separation of the sewage system from the storm water system.

According to ANDA, overall progress of this Program, to June 30,1989, was approximately 5%.

b. **AID Pilot Project**

Another important ANDA project is the Pilot Potable Water and Environment Support Project financed by AID. The purpose of this project is to provide water to needy rural areas, especially those not covered by GOES traditional water and sewer development programs. It seeks to introduce low-level service rather than a full-fledged piped system in isolated or small communities. As a second component, the pilot project seeks to design, construct, and improve water systems in larger villages.

The project started in 1986 with a donation of $400,000 and has grown yearly to the present amount of about $12.60 million. It will benefit a rural population of about 145,000. On the order 50% has been implemented.

c. **ANDA Studies**

Another program being considered for future implementation will be the "Water and Sanitation Project in 20 municipalities of the Central Area of the Country", a $8.5 million program financed by the KfW, presently under design and scheduled to start in 1990. This program will benefit about 110,000 persons.

At the request of the municipalities, ANDA has also undertaken studies for a several projects around the country. However, these have not been considered by lending agencies because of their high cost and lack of economic evaluation.

2. Planned ANDA Projects

a. **Rural Water Supply**

ANDA will be the Executing Agency for the Water and Sanitation component of the recently signed agreement AID 519-0320, Public Services Improvement Project.

This Project will provide support to the restoration and installation of water supply and sanitation systems in small rural communities. Communities with populations of 400 or less that have not been served by any agency or donor will be targeted. Approximately 900 simple systems (such as wells with hand pumps or gravity-fed) will be built where more sophisticated systems are neither financially nor technically

feasible. For communities between 400 and 2,000 persons, 120 systems currently not functioning at full capacity, will be restored or expanded. Approximately 600,000 persons will benefit directly from this component. The estimated cost of this project, including its health component, is on the order of $30 million.

b. **Other Projects**

ANDA is considerating presenting the San Salvador Metropolitan Area Sewage Treatment Plant Second Stage to the IDB. Designs are in preparation.

It has also contracted the feasibility studies of the following projects:

-Rural water supply and sanitation for municipalities in the Zona Central of El Salvador

-Water supply and sanitation master plans for the towns of Santa Ana, San Miguel and Sonsonate

-Systems for the treatment of sewage in 12 towns.

3. PLANSABAR Projects Underway

PLANSABAR is presently implementing its Rural Water Supply Program Stage III, partly financed by the IDB loan 772/SF-ES for $21.00 million. The total cost of the Program is equivalent to $28.00 million. This Program, started in 1986 and scheduled to be completed in 1990, consists of the following two components:

a. **Water Supply Subprogram**

This subprogram considers the construction of about 100 water supply systems that will serve approximately 230,000 persons living in about 410 communities, each with a population between 300 and 2,000 persons. However in the case of multiple systems with one source of water, smaller communities can also be served. This subprogram has the following components:

-Development of underground water sources from springs, infiltration galleries or deep wells with sufficient capacity to feed the systems. These sources normally do

not have contamination to require treatment other than chlorination.

-Installation of transmission lines to carry the water from the sources to the communities to be served.

-Construction of storage tanks and occasional installation of additional pumping equipment.

-Installation of distribution lines.

-Service connections and one indoor faucet per home.

Most of the projects consist of multiple systems with a common water source but with independent distribution systems. Work on this subprogram was 27.1% completed as of June 30, 1989.

Communities actively participate in the installation of the systems, contributing labor, local materials, rights of way and later on helping with the operation and maintenance of the systems.

b. **Latrinization Subprogram**

This subprogram covers the manufacturing and installation of 75,000 latrines adjacent to homes and schools. The installation of 16,000 latrines correspond to the area of the ongoing subprogram and 59,000 will be installed in areas where water supply has been implemented without latrines.

The latrines are manufactured by three factories managed by PLANSABAR. Site preparation, wells excavation, latrines (installation and housing) are provided by the community as part of their contribution to the subprogram. The progress of work on this subprogram was 18.4% as of June 30, 1989.

PLANSABAR is also manufacturing 60,000 latrines financed by UNICEF for the Country's Eastern Region. There is no information on how many of these have been manufactured and/or delivered to date.

Table III.C.5 shows details of the projects being implemented by PLANSABAR.

4. Planned PLANSABAR Projects

PLANSABAR has no other projects under implementation or in planning except manufacturing latrines, unless funding is continued.

5. Projects Underway by other Institutions

Save The Children is building water supply and sanitation facilities in Eastern Salvador this is being done with 60% AID funding and 40% community participation. It has completed about 15 systems to date, covering over 30

TABLE III. C. 5

RURAL WATER SUPPLY PROJECTS UNDERWAY

PLANSABAR

(TO JUNE 1989)

DEPARTMENT	RURAL POPULATION	SYSTEMS	LOCALITIES SERVED	POPULATION SERVED
SANTA ANA	258,000	13	67	29,753
AHUACHAPAN	210,000	4	17	8,772
SONSONATE	240,000	8	27	18,312
LA LIBERTAD	263,000	6	18	13,583
CHALATENANGO	92,000	1	4	1,395
SAN SALVADOR	213,000	3	11	4,959
LA PAZ	177,000	6	18	14,377
SAN VICENTE	116,000	2	9	4,393
CABANAS	104,000	0	0	0
CUSCATLAN	135,000	2	7	4,752
USULUTAN	275,000	1	1	435
SAN MIGUEL	270,000	3	9	10,984
MORAZAN	103,000	0	0	0
LA UNION	227,000	1	2	1,681
TOTAL	2,683,000	50	190	113,396
TOTAL LATRINES INSTALLED TO DATE : 5,617 UNITS				

SOURCE : PLANSABAR

communities totalling about 25,000 inhabitants and is ready to start a new project covering an additional 5,000. From 1984 to 1994, AID donations will probably be about $7 million, of which $1 million will be utilized in the Sanitary Sector benefiting about 50,000 people.

Project ELS/85/006, "Water Supply and Sanitation to Affected Communities", financed by the UNDP and implemented by PAHO/WHO, provides technical assistance to ANDA and PLANSABAR as well as hydrological studies to ascertain water sources and capabilities for rural water supply systems to be built by these agencies. Through 1990, this project will carry out 595 hydrological studies for projects that will benefit about 980,000 inhabitants.

D. DESIGN STANDARDS

1. ANDA Standards

ANDA has design standards for urban and rural water supply systems and waste water disposal as well as, technical specifications under which they design and construct their systems. These designs standards apply to new systems as well as for the expansion or rehabilitation of existing ones.

a. Urban Design Standards

- Design period

The design period, of 20 to 25 years, depends upon the capacity of the water supply, rate of population growth of and development.

- Population projections

For communities with less than 5,000 inhabitants, projections are made using the straight line (arithmetic) method. For those small communities having better growth possibilities and for towns of over 30,000, the geometric projections are using method.

- Demand

The average daily consumption of domestic water is estimated to range from 100 to 175 lt/day/person for small communities depending on their characteristics. Cities are provided with 275 lt/day/person and San Salvador up to 350. Industrial and commercial demands are not included in these figures.

-Demand Factors

Maximum Day: 1.2 to 1.5 of average daily consumption
Maximum Hour = 1.8 - 2.4 of the hourly average

- Pumping Equipment

Normally designed for a 10 to 13 year period. The number of pumps is always set as to have several working to cover maximum system demand.

- Suction Tanks

Required when the supply source is a spring or river.

- Transmission lines

Designed to carry the daily maximum at the end of the system design period. Water pressure limited to 70 mts and water velocity to 2 m/sec.

- Storage Reservoirs

Designed to cover hourly consumption fluctuations in accordance with the number of hours per day that the transmission lines operate. In addition, allowance must be made in the storage tanks for fire fighting demand and for probable interruptions in power supply.

- Distribution Systems

Designed to satisfy the maximum demand for domestic industrial and other uses. The design standards call for a 50 mt maximum design pressure and 1.5 m/sec maximum velocity.

- Treatment

A search for water sources with low contamination is recommended to avoid corrective treatment. Otherwise, a treatment plant is required.

b. Rural Design Standards

- Design period

Same as for the urban systems.

- Population projections

Assumes population doubles every 25 years.

- Demand

The average daily demand is estimated at 75 liters/day/person for rural communities with laundry facilities and stand pipes only; 100 liters/day/person for communities with combined service connections and stand pipes and 125 to 150 liter/day/person for communities that only have service connections.

- Demand variations, pumping equipment, transmission lines, storage reservoirs and distribution systems, same as for urban systems.

- Treatment

The water source should only require chlorination treatment.

c. **Waste Water Disposal**

- Design period

The design period is 25 to 30 years.

- Discharge Flows

For service connections and their collectors, 80% of the water demand plus an infiltration equivalent to 0.2 lt/sec/ha; double this amount for secondary collect main collectors add up to 75% to the secondary ones.

- Velocities

The maximum velocity in reinforced concrete pipes is 4 m/sec, 2 m/sec in non-reinforced concrete pipes; 0.6 m/sec minimum velocity to avoid silting.

2. PLANSABAR Standards

PLANSABAR uses design standards approved by IDB for their systems. They can be summarized as follows:

- Design Period

The design period for civil works and pipe lines is 20 years; 10 years for electromechanical equipment.

- Population Projections

A 3% rate of growth, using the arithmetic method.

- Demand

  For house connections, 100 lt/day/person; for only public services 30 lt/day/person.

- Demand Variation

  Maximum day = 1.2 of average day
  Maximum hour = 2.4 of average day

- Source Capacity

  For gravity systems at least equal to maximum day; for pumping systems, double this amount.

- Pipe Lines

  Transmissions line in gravity systems should be able to carry the maximum day; in pumping systems twice this amount over the number of working hours of the pumps. Distribution lines, should be able to carry the maximum hour, but not less than 0.3 liters/second.

- Storage and Reservoir

  Tanks to hold 40% of the daily average

- Pressure in Pipes

  Maximum 50 mts; minimum 10 mts

- Treatment

  Chlorination in all cases

The described technical design standards are very much in accordance with accepted practices in the sector. The deficient area is treatment, especially in the rural systems where only chlorination is considered. This chemical is often not available, so the water is frequently used without being treated at all. Table III.D.1 summarizes the design standards used by ANDA and PLANSABAR.

ANDA and PLANSABAR have maintenance manuals and standards. However, due to their continuous deficits, it is difficult for them to keep up with these standards. Their maintenance operates with substantial delays.

TABLE III.D.1

MAIN DESIGN STANDARDS

	ANDA URBAN	ANDA PLANSABAR RURAL
1. Design period		
a) System (pipe and civil works)	20-25 years	20 years
b) Electromechanical equipment	10-13 years	10 years
2. Population projection	Either Arithmetic or Geometric	3% arithmetic
3. Demand (lt/day/person)		
a) For house connection	Up to 300 LDP	100
b) For stand pipes		30
4. Demand factors		
a) Max daily (MDD)/(AD)	1.2 to 1.5	1.5
b) Max hourly (MHD)/(AD)	1.8 to 2.4	2.4
5. Source minimum flow		
a) by gravity	Study	MDD
b) by pumping		2*MDD
6. Design flows		
a) Gravity transmission line	MDD	MDD
b) Pumped transmission line	MDD	2*MDD
c) Distribution lines	MHD	MHD
7. Vol. of tanks and reservoirs	Study	40% AD
8. Pressure in the distribution line (in meters of water):		
a) Minimum	10	10
b) Maximum	50	50
9. Treatment	Total	Chlorination

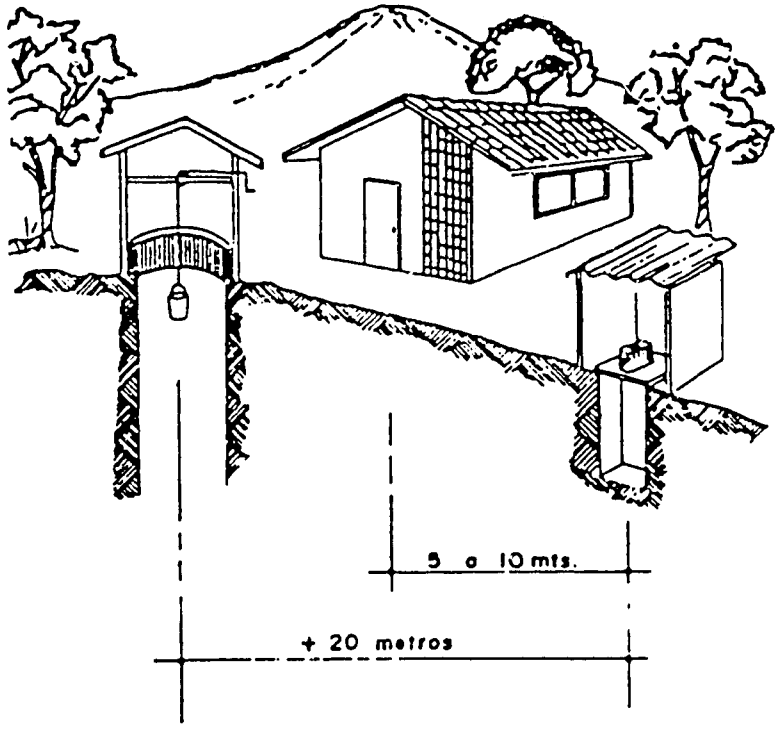
NOTES:

LDP: liters/day/person
AD: Average demand
MDD: Max daily demand
MHD: Max hourly demand
SOURCE: ANDA and PLANSABAR

3. Latrines

In the design of dry latrines, the locations are represented in Figure III.D.2.

Figure III.D.2



LATRINE LOACATION

SOURCE : PLANSABAR

4. Alternative Standards

In urban and especially rural areas, there are opportunities for identifying simplified, lower cost water sanitation design standards.

IDB is carrying out a project study on current design standards for rural water supply systems. This project consists of measuring water consumption at different rural water supply systems in El Salvador over a two-year period.

These measures will help to evaluate system behavior and real consumption values at different points. The values obtained will serve as parameters to review and redefine design standards, to provide more efficient designs, reduce the cost, optimize water sources and achieve better coverage of service with lower cost designs.

The most likely constraints to adoption of alternative standards are engineering tradition and practice, reflected in ANDA, private engineering and construction industry usage. Further contact of sanitary engineering professionals with alternative water programs would be useful.

E. CONSTRUCTION, OPERATION AND MAINTENANCE COSTS

1. Historical Review and Current Costs

According to ANDA and a large sanitation contractor, construction costs have increased by about 150% in the past ten years or so. This reported increase is less than Central Bank data estimates of a total increase of 286% in construction costs from years 1979-1988.

The main causes for this increases are:

-The ongoing conflict in the country since 1979

-world inflation in the construction industry

-the San Salvador earthquake of 1986

-domestic inflation including the devaluation of the colon in 1986, etc.

Construction, operation and maintenance costs are presented in the following sections by type of system.

2. Urban Systems

a. Construction Costs

ANDA contracts all of its construction, expansion and/or rehabilitation projects and carries out the operation and normal maintenance procedures by administration.

Information concerning construction costs for urban systems is limited. ANDA, has done little to rehabilitate or expand large systems, except on the ongoing San Salvador Metropolitan Area (SSMA) project. Data has been collected for recent projects such as the improvement of the San Martin Water Supply System, the Tres Pozos Project in the SSMA and others, mainly to supply and install pumping equipment.

However, our main source of up-to-date construction costs has been the consulting firm AMSA, which is presently preparing the Santa Ana, Sonsonate and San Miguel. Water Supply and Sewerage, masterplan. This firm graciously furnished their unit and total costs for most of the items we used in our own analysis of modular construction costs. These, in turn were based on a detailed review of water supply design and cost studies carried out in several other countries.

Following is a detailed explanation of financial cost calculations for system construction and expansion, as of December 1988.

(1) Modular Water Supply Systems

In the absence of detailed data on existing systems throughout the country, the consultants have prepared modular systems for populations of 400 to 50,000 inhabitants. Details are shown in Appendix III.E.1., and the following assumptions, have been made:

-The most common source of the water supply are wells.

-The population is concentrated in a limited number of blocks (100 m. x 100 m., that is of 1 hectare) assuming a variable population density, according to community size.

-Communities are located at elevations above water sources so pumping in is always needed.

-Average water consumption per person per day has been adopted in accordance to the size of the community as per ANDA design standards.

-Reservoirs and other system components have also been proportioned in accordance with ANDA design standards.

On the basis of these assumptions, the new systems have been designed, quantified and their total costs have been calculated. Because the prices given by AMSA are to September 1989, they have been sealed down December 1988.

Since many communities above population already have water supply facilities, we have only calculated the cost of only expanding those services to meet their future demands, which we estimated at 80% of new system costs.

In these modular designs we have arrived at an average per capita costs with and without water treatment. If so desired, average costs can also be calculated per cubic meter of water. A summary of these results is shown in Table III.E.1.

TABLE III. E. 1.

SUMMARY OF COSTS OF MODULAR WATER SUPPLY SYSTEMS

IN US DOLLARS

CONSTRUCTION

ITEM	DIFFERENT SYSTEMS SIZES						
	400	1,000	2,000	5,000	10,000	25,000	50,000
TOTAL COST	12,600	88,310	131,370	704,150	1,146,900	4,607,500	8,250,750
COST / CAPITA	31.50	88.31	65.69	140.83	114.69	184.30	165.02
EXPANSION				563,320	917,520	3,686,000	6,600,600
COST / CAPITA				112.66	91.75	147.44	132.01
EXPANSION + TREATMENT					1,292,820	4,182,600	7,375,300
COST / CAPITA					129.28	167.30	147.51

NOTE : AN ADDITIONAL 15% FOR ENGINEERING AND ADMINISTRATION AND 10% FOR CONTINGENCIES SHOULD BE ADDED TO ALL MODULAR SYSTEMS COSTS.

Finally, based on these results, Graph III.E.2 gives representative total cost curves for new projects, expansion projects and per capita costs for communities in the 2,000 to 50,000 population range. Per urban capita costs are shown to increase from small to large communities.

(2) Modular Sanitation Systems

Similarly for sanitation systems, detailed engineering and cost studies have been made for modular communities of 5,000, to 50,000 inhabitants, assuming the following:

- Population densities and water consumption, same as for the water supply systems.

- Disposal of the waste waters is, in all cases, without pumping (and without treatment, although this last condition is the least acceptable).

- Design considerations are according to ANDA standards.

On the basis of these assumptions, the new systems have been designed, quantified and their total costs have been calculated, once again using the cost analysis prepared by AMSA.

Costs have been deflated to December 1988. (Appendix III.E.1 contains Modular System cost calculations, and Appendix III.E.2 consists of the AMSA cost analysis, the basis for ISA calculations.

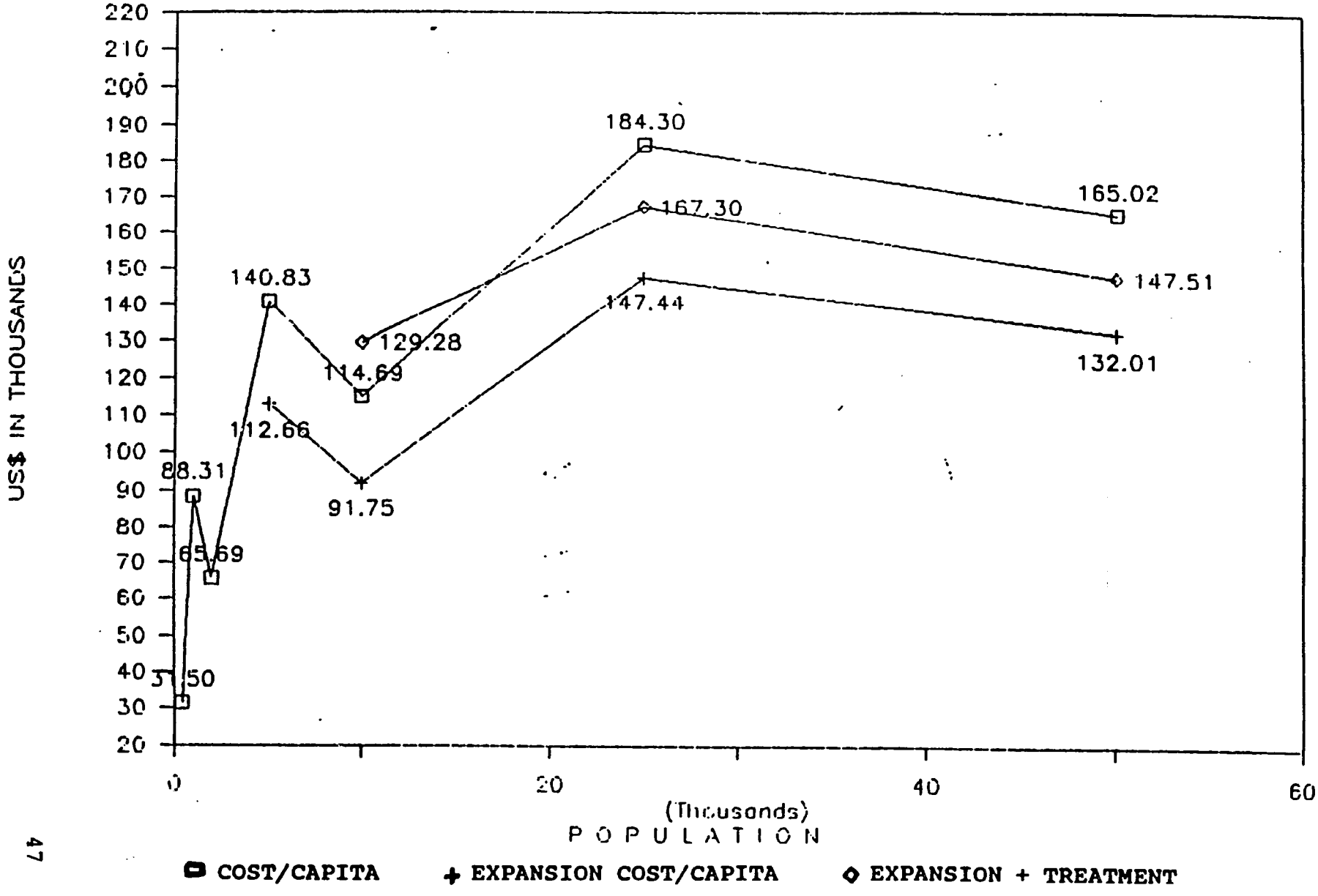
Total costs have been ascertained for international and local contracting. Fairly simple contracts can be executed under local contracting, thus lowering cost. Average per capita costs, with and without sewerage treatment have also been calculated. A summary of these results is shown in Table III.E.3. Average costs per cubic meter of waste water disposal may also be calculated.

Finally, based on these results, Graph III.E.4 gives total cost curves with alternative contracting procedures, as well as per capita costs for communities in the range of 5,000 to 50,000 population.

Table III.E.5 breaks down the costs of both water supply and sewerage systems in foreign and local currencies. Table III.E.6 breaks down the same costs in labor, materials, equipment, overhead and profit.

COST OF WATER SUPPLY SYSTEMS

(PRICES AT DECEMBER 1988)



GRAPH III.E.2

TABLE III. E. 3.

SUMMARY OF COSTS OF URBAN MODULAR SANITATION SYSTEMS

IN US DOLLARS

CONSTRUCTION

ITEM	DIFFERENT SYSTEMS SIZES			
	5,000	10,000	25,000	50,000
TOTAL COST	631,620	1,107,432	2,481,624	4,244,400
COST / CAPITA	126	111	99	85
LOCAL CONTRACTOR	101	89	79	68
LOCAL CONTRACTOR + TREATMENT		1,210,800	2,652,400	4,544,600
COST / CAPITA		121.08	106.10	90.89

NOTE : AN ADDITIONAL 15% FOR ENGINEERING AND ADMINISTRATION AND 10% FOR CONTINGENCIES SHOULD BE ADDED TO ALL MODULAR SYSTEMS COSTS.

GRAPH III.E.4

COST OF SEWERAGE SYSTEMS

(PRICES AT DECEMBER 1988)

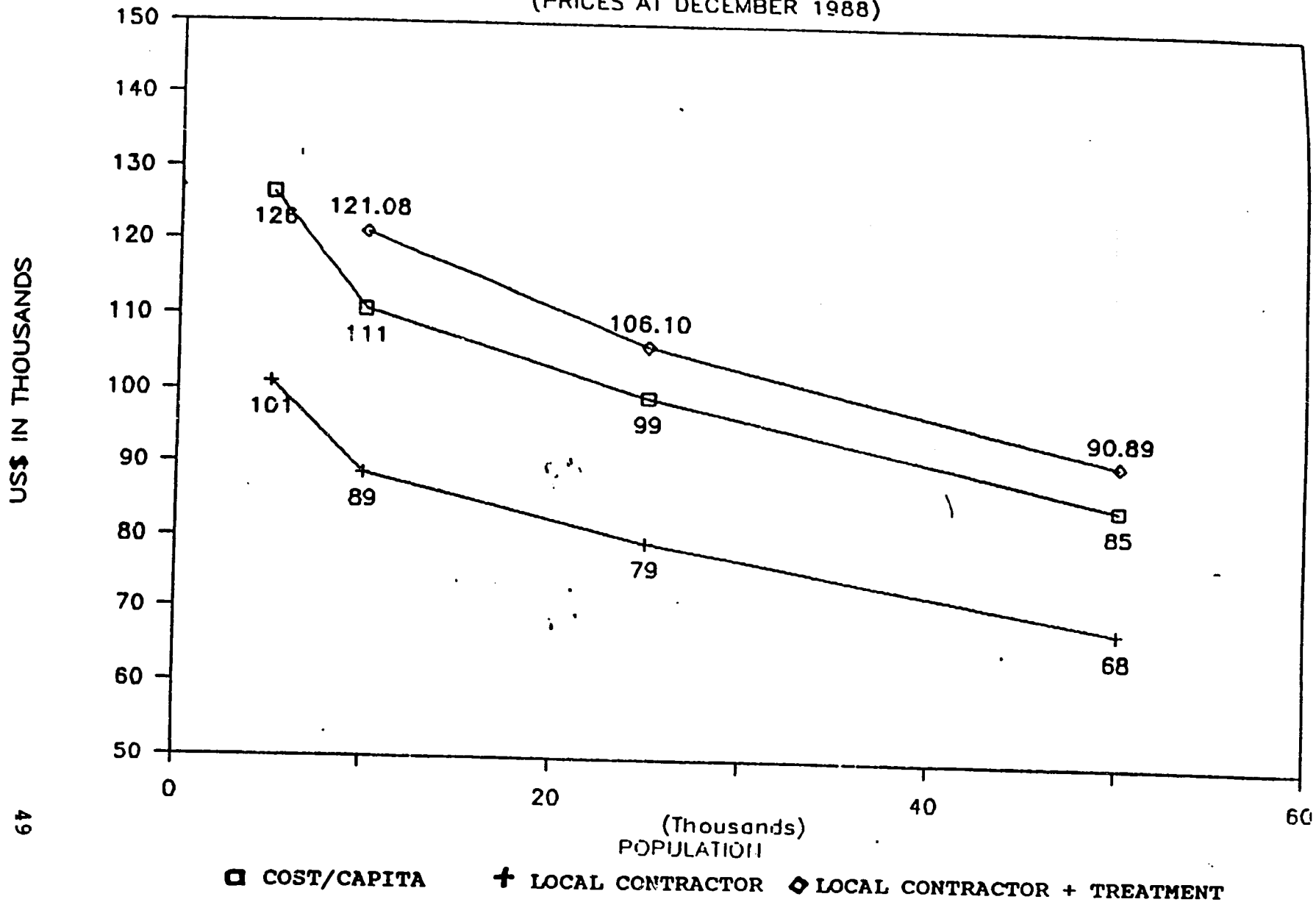


TABLE III.E.5

SUMMARY OF COST ANALYSIS

Water Supply	Foreign Currency %	Local Currency %
1. Well drilling and preparation	37	63
2. Pumping equipment	80	20
3. Transmission pipe line	49	51
4. Reservoirs - Civil works	27	73
Mechanical works	62	38
5. Distribution Lines 4" to 12"	49	51
2" or less	73	27
6. House connections	-	23
7. Electrical components	52	48
8. Other works and miscellaneous	28	72

Sewerage	Foreign Currency %	Local Currency %
1. House connections	10	90
2. Street collectors	57	43
3. Perimetral/Principal Collectors	54	46
4. Manholes	8	92
5. Latrines	-	100

TABLE III.E.6

COST ANALYSIS

Water Supply	Labor %	Material %	Equipment %	O&P %
1. Well drilling and preparation	30	8	46	16
2. Pumping equipment & installation	23	5	56	16
3. Transmission Lines	4	76	4	16
4. Reservoirs:				
Up to 2,000	28	47	8	16
Over 2,000	22	41	21	16
5. Distribution lines				
(12" to 4")	4	76	4	16
(2" and less)	5	75	4	16
6. House connections	12	30	42	16
7. Electrical components	23	46	15	16
8. Other works and misc.	25	51	8	16
Sewerage				
1. House connections	34	23	27	16
2. Street collector	34	23	27	16
3. Perimetral & main collectors	37	25	22	16
4. Manholes	22	55	7	16
5. Latrines	30	47	7	16

b. Operation and Maintenance Costs

The actual costs of operation and maintenance of the existing major systems varies considerably, not only in proportion to the size of the system, its condition, its location and type of system, but with the records kept by the ANDA regional offices under which the systems operate. Once again, AMSA has made the most extensive studies on this subject and has furnished us with their results.

However, for the total cost of the existing water supply systems operated by ANDA, we have used their 1984 to 1988 end-of-year financial statements as the most reliable source of information. We have arrived at the following average per capita yearly costs for 1988.

Operation		Maintenance	
Catchment and collection:	$0.87	Catchment and collection:	$0.08
Distribution:	$7.86	Distribution:	$3.50

The costs of operation and maintenance for urban sanitation systems operated by ANDA have been impossible to obtain in a consistent manner. Once again, we consider the ANDA Financial Statements to be the most reliable available source. The average per capita annual costs for 1988 are as follows:

Operation: US$0.99
Maintenance: US$0.31

Since sanitation systems in rural areas consist of latrines, their operation and maintenance cost are negligible.

Operation and maintenance costs for pumping systems can be calculated by the attached graphs III.E.7 and III.E.8, recently prepared by AMSA.

3. Rural Systems

a. Construction Costs

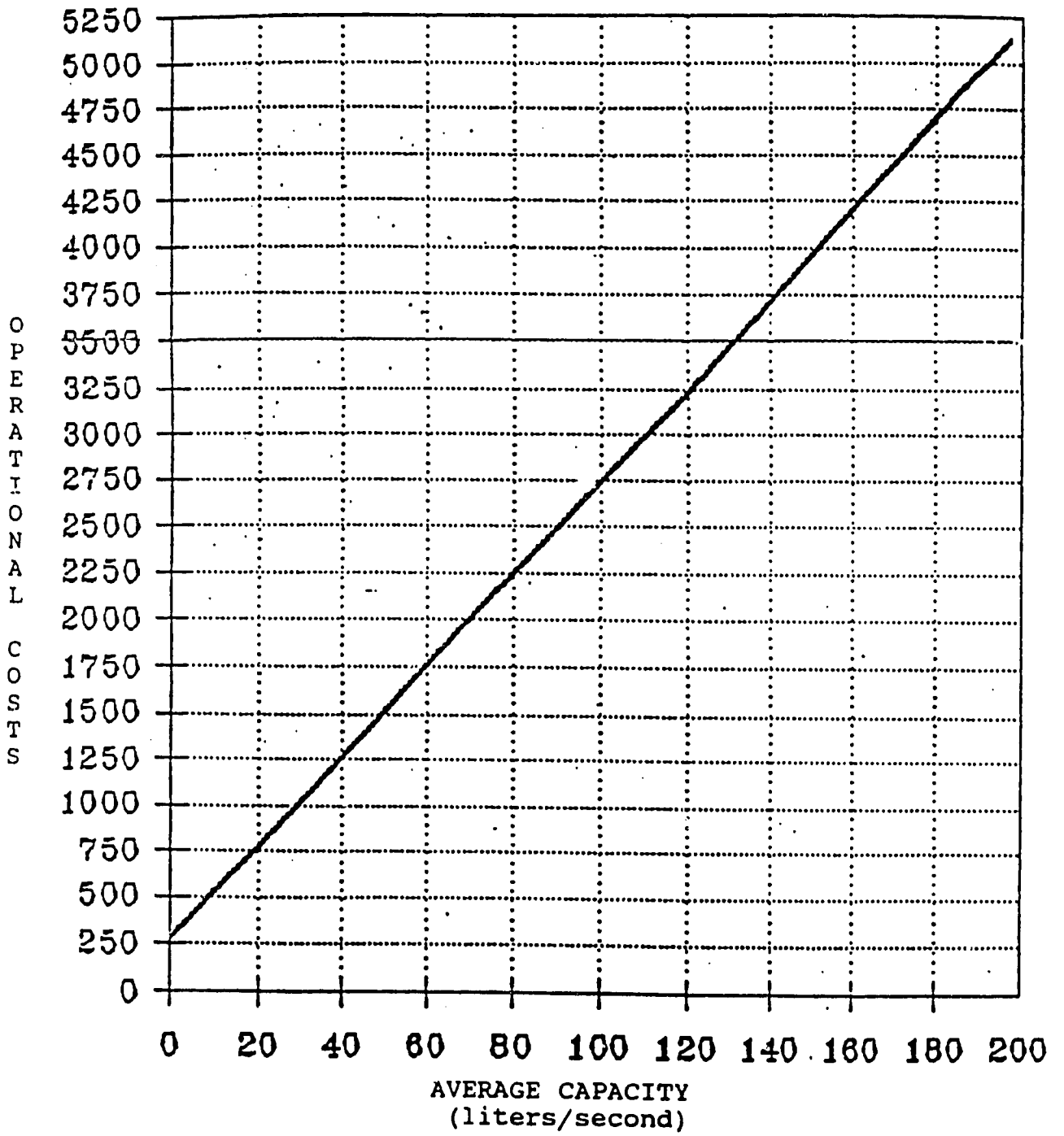
Rural Water Supply Systems in El Salvador are built mostly by PLANSABAR and ANDA. PLANSABAR has the most experience in rural systems, having built, to date, over 200 systems. It is presently building 100 additional systems under a Stage III Program financed by the IDB.

The construction method employed by PLANSABAR requires full community participation. Its cost is counted as part of counterpart funds and because of the low rural labor rates, the costs of PLANSABAR systems are relatively low.

GRAPH III.E.7

SENSIBILITY ANALYSIS OF OPERATIONAL COSTS

PUMPING STATIONS/WELL EXCAVATIONS



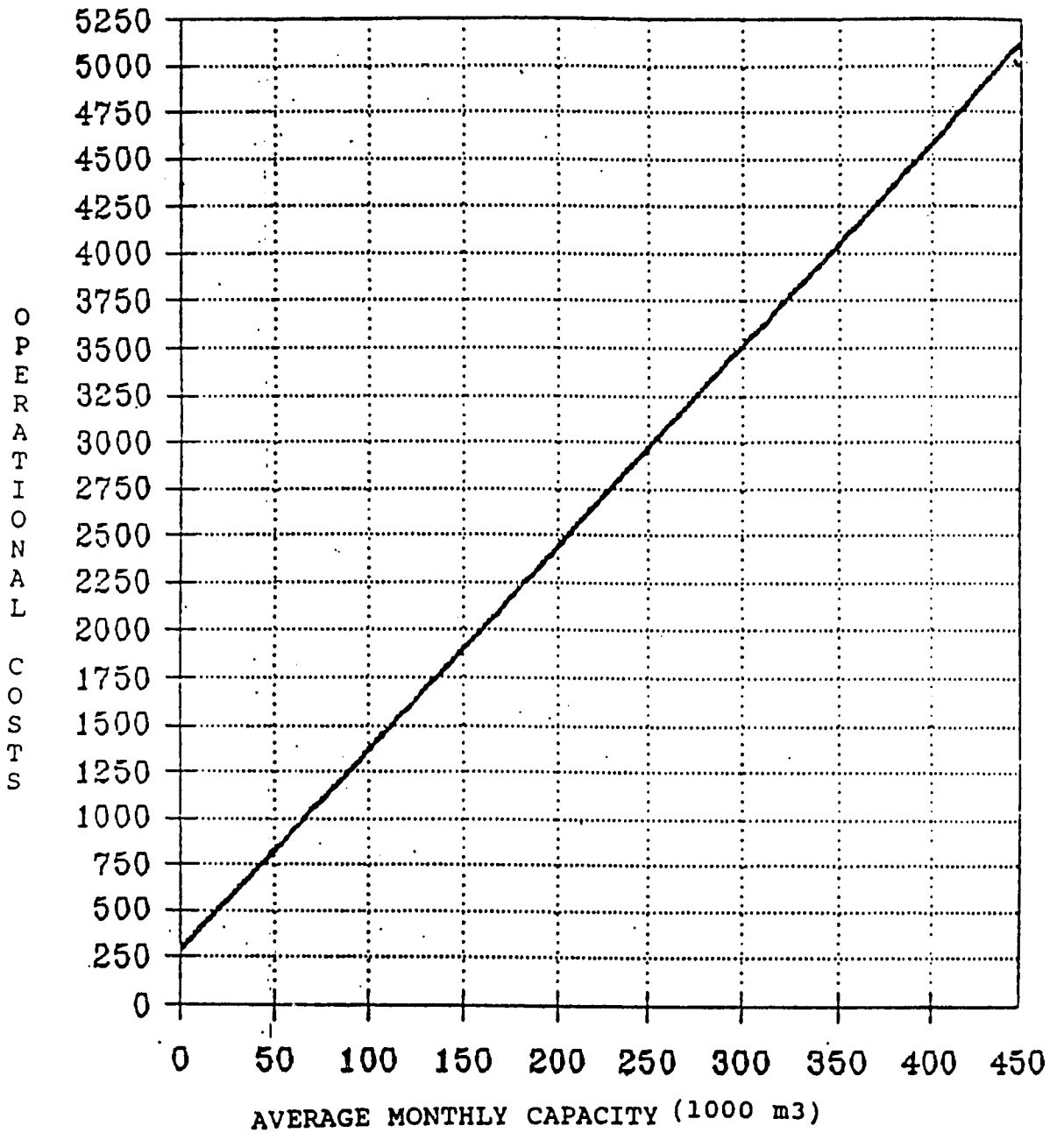
COSTS INCLUDE: Labor, Administration, MAintenance, Chemicals, Cleaning, Electricty, and Fuel, etc.

SOURCE : AMSA

GRAPH III.E.8

SENSIBILITY ANALYSIS OF OPERATIONAL COSTS

PUMPING STATIONS/WELL EXCAVATIONS



COSTS INCLUDE: Labor, Administration, MAintenance, Chemicals, Cleaning, Electricty, and Fuel, etc.

SOURCE : AMSA

On the other hand, ANDA contracts for all their rural systems, even when based on hand pumps, without community participation. As a result, investment costs are higher than PLANSABAR's. To justify their higher cost, they are considered "impact projects", for rapid implementation.

Table III.E.9 shows representative costs of PLANSABAR systems. Project costs vary from C153,000 (US$30,600) to C566,500 (US$113,300). Cost per capita vary from C71 (US$14) to C440 (US$88). The average weighted cost per capita of the PLANSABAR systems is C225 (US$45). However, if we consider factors such as contingencies and payment for community participation, this cost per capita rises to about C350 (US$70).

Finally, the IDB loan document for PLANSABAR's present program estimated the cost of rural water supply at US$20,045,000 and the population served at 230,000, for a cost per capita of US$87.

For average cost estimates, based on the figures above, we will use US$90 per capita for rural systems.

The ANDA rural water supply systems cost at least twice the amount of PLANSABAR system on a per capita basis.

The cost of a latrine is estimated at $19/person, and ANDA indicates hand-pump well systems cost C63,000, with the following breakdown:

Well drilling	C55,000
Cost of pump	5,700
Installation & misc.	2,300
TOTAL	C63,000 = US$12,600
About $31/capita	

b. **Operations & Maintenance**

Operations and maintenance costs for rural water supply systems have been averaged on a national basis using information obtained from PLANSABAR. At present, ANDA has little information on the actual cost of operations of rural systems, because system operations are left to the communities which establish their own tariffs to cover operating costs, consisting of an operator for about C600/month (US$120) and the electric bill, of about C300/month (US$60).

For PLANSABAR systems, which remain under community operation with PLANSABAR control the per capita averages for 1988, as shown in TAble III.E.10, are:

TABLE III. E. 9.
RURAL WATER SUPPLY SYSTEMS - III BID PROGRAM
COSTS OF COMPLETED SYSTEMS
TO DECEMBER 1988

PROJECTS	TOTAL COST (COLONES)	PERCAPITA COST PRESENT POPULATION	PERCAPITA COST FUTURE POPULATION	HYDRAULIC WORES TRANSMISION LINES-M.	HYDRAULIC WORES DISTRIBUTION LINES-M.	POPULATION PRESENT	POPULATION FUTURE	HOUSE CONNECTIONS PRESENT	HOUSE CONNECTIONS FUTURE	SOURC
1. Cas. La Galera, Cton. San Francisco Chamoco, J/San Vicente	152,952.43	137.00	86.00	1,033	3,443	1,113	1,781	128	297	M
2. Canton San Juan Yanez J/San Miguel	550,382.70	628.00	392.00	295	5,839	877	1,403	110	234	M
3. Caserio Las Granadillas, Cton. Ayuta, J/Santa Ana	212,595.35	113.00	71.00	184	3,628	1,878	3,012	274	502	M
4. Col. Aviles, Canton Comacayo M/Santa Ana	374,629.23	193.00	121.00	754	7,247	1,937	3,099	323	517	P
5. Canton La Guacamaya M/Nahuizalco J/Sonsonate	566,451.02	705.00	440.00	1,884	7,818	804	1,286	101	215	M
6. Canton Sihuatepec M/Nahuizalco J/Sonsonate	546,804.58	237.00	136.00	1,072	11,836	2,304	4,021	278	670	M
7. Cantones Istagapan y Miramar, M/Goaymango, J/Ahuachapan	432,111.37	362.00	226.00	2,333	12,311	1,194	1,911	128	319	M
8. Hda. San Alfonso y Cas. El Cenizo M/Tamanique, J/La Libertad	237,686.11	637.00	398.00	632	2,644	373	597	58	100	M
9. Cas. Rio Frio, Canton Parras Lempa M/San Vicente	162,599.67	493.00	308.00	413	2,005	330	528	55	88	M
10. Cas. Plan Palmira, Canton Sta. Cruz Loma M/Santiago Nonulaco J/La Paz	210,168.20	555.00	346.00	1,544	3,667	379	607	58	101	M
11. Cantones El Pedernal y El Norte M/Chilanga, J/Morazan	473,985.89	450.00	281.00	387	8,656	1,054	1,687	115	281	M
TOTAL	3,920,766.95	320.00	197.00			12,243	19,932	1,628	3,324	

SOURCE: PLANSABAR

NOTE = M ==> SPRING
P ==> WELL

Administrative expenses:	$ 0.92
Operating expenses:	$ 5.76
Maintenance expenses:	$ 2.15

These values have been obtained from computerized records kept by PLANSABAR for each of their systems. However, because of disparities and questionable input, the results are unreliable.

TABLE III.E.10

PLANSABAR SYSTEMS OPERATION
1988 BALANCE SHEET
(expressed in Colones)

REGION	Income	Expense			Balance
		Administration	Operation	Maintenance	
Occidental	10,622	667	3,606	1,365	4,984
Central	16,740	890	9,044	1,633	5,172
Paracentral	11,529	1,270	4,609	3,909	1,741
Oriental	8,270	924	6,338	1,909	895
TOTALS	47,161	3,751	23,597	8,816	12,792
	NB: Income - Expenses = Balance				
National Annual Average	11,790	938	5,899	2,204	3,198
Average Per Capita %	11.51	0.92	5.76	2.15	3.12

Source: PLANSABAR

Operating costs for new rural systems are computed as follows:

Operator of system (C800/month, including social benefits)	$ 160
Electricity C500/month	$ 100
Miscellaneous (chlorine, etc.)	$ 90
TOTAL	$ 350
Cost per capita (1000 aver.pop.) $3.50/year	

Annual maintenance costs of rural water supplies, according to industry standards, are on the order of 5 to 7% of the investment cost.

For hand pump well systems, operation and maintenance costs are estimated at US$40 per year, per well.

4. Summary

Table III.E.11 presents a synthesis of the construction,

TABLE III.E.11

OPERATION AND MAINTENANCE COST PER CAPITA
(IN US$ DOLLARS)

MODULAR SYSTEM	OPERATION & MAINTENANCE		RESIDUAL VALUE AFTER 20 YEARS
	EVERY YEAR	@ YEAR 10	
Rural			
400	0.10	3.50	-
1,000	8.83	18.68	20.93
2,000	8.83	15.53	7.37
Urban Expansion			
5,000	10.61	16.08	14.72
10,000	13.61	22.72	10.52
25,000	13.61	25.72	15.68
50,000	13.61	20.12	11.63

NOTES
* Local Contractors
Urban Expansion - Sometimes not possible in small towns is due tc age of existing systems

SOURCE : ISA Consultants

operations and maintenance costs per capita using urban expansion and local contractor estimates.

F. FINANCIAL POSITION

1. ANDA

Table III.F.1 represents ANDA's balance sheet from years 1983 to 1988. Table III.F.2 presents income statements for this time period.

The balance sheet underestimates ANDA's fixed assets and equity because no asset adjustment has taken place since the 1986 devaluation.

ANDA's most serious financial problem is that it has been incurring a net loss since 1984. The situation became so critical in 1987 that the government had to pay a subsidy of 20 million colones. This amount however was insufficient to significantly alter ANDA's position.

ANDA's financial difficulties can be traced to a slow growth in operating income, from 57 million colones in 1983 to 103 million in 1988, compared to an increase in expenses from 51 million to 122 million. Note that if assets had been revalued after the 1986 devaluation, the income statement would look much worse due to higher depreciation.

In 1988, ANDA's ratios of debt and equity to assets were 57 percent and 43 percent respectively. This compares with the 1983 ratios which were 42 percent and 58 percent. This is largely due to short term debt needed for the lack of income. Thus ANDA's short term debt increased from 8 percent of assets in 1983 to 22 percent today. Table III.F.3 presents the structure of ANDA's debt.

Most of ANDA's debt has concessionary terms with very low interest rates. Income is so low, however, that ANDA has had to resort to overdraft and short term loans with some interest rates reaching 20 percent.

Another method of leverage used by ANDA is to withhold payment to its creditors. In 1988, accounts payable reached 75 million colones, 84 percent of which is owed to autonomous agencies such as CEL or ANTEL. This compares with the amounts owed to ANDA of only 44 million colones.

Many users do not have meters and are charged on a average usage basis. There are also some users who tap into the system without payment. The San Salvador metropolitan area expansion program will seek to deal with these problems as

TABLE III.F.1

ANDA BALANCE SHEETS 1983- 1988
(in millions of Colones)

ITEMS	1983	1984	1985	1986	1987	1988
ASSETS						
FIXED ASSETS						
Fixed Assets in Service	237,797	470,996	498,384	510,622	696,329	747,439
Depreciation	68,414	76,162	90,204	106,705	118,669	137,412
Fixed Assets in Construction	202,893	7,623	7,034	13,019	26,684	26,373
Total Fixed Assets	509,104	554,781	595,622	630,346	841,682	911,224
CURRENT ASSETS						
Cash at Bank	2,856	4,075	5,342	2,617	25,153	26,646
Consumer Receivables	27,526	29,847	30,417	9,446	27,587	30,913
Other Receivables	4,641	2,196	2,093	1,034	11,394	14,271
Inventory	20,109	19,483	18,135	15,453	48,590	45,211
Other Current Assets	582	11	66	0	(6,567)	(756)
Total Current Assets	55,714	55,612	56,053	28,550	106,157	116,285
OTHER ASSETS	13,699	12,365	17,425	17,508	16,974	3,927
Total Other Assets	13,699	12,365	17,425	17,508	16,974	3,927
TOTAL ASSETS	578,517	622,758	669,100	676,404	964,813	1,031,436
EQUITY						
Capital	191,375	197,282	239,258	294,324	301,437	320,441
Retained Earnings	62,939	53,923	7,162	(23,139)	4,541	(9,049)
TOTAL EQUITY	254,314	251,205	246,420	271,185	305,978	311,392
LIABILITY						
Long Term Debt	152,076	157,650	15,135	130,679	281,795	260,119
Total Long Term Debt	152,076	157,650	15,135	130,679	281,795	260,119
CURRENT DEBT						
LTD Payments	9,614	6,022	16,406	19,528	28,013	43,219
Banks	5,720	28,411	22,591	3,429	0	0
Accounts Payable	6,278	15,481	30,168	27,268	64,106	75,598
Other Current Debt	29,381	11,666	22,823	10,905	26,738	39,638
Total Current Debt	50,993	61,580	91,988	61,130	118,857	158,455
TOTAL LIABILITIES	203,069	219,230	107,123	191,809	400,652	418,574

* These unaudited balance sheets are either missing an accounting item or in error, as liabilities plus equity does not equal assets. Complimentary information had not been received at report closing.

TABLE III.F.2

ANDA INCOME STATEMENTS, 1983 - 1988
(in millions of Colones)

ITEMS	1983	1984	1985	1986	1987	1988
SALES						
Water Sales	46,060	44,922	51,132	62,715	72,229	n.a
Sewerage Services	7,563	7,343	8,495	9,146	12,914	n.a
Other Income	3,713	3,799	5,063	0	3,001	
Total Income	57,336	56,064	64,690	71,861	88,144	103,866
OPERATING EXPENSES						
Total Operating Expenses	51,181	63,643	78,035	103,412	121,783	121,945
OPERATING INCOME	6,155	(7,579)	(13,345)	(31,551)	(33,639)	(18,079)
OTHER INCOME						
Total Other Income	2,822	1,541	2,295	3,966	19,687	5,172
PROFIT BEFORE FINANCIAL EXPENSES	8,977	(6,038)	(11,050)	(27,585)	(13,952)	(12,907)
Long Term Debts	1,085	2,183	2,234	6,028	7,735	9,484
NET PROFIT BEFORE TAX	7,892	(8,221)	(13,284)	(33,613)	(21,687)	(22,391)
NET PROFIT/LOSS (before Extra.Items)	7,892	(8,221)	(13,286)	(33,713)	(21,687)	(22,391)
EXTRAORDINARY ITEMS						
Grant from AID				15,862	11,784	-
GOES Subsidy				20,634	0	-
NET PROFIT/LOSS	7,892	(8,221)	(13,286)	2,783	(9,903)	(22,391)

well as other sources of leakage. No information was obtained to quantify these concerns. However, one of the above program purposes is to reduce leakage.

ANDA's bill collection record in the private sector is also fairly good, because it cuts its services to delinquent clients. Although, public sector receivable, are high, as noted above, payables are greater.

TABLE III.F.3

ANDA - Debt Structure
(in thousands of Colones)

EXTERNAL LOANS	Amount Contracted	Interest Rate %	Balance Dec/88
LOAN 426/SF-ES	150,000.0	2.00	132,500.0
LOAN 90-TF/ES/BID	22,000.0	2.75	3,352.0
LOAN FCIE-176-0-PZN	118,368.7	6./8.75	118,368.7
LOAN.CIC-SEURECA, PARIS,BY LEMPA RIVER	2,931.8	7.75	788.8
LOAN 801/SF-ES-BID	17,000.0	1./2.00	--
LOAN 813/SF-ES-BID	830,000.0	1./2.00	63,119.8
Sub-Total	1,140,300.5	n.a	318,129.3
INTERNAL LOANS			
LOAN LP-4/5-TF/BCR	2,100.0	4.00	525.0
LOAN LP-5/6-TF/BCR	6,750.0	4.00	1,687.5
LOAN AG-18/86-BCR	16,940.6	10.00	16,375.9
BONDS CIRC.ANDA 2000 BCR/PZN	50,000.0	5.00	36,250.0
LOAN CAPITALIZADOR BANK-PRONAVIPO 1	3,434.2	9.00	2,879.9
LOAN CAPITALIZADOR BANK-PRONAVIPO 2	2,574.3	9.00	2,574.3
LOAN SPECIAL FUNDS.MUNIC.SAN MIGUEL	695.8	-	148.5
LOAN FOSEP-BID-1/83A	1,250.0	7.00	250.0
LOAN FOSEP-BID-1/88-732/ES-PL-480/87	5,400.0	7.00	3,240.0
LOAN DIR.GRAL.TESOR MINI HACIENDA	1,000.0	1.00	243.1
LOAN B.A.C - ROTATING FUNDS	1,425.4	17.00	1,125.4
LOAN CUSCATLAN BANK-DCR-27666-9	4,000.0	17.00	4,000.0
LOAN COMERCIO BANK - OVERDRAFT	1,500.0	20.00	1,500.0
LOAN DIR.GRAL.TESOR.EMERGENCY FUND	1,500.0	-	1,500.0
LOAN SETEFE/AID PROGRAM U.D.I	5,000.0	14.00	1,800.0
Sub-Total	103,570.3	n.a	74,099.6
TOTAL	1,243,870.8	n.a	392,228.9

Marketing and administrative costs were the single largest expenditure from ANDA, every year between 1983 and 1986. The most recent figures were not available. Though a relative decrease in the above would be desirable, it would not radically change the situation at ANDA. Only an increase in revenues through higher tariffs as discussed in the next section, could bring about such a change.

In summary, ANDA is in a very serious financial situation which has already jeopardized the maintenance and operation

of it facilities and forced it to postpone necessary new investments.

2. Tariffs

ANDA's current tariff schedule is shown in Table III.F.4

TABLE III.F.4

ANDA - URBAN WATER SUPPLY TARIFFS
(Established in 1987)

CONSUMPTION (/Month)	TARIFF
0 to 15	C 4.00
16 to 30	C 4.00 plus C0.40 for each above 15 /month
31 to 60	C 10.00 plus C1,00 for each above 30/month
61 to 120	C 40.00 plus C1.10 for each above 60 /month
121 to 480	C106.00 plus C1.40 for each above 120 /month
more than 480	C610.00 plus C1.60 for each above 480 /month
House connections without meter	C12 up to 3/4 diameter connecting pipe.

ANDA used to be subsidized by the government. Some years ago, the Government eliminated the subsidies and allowed tariffs to rise accordingly. Despite the fact that non-users pay many times more then ANDA users for water, there was public protest and the tariffs were lowered again. Subsidies were not reinstated, leaving ANDA and PLANSABAR in a more critical situation. In one instance, one cubic meter of water costs ANDA C 1.60, and the tariff price is about C 0.40.

TABLE 111.F.5

FINANCIAL and TARIFF ANALYSIS - ANDA
(in thousands of Colones)

Component	1988 (C)	1987 (C)	Growth Rate %
OPERATING REVENUE	103,866	88,144	17.84
OPERATING EXPENSE	121,945	121,783	0.13
OPERATING INCOME	<18,079>	<33,639>	46.26
Interest Expense	9,484	7,735	22.61
TOTAL ASSETS	729,966	706,631	3.30
LIABILITIES	418,574	400,652	4.47
Long Term Debt	260,119	282,795	-7.69
EQUITY	311,392	305,979	1.77
Rate of Return (Operating Income/Total Assets)	-2.48 %	-4.76 %	

DESIRED RATE OF RETURN - CALCULATION

	AMOUNT (C)	RATIO %	COST RATE %	WEIGHTED COST %
Long Term Debt	260,119	45.51	3.65	1.66
Equity	311,392	54.49	3.30	1.80
TOTAL (sum of weighted costs)				3.46
DESIRED RATE OF RETURN :		3.46 %		
OPERATING INCOME REQUIREMENT:		25,247,805		
(Desired rate of Return/Total Assets)				
REVENUE DEFICIENCY		43,327,079		
(Operating Income Req./Operating Revenue)				
REQUIRED RATE CHANGE		41.71 %		
(Revenue deficiency/Operating Revenue)				

In 1988, ANDA's rate of return on assets (operating income/total assets) was -2.48 percent. The required rate of return is calculated by summing the weighted cost rate on the long term and equity components of ANDA's capital structure. The cost rate of long term debt is determined by dividing annual financing payments by long term debts. this yields a 3.65 percent cost rate of debt. The relatively low figure reflects the concessionary nature of much of ANDA's debt. The cost rate of equity is the growth in asset value from 1987 to 1988, 3.30 percent. It is assumed that in order to maintain a viable financial position a public utility's equity should grow at a rate approximating the growth of the system.

This estimate of the cost rate of equity is low because ANDA has not been investing in its system at an adequate rate.

ANDA investments have declined steadily since 1981 as shown in Table III.F.6. The table also shows a decline in ANDA's total expenditure and as a share of total public expenditure.

TABLE III.F.6

ANDA INVESTMENTS AND EXPENDITURES - 1981-1987
(in thousands of Colones)

Year	Investments (C)	Expenditures (C)	Expenditures % of Public Sector
1981	23.0	108.3	2.75
1982	19.8	72.4	1.78
1983	38.4	62.1	1.46
1984	26.1	65.8	1.30
1985	11.1	70.3	1.49
1986	13.6	73.1	1.21
1987	10.0	74.0	1.20
TOTAL	142.0	526.0	1.54

SOURCES: a) Programming and Evaluation Department, General Director of the Budget, Finance Ministry, 1988.
b) Statistical Department no. 8, 1987

These estimated cost rates are multiplied by the proportion of debt and equity applicable to each. The two resulting weighted cost rates are summed to derive ANDA's desired rate of return, 3.46 percent. A 3.46 percent return on assets yields an operating income requirement of 25.2 million. As ANDA's actual 1988 operating income was negative 18.1 million, ANDA has a revenue deficiency of 43.3 million. The revenue deficiency divided by ANDA's operating revenue yields a required rate increase of 41.7 percent. A premium should be added to compensate for inflation.

It should be noted that three factors make this a conservative estimate: 1) undervalued assets 2) ANDA's concessionary interest terms and 3) growth rate in asset value which is probably insufficient to maintain current operational levels. As this rate increase is based on constant monetary values, an inflation premium should be added over time.

A rate increase of this magnitude should be "phased-in" over a number of years in the near term. "Phasing-in" the rate increase will serve to lessen the rate shock to consumers and dampen the negative elasticity effects. A phased increase, if properly scheduled and announced, will avoid perceptions that ANDA is an unpredictable agency and will help to improve the business climate.

3. PLANSABAR

PLANSABAR has been executing smaller scale rural water supply projects with an emphasis on their social impact. Because it is part of the Ministry of Health, PLANSABAR is analyzed primarily in terms of its budget execution.

Table III.F.7 shows the tariffs applied by PLANSABAR.

From 1982 to 1984, budgets were implemented at about 80% of the assigned amounts, an acceptable level. However, from 1985 on there were implementation problems and major delays in the expansion program financed by the IDB. In May, 1988, work had only advanced 10% for water supply and 5% for latrine. Total investments were only $2,801,840: out of a total of $28 million; $563,740 from IDB and $2,268,100 from the GOES.

Most of the counterpart funds were used for administrative expenses, which were financed until December 1988 by AID funds. As a result, after being audited, PLANSABAR was declared ineligible for AID funds. To complete local counterpart funds, finance was obtained for two years, for a sum of C 4,700,000, from the local currency generated by Japan's grain donation.

TABLE III.F.7

RURAL WATER SUPPLY TARIFFS
(Established in December 1978)

A. Tariffs for Existing Systems

1. Gravity Systems
   - House connection C3.00 monthly subscription
   - Public service C0.50 monthly subscription

2. Electric pumping system
   - House connection C1.00 additional to above tariff, not to exceed C5.00
   - Public service C1.00 monthly subscription

3. Manual pumping system
   - public service C0.25 monthly subscription

B. Tariffs for New Systems

1. Gravity systems
   - House connection C3.00 monthly subscription
   - Public service C0.50 monthly subscription

2. Electric pumping systems
   - House connection C5.00 monthly subscription
   - Public service C1.00 monthly subscription

3. Manual pumping systems
   - Public service C0.25 monthly subscription

C. Tariffs for Consumption over 20/month
C3.00 per each above 20

Source: PLANSABAR

Current expenditure increased from C 760 thousand in 1982 to C 1,581,458.74 in 1988, and capital expenses rose from C 2,373 thousand in 1982 to C 11,742 thousand effectively spent in 1988, although C 27,190 thousand had been obligated.

The relation between income and expenditure for exploration and maintenance varied between 57% in 1982 to 222% in 1986, back to 57% in 1987 and 900% in 1988. This is largely due to reduced operation and maintenance costs. Income has increased only from C1,311,000 to C1,562,000 from 1986 to 1988. This seem to imply large variations in actual maintenance and operations from year to year, and indicates that the system is not operating properly.

Cost recovery was 73%, in 1983, declining to 60% in 1984 and 54% in 1988. Not only have rates increased but debt collection was abandoned in conflict zones. Contrary to a prior information, PLANSABAR has been successful in collecting water charges for most other systems, generally over 90% of bills, as shown in Appendix III.F.1.

G. PRIVATE ENGINEERING/CONSTRUCTION INDUSTRY

1. Limited Registries

CASALCO, the Salvadoran Chamber of Construction, is a private association of persons and companies working in the construction field. It classifies members into general contractors, consultants and suppliers. The Consultants have met with officials of this organization.

CASALCO does not rank either consultant or contractor members, and is only recently trying to gather information on member volume of business. This makes it difficult to assess the strength of firms in this field. At present, CASALCO's division of General Contractors has hired a marketing firm to study the situation of the construction industry in the country.

Contrary to other institutions, ANDA does not register firms with a ranking according to their technical, equipment and financial capabilities, or their experience. However, those firms currently registered with ANDA are listed in Appendix III.G.1.

2. Business Environment

In large projects open to international bidding, national firms complain of little or no participation. Salvadoran legislation doesn't require foreign firms enter into to joint ventures with local firms when bidding. Salvadoran firms are too small to pre-qualify for these consulting or contracting services, and their participation is normally limited to that of sub-contractors. There are probably not more than two or three local consulting and contracting firms able to carry out projects with construction costs beyond the 5 to 7 million dollar range. Should large projects develop in the future, both local consultants and contractors could rapidly improve their capabilities, by participating first in joint ventures with experienced foreign firms.

Local firms have proposed a "Regulatory law for the Contracting and Consulting Industry" by which foreign firms would be bound to enter into joint ventures with local firms in order to participate in Salvadoran Projects.

The ratio of shares still has not been established but a 60/40 foreign/national ratio is often mentioned.

During the past ten years some contractors have been working in, war areas after reaching special agreements with the insurgent forces. Because equipment and contractor

installations away from the urban centers are prone to be destroyed, contracting costs have risen appreciably.

Contractors can insure 50% of their equipment at job site, against damages by guerrilla warfare. The are low duties on the import of construction equipment and it is duty free for government projects.

3. Design and Construction

PLANSABAR constructs all their rural systems by administration, with community participation under formal subcontracts. Storage tank construction, pipelines and power lines are contracted out, normally within the rural communities. PLANSABAR also drills wells with equipment donated to them or purchased under the IDB programs.

ANDA executes all construction work by public national or international tender, depending on the source of finance. For national tenders, ANDA tries to break down the projects in packages to award them to several contractors.

H. PROBLEM AREAS

The Salvadoran sanitation sector faces large and unsurmountable problems.

1. Inadequate Water Supply Coverage

The Government's inability to keep abreast of domestic water needs in El Salvador is not a recent phenomenon. Needs have been compounded by the recent conflict which has contributed, in numerous ways, to the loss of services where they once existed. It has also displaced the country's population and has overstressed systems designed for smaller populations.

ANDA's large systems were not designed to handle the loads of the current populations in their service areas. This is due to normal population increases, lack of expansion, and recent population shifts attributable to the ongoing conflict. All systems need frequent repairs which are exacerbated by population overload.

Despite heavy annual rainfall, most communities lie outside the range of a formal water system for domestic use. Furthermore, those communities that do have systems are beset by, a myriad of problems, rendering their systems unreliable, inconvenient and unsafe.

Inadequate supply is a major contributor to health problems in El Salvador. Many people are treated for illnesses traceable to waterborne sources. Unfortunately, people

treated are released to the same environment and become sick again.

The situation is not improving. In fact, the agencies charged with providing adequate water are losing ground to the problem. It will compound itself in the future as current maintenance is inadequate and development plans aren't sufficient to cover the existing population plus the expected population growth.

2. Waste Water Disposal

Currently, waste water is discharged from existing systems into rivers and waterways without previous treatment. At best there is an oxidation process in the larger systems.

This is a matter of great concern because, as streams and underground waterways are being polluted in one area, the same water is later extracted in other areas as water supply. About 42,000 cubic meters of untreated waste waters are dumped daily in to the rivers and streams of the country. Treatment plants are only now being planned for San Salvador and other large cities.

There are too few statistics related to water sampling and testing at sources. ANDA has laboratories do not adequately serve the numerous systems throughout the country.

3. Institutional Problems

There is a lack of coordination and a redundancy in rural water supply planning capabilities, given the several agencies involved in these programs.

Local communities only participate in some aspects of construction and maintenance, and are at the receiving end of agency decisions.

Design standards are high, resulting in excessive costs for rural and small urban systems. Centralization results in the letting of larger construction contracts which also tend to increase design and construction costs.

National agencies have pre-emptied the municipal water supply role rather than seeking to enhance it.

4. Financial Problems and Tariffs

ANDA debt is way beyond its financial capacity. As of August, 1989 the debt has reached 544 million colones and long term debt is about 54 percent of assets. This situation grew when ANDA took on a foreign debt for the Northern region

(Zona Norte) project.

ANDA investments have declined steadily since 1981, while its debt increased considerably, largely to cover deficitary operations.

Total investment estimated to cover sector's deficit in facilities by the year 2000 would require annual investments totaling approximately $70 million. Even with donations, the country would have to provide counterpart funds amounting to annual disbursements of about $7 million above their present budget.

With low tariffs, operating income does not cover operating costs. Thus, even donations for investments increase losses. Systems have to operate with subsidies, without maintenance, or with deficits.

Water tariffs should be set to fully cover costs. However, water supply is traditionally perceived as a public service, and users do not expect to cover installation and operating costs.

To address, these problems the following steps should be taken.

- A full tariff study should be undertaken for both agencies including, review of metering and billing procedures,revaluation of assets, unwillingness to pay, and a medium term program to "phase in" new rates.

-The Government should revise tariffs on a gradual basis

-Further use should be made of community participation schemes, preferably with hired community labor.

-Donor countries and agencies should expand contributions to their maximum extent.

I. PUBLIC HEALTH

The purpose of reviewing El Salvador's public health situation is only to provide a basis for evaluation of the impact of water supply and sanitation programs upon health.

1. Water and Sanitation

A key determinant of public health is the human environment. Existing water and sanitation conditions are described at length in Section B (inventory of facilities).

The ecological status of a community's water supply is

represented by the type of water system and water source conditions.

For those without public water supply, water comes from open springs and is carried to houses or access points via bamboo or other tubes; hand-dug wells which lack curbing or protective covers creeks, rivers and lakes, and commercial sources. These are all subject to pollution and are generally considered major sources of waterborne diseases.

Human excreta are a major source of disease transmission. Contact with excreta can occur through poor personal hygiene, lack of sanitation facilities, and inadequate wastewater disposal.

2. Health Characteristics

a. Mortality

Mortality rates by department and location from 1980 through 1984 are shown in Appendix III.I.1. During these years, much fighting took place. People became refugees as the war intensified. Also, reporting procedures were not standardized and many deaths, even in non-violent circumstances were not reported. Therefore the data must be viewed as general indicators rather than as precise situational statements.

As would be expected, the death rate is, in general, higher for rural dwellers than those from urban areas. This is due to better access to clean water, health care facilities and education facilities.

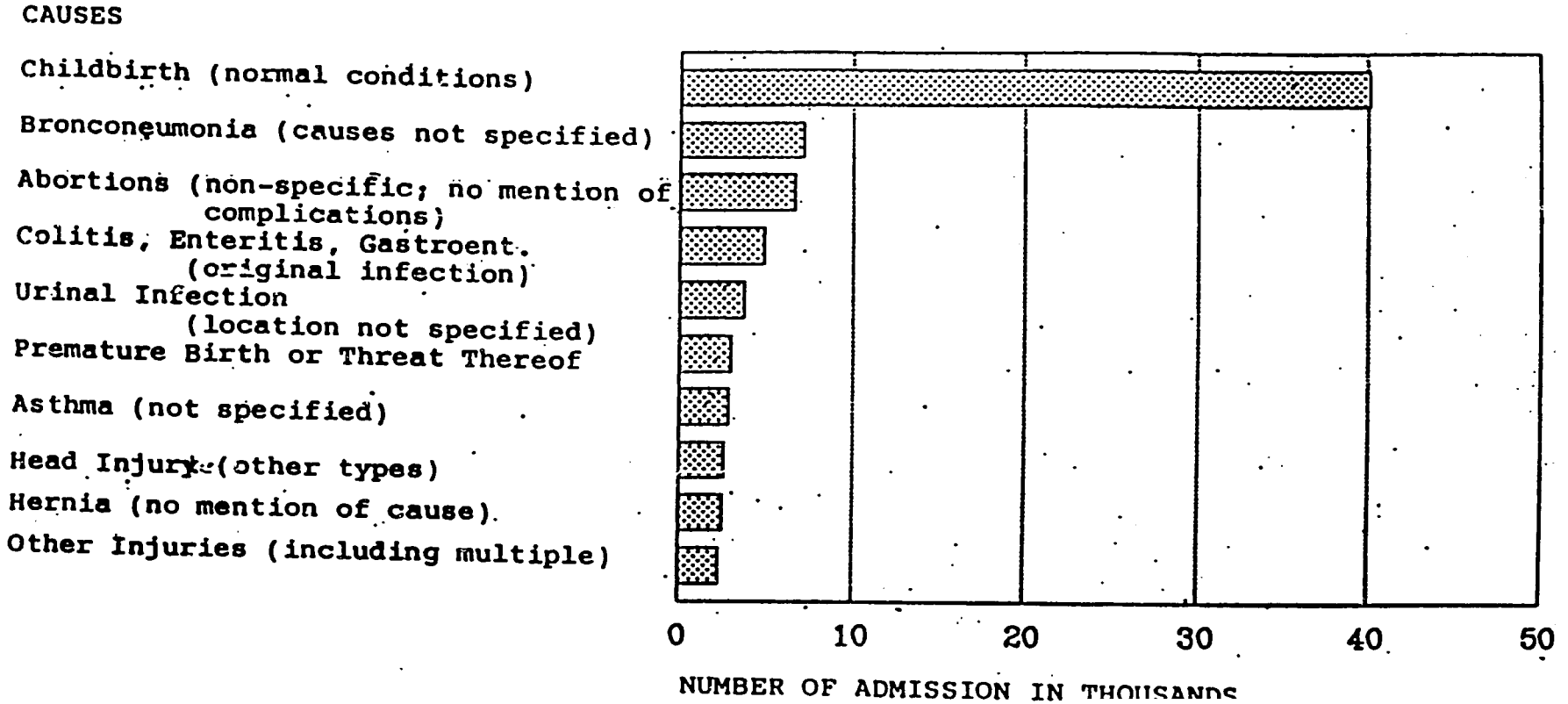
For some years, the difference in the mortality rate between rural and urban population closed, due to steady migration of the rural population into cities. This resulted in a population with a poorer health status, higher mortality rate and a further overburdening of the health care system. Also, being located in a urbanized area, deaths would be more likely to be reported.

b. Morbidity

A standardized reporting system was initiated by the Ministry of Health and USAID in 1987. While mortality rates are, as noted above, questionable, adult or regional morbidity information is even more scarce. Data for 1987 hospital admissions, are shown in Graph III.I.1.

However, the largest utilization of hospital care is for pregnant women. Disease-related admissions can serve as a proxy indicator of morbidity problems. Diarrhea, which is

TEN PRINCIPAL REASONS FOR HOSPITAL ADMISSIONS NATIONWIDE
EL SALVADOR - 1987



Data: Statistic Unit, MSPAS

GRAPH.III.I.1

included with gastro-intestinal problems, is the fourth ranked cause of hospitalization. This low rank is perhaps due to the urbanization of the client group and to their access to clean drinking water.

Morbidity by age and sex, like general morbidity is reflected in hospital admissions. Graph III.I.2 shows aggregate data for El Salvador in 1988, the first year with standardized reporting. The graph shows a high utilization of hospital services by infants and women of child-bearing age. Until the age of 13, hospital use by males runs slightly above that of females. This parallels the slightly higher mortality rate in males than in females and indicates a higher morbidity rate in male children. Once females reach child-bearing years they are the dominant client group, reaching a peak in their twenties and tapering off in their early fifty's. At this point males and females make approximately equal use of hospitals.

The vast majority of the illnesses in this country, rural or urban, never are of the reported. Hospitals services are expensive and many Salvadorans will never set foot inside of one. So these data are only a first and very skewed approximation of an unknown reality.

(1) Diarrhea/Morbidity

Diarrhea is no longer the number one killer of infants, as perinatal problems and respiratory diseases became the top two causes in infant mortabiltiy.

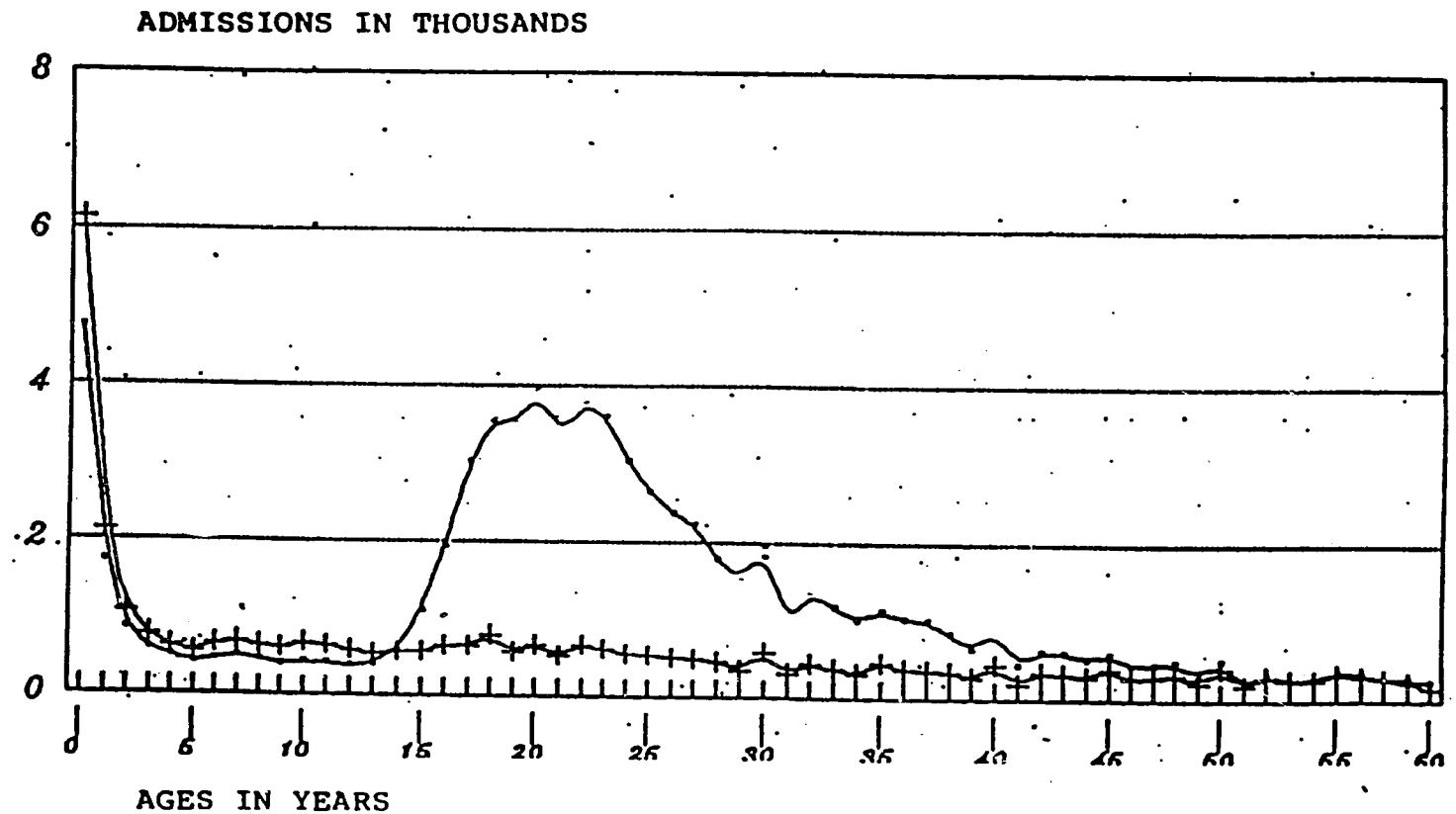
An estimated 150,000 cases of diarrhea were recorded in 1988 by the Ministry of Health. However, given the war and the limited number of points at which cases of diarrhea can be reported, this must be considered a very conservative figure.

Given the recent implementation of standardized health reporting, an accurate historical presentation of the incidence of diarrhea is not possible. USAID has estimated and projected the following rates of diarrhea per 1,000 population:

1986	1987	1988	1989	1990	1991
133	140	150	159	168	177

With the advent of the new reporting system and expanded health services, the reported incidence of diarrhea is expected to increase over the next several years even as water and health education is made available to a greater part of the population.

NATIONWIDE HOSPITAL ADMISSIONS
By AGE AND SEX
EL SALVADOR 1987



FEMALE - 79,605 MALE - 40,405

Data: Statistics Unit, MSPAS

· Female + Male

GRAPH III.I.2

Chart III.I.3 shows the prevalence of diarrhea by age of child and location. The survey method was used to collect this data. Health workers asked mothers if their child had diarrhea within the two weeks prior to the interview.

Table III.I.4 shows the estimates generated by the Association Demografica Salvadorena (Pro-Familia) and the National Center for Disease Control in Atlanta Ga., by age, and area for 1985 and 1988.

TABLE III.I.4

Percent of Children Having Diarrhea in a Two Week Period by Age and Area of Residence for 1985 and 1988

Area	Metropolitan		Other Urban		Rural		Total	
Age	1985	1988	1985	1988	1985	1988	1985	1988
0	33.4	23.4	43.7	27.6	48.6	46.8	43.3	38.3
1	44.8	33.3	49.3	40.4	53.3	50.0	49.9	44.6
2	31.0	15.5	50.0	29.9	35.0	32.2	37.6	28.9
3	24.2	13.8	25.5	16.8	26.7	16.3	26.7	15.9
4	19.1	8.3	22.0	15.5	24.3	14.6	22.3	13.6
Total	30.4	19.3	39.0	26.6	37.7	33.2	36.1	29.0

Source: FESAL: 88

A marked improvement in the morbidity rates due to diarrhea can be observed in the intra-area comparisons. In the two urban areas, the incidence of diarrhea dropped by one third and the rural areas showed an 8.8% improvement. Within age groups, there was an increase in morbidity for infants under one year but other age groups showed a decrease in morbidity.

c. Infant Mortality

As with morbidity rates, infant mortality rates vary by reporting system, and reporting agency. Appendix III.I.1 shows the infant mortality rate by department and urban/rural for the years 1980 to 1984.

Other estimates of infant mortality have been generated. Table III.I.5 shows the infant mortality rate by area of residence for 1985 and 1988. There is a consistent reduction in the mortality rates for all areas, with the largest gains falling in rural communities.

GRAPH III.I.3

INCIDENCE OF CHILD DIRRHEA IN CHILDREN UNDER FOUR
ACCORDING TO AREA OF RESIDENCE (%)

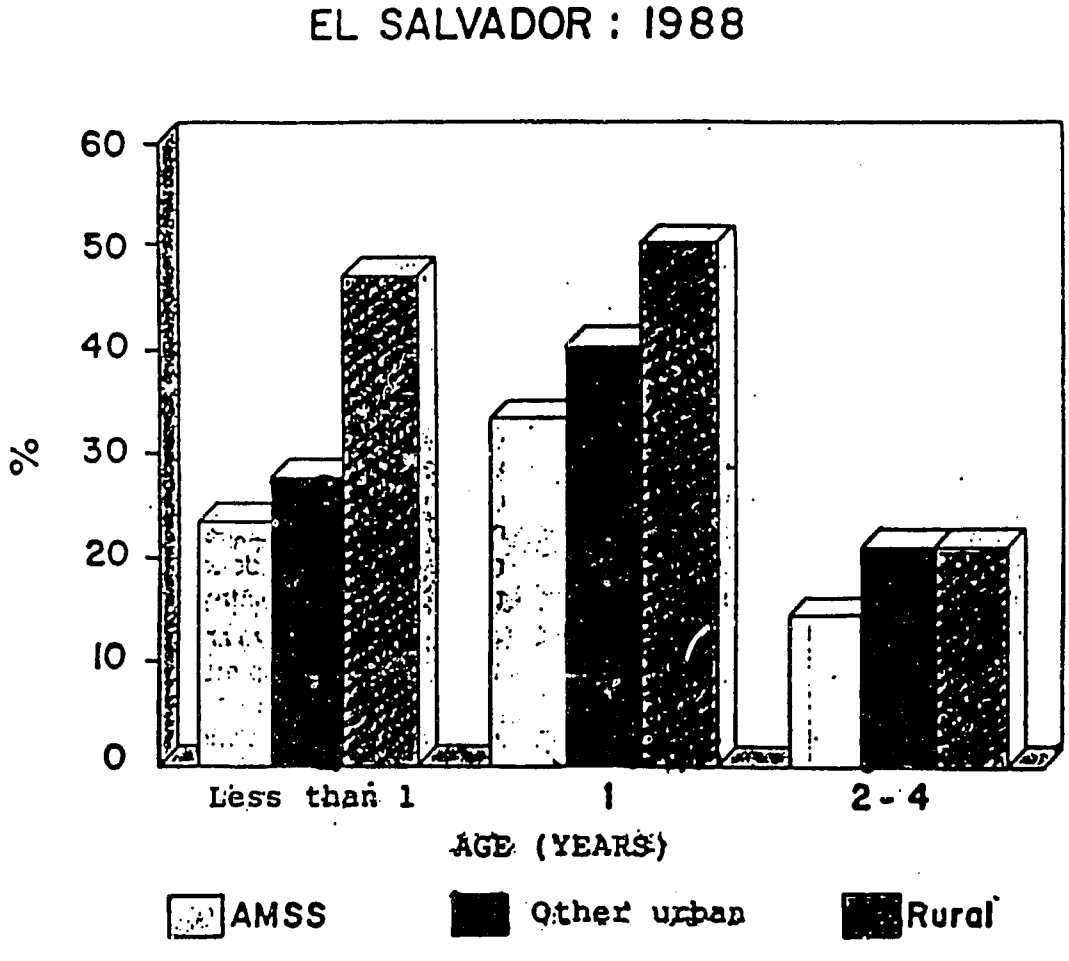


TABLE III.I.5

INFANT MORTALITY RATE BY AREA OF RESIDENCE
(per 1,000 live births)

Area of Residence	1985	1988
Metropolitan	46	42
Other Urban	56	40
Rural	81	56
Total	65	50

Source: FESAL '85/88

Table III.I.6 provides a view through time of the estimates of infant mortality made by different researchers.

While the quality of the data is subject to question and there is no reason to believe that there is consistency in research methods, the data does demonstrate a continuing improvement in the infant mortality situation.

TABLE III.I.6

COMPILATION OF ESTIMATES OF INFANT MORTALITY, 1951-1988
(per 1,000 live births)

Year	Mid Point	Rate	AUTHOR
1951-61	1956	137	S.S. ALENS ZELAYA
1961-71	1966	120	L. ROSERO B.
1966-67	-	116	HUGO BEHM
1970-71	-	95	J. POTTER (FESAL)
1980-84	1982	71	FESAL-85
1980-85	-	75	CELADE-88
1986	-	56	MONIT. Y EVALUACION DE S.I. MSPAS. EL SALVADOR
1988	-	50	FESAL-88

Source: Situation de la Nutricion y la Salud en El Salvador
FESAL 1988

d. Birth Rates

While the population is estimated to have grown at a rate of 3% from 1960 to 1978 gross, birth rates were not available. Appendix III.I.1 contains the number of live births by province and area for the years 1980-1984. Given that family size tends to be inversely related to income level, education achievements and urban locations, the table contains no surprises. In general the number of rural births continued consistently above the urban level. In all but two cases, the number of 1984 births was lower than the number in 1980.

While this data is five years old, it does indicate that the rate of increase in the population may be beginning to slacken. However, it also indicates that the need for public services will continue to grow as this population matures.

e. Health Interventions

The major effort in health interventions is being made at the community level through health education. Health education is a crucial part of the water and sanitation program. USAID is financing adult education on the use of portable water, sanitation and disease treatment.

To accomplish this, the Community Health Program is being integrated and expanded, bringing under one umbrella in the MOH, the Rural Health aides (ARC), the recently created Community Health aides and the Health Promoters of the HOPE Project. The program for fiscal 1990, supported by USAID Grant No. 519-0308 under PL-480-89, consists of 579 aides serving the same number of communities with an estimated population of 800,000. Under the terms of the agreement between USAID and the MOH, the MOH is to convert 70 aides per year to its permanent work force.

The reason for the merger of the three programs was to gain the benefits of integrated management, program development and training, eliminate duplication of effort and raise the level of care available to the communities. To assure the success of the program, it will be developed along the following guidelines:

- Aides will be selected from the communities in which they are to work.
- Community participation will be promoted in all projects.
- Preventive care, education and projects will be stressed.
- Simple medical treatments will be provided, including oral rehydration.
- Referrals to health centers will be made.
- A system of health records will be implemented including standardized reporting.

The general objective of the project is to diminish the incidence of morbidity and mortality through conscientious, organized and active participation of the community in remedial and progressive health programs. The aides will devote most of their time to education and preventive activities.

One of AID's criteria is that rural sanitation programs only be made available to communities with a health program similar to the above. Given the allocated funds, this criterion will not be difficult to meet. However, as plans are made to go beyond existing sanitation programs to reach all the country's population, the GOES capacity to carry out community health programs may be severely strained.

f. Other Health Interventions

The provision of health intervention services for the general public in El Salvador is the responsibility of the Ministry of Health and Social Services. The Ministry provides health services though hospitals and other units which are staffed by physicians, nurses, nurse assistants and operate as health education programs. The distribution of facilities and staff is shown in Table III.I.7.

TABLE III.I.7

HEALTH ESTABLISHMENTS BY DEPARTMENT

Department	Total	Hospitals	Centers	Units	Posts	Community Posts	Dispensaries
Ahuachapan	21	1	-	4	15	1	-
Santa Ana	34	1	2	10	15	6	-
Sonsonate	21	1	-	7	10	3	-
Chalatenango	36	1	1	5	29	-	-
La Libertad	29	1	-	9	12	7	-
Cuscatlan	14	-	2	3	9	-	-
La Paz	22	1	-	4	17	-	-
Cabanas	11	-	2	2	7	-	-
San Vicente	13	1	-	5	-	-	7
Usulutan	27	1	1	9	15	1	-
San Miguel	35	1	1	16	15	-	2
Morazan	23	-	1	8	14	-	-
La Union	31	-	2	10	17	-	2
San Salvador	41	5	1	23	4	8	-
Total Country	358	14	13	115	179	26	11

Source: Ministry of Planning

Centers : Locations staffed by physicians.
Unit : Locations visited by physicians.
Posts : Locations staffed by nurses or health workers.
Community posts : Locations visited by nurses or health workers.

It is clear that the present numbers of health centers are inadequate for a population of nearly 5,000,000. While each department has one Ministry of Health hospital, the accessibility of these facilities to the public is limited by location of domicile, awareness of available services and costs. Centers staffed by physicians are not available in all departments and suffer the same access limitations.

J. SOCIAL IMPACT

1. Public Health

The isolation of the impact of portable water systems upon diarrhea is extremely difficult. Infant diarrhea has a number of causes as well as a number of factors which are responsible or its occurrence.

Infectious agents, primarily ingested bacteria and viruses are the cause of the disease. It is commonly accepted that polluted water is one of the primary channels through which the disease travels. Water becomes polluted by human wastes and is then used for human consumption. However, infectious agents can be ingested with food, other liquids or simply by a child sucking its thumb. Thus, once the agent enters the household environment, drinking water is only a partial solution to diarrhea control. Factors as diverse as the availability of electricity for refrigeration, age and education level impact on the incidence of infant diarrhea and mortality.

Reduction of infant morbidity and mortality through the elimination of waterborne diarrheal agents is one of the main goals of water and sanitation projects world wide. A study was conducted by Esrey, Feachem and Hughes of the London School of Hygiene and Tropical Medicine of the results of water and sanitation projects world wide. After eliminating those projects without statistically viable results, they analyzed 97 projects. The results are shown in Table III.J.1.

TABLE III.J.1

PERCENTAGE REDUCTION IN DIARRHEAL MORBIDITY RATES ATTRIBUTED TO WATER OR EXCRETA DISPOSAL IMPROVEMENTS

Type of Improvement	Number of Projects	Reduction Mean %	Range %
All Interventions	53	22	0-100
Water quality	9	16	0- 90
Water availability	17	17	0-100
Water quality/availability	8	37	0- 82
Excreta Disposal	10	22	0- 48

Source: Interventions for the control of Diarrheal Diseases among young Children: Improving Water Supplies and Excreta Disposal Facilities, Esrey, Feachem and Hughes. Bulleting of WHO 1985.

To evaluate the impact of the potable water and sanitation projects morbidity in El Salvador, a model has been developed that incorporates these findings. The following assumptions were made:

- Health education is available to the target population and is effective.

- Health facilities are accessible to the target population.

- The impact of other variables (e.g., mother's age,etc) are randomly distributed.

- The number of children, under five, is distributed evenly among regions.

- The impact of the water and sanitation projects is equal for all projects.

- Water and sanitation projects will reach the total population.

The model results in an estimate of reduction in morbidity by area, as presented in table III.J.2.

Table III.J.3 presents an estimate of the investment needed to reduce the average number of cases of diarrhea at any given time. In rural areas, not only are costs low, the prevalence of the disease is higher.

To estimate the impact upon infant mortality, we also assume a direct lineal relationship between diarrheal morbidity and mortality exists. Thus the mortality figures can be reduced by 22 percent.

The age and education level of the mother plays a large part in whether or not her children suffer diarrhea. The availability of supporting health education programs is another. It is not feasible to define a specific mathematical relationship between clean water and reduced infant diarrhea. USAID has estimated that through its program to improve health and child survival, which includes the combined efforts of providing water and adult education, infant mortality will decline from 50 o/oo in 1988 to 42 o/oo in 1993. However, for purposes of estimating impact, we assume infant mortality rates as follows in Table III.J.4.

TABLE III.J.2

IMPACT OF MEETING WATER AND SANITATION NEEDS
ON CHILD DIARRHEAL MORBIDITY

(Deficit in Year 2000 including planned projects)
(Population in '000)

AREA	TOTAL	CHILDREN UNDER 4	MORBIDITY W/O WATER	MORBIDITY W/ WATER	CHANGE	CHANGE 1000 POP %
Rural	3164	506	147	115	32	10.2
Urban	556	89	24	19	5	9.3
AMSS	786	126	24	19	5	10.6
TOTAL	4506	721	195	153	42	9.3

AMSS - San Salvador Metropolitan Area

TABLE III.J.3

WATER SUPPLY & SANITATION INVESTMENT COST
TO REDUCE DIARRHEAL MORBIDITY BY ONE

AREA	AVERAGE INVEST. PER 1000	REDUCTION AVG.COST PER 1000	INVEST. COST REDUCED /20 YEARS
Rural	115,000	10.2	$ 564.0
Urban	340,000	9.3	$1,828.0

TABLE III.J.4

Area	Infant Mortality per/100 births without Water & Sewerage	with Water & Sewerage	Reduction
RURAL	66	51	15
URBAN	47	37	10
METROPOLITAN	33	26	7

Extrapolations of existing data were used to generate the number of live births, and number of infant deaths due to diarrhea for 1988. An impact estimate was than generated by subtracting the two mortality rates. The results are shown in Table III.J.5. In Table III.J.6, the investment cost to reduce infant deaths by one is roughly estimated. A constant birth rate in rural and urban areas is assumed in these two tables.

2. Employment Creation/Community Participation

Other social impacts of public works projects that merits consideration are increased labor generated by the repair and development of infrastructure, and community participation in project development and implementation. Three projects are currently underway in El Salvador in water and sanitation that have impacts in both of these areas. As future projects are carried out along a similar vein, there would be a comparable impact. Each is shown according to the following criteria:

- community actions taken
- employment created by type
- labor contributed by type
- User fees.

The aggregated employment impacts of typical projects by organization and skill level are shown in Table III.J.7. The employment and income benefits of water supply and sanitation projects are significant, especially since they benefit by providing many of the very poor with employment at the village level.

TABLE III.J.5

IMPACT OF MEETING WATER AND SANITATION NEEDS
ON INFANT MORTALITY
(Deficit in Year 2000 including planned projects)

AREA	TOTAL	LIVE BIRTHS	MORTALITY		CHANGE	CHANGE 1000 POP %
			W/O WATER	W/ WATER		
Rural	3,164,000	115,000	7,600	5,900	1,700	0.54
Urban	556,000	20,000	900	700	200	0.36
AMSS	786,000	28,000	900	700	200	0.25
TOTAL	4,506,000	163,000	9,600	7,500	2,100	0.47

SOURCE: ISA Consultants

TABLE III.J.6

WATER SUPPLY & SANITATION INVESTMENT COST
TO REDUCE INFANT MORTALITY BY ONE

AREA	AVERAGE INVEST PER 1000	REDUCTION IN DEATHS PER 1000	INVEST. COST REDUCED /20 YEARS
Rural	115,000	0.54	$10,600.0
Urban	340,000	0.36	$18,900.0

SOURCE: ISA Consultants

TABLE III.J.7

EMPLOYMENT IMPACT OF TYPICAL WATER PROJECTS BY ORGANIZATION AND SKILL LEVEL

	PLANSABAR	ANDA	SAVE THE CHILDREN
Typical Population	1,000	2,000	20,0000
SKILL LEVEL			
Supervisor	6	15	6
Skilled Labor	65	18	85
Unskilled Labor	150	250	2,500
TOTAL	222	283	3,358
per 1,000 people served	220	142	167

Average : 176

nb. 1 person per month = 26 days

SOURCE: ISA Consultants

a. **PLANSABAR**

PLANSABAR installs water systems in communities with populations between 400 and 2,000. Communities request a water system, create a junta to be responsible for managing the system and collecting user fees, and agree to provide labor and materials.

According to PLANSABAR sources, typical projects take an average of 5.5 months to complete.

Employment is generated for skilled labor, usually for masons in tank construction, electricians for putting in the power supply to the pumps, and for pipe fitters. On the average six workers in each category are used with pipe fitters working the length of the project while masons and electricians work percent of the project's duration. This yields an average of 66 man months of employment for skilled labor per project. Skilled laborers receive C45 per day.

The project generates community contributed labor. Labor needs are assessed against a community at the rate of one day per week per household. In those cases where a worker is not available, the household may pay for the labor at the standard rate of C 13 per day. Generally the labor is used for site clearing, ditch digging and transporting materials.

User fees are paid into the junta treasury. The junta can spend up to 30% of the income on maintenance of the system.

The balance is paid to PLANSABAR which holds overall maintenance responsibility.

b. **ANDA**

ANDA has two types of rural water systems. They are hand pumps and pipe line systems. Both of these systems are built at the request of rural communities, but without further participation of the community. However, inaccessible villages that wish to receive hand pumps must provide an access road for the drilling equipment.

- Hand Pump Systems

Well drilling and curbing takes an average of three days to complete. Drilling crews consist of five laborers and one supervisor. Laborers are paid C 60 per day and the supervisor receives C 120. Installation of the pumps takes one day to complete and requires the work of three men who receive C 40 per day each.

- Pipe Line Water Systems

These systems take an average of five months to build. Work is done by private contractors who have reported the following information. Construction requires 50 laborers for five months making C 21.63 per day and three supervisors making C 75 per day. Three and one half months of skilled labor, pipe fitters, masons, etc. are also required at C 30 per day.

ANDA's goal of turning each water system over to the community that it serves is a step in the direction to make the community responsible for collecting the user fees, employing the system operator and maintaining of the system. Each community is required to appoint a junta responsible for these functions.

c. **Save The Children**

Save the Children has two types of projects. Each of these are discussed below.

- Gravity Systems

A large project serving 20,000 people is located in eastern El Salvador. It is a gravity fed system which will take four years to build. Each family was assessed 150 days of labor over the life of the project, and had the option of paying C 12/day if they chose not or could not work. The community also provided local materials such as stone, sand and wood. The project employed 13 men per year, generating

71 man years of employment, and workers were paid C 30/day. Save The Children has completed smaller gravity projects averaging 30 families each and taking five months to complete.

- Hand Pumps

While site preparation and access may require some time, the drilling of the well, curbing, and site installation requires only three days. A drilling crew consists of a drill operator, supervisor and three laborers, who are paid C 100, C 200, and C 50 respectively. The project has generated approximately 150 days of work for drillers and supervisors and 450 days of employment for laborers.

K. ECONOMIC EVALUATION

1. Economic Costs

Using the shadow prices and conversion factors presented in Volume I (Macroeconomic Aspects) and the cost breakdown for each water and sewerage construction activity by labor, material, equipment and markup components shown in Table III.E.6, we have computed the economic costs for each of the modular systems.

The economic construction costs for each system are presented in Appendix III.K.1 and summarized in Table III.K.1. Since the evaluation is being performed for Modular composite water supply and sanitation systems, economic costs for both are summed. Without detailed field data for specific systems it is almost impossible to separate water and sanitation benefits.

For the systems serving 400, 1000 and 2000 people, latrine costs have been inserted based on the assumption of 6 persons/latrine. For populations of 10,000 , 25,000 and 50,000 , the inclusion of water and waste water treatment were considered as an alternative.

The operation and maintenance costs summarized in Table III.E.11 were calculated in economic terms based upon a breakdown of 60% labor and 40% equipment and material, resulting in a conversion factor of 1.

2. Economic Benefits

a. Approaches

There are two approaches to evaluating projects with significant social impacts such as water projects. These can be broken down as follows:

TABLE III.K.1

ECONOMIC COST PER CAPITA
MODULAR WATER SUPPLY AND SANITATION SYSTEMS

MODULAR SYSTEM		
POPULATION SERVED	DESIGN l/Person/day	$/CAPITA
Rural		
400	100	61.1
1,000	100	138.5
2,000	100	116.8
Urban Expansion w/out Treatment		
5,000	175	283.5
10,000	200	238.7
25,000	250	303.9
50,000	250	268.3
Urban Expansion with Treatment		
10,000	200	307.8
25,000	250	356.3
50,000	250	309.7

SOURCE: ISA Consultants

- the social welfare function

- the economic valuation of social impacts.

(1) Social welfare function.

The use of the social welfare function is based on the concept that society looks to achieve more than one objective. In addition to increased income per capita, for example, we also seek greater life expectancy.

Rather than compute the economic value of greater life expectancy, one explicitly recognizes that society seeks this as a humanitarian objective, separate from increased economic production, measured by income per capita. A typical social welfare function can be conceived as follows:

$$W = aX + bY + cZ$$

$$a + b + c = 1$$

Where X,Y and Z are measures of society's key objectives and a, b and c are weights which indicate the relative importance society attributes to each objective. These objectives might be:

- higher income per capita, reflected in the increased consumer surplus, measured by an internal rate of return.

- life expectancy, of which infant mortality is a key determinant in developing countries, and

- income distribution.

The weights can be dealt with in one of the following ways:

- Public opinion surveys, representative of society, allow weights to be specified

- They are defined by a democratically elected government accepted as effectively reflecting society's views in general

- The probable impacts of investments in each objective are presented separately, leaving it up to the decision-maker to set priorities by taking more than one objective into account. Implicit weights can then be calculated, based on the choices each decision-maker actually makes.

In the previous section the Consultants computed the impact

of water supply and sanitation projects on reduced diarrhea and infant mortality. In a welfare-function approach, these are measured in terms of the cost-effectiveness with which they are achieved, such as the water investment cost needed to reduce one infant death.

These can then be weighted to estimate increased social welfare. In this section, they are estimated in economic terms as discussed below.

(2) Economic Evaluation of Social Impacts.

For those who prefer to estimate the value of caring for and saving a life in economic terms, the consultants have included computations of health care and human resource savings, as defined below.

b. **Types of Benefits.**

These benefits are measured for the water-supply and sewerage projects:

- the increase in consumer surplus, i.e. more water at lower cost

- health care savings from decreases in infant morbidity, especially for children under 4, measured by reduced child care and oral rehydration therapy needs

- human resource savings from the decrease in infant mortality, incorporating only those reduced deaths under the age of one year, based upon an estimate of the value of a human life at birth.

All estimates continue to be based on the assumption made in Section 'J'. Other assumptions, made to obtain the estimates below, are set out as each calculation procedure is explained.

c. **Consumer Surplus**

Economic benefits have been calculated based upon the consumer surplus methodology described in Appendix I.C.2. of the summary report.

(1) PLANSABAR Base-line Survey

Data were obtained from a PLANSABAR base-line water user survey carried out in 1986 which estimated water consumption and costs with and without public water-supply for five projects, which were designed to serve from 1101 to 1916 persons. Details of the survey results are shown in Appendix

III.K.2. Table III.K.2 presents summary results which indicate the following averages:

Table III.K.2

Summary of Planasabar Base-Line Survey

Condition	Cubic meters/ person/year	Colones/ cubic meter
Without public water supply	8.3	5.57
With public water supply	27.4	0.06

This information is key to calculating project benefits expected from increases in water consumption and resulting consumer surplus. The quoted values are financial costs.

For urban systems, preliminary data was obtained from a survey recently carried out by AMSA as part of their three-city master plans, This data was corroborated by spot field checks.

(2) Reduction in the Economic Price of Water

Economic costs have been computed as follows:

The cost of water in urban areas is based on the share of water purchased from neighbors, brought by cart in containers and sold by the barrel from tank trucks. Thus, Table III.K.3 shows the economic cost of water without projects. It also presents costs with modular system implementation based upon full payment by users of economic construction, operation and maintenance costs over the life of each project.

The Consultants have not been able to locate PLANSABARS' base-line study's original computations, nor the bases adopted for calculating the cost of obtaining water from streams, public wells or filling containers from other sources. However, assuming that they used going unskilled labor rates, we have applied the appropriate conversion factor.

(3) Estimated Consumer Surplus

The estimated benefits gained from more water availability and lower cost assumes, for each modular system:

TABLE III.K.3

ECONOMIC PRICE AND MONTHLY TARIFF
WATER WITH & WITHOUT PROJECTS

MODULAR SYSTEM		ECONOMIC PRICE	ECONOMIC TARIFF
POPULATION SERVED	DESIGN Liters/person/day	Colones/ cu.m	Colones/ month
Rural			
400	100	0.41	7.4
1,500	100	1.39	25.1
2,000	100	1.26	22.7
Urban Expansion without Treatment			
5,000	175	2.43	43.8
10,000	200	1.15	20.8
25,000	250	1.36	24.6
50,000	250	1.24	22.4
Urban Expansion with Treatment			
10,000	200	1.90	33.4
25,000	200	1.69	30.5
50,000	250	1.52	27.4
Without Public Water Consumption			
400 - 2,000	23	7.9	
5,000 - 10,000	33	9.2	
25,000 - 50,000	50	11.4	

NOTES: 1. Economic Price includes sewerage & latrine costs
2. Economic Tariff does not include Latrine

SOURCE: ISA Consultants.

- population growth rate of 2.5% per annum for modules up to 10,000

- growth rate of 3% per year for modules of 25,000 or more

- preliminary costing assumptions found in Section 'E', including consumption in liters per day per family, water source, population densities, community elevations, etc.

d. **Health Care Savings**

A first attempt is made to place a value upon the reduction in diarrheal morbidity projected in Section 'J'. We assume that without water supply and sanitation:

- At any given time, 38% of rural children and 32% of children from ages 0 to 4 have diarrhea.

- Rural morbidity would be reduced to 29.6%, a decline of 8.4%.

- Given that 16% of the population are between 0 and 4 years of age, the projected reduction in morbidity is 1.34% of the rural population.

We assume that the family member would devote approximately 30% of his/her time to the child for a cost of $0.49 per day per sick child (monthly unskilled rate of $90/month * .85 conversion factor * .8 adjustment factor for this type of labor). The cost of oral rehydration therapy per day is estimated at $0.20. Thus, total cost per day that a child is sick is estimated at $0.69. There would be no measurable difference in productivity once the child grows up.

f. **Human Resource Savings**

A rough estimate is included for the value of the human lives saved through reduced diarrheal infant mortality. The following assumptions were made concerning this estimate:

To estimate a child's cost to society:

Poor families have an income of $960 per year.
A child under 10 represents approximately 10% of consumption of a typical family.
Consumption is 90% of income.

National income increases as follows:

National income per capita remains constant through 1993 and increases at 2% per year thereafter.
Income distribution does not change.

A youth is assumed to produce as follows:

From 10 to 19 years, a youth earns an average of 75% of adult pay and consumes 25%.

As an adult:

From 20 to 62, a person earns the prevailing average annual wage of $1920 and consumes 25%. After that age, projections are immaterial because the present value of income approaches zero.

Value of human life at birth today is approximately $3123.

The reduction in mortality is estimated as follows:

Infant mortality without water is 59%, on average (66% in rural areas and 47% in urban areas, excluding Metropolitan San Salvador). This would be reduced by 22% with water. There are annually 36 live births per 10,000 population. Deaths are reduced annually by 47 per 100,000 population.

3. Summary of Benefits

Table III.K.4 presents a breakdown of first year benefits by each system. The labor savings in fetching water and its increased availability are the key benefits. Public water is many times cheaper than when otherwise purchased. The economic valuations of saving in health care and human resources are much lower.

TABLE III.K.4

FIRST YEAR BENEFITS - WATER AND SEWERAGE MODULAR SYSTEMS

MODULAR SYSTEM (POP)	CONSUMER SURPLUS/CAPITA VAR P C/cu.m.	VAR cu.m.	CS Colones	HEALTH CARE SAVINGS	HUMAN RESOURCE SAVINGS	TOTAL COLONES
400	7.49	28.20	167.77	19.62	1.84	189.23
1000	6.51	28.20	145.75	19.62	1.84	167.21
2000	6.64	28.20	148.71	19.62	1.84	170.17
5000	6.77	30.88	206.04	16.52	1.31	223.86
10000	7.31	40.00	255.97	16.52	1.31	273.80
25000	9.71	41.25	404.04	16.52	1.31	421.10
50000	9.88	41.25	411.27	16.52	1.31	429.0989

As the impact of diarrhea upon public health has declined with the advent of extensive health programs, the remaining impact of water and sanitation declines. In general, the impact of public health programs over the years has reduced the prevalence of waterborne diseases. Thus, while still very important, the impact of water programs upon health has declined somewhat. Yet, the argument remains in favor of prevention rather than even simple cures.

4. Benefit-Cost Comparisons

The seven modular water and sanitation systems have been evaluated and the results are shown in Table III.K.5 and Figure III.K.6. Detailed compilations are shown in on Appendix III.K.3.

The following indicators have been used:

- internal rate of return

- net benefits/investment

The hand pumps and latrine module for 400 persons is highly feasible largely due to its low cost. To the extent there is significant cost computations in obtaining water from the pumps, the 44.9% internal rate of return may be reduced. Low internal rates of return for modules from 1000 to 5000 table iii.K5 suggest special care in:

- devising simplified design standards, including possible house connection - handpump combinations, balanced against a careful evaluation of demand and capacity to pay

- equitable and economic tariff and collection systems.

The expansion of water and sewerage systems in towns between 10,000 and 50,000 inhabitants are feasible, especially due to their capacity to pay for more water.

This analysis indicates that the highest economic and social returns can be expected from rural water supply and latrinization with large urban systems a close second. It has, however, the following limitations:

- We have not evaluated sewerage projects separately. Projects in those areas where water supply is already available as well as treatment programs to prevent discharging raw sewage may be especially important.

- The individual circumstances of each town and project will vary in terms of construction cost, prevailing water charges and health conditions.

TABLE III. K. 5.

ECONOMIC EVALUATION
MODULAR WATER SUPPLY & SANITATION SYSTEMS

POPULATION SERVED	DESIGN L/P/D	INTERNAL RATE OF RETURN (%)	NET BENEFIT/ INVESTMENT
Rural			
400	100	44.9	3.69
1,000	100	13.3	1.08
2,000	100	16.2	1.27
Urban Expansion without Treatment			
5,000	175	8.3	0.79
10,000	200	35.8	1.73
25,000	250	28.2	1.49
50,000	250	31.2	1.61
Urban Expansion with Treatment			
10,000	200	9.0	0.82
25,000	250	17.9	1.39
50,000	250	21.2	1.63

SOURCE: ISA Consultants

ECONOMIC EVALUATION
modular water supply & sanitation

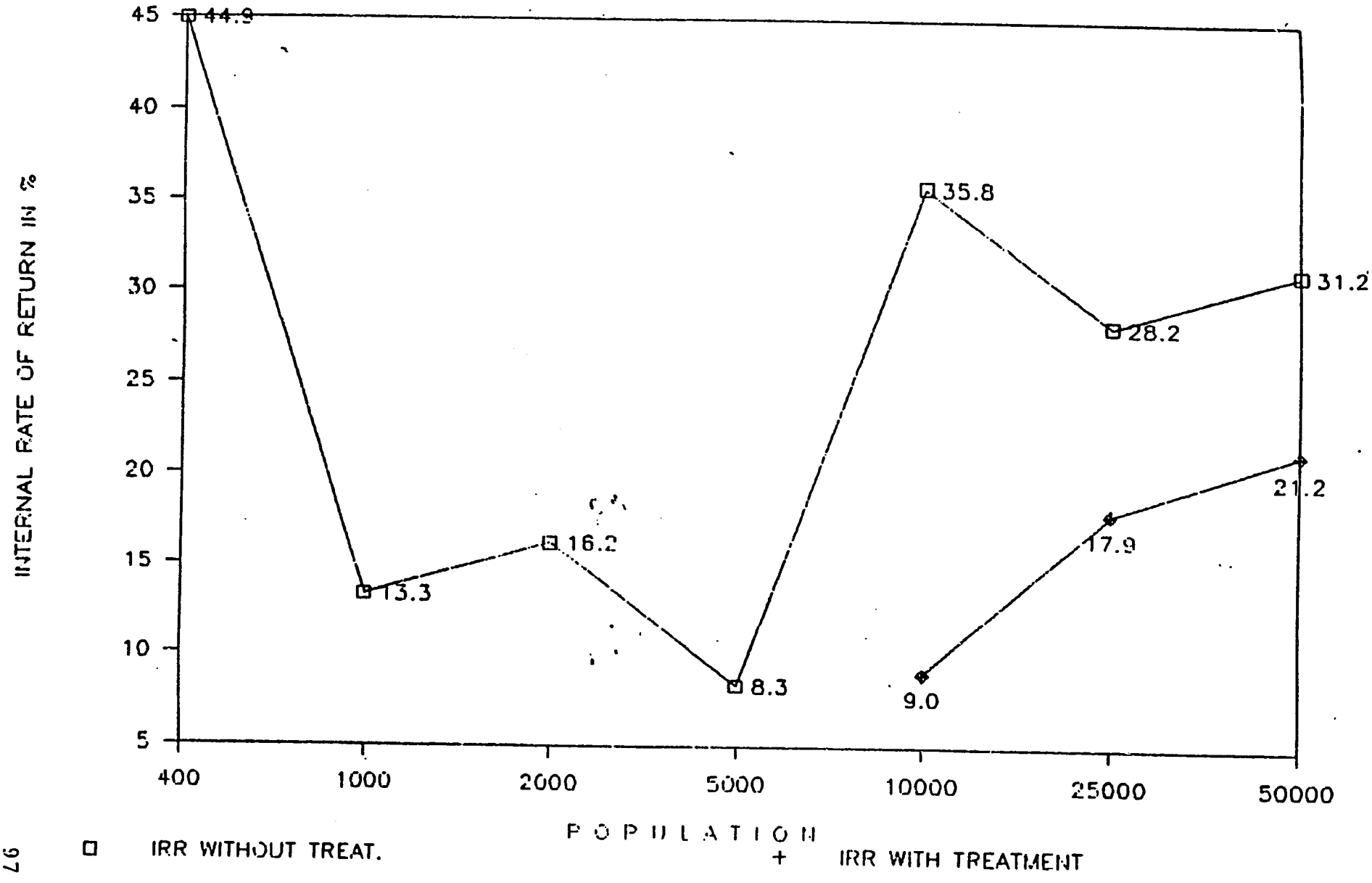


FIGURE III. K. 6

The amount of water supplied has a major impact upon benefits. Therefore, the concern with reducing costs by supplying less should be balanced with the value attributed to additional demand. It is economically feasible to provide towns of 25,000 and 50,000 people with full water and waste water treatment.

L. SECTOR PROJECT NEEDS

1. Nationwide Needs

Water supply and sanitation needs are considered for rural and urban areas separately. Urban areas are defined as the 262 municipal seats and all communities with over 2,000 population. Rural areas include all communities with population up to 2,000, except municipal seats which, regardless of their population, are considered urban areas.

Tables III.L.1 and III.L.2 show the deficits in population served respectively with water supply and sanitation facilities for the year 2000.

Excluding those projects which have committed financing, a total of 2.9 million people will lack water supply, and 1.9 million will need sanitation facilities by the year 2000.

In general, unless considerable further investments are made, only slow progress will be made towards the objective of universal coverage. Coverage is expected to improve somewhat in rural areas but only to about 2/5 of the population. It will actually decline in urban areas. (see Table III.L.3 below).

TABLE III.L.3

ESTIMATED COVERAGE OF WATER SUPPLY AND SANITATION, 1988 - 2000

Type	Urban		Rural		TOTAL	
	1988	2000	1988	2000	1988	2000
WATER SUPPLY	83.9	71.4	10.1	42.0	44.5	56.3
SANITATION	85.6	72.6	38.6	71.6	60.5	72.1

nb: Figures are to be revised with data from AID planning survey underway.

SOURCE : Tables III.B.1,III.L.1, and III.L.2.

This decline will be checked, however, if urban projects currently being studied are funded and implemented. On the other hand, the decline would be greater if rural-urban

TABLE III. L. 1

ESTIMATES OF WATER SUPPLY NEEDS
TO YEAR 2000

(EXCLUDING UNDERWAY/PLANNED PROJECTS)
Population in Thousands
Cost in thousands of Dollars

DESCRIPTION	URBAN	RURAL	TOTAL
POPULATION AT YEAR 2,000	3,256	3,439	6,695
PRESENT POPULATION SERVED	1,914 (83.9%)	275 (10.1%)	2,189
BALANCE TO YEAR 2,000	1,342	3,164	4,506
POPULATION TO BE SERVED BY UNDERWAY/PLANNED PROJECTS	410	1,165	1,575
DEFICIT TO YEAR 2,000	932	1,999	2,931

SOURCE: ISA Consultants

TABLE III.L.2

ESTIMATES OF SEWERAGE NEEDS
TO YEAR 2000

(EXCLUDING UNDERWAY/PLANNED PROJECTS)
Population in thousands
Cost in thousand of Dollars

DESCRIPTION	URBAN	RURAL	TOTAL
POPULATION AT YEAR 2,000	3,256	3,439	6,695
PRESENT POPULATION SERVED	1,953 (85.6%)	1,049 (38.6%)	3,002
BALANCE TO YEAR 2,000	1,303	2,390	3,693
POPULATION TO BE SERVED BY UNDERWAY/PLANNED PROJECTS	410	1,415	1,825
DEFICIT TO YEAR 2,000	893	975	1,868

SOURCE: ISA Consultants

migration is greater than projected.

2. A Program For Rural Areas.

Other than the projects listed as underway and planned, no additional programs are known to be under consideration. Ideally, a rural program would be based on a complete inventory, community by community, of their needs. However, for lack of this detail, the only pragmatic approach is to continue the present system which consists of the receipt of applications from rural communities, surveys and socio-economic evaluations.

An important factor in the implementation of rural programs is community participation in design, construction, operation and maintenance. PLANSABAR, Save the Children and other agencies have considerable experience in these areas. This should be reviewed, along with international experience, to design and implement a national basis for community participation. Present construction cost records for rural systems, with and without ample community participation, show that projects without participation cost between 50% and 150% more than with, even when the cost of contracted labor and materials is fully valued. Community-based programs also have a better record of fee collection and maintenance.

a. **Hand-pumps and Latrines**

The economic analysis of modular systems indicates first priority for small projects for communities of approximately 400 persons, without water supply, sanitation and health services. The systems consist of hand-pumps and latrines. The agencies have ample experience in their implementation. One pump serves from 125 to 450 persons. Once the source of water has been located, they can be installed in 3 to 5 days.

In rural areas, the latrine system is most effective for the disposal of excreta. According to ANDA statistics, 38.6% of the rural population have latrines. This appears to be the result of large latrine campaigns carried out in the past, when latrines were provided free of charge.

Under AID's 0320 project, the ongoing IDB Rural Water Supply and Sanitation program, and a UNICEF program, over 200,000 latrines will be distributed in the rural areas. These three programs alone will add sanitation facilities to a rural population of approximately 1.4 million.

Along with latrine programs, health education programs are needed, including the proper location of latrines, their construction, use, maintenance and regular treatment with chemicals. Since excreta are biodegradable, with proper

latrines, their disposal can be controlled without harming the environment. In our opinion, under present economic conditions of the rural population, the type of latrines currently used is adequate. The only recommendations would be to keep the outside clean, the door closed, and pour some ash or lime in the pit regularly. This opinion is subject to change in the event other types are devised with no significant additional cost.

b. **Other Rural Projects**

Modular systems, as described in Section E, are proposed for communities in the 1000-2000 range. As presently designed, these projects are only marginally economically feasible. There is a need to seek simplified designs and lower-cost construction systems, including combinations of hand-pump and house connections, reducing per-capita water use and pipe diameter.

c. **Community Survey**

USAID funded a study of 120 rural communities described in the Inventory of Facilities. Appendix III.L.1 presents the costs estimated to provide services to these communities.

3. Programs for Urban Areas

a. **System Maintenance**

The most urgent need is to set up of a good regular maintenance program for ANDA equipment. It would cover at least regular oiling, adjustments, change of gaskets, etc. At present, these operations are carried out mostly on an emergency basis. Equipment is not checked until it develops serious problems. Spot inspections indicated a number of serious water leaks, overheating, etc.

b. **Urgent Need for Sewerage Systems**

Waste water collection and disposal need urgent attention. Only 51 percent of the urban population have house connections, whereas others have latrines. In many towns, there is an imbalance between water supply and sewerage services.

Urban waste water collection and disposal need urgent attention. The waste waters are all dumped into rivers, streams and lakes without treatment. Only in the major towns are aeration/oxidation ponds employed before dumping the waste waters. If we assume a low 30 lt/per day as waste water per capita and the present urban population of about 1,339,600, this represents approximately 42,000 cubic meters

untreated waste water being dumped daily into rivers and streams that sooner or later become sources of water supply. The pollution and contamination that this condition creates is evident in rivers as the Acelhuate in San Salvador, the Ilopango lake and others throughout the country.

An urgent crash program is needed to provide sewerage systems that are capable of covering the entire urban population and to arrange for proper waste disposal with secondary treatment.

c. Rehabilitation and Expansion

In setting priorities for urban areas, expansion, rehabilitation and/or replacement of existing systems should be taken into consideration. ANDA is presently carrying out the following studies to submit to funding agencies.

- Expansion of the Sewerage System of San Salvador, II Stage. The feasibility studies are completed; final designs are being prepared. This project, costing approximately US$ 150 million, is under consideration by IDB.

- Expansion of water supply and sewerage disposal for the cities of Santa Ana, Sonsonate and San Miguel. Feasibility studies will be completed in December 1989.

- Primary treatment of domestic waste water in 12 existing systems. Feasibility studies are also underway.

Next in priority would be the expansion and/or rehabilitation of many of their existing systems which in general are over 25 years old and require one or more of the following:

- expansion due to population increases or reduction in flow of water at source

- rehabilitation due to age and lack of proper maintenance

- need of primary sewage treatment in major towns

IDB has requested that ANDA prepare an equipment inventory establishing its condition, however, ANDA does not yet have a detailed list. ANDA officials only stated that the age and condition of their systems is of great concern.

Equipment purchase prices were adapted from the 1988 financial statement based on year purchased and our spot visits. A rough estimate of the rehabilitation cost is, according to Appendix III.L.2:

Repairs and Rehabilitation	US$	7 million
Replacement		33 "

TOTAL		40 "

If this program is not carried out in the near future, ANDA may have to curtail rather than expand services.

d. **Balancing Water Supply and Sewerage Systems**

Sanitation systems (sewers or latrines) are needed for all municipal seats that presently have water supply systems. Table III.L.4, and Appendix III.L.3 show the communities that require them, the future design population, and cost of the program, estimated at 11 million dollars to serve 349,000 people.

Urban communities need to balance their water supply with waste water disposal systems. To provide a community with only water supply or to increase its water supply without providing a sewered waste water collection system, is to increase community health and environment problems.

Most of the urban communities that are to be served are small, and the economic feasibility of this program in small communities may require a review of design standards in terms of consumption per capita and pipe diameters.

e. **Other Needs**

Next on the list of priorities would be to expand existing systems and to build new ones to cover the remaining urban needs in water supply and sewerage disposal to the year 2000. With the information available, this package can not be defined further and, to do so, it will require an accurate survey of all urban areas, their water supply and sewerage facilities.

4. Summary of Investment Needs

It is not clear as to whether the levels of funding required to carry out investments needed in this sector will be available.

However, Table III.L.5 shows a summary of rural and urban projects underway, planned, under study and remaining needs to achieve universal coverage by the year 2000. The costs are based on order of magnitude estimates. Table III.L.6 summarizes these estimates of investment needs by area and

TABLE III.L.4

URBAN SEWERAGE REQUIREMENT TO BALANCE WITH WATER SUPPLY SERVICES BY DEPARTMENT

Department	Existing House Connections		Required Services		System Cons. & Extension Cost
	Water	Sewerage	No. House Connections	Future Population	
Ahuachapan	6,794	3,451	3,343	29,800	1,183,000
Santa Ana	26,487	19,604	6,813	28,476	1,233,400
Sonsonate	13,803	10,439	3,364	20,446	759,800
Chalatenango	3,249	1,522	1,727	14,849	519,700
La Libertad (1)	26,069	23,118	3,243	23,535	823,700
San Salvador (2)	153,863	135,812	3,088	25,557	1,000,000
Cuscatlan	5,087	2,900	2,187	19,023	764,600
La Paz	6,020	2,987	3,033	26,388	929,100
Cabanas	3,303	1,730	1,573	14,251	498,800
San Vicente	5,083	3,082	2,001	18,129	639,900
Usulutan	8,739	4,935	3,809	31,353	1,027,200
Morazan	1,425	779	646	4,960	173,600
La Union	3,767	1,142	2,625	23,307	835,800
San Miguel	14,968	11,768	3,173	19,090	560,300
TOTAL	278,657	223,269	40,625	299,164	10,948,900

SOURCE : ISA Consultants

DECEMBER, 1988 PRICES

(1) The Municipalities under ongoing San Salvador Metropolitan area project are not included: Nueva San Salvador, Antiguo Cuscatlan

(2) The Municipalities under ongoing San Salvador Metropolitan area project are not included: San Salvador, Mejicanos, Soyapango, Delgado, Ilopango, Ayutuxtepeque, San Marcos, Cuscatancingo

TABLE III. L. 5.

WATER SUPPLY AND SANITATION INVESTMENT NEEDS, 1989 - 2000

AREA/PROGRAM	POPULATION COVERED		ESTIMATED COST (US $1000)
	WATER SUPPLY	SANITATION	
RURAL AREAS			
PROJECTS UNDERWAY & PLANNED			
ANDA AID-0320	600,000	600,000	30,050
ANDA AID PILOT	72,500	72,500	6,300
ANDA KFW	110,000	110,000	8,500
PLANSABAR IDB-III	378,000	193,200	23,520
PLANSABAR-UNICEF	-	360,000	6,840
SAVE THE CHILDREN	25,000	25,000	700
OTHER MINOR	30,000	30,000	3,000
TOTAL	1,215,500	1,390,700	78,910
REMAINING NEEDS			
1989 - 1994	500,000	-	30,250
1995 - 2000	1,500,000	980,000	109,370
TOTAL	2,000,000	980,000	139,620
TOTAL RURAL AREAS	3,215,500	2,370,700	218,530
URBAN AREAS			
ANDA PROJECTS UNDERWAY & PLANNED			
S.SALVADOR M.A. WS/S *	410,000	410,000	184,500
ANDA PROJECTS UNDER STUDY **			
S.SALVADOR METRO SEWERAGE EXP.	-	200,000	150,000
SANTA ANA/SAN MIGUEL/SONSONATE	100,000	167,000	27,000
12 SYSTEM WASTE WATER TREATMENT	-	40,000	6,000
TOTAL	510,000	817,000	367,500
REMAINING NEEDS			
1989 - 1994			
REHABILITATION	150,000	-	40,000
BALANCE MUNICIPAL SEWERAGE SYS.	-	349,000	11,000
OTHER MINOR	150,000	-	33,300
1995 - 2000	532,000	137,000	134,270
TOTAL	832,000	486,000	218,570
TOTAL - URBAN AREAS	1,342,000	1,303,000	780,570

SOURCE : ISA Consultants

* ASSUMES ALL BEGAN IN 1989 AND WILL BE COMPLETED BY 1994.

TABLE III. L. 6.

WATER SUPPLY AND SANITATION INVESTMENT NEEDS
1989 - 2000, BY PERIOD

AREA	POPULATION COVERED		ESTIMATED COST
	WATER SUPPLY	SANITATION	(US$1000)
RURAL AREAS			
1989 - 1994	1,715,500	1,390,700	109,160
1995 - 2000	1,500,000	980,000	109,370
TOTAL	3,215,500	2,370,700	218,530
URBAN AREAS			
1989 - 1994	730,000	840,000	352,300
1995 - 2000	612,000	463,000	428,270
TOTAL	1,342,000	1,303,000	780,570

period.

M. IMPLEMENTATION

1. Studies and Design

The following studies are currently underway. Design should follow shortly thereafter.

- water-supply and sewerage expansion for Santa Ana, Sonsonate and San Miguel

- waste water treatment of 12 existing systems

In addition, the following planning activities are recommended:

- the preparation of a rural water supply policy paper

- ANDA, and possibly PLANSABAR, overall tariff study

- ANDA equipment inventory and maintenance program design

- an institutional review of PLANSABAR

- study and design of the balancing of sewerage facilities and expansion of services in urban communities.

These studies are further discussed below.

a. Planning For Rural Areas

In recognition of the poor coverage in rural areas, many agencies are presently involved in programs which try to remedy this problem. However, if better results are to be achieved by the year 2000, there is a need to more clearly define a sector policy for project implementation, which should consider those items specified in the 519-0320 Project Paper, including:

- donor coordination

- project finance, financing methods and cost recovery

- coordination between existing agencies

- decentralization and community participation in planning and execution decisions, including contracting at the municipal and community levels.

Terms of reference should be prepared for a sector policy paper to be reviewed by CONIAPOS or equivalent coordinating

body, and its technical committee should then work with. international technical assistance in preparing this paper GOES consideration.

b. Tariff Study

There is a need to further review ANDA's tariff structure. This should include asset revaluation, improved metering and billing and, as an option, a similar review of PLANSBAR rates. Certainly, those without there services pay many times more per cubic meter of water.

c. **Equipment Inventory and Maintenance Program**

There is an urgent need to establish the quantity and condition of urban water supply and sanitation equipment which has deteriorated due to poor maintenance.

The inventory should be computerized showing present condition and maintenance needed, an appropriate maintenance program for ANDA's equipment and systems should then be set up.

d. **Institutional Review of PLANSABAR**

Plansabar has a number of serious problems including lack of autonomy and insufficient financial controls. Yet, it has several positive aspects.

Its experience in the rural water supply and sanitation field is too valuable, even within its present limitations, to be lost once its ongoing program with the IDB is completed.

These facts should be carefully reviewed along with alternatives to PLANSABAR's future, enhance its role, efficiency and effectiveness, and consider whether it should be relocated within the MOH or in GOES.

e. **Studies and Design of Individual Systems**

Considering the few professionals in ANDA's Engineering Department, we recommend that all study and design of urban systems should be done by consultants. A simplified study and design method should be devised for rural projects which allows for Consultant participation. This should release ANDA engineers to concentrate on the review, preparation of bid documents and construction supervision and would also reactivate the currently sluggish situation of the Salvadoran sanitation industry.

f. Consulting Contracts

Unless the project is large and/or complicated, we recommend the use of the lump sum method, with a reasonable implementation period, subject to penalties for unjustified delays. For large and/or complicated projects, the cost plus contract method with budget limits seem to be most advisable.

2. Participation of Municipalities

Municipalities have recently been declared autonomous institutions with income of their own and as such could be creditworthy institutions. On this basis, they can, in the future, participate more directly in project implementation

User fees could then be set to recover the cost of operation, maintenance, debt service and amortization although there would then be the problem of different national and municipal Tariffs.

3. Construction

ANDA, as a matter of policy, contracts for all their construction, expansion and rehabilitation projects, even for hand pumps. PLANSABAR, on the other hand, builds all its systems by force account with maximum community participation.

The unit cost procedure is the most expeditious construction contract method. However, this method requires careful design and a clear definition of construction items to avoid costly claims and litigation.

The force account procedure should be employed only for small, complex or specialized projects, with major contingencies. In unit price or lump-sum contracts, force account procedures should be incorporated for emergency works, or when negotiations for unit prices not included in the original contract are unsuccessful.

For rural projects, maximum community participation is recommended not only because the cost of the project is reduced, but because the community becomes identified with the project and then its operation and maintenance.

Turnkey methods do not seem plausible. As tariffs have to be set by the turnkey operator, only very affluent communities could use this method.

Of course, since all large projects are partly financed by donors and lending agencies, engineering and construction contracts follow funding entity policies.

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APPENDIX III. B. 1.

INVENTORY OF MAJOR SYSTEMS IN THE COUNTRY ADMINISTRATED BY ANDA.

DESCRIPTION	1	2	3	4	5	6	7	8	9
GENERAL ASPECTS									
DEPARTMENT	SAN SALV.	SAN SALV.	SAN SALV.	SAN SALV.	SAN SALV.	SAN SALV.	SAN SALV.	SAN SALV.	SAN SALV.
MUNICIPALITY	SAN SALV.	APOPA	TONACATEP	MEJICANOS	AYUTUXTE	CUSCATANC	C.DELGADO	ILOPANGO	ANT. CUSC
URBAN POPULATION	476,066	39,205	13,673	92,295	67,835	35,325	42,285	74,407	64,37
A.- WATER SUPPLY									
POPULATION SERVED	432,630	36,852	11,664	78,000	59,118	21,150	30,120	64,842	57,42
WATER SOURCE	NOTE 1	NOTE 2	NOTE 3	NOTE 4	NOTE 5	NOTE 6	NOTE 7	NOTE 8	NOTE 9
TYPE OF SYSTEM	NOTE 1	NOTE 2	NOTE 3	NOTE 4	NOTE 5	NOTE 6	NOTE 7	NOTE 8	NOTE 9
PRODUCTION DEMAND (M3/DAY)	142,819	11,761	2,050	27,688	20,350	10,397	12,685	22,322	19,312
STORAGE (M3)	64,620	2,316	150	10,300	250	20,000	250	500	10,500
AGE OF SYSTEM (YEARS)	NOTE 1	26	26	25	21	20	35	35	20
WATER TREATMENT	CG	CG	HTH	HTH	HTH,CG	HTH,CG	HTH	HTH	HTH,CG
SERVICE CONNECTIONS	72,105	6,142	1,944	13,000	9,853	3,525	5,020	10,807	9,571
ACTUAL PRODUCTION (M3/DAY)	96,784	11,180	1,931	17,844	8,140	6,358	8,616	10,785	10,113
COVERAGE (%)	91	94	85	85	87	60	71	87	89
OPERATIONAL EFFICIENCY (%)	68	95	94	64	40	60	68	48	52
QUALITY CONTROL	YES	YES	YES	YES	YES	YES	YES	YES	YES
MAINTENANCE CONDITIONS	GOOD	REGULAR	REGULAR	GOOD	GOOD	GOOD	REGULAR	REGULAR	GOOD
MAINTENANCE COST/YEAR (US $)*	1,534.0	131.9	41.9	279.0	211.6	75.7	107.8	232.0	205.0
OPERATION COST/YEAR (US $)*	3,741.0	321.7	102.3	680.9	516.1	184.6	263.0	566.0	501.0

APPENDIX III. B. 1.

INVENTORY OF MAJOR SYSTEMS IN THE COUNTRY

ADMINISTRATED BY ANDA.

DESCRIPTION	1	2	3	4	5	6	7	8	9
GENERAL ASPECTS									
DEPARTMENT	SAN SALV.	SAN SALV.	SAN SALV.	SAN SALV.	SAN SALV.	SAN SALV.	SAN SALV.	SAN SALV.	SAN SALV.
MUNICIPALITY	SAN SALV.	APOPA	TONACATEP	MEJICANOS	AYUTUXTE	CUSCATANC	C.DELGADO	ILOPANGO	ANT. CUSC
URBAN POPULATION	476,066	39,205	13,673	92,295	67,835	35,325	42,285	74,407	64,376
B.- SEWERAGE SYSTEMS									
POPULATION SERVED	402,390	35,262	10,728	61,590	52,524	13,248	14,628	59,454	56,952
SERVICE CONNECTIONS	67,065	5,877	1,788	10,265	8,754	2,208	2,438	9,909	9,492
COVERAGE (%)	85	90	78	67	77	38	35	80	88
MAINTENANCE COST/YEAR (US $)*	37.30	10.90	3.32	19.10	16.30	4.11	4.55	18.40	17.60
OPERATION COST/YEAR (US $)*	119.30	34.90	10.60	60.90	52.00	13.10	14.50	58.80	56.30

* US $ = IN THOUSAND DOLLARS

HTH = CALCIUM HYPOCHLORITE

CG = CHOLRINE GAS

SOURCE : A N D A

APPENDIX III. B. 1.

INVENTORY OF MAJOR SYSTEMS IN THE COUNTRY ADMINISTRATED BY ANDA.

DESCRIPTION	10	11	12	13	14	15	16	17	18
GENERAL ASPECTS									
DEPARTMENT	S.VICENTE	CUSCATLAN	SAN SALV.	LA LIBERT	SAN SALV.	SANTA ANA	SONSONATE	Sn MIGUEL	SANTA ANA
MUNICIPALITY	S.VICENTE	COJUTEPEQUE	SOYAPANGO	Nva.Sn S.	Sn MARCOS	SANTA ANA	SONSONATE	Sn MIGUEL	CHALCHUAP
URBAN POPULATION	20,455	26,958	169,038	73,970	29,931	137,873	51,402	81,755	24,254
A.- WATER SUPPLY									
POPULATION SERVED	17,676	17,376	145,056	66,504	24,108	117,906	43,926	70,302	19,494
WATER SOURCE	NOTE 10	NOTE 11	NOTE 12	NOTE 13	NOTE 14	NOTE 15	NOTE 16	NOTE 17	NOTE 18
TYPE OF SYSTEM	NOTE 10	NOTE 11	NOTE 12	NOTE 13	NOTE 14	NOTE 15	NOTE 16	NOTE 17	NOTE 18
PRODUCTION DEMAND (M3/DAY)	4,091	6,740	50,711	23,000	8,979	41,361	15,420	24,526	6,700
STORAGE (M3)	2,770	795	5,000	17,900	3,175	11,500	2,200	8,200	1,890
AGE OF SYSTEM (YEARS)	27	40	20	25	30	56	30	50	40
WATER TREATMENT	HTH	CG	HTH	CG	HTH	HTH	HTH,CG	HTH,CG	HTH
SERVICE CONNECTIONS	2,946	2,896	24,176	11,084	4,018	19,651	7,321	11,717	3,249
ACTUAL PRODUCTION (M3/DAY)	2,209	6,008	44,385	13,800	6,560	36,882	5,200	23,004	6,485
COVERAGE (%)	86	64	86	90	81	86	85	86	80
OPERATIONAL EFFICIENCY (%)	54	89	88	60	73	89	34	94	97
QUALITY CONTROL	YES	YES	YES	YES	YES	YES	YES	YES	YES
MAINTENANCE CONDITIONS	GOOD	REGULAR	GOOD	GOOD	GOOD	GOOD	REGULAR	GOOD	GOOD
MAINTENANCE COST/YEAR (US $)*	63.3	64.7	519.0	253.5	86.3	420.0	155.7	247.1	69.0
OPERATION COST/YEAR (US $)*	154.3	157.9	1,266.0	618.3	210.5	1,024.0	379.6	602.6	168.4

APPENDIX III. B. 1.

INVENTORY OF MAJOR SYSTEMS IN THE COUNTRY ADMINISTRATED BY ANDA.

DESCRIPTION	10	11	12	13	14	15	16	17	18
GENERAL ASPECTS									
:PARTMENT	S.VICENTE	CUSCATLAN	SAN SALV.	LA LIBERT	SAN SALV.	SANTA ANA	SONSONATE	Sn MIGUEL	SANTA ANA
JNICIPALITY	S.VICENTE	COJUTEPEQUE	SOYAPANGO	Nva. Sn S.	Sn MARCOS	SANTA ANA	SONSONATE	Sn MIGUEL	CHALCHUAP
'BAN POPULATION	20,455	26,958	169,038	73,970	29,931	137,873	51,402	81,755	24,254
B.- SEWERAGE SYSTEMS									
PULATION SERVED	14,004	12,090	138,270	65,670	17,136	97,980	38,646	66,102	11,748
RVICE CONNECTIONS	2,334	2,015	23,045	10,945	2,856	16,330	6,441	11,017	1,958
VERAGE (%)	68	45	82	89	57	71	75	81	48
INTENANCE COST/YEAR (US $)*	4.34	3.75	42.80	20.30	5.31	30.40	11.90	20.50	3.64
:RATION COST/YEAR (US $)*	13.80	12.00	136.80	65.00	16.90	97.00	38.20	65.40	11.60

$ = IN THOUSAND DOLLARS

= CALCIUM HYPOCHLORITE

= CHOLRINE GAS

CE : A N D A

APPENDIX III. B. 1.

INVENTORY OF MAJOR SYSTEMS IN THE COUNTRY ADMINISTRATED BY ANDA.*

DESCRIPTION	19	20	21	22	23	24	25	26	27
GENERAL ASPECTS									
DEPARTMENT	SONSONATE	SONSONATE	SONSONATE	AHUACHAP.	LA LIBERT	LA LIBERT	LA LIBERT	LA PAZ	LA UNION
MUNICIPALITY	ACAJUTLA	ARMENIA	IZALCO	AHUACHAP.	Cd. ARCE	LA LIBERT	QUEZALTE.	ZACATECOL	LA UNION
URBAN POPULATION	16,674	13,581	13,446	24,092	11,588	14,356	21,274	24,088	23,379
A.- WATER SUPPLY									
POPULATION SERVED	6,660	6,450	7,806	20,670	4,668	6,468	14,424	15,564	9,918
WATER SOURCE	NOTE 19	NOTE 20	NOTE 21	NOTE 22	NOTE 23	NOTE 24	NOTE 25	NOTE 26	NOTE 27
TYPE OF SYSTEM	NOTE 19	NOTE 20	NOTE 21	NOTE 22	NOTE 23	NOTE 24	NOTE 25	NOTE 26	NOTE 27
PRODUCTION DEMAND (M3/DAY)	3,334	2,376	2,353	6,023	2,317	2,871	4,254	4,817	4,675
STORAGE (M3)	3,000	400	600	2,210	600	1,000	900	860	1,100
AGE OF SYSTEM (YEARS)	26	38	30	26	27	27	27	27	29
WATER TREATMENT	HTH	HTH	HTH	CG	HTH	HTH,CG	HTH	HTH	HTH
SERVICE CONNECTIONS	1,110	1,075	1,301	3,445	778	1,078	2,404	2,594	1,653
ACTUAL PRODUCTION (M3/DAY)	1,225	1,827	1,467	3,595	1,118	1,722	3,800	3,612	3,038
COVERAGE (%)	40	47	58	86	40	45	68	65	42
OPERATIONAL EFFICIENCY (%)	37	77	62	60	48	60	89	75	65
QUALITY CONTROL	YES	YES	YES	YES	YES	YES	YES	YES	YES
MAINTENANCE CONDITIONS	REGULAR	REGULAR	REGULAR	REGULAR	REGULAR	REGULAR	REGULAR	REGULAR	GOOD
MAINTENANCE COST/YEAR (US $)*	23.1	22.5	27.1	72.6	16.7	23.1	51.6	55.7	35.5
OPERATION COST/YEAR (US $)*	56.5	54.8	66.2	177.0	40.7	56.5	125.9	135.8	86.0

APPENDIX III. B. 1.

INVENTORY OF MAJOR SYSTEMS IN THE COUNTRY ADMINISTRATED BY ANDA.

DESCRIPTION	19	20	21	22	23	24	25	26	27
GENERAL ASPECTS									
DEPARTMENT	SONSONATE	SONSONATE	SONSONATE	AHUACHAP.	LA LIBERT	LA LIBERT	LA LIBERT	LA PAZ	LA UNION
MUNICIPALITY	ACAJUTLA	ARMENIA	IZALCO	AHUACHAP.	Cd. ARCE	LA LIBERT	QUEZALTE.	ZACATECOL	LA UNION
URBAN POPULATION	16,674	13,581	13,446	24,092	11,588	14,356	21,274	24,088	23,379
B.- SEWERAGE SYSTEMS									
POPULATION SERVED	4,860	4,092	3,888	13,914	2,880	2,364	12,456	11,586	4,152
SERVICE CONNECTIONS	810	682	648	2,319	480	394	2,076	1,931	692
COVERAGE (%)	29	30	29	58	25	16	59	48	18
MAINTENANCE COST/YEAR (US $)*	1.50	1.27	1.20	4.31	0.90	0.73	3.86	3.60	3.07
OPERATION COST/YEAR (US $)*	4.81	4.05	3.85	13.70	2.89	2.34	12.30	11.50	9.82

* US $ = IN THOUSAND DOLLARS

HTH = CALCIUM HYPOCHLORITE

CG = CHOLRINE GAS

SOURCE : A N D A

NOTES TO APPENDIX III.B.1

The numbers refer to the inventory order number.
System ages are presented in parentheses.

1) The municipality has 26 systems: Page 7/9

1.1) Caites del Diablo: Water intake, cistern, repumping (25 years)
1.2) El Socorro: Water intake, cistern, repumping (20 years)
1.3) Rio Urbina: Water intake, deep well, repumping (30 years)
1.4) Circulo Estudantil: Water intake, cistern,repumping (25 years)
1.5) Santa Carlota: deep well, cistern, repumping (25 years)
1.6) La Militar: deep well (30 years)
1.7) El Coro: Water intake, cistern, repumping (40 years)
1.8) Bombas Col. Centroamerica: deep well (35 years)
1.9) El Carmen: storage (8 years)
1.10) Miralvalle: storage (8 years)
1.11) San Antonio Abad: storage (8 years)
1.12) San Benito: storage (8 years)
1.13) Maquilishuat: storage (8 years)
1.14) Escalon B: storage (8 years)
1.15) Pozo San Antonio Abad: deep well (20 years)
1.16) Campestre: deep well, storage and repumping (25 years)
1.17) Estadio I: deep well (30 years)
1.18) America: deep well (25 years)
1.19) Monserrat II: deep well (30 years)
1.20) Universitaria: deep well (20 years)
1.21) San Josede La Montana:2 deep well (25 years)
1.22) Pasaje Verde: deep well (20 years)
1.23) Monserrat I: deep well (30 years)
1.24) Coruna: deep well (6 years)
1.25) Altos del Cerro: deep well (5 years)
1.26) San Jose II: deep well (8 years)

2) The municipality has 4 systems:

2.1) El Castillo: spring pump (26 years)
2.2) El Angel : repumping (3 years)
2.3) Sta. Marta : deep well (9 years)
2.4) La Cancha : repumping (13 years)

3) The municipality has 1 system:

3.1) Aguacaliente: spring, pump (26 years)

4) The municipality has 3 systems:

4.1) Apopa Scandia:deep wells, water intake, repumping,3,800 m3 storage (16 years)
4.2) Las Margaritas:deep wells (21 years)
4.3) San Ramon :deep well, repumping,6,500 m3 storage (10 years)

5) The municipality has 3 systems:

5.1) Zacamil II :deep well (21 years)
5.2) Villa Mariona II :repumping, 250 m3 storage (10 years)
5.3) Villa Mariona I :deep well, cistern, repumping (8 years)

6) **The municipality has 2 systems:**

6.1) San Ramon : deep well (20 years)
6.2) San Miguel, Mejicanos: deep well (10 years)

7) **The municipality has 4 systems:**

7.1) Caites del diablo: water intake, repumping (35 years)
7.2) Milingo : deep well
7.3) San Jose Cortez : deep well
7.4) Urbina : water intake, repumping

8) **The municipality has 3 systems:**

8.1) La Chacra : water intake and repumping (35 years)
8.2) Apulo : water intake and repumping (10 years)
8.3) San Felipe: deep well (6 years)

9) **The municipality has 5 systems:**

9.1) Pozo 18: deep well (20 years)
9.2) Cumbres de Cuscatlan: deep well (10 years)
9.3) Cumbres de La Libertad: deep well (15 years)
9.4) Jardines de La Hacienda: deep well (15 years)
9.5) Santa Tecla: distribution tank (8 years)

10) **The municipality has 6 systems:**

10.1) Ana Guerra de Jesus: deep well (15 years)
10.2) Los Pozos: deep well (27 years)
10.3) Agua Caliente: Grave system (27 years)
10.4) El Zapote: Grave system (27 years)
10.5) La Quinta: Grave system (27 years)
10.6) Zapote: El Cubo, grave system (27 years)

11) **The municipality has 1 system:**

11.1) El Cacahuacal: spring, pump (40 years)

12) **The municipality has 6 systems:**

12.1) Plan del Pino: deep well (3 years)
12.2) Guayacan: deep well (6 years)
12.3) Los Conacastes: deep well (4 years)
12.4) Santa Lucia: repumping, tail tank (4 years)
12.5) Montes de San Bartolo: deep well (7 years)
12.6) Amatepec: spring (20 years)

13) **The municipality has 7 systems:**

13.1) Los Chorros: water intake (15 years)
13.2) Loma Larga: water intake (25 years)
13.3) La Sultana: deep well (20 years)
13.4) Los Andes: water intake (25 years)
13.5) Quetzaltepeque: deep well (15 years)
13.6) Ayagualo: water intake (25 years)
13.7) Santa Tecla A: distribution tank (8 years)

14) **The municipality has 2 systems:**

14.1) El Cafetal: repumping and distribution tank (7 years)
14.2) El Milagro: deep well and repumping (30 years)

15) **The municipality has 3 systems:**

15.1) Captaciones El Molino: Filtering galkry
15.2) Sapoada: deep well and repumping (56 years)
15.3) Chinameca: deep well and repumping (56 years)
15.4) Bodega de Sanidad: deep well and repumping (56 years)

16) **The municipality has 2 systems:**

16.1) Fuente San Antonio: gravity system (40 years)
16.2) Fuente Santa Lucia: gravity system (40 years)

17) **The municipality has 8 systems:**

17.1) El Molino: deep well
17.2) San Carlos: deep well
17.3) La Paz: deep well
17.4) Belen: deep well
17.5) Milagro De La Paz: deep well
17.6) Moncagua: spring
17.7) Hirleman: deep well
17.8) Jalcatal: deep well

18) The municipality has a filtering gallery and 4 sets of pumping equipment. There are no public washing-tanks. To cover the current deficit, it is necessary to drill wells and construct new impelence lines.

19) The municipality has a pumping system and deep wells with daily chlorination.

20) The municipality has a combined pumping and gravity system, with two sets of 60HP equipment, one for each deep well. To cover the system deficiencies, an attempt will be made to locate new sources.

21) The municipality has pumping and gravity systems. The water intake is at a hillside location. Low production at the source causes deficits. Attempts are being made to cover the deficit by drilling a well.

22) The municipality has a water intake by way of a filtering gallery. There is little collection of water at the Apunian spring. To cover the deficit it is necessary to increase production at the spring.

23) No information available

24) **The municipality has 1 system:**

24.1) Los Chorros: grave system (27 years)

25) **The municipality has 1 system:**

25.1) San Francisco: deep well (27 years)

26) **The municipality has 2 systems:**

26.1) Santa Fe: deep well (10 years)
26.2) Grupo Los Pozos: deep well (27 years)
This system has damage estimated at $9266.00

27) **The municipality has 2 systems:**

27.1) El Golfo: deep well
27.2) Las Flores: deep well

APPENDIX III.B.2
(See Tables attached)

NATIONAL ADMINISTRATION OF SEWERAGE
ASSISTANCE PLANNING DIVISION

Glossary of terms for project selection indicators

Spanish	English
1. Localidades	1. Localities
2. Produccion m3/mes	2. Production m3/month
3. Consumo m3/mes	3. Consumption m3/month
4. Agua no contabilizada %	4. Water well %
5. Poblacion urbana	5. Urban population
6. Poblacion servida	6. Population served
7. Cobertura de servicios %	7. Covered areas
8. Horas de servicio	8. Service hours
9. Numero de servicios acueducto	9. Number of aqueducts & sewers
10. Consumo promedio p/servicios m3/mes Colones	10. Average consumption p/served m3/month C
11. Ingreso Mensual Colones	11. Monthly income C
12. Ingreso promedio por conexion Colones	12. Connection average Income p/connection
13. Prioridad	13. Priority
14. Demanda m3/mes	14. Demand m3/month
15. Produccion demandada %	15. Production/demand %
16. Consumo promedio L/P/D	16. Average consumption L/P/D
17. Dotacion L/P/D	17. Amount L/P/D
18. Numero de servicios de alcantarillado	18. Number of seweraged served
19. Poblacion servida Alcantarillado	19. Served population sewerage
20. Eficiencia del Sistema	20. System's efficiency
Departamento de Desarrollo Fisico	Department of Physical Development

ADMINISTRACION NACIONAL DE ACUEDUCTOS Y ALCANTARILLADOS

DIVISION ASESORA DE PLANIFICACION

INDICADORES PARA SELECCION DE PROYECTOS

LOCALIDADES	PRODUC. M^3/MES	CONSUMO M^3/MES	AGUA NO CONTAB. %	POBLACION URBANA	POBLACION SERVIDA	COBERT. DE SERVIC. %	HORAS DE SERVIC.	NUMERO DE SERVICIOS ACUEDUCTO	CONSUM. PROMED. P/SERV. M^3/MES	INGRESO MENSUAL ¢	INGRESO PROMED. POR CONEXION ¢	PRIORIDAD	DEMANDA M^3/MES	PRODUCCION DEMAND. %	CONSUM. PROMED. L/P/D	DOTAC. L/P/D	NUMERO DE SERVICIOS DE ALCANTARILLADO.	POBLACION SERVIDA ALCANTAR.	EFICIENCIA DEL SISTEMA %
I - POBLACION MAYOR DE 25,000 HABITANTES.																			
[illegible] Ana	1,067,299	824,682	23	137,873	117,300	85	12	19,[illegible]	42	472,14[illegible]	24	3a.	1,240,8[illegible]	86	211	300	16,119	97,980	72
[illegible]	156,024	295,580		51,402	43,488	85	12	7,2[illegible]	41	161,985	22	1p.	462,600	33	230	300	6,441	38,646	28
[illegible]	346,585	149,103	57	39,205	41,880	107	24	6,9[illegible]	21	86,451	21	2cf	429,000	80	117	200	6,913	41,478	70
[illegible]	186,242	105,509	43	26,958	17,176	65	18	2,8[illegible]	36	56,715	20	2cf	429,000	41	200	200	2,015	12,090	42
[illegible] Miguel	1,202,699	392,222	67	81,755	69,030	85	11	11,50[illegible]	34	219,055	19	1cf	611,170	196	189	250	11,017	66,102	74
[illegible] Salvador	4,049,010	1,113,429	62	476,066	132,630	28	17	22,10[illegible]	50	751,582	34	Diseño	4,941,565	82	277	346	20,081	120,486	71
[illegible]	535,320	431,148	20	92,295	78,000	84	20	13,000	33	218,751	17	Diseño	996,786	54	181	360	10,265	61,590	83
[illegible]	1,331,550	577,727	57	169,038	145,056	86	16	24,17[illegible]	24	346,899	14	Diseño	1,394,563	95	131	275	23,045	138,270	67
[illegible] Delgado	258,480	177,089	32	42,285	30,120	71	14	5,02[illegible]	35	89,001	18	Diseño	384,851	74	191	275	2,438	14,628	58
[illegible]	76,470	294,545		67,835	59,118	87	20	9,85[illegible]	30	136,21[illegible]	14	Diseño	732,618	10	166	360	8,754	52,524	83
[illegible] Pirrios	196,800	126,868	36	29,931	24,108	80	11	4,018	31	63,291	16	Diseño	246,930	80	172	275	2,856	17,136	46
Tuscatancingo	95,370	106,174		35,325	21,150	60	20	3,52[illegible]	30	49,070	14	Diseño	381,510	25	166	360	2,208	13,248	83
[illegible]	323,550	362,204		74,407	64,842	87	16	10,807	33	185,643	17	Diseño	611,857	53	183	275	9,909	59,454	67
Nueva San Salvador	690,240	480,729	31	73,970	70,824	96	18	11,084	43	295,921	27	Diseño	793,876	96	238	360	10,945	65,670	75
[illegible] Cuscatlán	303,390	363,289		64,376	57,426	89	19	9,571	38	223,693	23	Diseño	695,260	44	211	360	9,492	56,952	79
Zacatecoluca	230,700	108,840	53	28,261	15,264	54	24	2,544	43	63,689	25	1a.	169,566	73	215	200	2,086	12,516	85

DEPARTAMENTO DE DESARROLLO FISICO

* [illegible]

AGOSTO 1989

ADMINISTRACION NACIONAL DE ACUEDUCTOS Y ALCANTARILLADOS

DIVISION ASESORA DE PLANIFICACION

INDICADORES PARA SELECCION DE PROYECTOS

LOCALIDADES	PRODUC. M^3/MES	CONSUMO M^3/MES	AGUA NO CONTAB. %	POBLACION URBANA	POBLACION SERVIDA	COBERT. DE SERVIC. %	HORAS DE SERVIC.	NUMERO DE SERVICIOS ACTUALMENTE	CONSUM. PROMED. P/SERV. M^3/MES	INGRESO MENSUAL Q	INGRESO PROMED. POR CONEXION Q	PRIORIDAD	DEMANDA M^3/MES	PRODUCCION DEMAND. %	CONSUM. PROMED. L/P/D	DOTAC. L/P/D	NUMERO DE SERVICIOS DE ALCANTARILLADO.	POBLACION SERVIDA ALCANTAR.	EFICIENCIA DEL SISTEMA %
II- POBLACIONES DE 10,000 A 25,000 HABITANTES.																			
Chalchuapa	194,556	115,078	41	24,254	19,290	79	12	3,215	36	60,120	19	2CF	181,905	93	200	250	1,958	11,748	74
** Metapán	22,770	34,291	?	11,281	8,526	76	8	1,421	24	16,016	11	Diseño	67,686	34	120	200	984	5,904	23
Acajutla	36,738	47,080	?	16,674	6,468	39	18	1,078	44	28,959	27	1 a 2 m	100,044	37	244	200	810	4,860	30
Armenia	49,626	36,066	27	13,581	6,276	47	18	1,046	34	19,949	19	1 a 2 m	71,300	70	188	175	682	4,092	69
Izalco	44,010	42,948	2	13,446	7,584	58	12	1,264	34	22,511	18	2 p	70,591	62	188	175	648	3,888	60
Ahuachapán	185,616	141,072	24	24,092	2,028	86	18	1,338	42	78,477	21	1 a	180,690	103	213	250	2,319	13,914	44
Tonacatepeque	44,193	51,477	?	13,673	11,472	85	24	1,912	27	19,444	10	3 a	61,588	72	150	150	1,788	10,728	65
San Martín	87,450	42,974	51	12,343	10,890	88	5	1,815	24	24,195	13	Diseño	74,058	118	120	200	1,179	7,074	34
Ciudad Arce	60,264	26,641	56	11,588	4,668	40	20	778	34	14,714	19	2CF, 1a	69,528	87	188	200	486	2,916	50
La Libertad	169,007	57,344	66	14,356	6,468	45	24	1,078	53	37,290	35	1cF, 1m	75,369	224	294	175	394	2,364	100
Quezaltepeque	113,832	86,646	24	21,274	14,424	68	14	2,404	36	43,318	18	3 m	127,644	89	200	200	2,076	12,456	55
Zacatecoluca	432,527	115,183	73	24,088	15,564	65	14	2,594	44	66,441	56	1cF, 1a	144,528	300	244	200	1,931	11,586	65
San Vicente	376,430	132,812	65	20,455	17,676	86	21	2,946	45	73,822	25	1cF	122,730	307	250	200	2,334	14,004	66
Santiago de María	48,103	34,153	29	10,531	6,432	61	4	1,072	32	16,018	15	Diseño	55,288	87	177	175	909	5,454	43
La Unión	130,334	75,238	42	23,379	9,918	42	17	1,651	45	50,054	30	2cF-2a	140,274	92	250	200	692	4,152	64
Aquilares	22,290	8,962	60	13,372	3,636	27	3	606	15	8,860	15	1cF	80,232	359	75	200	227	1,362	11

** Proyecto incluido en el Programa AID

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LOCALIDADES	PRODUC. M^3/MES	CONSUMO M^3/MES	AGUA NO CONTAB. %	POBLACION URBANA	POBLACION SERVIDA	COBERT. DE SERVIC. %	HORAS DE SERVIC.	NUMERO DE SERVICIOS ACUEDUCTO	CONSUM. PROMED. P/SERV. M^3/MES	INGRESO MENSUAL $	INGRESO PROMED. POR CONEXION $	PRIORIDAD	DEMANDA M^3/MES	PRODUCCION DEMAND. %	CONSUM. PROMED. L/P/D	DOTAC. L/P/D	NUMERO DE SERVICIOS DE ALCANTARILLADO.	POBLACION SERVIDA ALCANTAR.	EFICIENCIA DEL SISTEMA %
III- POBLACIONES DE 5,000 a 10,000 HABITANTES																			
Atiquizaya	83,780	47,336	43	9,274	7,932	85	20	1,327	36	25,942	20	2cP	55,644	150	200	200	807	4,842	100
Concepción de Ataco	15,099	11,811	22	6,219	2,436	39	18	406	29	6,121	16	2cP,2a	32,649	46	161	175	212	1,272	54
Chalatenango	15,876	15,662	1	5,265	2,430	46	18	405	39	7,497	18	3P 2m	27,641	57	216	175	334	2,004	49
Nahuizalco	23,328	24,885	?	9,144	3,048	33	20	508	49	12,642	25	1a,3p	54,864	42	272	200	373	2,238	40
Juayúa	56,734	25,310	55	7,127	3,840	54	24	640	40	14,054	22	2cP,1m	37,417	152	222	175	542	3,252	92
Sonzacate	62,208	34,189	45	6,649	5,730	86	24	955	36	12,779	13	2cP,2m	29,920	208	200	150	576	3,456	100
Chalatenango	126,631	41,955	67	7,533	5,784	77	24	964	43	19,096	20	1cP,1m	39,538	320	238	175	843	5,058	95
** Nueva Concepción	45,090	24,886	55	5,668	4,908	87	11	818	30	10,314	20	Diseño	29,757	66	114	175	519	3,114	44
* Guazapa	13,830	16,854		6,172	4,092	66	6	682	25	5,138	7	Diseño	21,483	155	142	175	321	1,926	15
Santo Tomás	40,979	31,049	24	7,200	4,206	58	16	701	44	12,994	18	1m,2a	32,400	126	244	150	8	48	71
* Panchimalco	-	5,461	-	6,172	648	10	-	108	50	2,432	22	Diseño	-	-	-	-	81	486	
* Santiago Texacuangos	13,258	11,847	10	5,143	2,208	43	10	368	32	5,007	13	2a,3p	23,143	57	177	150	0	0	36
San Juan Opico	26,784	25,705	4	7,264	3,924	54	8	654	39	11,377	17	2p	38,136	70	216	175	430	2,580	37
Suchitoto	11,664		?	5,829	3,786	65	14	631	-			2m	21,858	53	-	125	497	2,982	58
Santiago Nonualco	24,039	24,245	?	5,910	3,618	61	12	603	40	13,641	22	2m	26,595	90	122	150	327	1,962	52
Sensuntepeque	122,927	55,836	55	9,861	8,730	88	24	1,455	38	28,968	20	2cP,2a	51,770	237	211	175	715	4,290	90
Ilobasco	79,638	40,097	49	8,894	8,004	90	11	1,334	30	21,225	16	2cP	53,364	149	167	200	1,022	6,132	49
San Sebastián	28,078	17,413	38	5,669	3,570	63	10	595	29	7,123	12	3cP,3p	29,762	94	161	175	438	2,628	30
Jiquilisco	38,304	16,907	56	7,844	2,826	36	12	471	36	8,978	19	2cP,2a	35,298	100	200	150	332	1,992	76
Jucuapa	59,376	29,926	50	7,415	5,490	74	24	915	33	14,361	16	3cP, 2m	38,929	152	183	175	630	3,780	93
Berlín	18,007	11,904	34	7,307	3,306	45	11	551	22	5,142	9	3cP, 2p	27,401	66	122	125	275	1,650	38
Puerto El Triunfo	41,970	12,168	71	7,199	4,002	56	12	667	18	8,155	12	1cP, 2a	37,795	111	100	175	633	3,828	48
Santa Elena	13,662	20,823		5,266	4,086	77	8	681	30	8,257	12	2p	23,697	58	167	150	103	618	36
El Tránsito	30,426	17,549	42	7,973	3,486	44	10	581	30	8,010	14	2cP, 3p	35,878	85	167	150	346	2,076	39
Chinameca	31,401	20,608	34	7,161	5,244	73	12	874	24	9,601	11	3cP, 3p	32,226	97	133	150	515	3,090	69
Chirilagua	14,346	7,188	50	6,622	2,304	35	7	384	19	3,359	10	2cP, 2p	24,832	58	105	125	0	0	74
San Rafael Oriente	29,721	7,209	76	6,351	2,130	33	16	355	20	4,149	12	1cP, 2a	28,579	103	111	150	131	786	77
San Francisco Gotera	89,726	35,003	61	5,562	4,830	87	6	805	43	20,164	25	3cP,	33,372	269	238	200	641	3,846	56
Santa Rosa de Lima	57,524	10,220	82	7,687	4,710	61	5	785	13	11,129	14	1cP,	40,357	25	72	175	290	1,740	31

* Incluidas en el Programa KFW

** Incluida en el Programa AID

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INDICADORES PARA SELECCION DE PROYECTOS

LOCALIDADES	PRODUC. M^3/MES	CONSUMO M^3/MES	AGUA NO CONTAB. %	POBLACION URBANA	POBLACION SERVIDA	COBERT. DE SERVIC. %	HORAS DE SERVIC.	NUMERO DE SERVICIOS ACUEDUCTO	CONSUM. PROMED. P/SERV. M^3/MES	INGRESO MENSUAL $	INGRESO PROMED. POR CONEXION $	PRIORIDAD	DEMANDA M^3/MES	PRODUCCION/DEMAND. %	CONSUM. PROMED. L/P/D	DOTAC. L/P/D	NUMERO DE SERVICIOS DE ALCANTARILLADO.	POBLACION SERVIDA ALCANTAR.	EFICIENCIA DEL SISTEMA %
IV- POBLACION CON MENOS DE 5,000 HABITANTES.																			
Tacuba	20,736	11,830	43	4,255	2,274	53	18	379	31	3,764	10	2cf, 3a.	22,339	93	172	175	115	690	81
San Pedro Puxtla	2,514	4,599	?	1,745	882	51	24	147	31	1,580	11	1m.	6,543	38	172	125			100
Apaneca	14,592	8,885	39	3,764	1,704	45	24	284	31	3,121	11	2cf, 2a.	16,938	86	172	150			100
San Francisco Menéndez	7,776	2,212	71	1,249	504	40	20	84	26	801	9	1cf, 2a.	4,684	166	144	125			59
Guaymango	5,070	3,081	73	1,418	618	44	12	103	30	1,004	10	1cf, 1m.	5,317	95	166	125			81
Jujutla	5,184	714	86	1,200	504	42	20	84	9	871	10	1cf, 2a.	4,500	115	50	125			109
Turín	11,880	10,298	13	3,273	1,962	53	20	327	31	3,421	10	1m.	12,274	97	172	125			96
El Refugio	22,191	7,708	65	1,638	1,404	86	12	234	33	2,825	12	1cf, 1m.	6,142	361	183	125	1	6	100
Candelaria de la Frontera.	24,705	16,400	34	3,761	3,150	84	12	525	31	5,810	11	3cf, 1m.	16,924	146	172	150	239	1,434	100
Texistepeque	19,006	12,467	34	2,506	2,484	99	15	414	30	4,813	12	3cf, 1m.	11,277	168	166	150	7	42	100
San Sebastián Salitrillo	2,376	2,138	10	940	498	53	8	83	26	635	8	2p, 2m.	3,525	67	144	125	1	6	56
Santiago de la Frontera.	5,184	2,740	47	1,880	792	42	20	132	21	1,053	8	2cf	7,050	73	116	125			60
Masahuat	2,592	1,731	33	564	360	64	20	60	29	678	11	1cf, 1m.	2,115	122	161	125			91
Santa Rosa Guachipilín	3,870	1,421	92	753	294	39	20	49	29	384	8	1cf, 1m.	2,259	171	161	100			100
San Antonio Pajonal	7,776	5,455	30	2,445	1,308	53	8	218	25	1,595	7	2cf, 3p.	11,002	71	138	150			19
San Julián	8,250	7,041	15	3,227	1,596	49	12	266	26	2,568	10	2p.	14,521	57	144	150	194	1,164	56
San Antonio del Monte	51,840	9,886	81	3,496	2,340	67	20	390	25	3,860	10	1cp.	15,732	329	138	150	167	1,002	100
Santa Isabel Ishuatán	480	2,054	?	941	510	54	6	85	24	489	6	1p.	2,823	17	133	100	1	6	17
Sacacoyán	5,430	2,327	57	2,152	726	34	18	121	19	1,308	11	1cp, 2a.	8,070	67	105	125	62	372	60
Citeo	2,580	1,737	33	1,009	306	30	12	51	34	1,004	20	2cp, 3p.	3,027	85	188	100			69
Arcatao	5,700			1,849	780	42	9	130	-	-	-	2m.	6,933	82	-	125			36
San Antonio Los Ranchos	4,920			1,354															
San Luis del Carmen	4,920	2,009	59	776	666	86	24	111	18	542	5	2cp.	2,328	211	100	100			100
Cancasque		3,280		1,218	492	40		82	40	992	12	3m.	-	-	220	100	-	-	-
Ojos de Agua	6,210			1,263			12	-	-	15	-	3m	4,736	131	-	125	-	-	50

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LOCALIDADES	PRODUC. M^3/MES	CONSUMO M^3/MES	AGUA NO CONTAB. %	POBLACION URBANA	POBLACION SERVIDA	COBERT. DE SERVIC. %	HORAS DE SERVIC.	NUMERO DE SERVICIOS ACUEDUCTO	CONSUM. PROMED. P/SERV. M^3/MES	INGRESO MENSUAL $	INGRESO PROMED. POR CONEXION $	PRIORIDAD	DEMANDA M^3/MES	PRODUCCION DEMAND. %	CONSUM. PROMED L/P/D	DOTAC. L/P/D	NUMERO DE SERVICIOS DE ALCANTARILLADO.	POBLACION SERVIDA ALCANTAR.	EFICIENCIA DEL SISTEMA %
La Laguna	8,280	-	-	1,285	-	-	10	-	-	-	-	3m.	-	-	-	125	-	-	41
Agua Caliente	4,500	4,724	[illegible]	1,579	828	52	11	138	34	1,349	10	3p.	5,921	76	188	125	-	-	45
El Paraíso	780	2,280	[illegible]	1,399	510	36	1	85	27	572	7	Diseño	5,246	148	150	125	-	-	3
Cimalapa	10,890	3,941	-	1,002	846	84	24	141	29	920	7	Diseño	4,175	260	161	125	2	12	100
San Fernando	14,250	-	-	541	-	-	24	-	-	-	-	3m.	2,029	702	-	125	-	-	100
Santa Rita	2,970	987	67	812	282	35	11	47	21	498	11	Diseño	2,416	122	116	100	-	-	45
San Miguel de Mercedes	10,380	2,445	76	1,127	1,302	115	24	217	11	602	3	Diseño	3,381	307	61	100	-	-	157
Tejapa	23,760	17,196	28	4,114	2,592	63	19	432	40	6,379	15	1m.	18,513	120	222.2	150	133	790	75
Guazúcar	3,780	3,173	16	2,421	714	29	12	119	27	1,172	10	2m.	7,263	52	150.0	100	-	-	54
San José Villanueva	15,540	4,473	71	2,249	958	38	24	143	31	1,545	11	Est.Fact.	6,747	66	310	100	-	-	100
Colón y Chiquisilo	134,280	113,113	16	22,000	16,416	75	11	2,736	41	52,777	19	3f.	21,792	616	227.8		12	72	
San Matías	5,820	2,839	51	1,384	564	41	8	94	30	1,428	15	Est.Fact.	5,190	112	240	125	-	-	47
Chiquayo	5,070	2,123	58	2,249	570	25	8	95	22	1,246	13	2cf, 1p.	8,433	60	122.2	125	-	-	35
Huehuetique	13,140	80	99	2,940	1,206	41	10	201	40	2,164	11	1p, 1m.	13,230	99	222.2	150	-	-	30
Tecalapa	13,140	-	-	865	78	9	10	13	-	144	11	1p.	-	-	-	150	-	-	30
Jocotepeque	5,034	16,741	[illegible]	3,805	2,496	66	12	416	40	6,431	15	Diseño	17,123	98	266	150	3	18	50
San Rafael Cobrue	37,350	9,878	73	2,238	1,500	67	24	250	39	3,627	14	1cf, 1m.	8,392	445	216.7	125	135	810	100
San Bartolomé Perulapía	28,290	14,612	48	3,175	2,598	82	12	433	34	5,696	13	2cf, 3p.	11,906	237	188.9	125	433	2,598	73
San Pedro Perulapán	4,320	3,625	16	1,301	660	51	7	110	33	1,241	11	3p.	4,879	88	183.3	125	110	660	29
Provincipo	4,530			1,717	696	41	15	116				1m.	5,151	88	-	100	-	-	70
Cudalaria	1,950	2,833	[illegible]	1,509	480	32	12	80	35	970	12	1p. 1m.	4,527	43	194	100	-	-	26
Santa Cruz Michapa	5,520	5,928	[illegible]	1,016	900	88	9	150	39	2,255	15	1m.	3,810	145	216.7	125	1	6	41
San Ramón		2,244		1,197	420	35	11	70	32	657	9	3m.	7,182	-	177.8	200	-	-	42
El Carmen		207		.312	36	11	11	6	34	109	18	3m.	1,872	-	188.9	200	-	-	42
Santa Cruz Analquito	6,060	1,856	69	1,562	480	31	12	80	23	810	10	1cf.	5,857	104	127.8	125	-	-	55
San José Guayabal	9,990			2,446	1,794	73	11	299	-	3,726	12	3p.	9,172	109	-	125	1	6	46
San Juan Nonualco	67,080	15,506	77	4,638	2,586	56	24	431	36	5,734	13	1cf.	17,392	386	200.0	125	170	1,020	100
San Pedro Nonualco	2,670	9,394		3,740	1,902	51	7	317	30	2,567	8	1p.	14,025	19	166.7	125	103	618	12
Olocuilta	20,220	13,413	34	4,632	2,538	55	16	423	32	5,556	13	1m.	17,370	116	177.8	125	94	564	94
San Pedro Masahuat	6,150	7,590		2,918	1,716	59	5	286	26	2,015	7	1p.	10,942	56	144.4	150	-	-	16

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San Juan Tahu	6,120	5,226	15	3,217	1,134	35	6	189	28	1,621	58	Est.Fact.	12,063	51	224	125	49	294	27
Rosario de La Paz	18,180	13,182	27	4,189	2,172	52	12	362	36	4,463	12	Est.Fact.	18,850	96	240	150	188	1,128	56
Santa María Ostuma	1,452	2,978		1,646	660	40	24	110	27	1,055	10	Est.Fact.	4,938	29	270	100	-	-	103
San Miguel Tepezontes	2,190	2,977		3,292	582	18	2	97	30	1,007	10	Est.Fact.	12,345	18	240	125	-	-	9
San Rafael Obrajuelo	34,560	13,088	62	2,544	1,992	78	24	332	39	4,896	15	[illegible]	9,540	162	315	125	181	1,086	197
Tapalhuaca	3,630	-	-	1,048	-	-	20	-	-	-	-	-	-	-	-	100	-	-	83
San Luis Talpa	10,380	4,951	48	2,020	1,992	98	12	128	39	1,786	14		7,575	137	216.7	125	-	-	49
San Antonio Masahuat	3,900	3,019	22	1,496	672	45	12	112	27	1,045	9	[illegible]	4,488	87	270	100	-	-	65
Moromeno La Ceiba	552	563		449	138	31	10	23	24	203	9	Est. Fact.	1,347	41	240	100	-	-	41
Jerusalén	552	867		748	168	22	10	28	31	273	10	Est.Fact.	2,244	25	310	100	-	-	41
San Juan Tepezontes	2,190	-	-	1,346	-	-	5	-	-	-	-	-	-	-	-	125	-	-	9
San Emigdio	3,120	1,235	60	1,346	220	11	10	37	33	614	17	2cf, 1m.	4,038	77	183.3	100	-	-	47
Paraíso de Osorio	9,360	1,882	80	1,945	564	29	15	94	20	1,018	11	1cf.	7,294	128	111.1	125	-	-	87
Victoria	2,730	-	-	2,029	486	24	4	81	-	-	-	1p.	7,609	36	-	125	-	-	16
San Isidro	7,260	6,616	9	1,694	1,482	87	8	247	27	3,170	13	3p, 2m.	6,352	114	150.0	125	37	222	32
Tepelqueque	2,850	5,027		1,846	1,344	73	10	224	22	1,503	7	3p.	5,538	51	122.2	100	-	-	41
Jutiapa	5,970	-		1,095	-	-	11	-	-	-	-	3m.	-	-	-	125	-	-	45
Ayutepeque	14,520	10,356	29	3,779	2,100	55	11	350	30	3,587	10	1p.	17,005	35	166.7	150	233	1,398	44
Quebrajo	6,270	4,746	24	2,220	978	44	9	163	29	1,540	9	2p.	8,335	75	161.1	125	2	12	34
Santo Domingo	27,180	9,213	66	1,890	1,236	65	10	206	48	3,300	16	1cf, 1m.	9,922	274	266.7	175	115	690	30
Tecoluca	36,810	2,075	94	2,882	1,890	66	19	315	7	2,683	9	1cf.	12,969	230	38.9	150	-	-	80
Verapaz	4,410	4,426		1,898	834	44	5	139	32	1,424	10	1m.	7,117	62	177.8	125	1	6	32
Tecoluca	2,820	1,227	56	992	294	30	7	49	25	533	11	2cf, 3p.	3,720	76	138.9	125	-	-	24
San Cayetano Istepeque	6,570	3,216	51	1,370	396	29	9	66	49	1,476	22	2cf.	5,137	128	272.2	125	1	6	38
San Esteban Catarina	2,070	1,401	68	1,748	420	24	3	70	20	463	6	1cf.	6,555	32	111.1	125	-	-	11
San Lorenzo	8,640	4,020	53	1,654	936	57	14	156	26	1,164	7	2cf.	6,202	139	144.4	125	-	-	56
Santa Clara	2,250	2,080	8	1,370	564	41	5	94	22	558	6	1p.	5,137	44	522.2	125	-	-	22
Estanzuelas	9,846	6,971	29	3,331	1,488	45	9	248	28	2,170	9	3cf, 2p.	14,969	66	155.6	150	1	6	24
Alegría (Obrajuelo)	6,210	1,361	78	1,719	876	51	9	146	9	517	3	Diseño	7,735	80	72	150	-	-	48
Jucuarán	5,655	-	-	2,149	714	33	3	119	-	-	-	1p.	8.059	70	-	125	-	-	18
Villa El Triunfo	40,680	12,168	70	2,379	4,002	155	12	667	61	8,154	12	1cf,	13,540	300	334.9	150	-	-	24

DEPARTAMENTO DE DESARROLLO FISICO

AGOSTO 1989

ADMINISTRACION NACIONAL DE ACUEDUCTOS Y ALCANTARILLADOS

DIVISION ASESORA DE PLANIFICACION

INDICADORES PARA SELECCION DE PROYECTOS

LOCALIDADES	PRODUC. M^3/MES	CONSUMO M^3/MES	AGUA NO CONTAB. %	POBLACION URBANA	POBLACION SERVIDA	COBERT. DE SERVIC. %	HORAS DE SERVIC.	NUMERO DE SERVICIOS ACUEDUCTO	CONSUM. PROMED. P/SERV. M^3/MES	INGRESO MENSUAL $	INGRESO PROMED. POR CONEXION $	PRIORIDAD	DEMANDA M^3/MES	PRODUCCION - DEMAND. %	CONSUM. PROMED L/P/D	DOTAC. L/P/D	NUMERO DE SERVICIOS DE ALCANTARILLADO.	POBLACION SERVIDA ALCANTAR.	EFICIENCIA DEL SISTEMA %
Nueva Granada	-	-	-	1,827	546	30	-	91	-	-	-	-	-	-	-	150	-	-	
Tucapán (Tetralogía)	5,151	2,539	46	2,041	750	37	9	125	41	653	5	Diseño	7,654	67	227.8	125	-	-	48
Santa María	4,743	1,889	40	1,182	438	37	9	73	65	542	7	Icf. 3p.	4,432	107	361.1	125	-	-	41
San Buenaventura	4,707	5,506	0	1,612	1,224	76	9	204	23	1,504	7	2p.	7,254	65	127.8	150	-	-	60
California (Tetralogía)	5,151	2,683	48	1,827	456	25	9	76	68	1,075	14	Diseño	6,851	75	377.8	125	-	-	35
Concepción Batres	3,138	575	82	2,257	366	16	8	61	51	669	11	Icf.	11,849	26	283.3	100	-	-	60
[illegible]	13,620	60	99	4,084	1,992	49	12	332	41	3,528	11	Icf.	18,378	74	227.8	150	-	-	45
[illegible]	6,480	240	96	1,625	894	55	8	149	43	1,752	12	Icf.	6,093	106	238.9	125	-	-	35
[illegible]	7,278	5,906	18	1,496	1,296	87	11	216	34	2,062	10	3p.	5,610	130	188.9	125	-	-	71
[illegible]	5,625	-	-	1,622	786	48	11	131	43	1,332	10	1m.	6,082	92	238.9	125	-	-	29
[illegible]	5,919	10,453	-	1,081	640	60	10	108	55	2,645	24	1m.	4,053	146	305.6	100	-	-	76
[illegible]	7,122	5,664	20	3,378	984	29	11	164	43	1,831	11	1m.	12,667	56	238.9	125	-	-	36
[illegible]	3,888	72	98	2,027	762	37	3	127	0.5	1,447	11	1p.	7,601	51	3	125	-	-	17
San Gerardo	3,888	-	-	1,892	-	-	7	-	-	-	-	2p.	7,095	55	-	-	-	-	25
San Jorge	8,988	3,450	62	4,730	762	16	16	127	27	1,398	11	Icf	17,737	51	150	125	-	-	41
[illegible]	11,664	321	97	2,420	1,884	78	3	314	1	3,528	11	Icf.	10,890	107	5	150	149	894	
[illegible]	12,672	-	-	1,011	-	-	-	-	-	-	-	3m.	-	-	-	100	-	-	162
[illegible]	6,984	509	92	1,170	702	60	-	117	5	1,305	11	Icf.	5,265	133	27	150	-	-	48
[illegible]	3,600	-	-	638	240	38	-	40	-	468	12	3m.	1,914	188	-	100	-	-	41
[illegible]	-	-	-	426	534	125	-	89	-	-	-	3m.	1,278	-	-	-	-	-	-
Tilipucá	11,211	8,913	20	4,384	2,202	50	7	367	24	2,947	8	2p.	19,728	57	133	150	170	1,020	37
San Alejo	12,834	8,637	33	4,574	2,298	50	9	383	22	3,976	10	2p.	20,583	62	122	150	-	-	37
[illegible]	3,888	352	91	1,306	1,152	88	3	192	2	2,203	11	Icf.	4,897	79	11	125	-	-	24
Nueva Esparta	9,570	-	-	1,779	1,224	69	10	204	-	2,376	12	3m.	5,337	179	-	100	-	-	78
[illegible]	1,593	-	-	1,151	996	86	8	166	-	1,980	12	1p.	4,316	37	-	125	-	-	8
[illegible]	3,045	2,519	18	1,334	570	43	8	95	26	741	8	2p.	5,002	67	144	125	-	-	53
El Carmen	1,296	3,701		847	870	102	2	145	26	942	6	1p.	3,176	41	805	125	-	-	23

DEPARTAMENTO DE DESARROLLO FISICO

AGOSTO 1989

APPENDIX III.B.3
(See Tables attached)

MINISTRY OF PUBLIC HEALTH AND SOCIAL ASSISTANCE
NATIONAL PLAN OF RURAL BASIC SANITATION
PLANSABAR

Regular Program

Glosarry of terms for project selection indicators

Spanish	English
1. Localidad	1. Locality
2. Municipio	2. District
3. Departamento	3. Department
4. Region	4. Region
5. Sistema	5. System
6. Estado de funcion	6. Function condition
7. Conexion	7. Connection
8. Cantarera	8. Outlet
9. Tarifa	9. Tariff

MINISTE) DE SALUD PUBLICA Y ASISTENCIA OCIAL

PLAN NACIONAL DE SANEAMIENTO BASICO RURAL

P L A N S A B A R

PROGRAMA REGULAR

Nº	LOCALIDAD	MUNICIPIO	DEPARTAMENTO	REGION	SISTEMA	ESTADO DE FUNCION.	CONEXION.	CANTARER.	TARIFA
1	Ctón. Cañas Dulces	Metapán	Santa Ana	Occidental	Gravedad	Funciona	42	-	¢ 3.00
2	Cas. El Changuite,C/Limón	Metapán	Santa Ana	Occidental	Gravedad	Funciona	128	-	3.00
3	Cas. Los Llanitos,C/Sta.Rita	Metapán	Santa Ana	Occidental	Gravedad	Funciona	115	-	3.00
4	Cas.Sn. Juan Chiquito	El Porvenir	Santa Ana	Occidental	Gravedad	Funciona	14	-	3.00
5	Cas. Ayutica,C/Ayuta	Santa Ana	Santa Ana	Occidental	B.E.	Funciona	42	-	5.00
6	Ctón. Piletas	Stgo.de la Front.	Sta. Ana	Occidental	Gravedad	Funciona	111	-	3.00
7	Cas. Los Guiroles,C/Primav.	Santa Ana	Santa Ana	Occidental	B.E.	Funciona	70	-	5.00
8	Ctón. Anal Abajo	Nahuizalco	Sonsonate	Occidental	Grav.	Funciona	110	-	3.00
9	Ctón. El Cerrito	Nahuizalco	Sonsonate	Occidental	Grav.	Funciona	139	-	3.00
10	C/Sn. Juan Arriba	Nahuizalco	Sonsonate	Occidental	Grav.	Funciona	47	-	3.00
11	C/Talcomunca	Izalco	Sonsonate	Occidental	Grav.	Funciona	81	-	3.00
12	C/El Castaño	Sn. Ant. del M.	Sonsonate	Occidental	B.E.	Funciona	125	-	5.00
13	Col. La Reyna,C/Sta. Rosa	Chalchuapa	Sta. Ana	Occidental	B.E.	Funciona	180	-	5.00
14	Ctón. Julute	Chiltiupán	La Libertad	Central	Grav.	Funciona	12 16	1097 5	¢3.00/ ¢0.5
	Cas. Shutía,C/Taquillo					Funciona	3	106	
15	Hda. Melara,C/Melara	La Libertad	La Libertad	Central	B.E.	Funciona	252		¢ 5.00
16	Ctón. Llano Grande	Concep. Quezalt.	Chalatenango	Central	Grav.	Funciona			
17	Ctón. Llano de la Virgen	Citalá	Chalatenango	Central	Grav.	Funciona			
18	Ctón. Los Amates	Sn. Isidro Libert.	Chalatenango	Central	Grav.	Funciona			
19	Ctón. Los Henríquez	Nombre de Jesús	Chalatenango	Central	Grav.	Funciona			
20	Cas. Hda. Vieja,C/Plazuelas	Nombre de Jesús	Chalatenango	Central	Grav.	No Func.			
21	Ctón. El Sitio					Funciona			
	Cas. Los Rivera,C/El Sitio	Nva. Trinidad	Chalatenango	Central	Grav.	Funciona			
	Cas. Los Varela,C/El Sitio					Funciona			
	Cas. Los Miranda,C/El Sitio					Funciona			
22	Cas. Los Quintanilla,C/Sta.T.	Potonico	Chalatenango	Central	Grav.	Funciona			

Cerrito

MINISTERIO DE SALUD PUBLICA Y ASISTENCIA SOCIAL

PLAN NACIONAL DE SANEAMIENTO BASICO RURAL

PLANSABAR

PROGRAMA REGULAR

Nº	LOCALIDAD	MUNICIPIO	DEPARTAMENTO	REGION	SISTEMA	ESTADO DE FUNCION.	CONEXION.	CANTARER.	TARIFA
23	Ctón. Los Planes	La Palma	Chalatenango	Central	Grav.	No Func.			
24	Ctón. La Montañita	Ojos de Agua	Chalatenango	Central	Grav.	Funciona			
25	Ctón. Laguna Seca	Nva. Concep.	Chalatenango	Central	Grav.	Funciona	[illegible]		
26	Ctón. Las Pilas	Sn. Ignacio	Chalatenango	Central	Grav.	No Funcio.			
27	Cas.Sn. Luis El Terreno C/T	Sn. Fco. Morazán	Chalatenango	Central	Grav.	Funciona			
28	Cas. El Tunal,C/Sn.José Sa.	La Palma	Chalatenango	Central	Grav.	Funciona			
29	Ctón. El Salitre	Tejutla	Chalatenango	Central	Grav.	No Func.			
30	Ctón. Sn. Ramón	Citalá	Chalatenango	Central	Grav.	No Func.	[illegible]	33	
31	Ctón. Los Planes	Citalá	Chalatenango	Central	Grav.	No Func.			
32	Ctón. Los Naranjos	Sn. Luis del Car.	Chalatenango	Central	Grav.	Funciona			
33	Ctón. El Pinar Sn. Ignacio	Chalatenango	Chalatenango	Central	Grav.	Funciona			
34	Cas. Barrancón,C/Tilapa	La Reina	Chalatenango	Central	Grav.	Funciona			
35	Ctón. Asentamiento El Dorado	Chalatenango	Chalatenango	Central	B.E.	Funciona	309	-	¢ 3.00
	" Asent. El Dorado N. II	Chalatenango	Chalatenango	Central	B.E.	Funciona	[illegible] 309	-	¢ 3.00
	" Asent. El Dorado N.III	Chalatenango	Chalatenango	Central	B.E.	Funciona	[illegible] 197	-	¢ 3.00
36	Ctón. El Portillo	Ojos de Agua	Chalatenango	Central	Grav.	Funciona			
37	Ctón. Concepción	Tejutla	Chalatenango	Central	Grav.	Funciona			
38	Ctón. Sn. José Loma	Stgo. Nonualco	La Paz	Paracent.	Grav.	Funciona	[illegible] 44	12	¢ 0.50
	Ctón. Sn. José Obrajito					Funciona	[illegible] 107		3.00
	Cas. Sta. Lucía,Sn.José Abajo					Funciona	[illegible] 48		3.00
	Cas. Km. 45,C/Sn.José Abajo					Funciona	76 84		3.00
39	Ctón. Sta. Cruz Loma	Stgo. Nonualco	La Paz	Paracent.	Grav.	Funcionan		97	0.50
	Ctón. Sn. Ramón	Sn. Pedro Nonualco	La Paz				10 38		3.00
40	Ctón. Concepción	Sta. Ma.Ostuma	La Paz	Paracent.	B.E.	Funciona	37		5.00
41	Ctón. Sn. Antonio	Cuyultitán	La Paz	Paracent.	B.E.	Funciona	11/104		5.00
	Cas. Las Piedritas,C/Sn.Ant.								

MINISTE) DE SALUD PUBLICA Y ASISTENCIA OCIAL
PLAN NACIONAL DE SANEAMIENTO BASICO RURAL
P L A N S A B A R
PROGRAMA REGULAR

Nº	LOCALIDAD	MUNICIPIO	DEPARTAMENTO	REGION	SISTEMA	ESTADO DE FUNC.	CONEXION	CANTARER	TARIFA
42	Ctón. El Carmen	Sn.Pedro Masah.	La Paz	Paracent.	B.E.	Funciona	77		$ 5.00
	Ctón. Dulce Nombre					Funciona	103 10		5.00
43	Ctón. Los Romero	Jerusalén	La Paz			Funciona	40		5.00
	Ctón. El Espino			Paracent.	B.B.	Funciona	32		5.00
	Ctón. Sn. Jerónimo Limón		Sn. Vicente			Funciona	28		5.00
44	Cas. Sn. Fco. El Dorado				Grav.	Funciona	54	146	3.00/0.50
	Cas. Pie de la caseta,C/S.F.	Sn. Isidro	Cabañas	Paracent.	Grav.				
	Cas. Los Jobitos,C/Sn.Fco.								
	Cas.Hda.Mtaja,C/Sn.Fco.								
45	Ctón. El Bañadero	Guacotocti	Cabañas	Paracent.	Grav.	Funciona	29	88	3.00/0.50
46	Cas. El Carmen,C/Potrero	Ilobasco	Cabañas	Paracent.	Grav.	Funciona		86	0.50
47	Ctón. Batres	Stgo.María	Usulután	Oriental	Grav.	Funciona	-	117	0.50
48	Cas. El Recreo,C/Sn.Juan Loma	Alta/Berlín	Usulután	Oriental	Grav.	No Func.		78	3.00/0.50
	Ctón. Sn.JuanLoma Alta	Berlín	Usulután	Oriental	Grav.	No Func.	56	178	3.00/0.50
49	Ctón. Marquezado	Sgo. de María	Usulután	Oriental	Grav.	No Func.			
50	Cas. El Pacún,C/Candelaria	Comacarán	Sn. Miguel	Oriental	Grav.	Funciona	13	9	3.00/0.50
51	Cas. Crucero,C/Hormiguero	Comacarán	Sn. Miguel	Oriental	Grav.	Funciona	85		3.00/0.50
	Ctón. El Hormiguero								
52	Ctón. Nva. Concepción	Chirilegua	Sn. Miguel	Oriental	Grav.	Funciona		37	0.50
53	Cas. Los Velásquez, C/Sn.Juan	Sn. Luis de la	Rei. Sn. Mig.	Oriental	Grav.	No Func.			
	Ctón. Sn. Juan								
54	Ctón. Sn.Pedro El Jiote	Chapeltique	Sn. Miguel	Oriental	Grav.	Funciona	38	-	3.00
55	Ctón. El Jicaral	Comacarán	Sn. Miguel	Oriental	Grav.	No Func.			
56	Ctón. El Colorado	Comacarán	Sn. Miguel	Oriental	Grav.	Funciona	53	90	3.00/0.50
57	Cas.Guanaste,C/Guanaste	Cdad. Barrios	Sn. Miguel	Oriental	Grav.	Funciona	195		3.00
	Cas. La Coyotera,C/Guanaste	Cdad. Barrios	Sn. Miguel	Oriental	Grav.				

MINISTE) DE SALUD PUBLICA Y ASISTENCIA OCIAL
PLAN NACIONAL DE SANEAMIENTO BASICO RURAL
P L A N S A B A R
PROGRAMA REGULAR

Nº	LOCALIDAD	MUNICIPIO	DEPARTAMENTO	REGION	SISTEMA	ESTADO DE FUNC.	CONEXION	CANTARER.	TARIFA
	Cas. Loma de Enmedio,C/Guana.								
	Cas. Cerro de Arena,C/Guana.								
58	Ctón. Cerro del Coyol	Oscicala	Morazán	Oriental	Grav.	Funciona	6	18	3.00/0.50
59	Ctón. Llano Alegre	Oscicala	Morazán	Oriental	Grav.	Funciona	34	-	3.00
60	Ctón. Sn. Pedro Río Seco Arrib.	El Divisadero	Morazán	Oriental	Grav.				
	Ctón. Sn. Pedro Río Seco Abajo	El Divisadero	Morazán	Oriental	Grav.	Funciona	29	90	3.00/0.50
61	Ctón. Flamenco	Jocoro	Morazán	Oriental	Grav.	Funciona	20	96	3.00/0.50
62	Ctón. El Acoituno	Yoloaiquín	Morazán	Oriental	Grav.	Funciona	32	10	3.00/0.50
63	Ctón. Sn. Juan de la Cruz	Yamabal	Morazán	Oriental	Grav.	Funciona	23	64	3.00/0.50
64	Ctón. El Rodeo	Sensembra	Morazán	Oriental	Grav.	No Funcio.			
65	Ctón. Ojos de Agua	Villa del Ros.	Morazán	Oriental	Grav.	No Func.	29	3	3.00/0.50
66	Ctón. Piedra Parada	Sn. Isidro	Morazán	Oriental	Grav.	Funciona	-	53	0.50
67	Cas. Pueblo Viejo,C/Agua Zar.	Oscicala	Morazán	Oriental	Grav.	Funciona	34	-	3.00
68	Ctón. La Cuchilla	Delicias de Con.	Morazán	Oriental	Grav.	Funciona	139	-	3.00
69	Cas. El Tempisque,C/Terreno	B. Sn. Alejo	La Unión	Oriental	Grav.	Funciona	-	18	0.50
70	Ctón. Agua Fría	Sn. Alejo	La Unión	Oriental	Grav.	Funciona	96	-	3.00
71	Mpio.Concep. de Oriente	Concep. Ote.	La Unión	Oriental	Grav.	Funciona	154	-	3.00
72	Ctón. Huertas Viejas	Anamorós	La Unión	Oriental	Grav.	Funciona	1	41	3.00/0.50
73	Ctón. Candelaria	Yucuaiquín	La Unión	Oriental	Grav.	No Func.	43	-	3.00
74	Cas.Albornos Abajo,C/Chorre	Sta. Rosa Lima	La Unión	Oriental	Grav.	Funciona	-	34	0.50
75	Cas. Los Velásquez,C/El Port.	Nva. Esparta	La Unión	Oriental	Grav.	No Func.	1	27	3.00/0.50
76	Cas. El Portillo,C/El Port.	Nva. Esparta	La Unión	Oriental	Grav.	No Funcio.	16	5	3.00/0.50
77	Cas. Maderas Siramas	La Unión	La Unión	Oriental	Grav.	Funciona	-	99	0.50
78	Ctón. Bobadilla	Sn. Alejo	La Unión	Oriental	Grav.	Funciona	86	-	3.00
79	Cas. El Tejar,C/El Pastor	Yayantique	La Unión	Oriental	Grav.	Funciona	100	-	3.00

ANEXO N° 2

MINISTERIO DE SALUD PUBLICA Y ASISTENCIA SOCIAL

PLAN NACIONAL DE SANEAMIENTO BASICO RURAL

P L A N S A B A R

PRESTAMO 324/SF-ES

Nº	LOCALIDAD	MUNICIPIO	DEPARTAMENTO	REGION	SISTEMA	ESTADO	CONEXION	CANTARERA	TARIFA
1	01 Ctón. La Puerta	Tacuba	Ahuachapán	Occidental	B.E.	[illegible]	[illegible]		[illegible]
	02 Ctón. Loma Larga	Tacuba	Ahuachapán	Occidental	B.E.	Funcionando	60		5.00
	03 Ctón. El Rodeo	Tacuba	Ahuachapán	Occidental	B.E.	[illegible]	[illegible]		5.00
2	04 Cas.Pte.Arce,C/Jocotillo	SanFco.Menéndez	Ahuachapán	Occidental	B.E.	Funcionando	[illegible]		5.00
3	05 Ctón. Platanares	Guaymango	Ahuachapán	Occidental	Grav.	Funcionando	[illegible]		3.00
4	06 Ctón. Llanos de D.María	Ahuachapán	Ahuachapán	Occidental	Grav.	Funcionando	131		3.00
	07 Ctón. Sta.Rosa Acacalco	Ahuachapán	Ahuachapán	Occidental	Grav.	Funcionando	[illegible]		3.00
	08 Ctón. San Lázaro	Ahuachapán	Ahuachapán	Occidental	Grav.	Funcionando	[illegible]		3.00
5	09 C/Texis Junction,Coyote	Texistepeque	Santa Ana	Occidental	B.E.	Funcionando	[illegible]		5.00
6	10 C/San Sebastián Las Ig.	Chalchuapa	Santa Ana	Occidental	Grav.	Funcionando	73		3.00
7	11 La Cuchilla,C/Nancintep.	Santa Ana	Santa Ana	Occidental	Grav.	Funcionando	[illegible]		3.00
8	12 Cas.Sn.Miguelito,C/Sn.Jto.	Coatepeque	Santa Ana	Occidental	B.E.	Funcionando	127		5.00
	13 Cas.Sitio El Rosario,C/El Resb.	Coatep.	Santa Ana	Occidental	Grav.	Funcionando			
9	14 Ctón. El Resbaladero	Coatepeque	Santa Ana	Occidental	Grav.	Funcionando	50		3.00
10	15 Ctón. San Jacinto	Coatepeque	Santa Ana	Occidental	B.E.	Funcionando	125		5.00
11	16 Ctón. Galeano	Chalchuapa	Santa Ana	Occidental	B.E.	Funcionando	144		5.00
12	17 Ctón. Santa Rita	Metapán	Santa Ana	Occidental	Grav.	Funcionando	105		3.00
13	18 Ctón. El Panal	Metapán	Santa Ana	Occidental	B.E.	Funcionando	94		5.00
14	19 Ctón. San Jerónimo	Metapán	Santa Ana	Occidental	Grav.	Funcionando	125		3.00
15	20 Ctón. Llanos de la Majada	S.R.Guacipilín	Santa Ana	Occidental	B.E.	Funcionando			
16	21 Ctón. La Isla	Metapán	Santa Ana	Occidental	Grav.	Funcionando			
	22 Ctón. La Vega	Metapán	Santa Ana	Occidental	Grav.	Funcionando			
	23 Ctón. La Juntita	Metapán	Santa Ana	Occidental	Grav.	Funcionando			
17	24 Cas.Sta.Ines,C/Matalapa	Metapán	Santa Ana	Occidental	Grav.	Funcionando	83		3.00
18	25 Ctón. Tunalmiles	Izalco	Sonsonate	Occidental	Grav.	Funcionando	45		3.00
19	26 Ctón. Cruz Grande	Izalco	Sonsonate	Occidental	Grav.	Funcionando	105		3.00

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20	27 Ctón. Tapalchucut	Izalco	Sonsonate	Occidental	Grav.	[illegible]	[illegible]		$ 3.00
21	28 Ctón. Huiscoyolate	Izalco	Sonsonate	Occidental	Grav.	Funcion	165		[illegible].00
22	29 Ctón. Sub.Sn.Juan Abajo	Nahuizalco	Sonsonate	Occidental	Grav.	Funcion	104		3.00
	30 Ctón. Almendro Arriba	Sonsonate	Sonsonate	Occidental	Grav.	Funcion	67		3.00
23	31 Ctón. Almendro Abajo	Sonzacate	Sonsonate	Occidental	Grav.	Funcion	133		3.00
24	32 Ctón. Cusamaluco	Nahuizalco	Sonsonate	Occidental	Grav.	Funcion	74		3.00
	33 Ctón. Tajcuilujlan	Nahuizalco	Sonsonate	Occidental	Grav.	Funcion	25		3.00
	34. Ctón. Pushtan	Nahuizalco	Sonsonate	Occidental	Grav.	Funcion	66		5.00
25	35 Ctón. Los Arenales	Nahuizalco	Sonsonate	Occidental	B.E.	Funcion	[illegible]		5.00
	36 Ctón. El Chaparrón	Nahuizalco	Sonsonate	Occidental	Grav.	Funcion	50		3.00
26	37 Ctón. Santa Rosa	Ciudad Arce	La Libertad	Central	B.E.	Funcion	[illegible]		4.00
	38 Cas.Santa Lucía	Ciudad Arce	La Libertad	Central	B.E.	Funcion	430		4.00
27	39 Cas.La Estación,C/Sn.Is.	Tacachico	La Libertad	Central	B.E.	Funcion	104		4.25
28	40 Ctón. La Joyita	Ciudad Arce	La Libertad	Central	B.E.	Funcion	201		4.00
	41 Ctón. La Reforma	Ciudad Arce	La Libertad	Central	B.E.	Funcion	87		4.00
29	42 Ctón. Zapotitán	Ciudad Arce	La Libertad	Central	B.E.	Funcion	334		4.00
	43 Ctón. Veracruz	Ciudad Arce	La Libertad	Central	B.E.	Funcion	90		4.00
30	44 Ctón. Segura	Juezaltepeque	La Libertad	Central	Grav.	En planificación por estar en zona conflic.			
31	45 Ctón. El Limón	Soyapango	San Salvador	Central	B.E.	No funciona	55		5.00
32	46 Ctón. Amate Blanco	Rosario de Mora	San Salvador	Central	Grav.	Funcion	74		3.00
	47 Ctón. El Carrizal	Rosario de Mora	San Salvador	Central	Grav.	Funcion	47		3.00
	48 Ctón. San Ramón	Rosario de Mora	San Salvador	Central	Grav.	Funciona	14		3.00
	49 Ctón. Las Barrosas	Rosario de Mora	San Salvador	Central	Grav.	Funciona	38	2	3.00 0.50
33	50 Ctón. Los Naranjos	Las Vueltas	Chalatenango	Central	Grav.	Funciona	37		
34	51 Ctón. Laguna Seca	Nva.Concepción	Chalatenango	Central	Grav.	Funciona	104		3.00
35	52 Ctón. Pacayas	La Laguna	Chalatenango	Central	Grav.	No func.	104	28 2 /	3.00/0.50

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	53 Ctón. Comalapa	Comalapa	Chalatenango	Central	Grav.	[illegible]	[illegible]		
35	54 Cas.Cancuyo,C/Chiapas	Chalatenango	Chalatenango	Central	Grav.	Funcionando	35		3.00
37	55 Cas.Guarjilito,C/Guarjil	Chalatenango	Chalatenango	Central	Grav.	Funcionando	6		3.00
38	56 Ctón. Vainillas	El Carrizal	Chalatenango	Central	Grav.	Funcionando	51		3.00
	57 Ctón. Potrerillos	El Carrizal	Chalatenango	Central	Grav.	Funcionando	41	1/	3.00/0.50
39	58 Ctón. Chiapas	Chalatenango	Chalatenango	Central	Grav.	Funcionando	95		3.00
40	59 Ctón. Hacienda Vieja	SanPedro Non.	La Paz	Paracentral	B.E.	Funcionando	120		5.00
41	60 Ctón. Santa Teresa	Stgo.Nonualco	La Paz	Paracentral	Grav.	Funcionando	114		3.00
42	61 Ctón. El Tránsito	Sta.Ma.Ostuma	La Paz	Paracentral	B.E.	Funcionando	[illegible]		5.00
	62 Ctón. San Antonio	Sta.Ma.Ostuma	La Paz	Paracentral	B.E.	Funcionando	66		5.00
	63 Ctón. El Chaperno	Sta.Ma.Ostuma	La Paz	Paracentral	B.E.	Funcionando	74	14 2/	5.00/1.00
43	64 Ctón.San José Carrizal	Sta.Ma.Ostuma	La Paz	Paracentral	B.E.	Funcionando	98		5.00
44	65 Ctón. Veracruz	San Juan Talpa	La Paz	Paracentral	Grav.	No func.	[illegible]	46 2/	3.00/0.50
	66 Ctón. Tobalón	San Juan Talpa	La Paz	Paracentral	Grav.	Funcionando	40		3.00
	67 Ctón. Cupinco	Olocuilta	La Paz	Paracentral	Grav.	Funcionando	30		3.00
45	68 Ctón.San José Bna.Vista	Olocuilta	La Paz	Paracentral	Grav.	Funcionando	48		3.00
	69 Ctón.Planes de Los Delic	Olocuilta	La Paz	Paracentral	Grav.	Funcionando	105		3.00
	70 Ctón. Valle Nuevo	Olocuilta	La Paz	Paracentral	Grav.	Funcionando	174		3.00
	71 Ctón. Jayuca	Olocuilta	La Paz	Paracentral	Grav.	Funcionando	50		3.00
	72 Ctón. Santa Fé	Olocuilta	La Paz	Paracentral	Grav.	Funcionando	[illegible]		3.00
	73 Ctón. San Sebastián	Olocuilta	La Paz	Paracentral	Grav.	Funcionando	[illegible]	20 2/	3.00/0.50
46	74 Ctón. La Esperanza	Olocuilta	La Paz	Paracentral	B.E.	Funcionando	153		5.00
47	75 Ctón. El Chunte	Sensuntepeque	Cabañas	Paracentral	Grav.	Funcionando	87	14 2/	3.00/0.50
48	76 Ctón. La Escopeta	Cinquera	Cabañas	Paracentral	Grav.	No func.	25	28 2/	2.00/0.25
49	77 Montepeque	Suchitoto	Cuscatlán	Paracentral	Grav.	No func.	[illegible]		3.00
50	78 Ctón. El Salitre	Sn.José Guayabal	Cuscatlán	Paracentral	Grav.	No func.	43		3.00

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Nº	LOCALIDAD	MUNICIPIO	DEPARTAMENTO	REGION	[illegible]	ESTADO	POBLACION	CANTARERA	TARIFA
	[illegible]	Suchitoto	Cuscatlán	Paracentral	[illegible]	[illegible]	[illegible]		[illegible]
1	79 Ctón. [illegible]	Suchitoto	Cuscatlán	Paracentral	B.E.	No func.	160		5.00
	80 Ctón. Ichanguazo	Suchitoto	Cuscatlán	Paracentral	B.E.	No func.	60		5.00
	81 C/San Rafl.La Bermuda	Suchitoto	Cuscatlán	Paracentral	B.E.	No func.	56		5.00
	82 Ctón. El Molino	Suchitoto	Cuscatlán	Paracentral	B.E.	No func.	[illegible]		5.00
	83 Ctón/ Tecomatepeque	Sn/Pedro Par.	Cuscatlán	Paracentral	B.E.	No func.	66		5.00
52	84 Ctón. El Paríso	San Sebastián	San Vicente	Paracentral	B.E.	No func.	[illegible]		5.00
53	85 Ctón. El Arco	Tecoluca	San Vicente	Paracentral	Grav.	Funciona	81		
	86 Ctón. San Diego	San Vicente	San Vicente	Paracentral	B.E.	No func.	104		5.00
54	87 Ctón. El Espino	San Buena Vent.	Usulután	Oriental	B.E.	Funciona	56		5.00
	88 Ctón. Las Charcas	San Buena Vista	Usulután	Oriental	B.E.	Funciona	65		5.00
	89 Ctón. El Jícaro	Lolotique	San Miguel	Oriental	B.E.	Funciona	65		5.00
55	90 Cas.Las Salina,C/Pto.Par.	Usulután	Usulután	Oriental	B.E.	Funciona	112		5.00
56	91 Ctón. San Juan Loma Alta	Berlín	Usulután	Oriental	Grav.	No func.	56	zona conflictiva	
57	92 Ctón. Samuria	Jucuarán	Usulután	Oriental	B.E.	Funciona	104		
58	93 Ctón. Valle Alegre	Moncagua	San Miguel	Oriental	B.E.	Funciona	201		5.00
59	94 Cas. Llano Gde.C/Corralito	Corinto	Morazán	Oriental	Grav.	Funciona	27		3.00
60	95 Cas.San Luis,C/La Joya	Meanguera	Morazán	Oriental	Grav.	No func.	26	zona conf.	3.00
61	96 Ctón. El Rodeo	Jocoaitique	Morazán	Oriental	Grav	No func.	50		
	97 Ctón. El Volcancillo	Jocoaitique	Morazán	Oriental	Grav.	No func.	38	zona conf.	3.00
62	98 Ctón. El Cerro	San Simón	Morazán	Oriental	Grav.	Funciona	[illegible]		3.00
	99 Ctón. Las Quebradas	San Simón	Morazán	Oriental	Grav.	Funciona	20		
63	100 Ctón. Valle Grande	San Simón	Morazán	Oriental	Grav.	Funciona	68		3.00
64	101 Cas.El Carmen,C/Ciricuario	Yucuaiquín	La Unión	Oriental	Grav.	Funciona	76	7 2/	3.00/0.50
65	102 Ctón. Ciricuario	Yucuaiquín	La Unión	Oriental	Grav.	Funciona	42		3.00
66	103 Ctón. El Derrumbado	Lislique	La Unión	Oriental	Grav.	Funciona	10		3.00

*zona.

* Funciona, no cotiza y se encuentra en zona conflictiva.

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Nº	LOCALIDAD	MUNICIPIO	DEPARTAMENTO	REGION	SISTEMA	ESTADO	POBLACION	CANTONES	TARIFA
01	Ctón. Chancavo	Ahuachapán	Ahuachapán	Occidental	[illegible]	[illegible]	[illegible]		c. 5.00
02	Ctón. El Roble	Ahuachapán	Ahuachapán	Occidental	B.E.	Funcionando	[illegible]		5.00
03	Ctón. El Tigre	Ahuachapán	Ahuachapán	Occidental	B.E.	Funcionando	200		5.00
04	Ctón. Palo Pique	Ahuachapán	Ahuachapán	Occidental	B.E.	Funcionando	[illegible]		5.00
05	Ctón. Los Toles	Ahuachapán	Ahuachapán	Occidental	B.E.	Funcionando	96		5.00
06	Ctón. La Coyotera	Ahuachapán	Ahuachapán	Occidental	B.E.	Funcionando	[illegible]		5.00
07	Ctón. El Junquillo	Ahuachapán	Ahuachapán	Occidental	B.E.	Funcionando	262		5.00
08	Cas.Las Viñas,C/Junquillo	Ahuachapán	Ahuachapán	Occidental	B.E.	Funcionando	[illegible]	[illegible]	
09	Cas.Tanuaca,C/Junquillo	Ahuachapán	Ahuachapán	Occidental	B.E.	Funcionando			
10	Ctón. Guascota	San Lorenzo	Ahuachapán	Occidental	B.E.	Funcionando	67		5.00
11	Ctón. Conucaste	San Lorenzo	Ahuachapán	Occidental	B.E.	Funcionando	100		5.00
12	Ctón. El Tortuguero	Atiquizaya	Ahuachapán	Occidental	Grav.	Funcionando	[illegible]		3.00
13	Ctón. Santa Rita	Atiquizaya	Ahuachapán	Occidental	Grav.	Funcionando	10		3.00
14	Ctón. El Chayal	Atiquizaya	Ahuachapán	Occidental	Grav.	Funcionando	[illegible]		3.00
15	Ctón. El Tapacún	Atiquizaya	Ahuachapán	Occidental	Grav.	Funcionando	[illegible]		3.00
16	Ctón. El Paraíso	Turín	Ahuachapán	Occidental	Grav.	Funcionando	[illegible]		3.00
17	Ctón. La Esperanza	Atiquizaya	Ahuachapán	Occidental	Grav.	Funcionando	10		3.00
18	Ctón. El Pepenance	Atiquizaya	Ahuachapán	Occidental	Grav.	Funcionando	[illegible]		3.00
19	Ctón.Joya del Zapote	Atiquizaya	Ahuachapán	Occidental	Grav.	Funcionando	[illegible]		3.00
20	Ctón. La Hachadura	San Fco. Men.	Ahuachapán	Occidental	B.E.	Funcionando	106		5.00
21	Ctón. Cerro Sucio	San Fco. Men.	Ahuachapán	Occidental	B.E.	Funcionando	[illegible]		5.00
22	Ctón. La Esperanza 1/	Atiquizaya	Ahuachapán	Occidental	B.E.	Funcionando	[illegible]		5.00
23	Ctón. Pepenance	Atiquizaya	Ahuachapán	Occidental	B.E.	Funcionando	[illegible]		5.00
24	Ctón. Joya del Zapote	Atiquizaya	Ahuachapán	Occidental	B.E.	Funcionando	45		5.00
25	Ctón. Joya del Platanar	Atiquizaya	Ahuachapán	Occidental	B.E.	Funcionando	[illegible]		5.00
26	Ctón. Rincón Grande	Atiquizaya	Ahuachapán	Occidental	B.E.	Funcionando	51		5.00

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Nº	LOCALIDAD	MUNICIPIO	DEPARTAMENTO	REGION	SISTEMA	ESTADO	CONEXION	CANTARERA	TARIFA
27	Ctón. [illegible]	Atiquizaya	Ahuachapán	Occidental	B.E.	[illegible]	[illegible]		5.00
28	Ctón. El Rosario	El Refugio	Ahuachapán	Occidental	B.E.	Funcionando	76		5.00
29	Ctón. El Jobo	Jurín	Ahuachapán	Occidental	B.E.	[illegible]	[illegible]		
30	Ctón. Montañita	Ahuachapán	Ahuachapán	Occidental	B.E.	Funcionando	[illegible]		5.00
31	Ctón. El Chayal	Atiquizaya	Ahuachapán	Occidental	B.E.	Funcionando	[illegible]		5.00
32	Ctón. El Ranchador	Santa Ana	Santa Ana	Occidental	B.E.	Funcionando	247		5.00
33	Ctón. Primavera	Santa Ana	Santa Ana	Occidental	B.E.	Funcionando	457		5.00
34	Cas.Primaverita,C/Primavera	Santa Ana	Santa Ana	Occidental	B.E.	Funcionando			
35	Cas.Primaverona,C/Primavera	Santa Ana	Santa Ana	Occidental	B.E.	Funcionando			
36	Cas. Versalles,C/Primavera	Santa Ana	Santa Ana	Occidental	B.E.	Funcionando			
37	Cas.El Bejuco, C/Primavera	Santa Ana	Santa Ana	Occidental	B.E.	Funcionando			
38	Ctón. Cutumay Camones	Texistepeque	Santa Ana	Occidental	B.E.	Funcionando	138		5.00
39	Ctón. Cujucuyo	Texistepeque	Santa Ana	Occidental	Grav.	Funcionando	60		3.00
40	Ctón. San Cristóbal	El Porvenir	Santa Ana	Occidental	B.E.	Funcionando	90		5.00
41	C/Paraje Galán,C/Sn.Vic.(2/)	Cand.de La Fr.	Santa Ana	Occidental	B.E.	Funcionando	152		5.00
42	Ctón. San José	Chalchuapa	Santa Ana	Occidental	B.E.	Funcionando	72		5.00
43	Ctón. Las Flores	Chalchuapa	Santa Ana	Occidental	B.E.	Funcionando	75		5.00
44	Ctón. El Cuje	Chalchuapa	Santa Ana	Occidental	B.E.	Funcionando	108		5.00
45	Ctón. Los Amates	Sn.Seb.Salit.	Santa Ana	Occidental	B.E.	Funcionando	[illegible]		5.00
46	Ctón. San Luis	Sn.Seb.Salit.	Santa Ana	Occidental	B.E.	[illegible]	[illegible]		5.00
47	Ctón. Tres Ceibas	Izalco	Sonsonate	Occidental	Grav.	[illegible]	[illegible]		3.00
48	Ctón. San Genaro,C/Lomas M.	Sonsonate	Sonsonate	Occidental	B.E.	Funcionando	447	[illegible]	5.00
49	Ctón. Las Higueras 3/	Izalco	Sonsonate	Occidental	Grav.	Funcionando	125		3.00
50	Ctón. Quebrada Española	Izalco	Sonsonate	Occidental	Grav.	Funcionando	[illegible]		3.00
51	Ctón. Joya del Cerén	Izalco	Sonsonate	Occidental	Grav.	Funcionando	55		3.00
52	Ctón. Piedras Pachas	Izalco	Sonsonate	Occidental	Grav.	Funcionando	177		3.00

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53	Cón. Ceiba del Charco	Izalco	Sonsonate	Occidental	Grav.	[illegible]	[illegible]		[illegible].00
54	Crío.Los Pinte,C/Tunalmiles	Izalco	Sonsonate	Occidental	Grav.	Funciona	[illegible]		3.00
55	Ctón. Teshcal	Izalco	Sonsonate	Occidental	Grav.	Funciona	76		3.00
56	Ctón. Chorro Arriba	Izalco	Sonsonate	Occidental	Grav.	Funciona	42		3.00
57	Ctón. Cruz Grande Norte	Izalco	Sonsonate	Occidental	Grav.	Funciona	105		3.00
58	Ctón. Shon-Shon	Izalco	Sonsonate	Occidental	Grav.	Funciona	[illegible]		3.00
59	Ctón. Cuyagualo	Izalco	Sonsonate	Occidental	Grav.	Funciona	150		3.00
60	Ctón. San Luis	Izalco	Sonsonate	Occidental	Grav.	Funciona	25		3.00
61	Ctón/ Cuntan	Izalco	Sonsonate	Occidental	Grav.	Funciona	72		3.00
62	Ctón. El Sitio	Izalco	Sonsonate	Occidental	Grav.	Funciona	10		3.00
63	Ctón. Chorro Abajo	Izalco	Sonsonate	Occidental	Grav.	Funciona	[illegible]		3.00
64	Ctón. El Zunza	Izalco	Sonsonate	Occidental	Grav.	Funciona	111		3.00
65	Ctón. El Morro	Izalco	Sonsonate	Occidental	Grav.	Funciona	41		3.00
66	Ctón. Tunalmiles Norte	Izalco	Sonsonate	Occidental	Grav.	Funciona	65		3.00
67	Crío. El Tigre, C/Ateos	Sacacoyo	La Libertad	Central	B.E.	Funciona	60		5.00
68	Col. Escalante, C/Ateos	Sacacoyo	La Libertad	Central	B.E.	Funciona	58		5.00
69	Ctón. Ateos	Sacacoyo	La Libertad	Central	B.E.	Funciona	114		5.00
70	Ctón Entre Ríos	Colón	La Libertad	Central	B.E.	Funciona	120		5.00
71	Crío. Curazao,C/Las Flores	Jayaque	La Libertad	Central	B.E.	Funciona	131		5.00
72	Ctón. La Labor	Jayaque	La Libertad	Central	B.E.	Funciona	60		5.00
73	Ctón. Las Flores	Jayaque	La Libertad	Central	B.E.	Funciona	103		5.00
74	Ctón. Nueva Encarnación	San Juan Opico	La Libertad	Central	B.E.	Funciona	90		5.00
75	Ctón. Lomas del Copinol	San Juan Opico	La Libertad	Central	B.E.	Funciona	42		5.00
76	Ctón. San Pedro Mártir	San Juan Opico	La Libertad	Central	B.E.	Funciona	43		5.00
77	Ctón. Chuntuanene	San Juan Opico	La Libertad	Central	B.E.	Funciona	40		3.00
78	Ctón. Los Amates	San Juan Opico	La Libertad	Central	B.E.	Funciona	70		5.00

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79	Ctón. Barranca Honda	San Juan Opico	La Libertad	Central	B.E.	[illegible]	[illegible]		5.00
80	Crío.Los Mangos,C/San Ant.	San Juan Opico	La Libertad	Central	B.E.	Funcionando	[illegible]		5.00
81	Crío.La Bolsa, C/San antonio	San Juan Opico	La Libertad	Central	B.E.	Funcionando	[illegible]		5.00
82	Crío. La Gloria, C/San Ant.	San Juan Opico	La Libertad	Central	B.E.	Funcionando	[illegible]		5.00
83	Ctón. San Antonio	San Juan Opico	La Libertad	Central	B.E.	Funcionando	[illegible]		5.00
84	Crío.El Espino,C/Chuntusnene	San Juan Opico	La Libertad	Central	B.E.	Funcionando	[illegible]		5.00
85	Cantón El Morro	Stgo. Texac.	San Salvador	Central	B.E.	Funcionando	72		5.00
86	Cantón San Jerónimo	Guazapa	San Salvador	Central	B.E.	Funcionando	[illegible]		5.00
87	Crío.Chilín,C/Potrero Sula	Nva. Concepción	Chalatenango	Central	Grav.	Funcionando	[illegible]	4	
88	Cantón Los Guardados	San Rafael	Chalatenango	Central	B.E.	Funcionando	61		5.00
89	C/San Antonio Buena Vista	San Rafael	Chalatenango	Central	B.E.	Funcionando	46		5.00
90	C/San José Los Sitios	San Rafael	Chalatenango	Central	B.E.	Funcionando	47		5.00
91	Cantón Valle de Jesús	San Fernando	Chalatenango	Central	Grav.	Funcionando	90		
92	Ctón. Monte Redondo	Concep.Quezalt.	Chalatenango	Central	Grav.	Funcionando	65		3.00
93	Ctón. El Pepeto	Concep.Quezalt.	Chalatenango	Central	Grav.	Funcionando			
94	Cas.Los Cerritos,C/Conacaste	Concep.Quezalt.	Chalatenango	Central	Grav.	Funcionando			
95	Cas. Las Chinas,C/Olosingo	Concep.Quezalt.	Chalatenango	Central	Grav.	Funcionando			
96	Cantón Conacaste	Concep.Quezalt.	Chalatenango	Central	Grav.	Funcionando	120		3.00
97	Cantón Olosingo	Concep.Quezalt.	Chalatenango	Central	Grav.	Funcionando	46		3.00
98	Cantón San Antonio Abajo	Stgo.Nonualco	La Paz	Paracentral	Grav.	Funcionando	141		5.00
99	Ctón. San Antonio Arriba	Stgo.Nonualco	La Paz	Paracentral	B.E.	No Func.			
100	Cantón Santa Rita Almendros	Stgo.Nonualco	La Paz	Paracentral	B.E.	Funcionando	40		5.00
101	Cantón Chacastal	Stgo.Nonualco	La Paz	Paracentral	B.E.	Funcionando	60		5.00
102	Cantón Amulunco	Stgo.Nonualco	La Paz	Paracentral	B.E.	Funcionando	47		5.00
103	Cantón La Herradura	Zacatecoluca	La Paz	Paracentral	B.E.	No Func.	[illegible]		5.00
104	Cantón Cerro Colorado	Ilobasco	Cabañas	Paracentral	B.E.	Funcionando	110		5.00

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P L A N S A B A R

Nº	LOCALIDAD	MUNICIPIO	DEPARTAMENTO	REGION	SISTEMA	ESTADO	CONEXIONES	CONTRARERA	TARIFA
105	Cantón Agua Zarca	Ilobasco	Cabañas	Paracentral	B.E.	[illegible]	-		[illegible]
106	Cantón El Espinal	San Ref. Cedro	Cuscatlán	Paracentral	B.E.	Funciona	5		5.00
107	Cantón Cerro Colorado	San Ref. Cedro	Cuscatlán	Paracentral	B.E.	Funciona	52		5.00
108	Cantón La Labor	San Sebastian	San Vicente	Paracentral	B.E.	No func.	90	sin conf.	5.00
109	Cantón Aguacayo	Suchitoto	Cuscatlán	Paracentral	B.E.	No func.	113		5.00
110	Cantón El Espino	San Ped. Perul.	Cuscatlán	Paracentral	B.E.	Funciona	124		5.00
111	Cantón Copalchán	Tenancingo	Cuscatlán	Paracentral	B.E.	No func.	105		5.00
112	Cantón El Carmen	San Ped. Perul.	Cuscatlán	Paracentral	B.E.	Funciona	118		5.00
113	El Escarbadero	Estanzuelas	Usulután	Oriental	B.E.	Funciona	90		5.00
114	Cantón El Tacomatal	Estanzuelas	Usulután	Oriental	B.E.	Funciona	67		5.00
115	Cantón El Condedillo	Estanzuelas	Usulután	Oriental	B.E.	Funciona	[illegible]		5.00
116	Cantón Joya Ancha Arriba	Santa Elena	Usulután	Oriental	B.E.	Funciona	[illegible]		[illegible]
117	Cantón Joya Ancha Abajo	Santa Elena	Usulután	Oriental	B.E.	Funciona	167		5.00
118	Cantón El Volcán	Santa Elena	Usulután	Oriental	B.E.	Funciona	58		5.00
119	Cantón El Nanzal	Santa Elena	Usulután	Oriental	B.E.	En const.			
120	El Nisperal	Santa Elena	Usulután	Oriental	B.E.	En const.			
121	Cantón El Jícaro	Mercedes Umaña	Usulután	Oriental	B.E.	Funciona	33		5.00
122	Cas.Vacas Gordas,C/Las Delic	Berlín	Usulután	Oriental	B.E.	Funciona	98		5.00
123	Cas.El Triángulo,C/Las Delic	Berlín	Usulután	Oriental	B.E.	En const.			
124	Cantón Santa Cruz	Berlín	Usulután	Oriental	B.E.	En const.			
125	Cantón San Felipe	Berlín	Usulután	Oriental	B.E.	En const.			
126	Cantón Las Piletas	Berlín	Usulután	Oriental	B.E.	En const.			
127	Cantón La Unión	Berlín	Usulután	Oriental	B.E.	En const.			
128	Cantón Nombre de Dios	San Agustín	Usulután	Oriental	B.E.	En const.			
129	Cantón El Corozal	Berlín	Usulután	Oriental	B.E.	En const.			
130	Cantón Montañita	Mercedes Umaña	Usulután	Oriental	B.E.	Funciona			

MINISTERIO DE SALUD PUBLICA Y ASISTENCIA SOCIAL
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P L A N S A B A R

Nº	LOCALIDAD	MUNICIPIO	DEPARTAMENTO	REGION	SISTEMA	ESTADO	CONEXION	CISTERNA	TARIFA
131	Cantón El Colón	Berlín	Usulután	Oriental	B.E.	[illegible]	20		[illegible]
132	Cantón El Tablón	Berlín	Usulután	Oriental	B.E.	[illegible]			
133	Cantón Tulpetate	Berlín	Usulután	Oriental	B.E.	Funciona	40		5.00
134	Cantón Virginia	Berlín	Usulután	Oriental	B.E.	[illegible]	20		[illegible]
135	Crío,Chaparro,C/Las Delicias	Berlín	Usulután	Oriental	B.E.	Funciona			
136	Crío.La Canastilla,C/Las Del.	Berlín	Usulután	Oriental	B.E.	[illegible]			
137	Crío.El Equilibrio,C/Las D.	Berlín	Usulután	Oriental	B.E.	[illegible]			
138	Crío.Los Alvarenga,C/Las D.	Berlín	Usulután	Oriental	B.E.	Funciona			
139	Cantón San Luisito	Cd.Barrios	San Miguel	Oriental	Grav.	[illegible]	67		7.00
140	Cantón Tierra Blanca	Chirilagua	San Miguel	Oriental	B.E.	Funciona	176		5.00 1.00
141	Cantón Rosas de Nacaspilo	Caroline	San Miguel	Oriental	Grav.	No func.			
142	Crío.Los Jobos	Caroline	San Miguel	Oriental	Grav.	No func.			
143	Crío. La Chacra	Caroline	San Miguel	Oriental	B.E.	No func.			
144	Crío. La Loma	Caroline	San Miguel	Oriental	Grav.	No func.			
145	Crío. La Lomita	Caroline	San Miguel	Oriental	Grav.	No func.			
146	Cantón San pedro	Chirilagua	San Miguel	Oriental	B.E.	No func.	103		5.00
147	Crío.El Castaño,C/San Pedro	Chirilagua	San Miguel	Oriental		No se [illegible]	126		
148	Crío. Sincuya, C/Sirama	La Unión	La Unión	Oriental	Grav.	Funciona	72		3.00
149	Cantón Agua Caliente	La Unión	La Unión	Oriental	B.E.	Funciona	168		5.00
150	Cantón El Jícaro	La Unión	La Unión	Oriental	B.E.	Funciona	140		5.00
151	Crío.el Nacimiento,C/el Jícaro	La Unión	La Unión	Oriental	B.E.	Funciona	42		3.00

* Funcionando, no cotiza y se encuentran con conflicto.
** Parado en Febrero de 1988, se secó fuente.

*zm.

COMPLETED PLANSABAR PROJECTS

AS OF AUGUST , 1989

No	LOCALIDAD	MUNICIPIO	DEPARTAMENTO	SISTEMA	ESTADO	CONEXIONES	F.DEFIN	COSTO	GRUPO
1	Cas.Los Granadillos C/Ayut&	Santa Ana	Santa Ana	Gravedad	Funciona	291	1878	[illegible]	1
2	Col.A.Lopez,Cton.Comecayo	Santa Ana	Santa Ana	Bombeo	Funciona	[illegible]	19[illegible]	[illegible]	1
3	Cto.Atiquizaya y Miramar	Guaymango	Ahuachapan	Gravedad	Funciona	228	1194	413700.00	1
4	Canton La Chacamaya	Nahuizalco	Sonsonate	Gravedad	Funciona	183	8[illegible]	[illegible]	1
5	Canton Sacamolapal	Nahuizalco	Sonsonate	Gravedad	Funciona	[illegible]	[illegible]	[illegible]	[illegible]
6	Hacienda y Cton. San Alfonso	Tamanique	La Libertad	Gravedad	Funciona	47	1057	171150.00	2
7	C.P.de Palmira,C.Sta.Cruz Loma	Sdgo.Nonualco	La Paz	Gravedad	Funciona	73	379	129000.00	1
8	Cas.Rio Frio,C/Parras Lempa	San Vicente	San Vicente	Gravedad	Funciona	35	[illegible]	113400.00	2
9	Cs.La Galera,C/S.Fco.Chamuco	San Vicente	San Vicente	Gravedad	Funciona	121	1113	215300.00	2
10	Canton Juan Yanez	Uluazapa	San Miguel	Gravedad	Funciona	121	877	365900.00	1
11	Cto.El Pedernal y El Norte	Chalatenango/Agua	Chalatenango	Gravedad	Funciona	[illegible]	1054	[illegible]	1
12	Col.2 de Mayo,Cton.La labor	Jayaque	La Libertad	Gravedad	Funciona	153	1057	171150.00	2
13	Cs.Palmira,Cton. Sta. Barbara	Guazapa	San Salvador	Bombeo	Funciona	190	1244	454300.00	1
14	Col.Mendez,Cto.Comecayo	Santa Ana	Santa Ana	Bombeo	NO/FUNC.	286	2369	577800.00	1
15	Mult. Hda. Santo Tomas	San Luis Talpa	La Paz	Bombeo	NO/FUNC.	381	3225	1063700.00	1
16	Cs.Guayanque,Cto.El Acaituno	Yoloaiquin	Morazan	Gravedad	EN PRUEBA	135	1434	771500.00	2
***	Total ***					3007	22256	6466400.00	

APPENDIX III.B.4

FINAL DISCHARGE OF WASTE WATERS, BY MUNICIPALITIES
METROPOLITAN AND CENTRAL ZONES

Department of Chalatenango

MUNICIPALITY	DISCHARGE
1. Chalatenango	Quebrada el Gualcocho, Rio Lempa
2. La Palma	Rio La Palma, Rio Jupulo, Rio Lempa
3. Nueva Concepcion	Quebrada sin nombre, Rio Mojaflores

Department of La Libertad

MUNICIPALITY	DISCHARGE
1. Nueva San Salvador	Primary Collector No. 3, Collector Alcaine, Rio Acelhuate, Rio Lempa
2. La Libertad	Treatment Plant Chilama hacia puerto La Libertad
3. Quetzaltepeque	Quebrada El Coyol, Rio Sucio, Rio Lempa
4. San Juan Opico	Quebrada Agua Zarca, Rio Sucio, Rio Lempa
5. Ciudad Arce	Quebrada sin nombre, Rio Agua Caliente, Rio Sucio, Rio Lempa
6. Antiguo Cuscatlan	Primary Collector No. 3, Colector Alcaine Rio Acelhuate, Rio Lempa.

Department of San Salvador

MUNICIPALITY	DISCHARGE
1. San Salvador	Primary Collectors Nos. 2 and 3, Rio Tomayate and Rio Acelhuate, Rio Lempa
2. Mejicanos	Primary Collector No. 1, Rio Tomayate, Rio Lempa
3. Soyapango	Primary Collector No. 4, Rio Canas, Rio Lempa
4. Cuidad Delgado	Rio Tomayate, Rio Acelhuate, Rio Lempa
5. Tonacatepeque	Rio Los Naranjos, Rio Sucio, Rio Lempa
6. Ilopango	Primary Collector No. 4, Rio Las Canas, Rio Lempa
7. Guazapa	Rio Guazapa, Rio Acelhuate, Rio Lempa
8. San Martin	Rio Sucio, Rio Lempa
9. Apopa	Rio Acelhuate, Rio Lempa
10. Nejapa	Rio San Antonio, Rio Acelhuate, Rio Lempa
11. Aguilares	Rio Acelhuate, Rio Lempa
12. Ayutuxtepeque	Primary Collector No. 1, Rio Tomayate, Rio Lempa
13. Panchimalco	Rio El Muerto, Rio Huiza, Estero De Toluca
14. San Marcos	Collector San Marcos, Primary Collector No. 3, Alcaine Collector, Rio Acelhuate, Rio Lempa
15. Cuscatancingo	Primary Collector No. 1, Rio Tomayate, Rio Lempa
16. Santo Tomas	Rio El Jocote, Rio de Ilopango

Department of Cuscatlan

MUNICIPALITY	DISCHARGE
1. Cojutepeque	Quebrada Cupanaste, Rio Tempisque, Rio Quezalapa, Rio Lempa
2. San Rafael Cedros Cuchuta	Quebrada sin nombre, Rio Cuchuta, Rio Jiboa
3. Suchitoto	Quebrada Ocupa, Rio San Juan, Rio Lempa
4. San Bartolome Perulapia	Rio Sucio, Rio Lempa
5. San Pedro Perulapan	Rio Sucio, Rio Lempa

Department of La Paz

MUNICIPALITY	DISCHARGE
1. Zacatecoluca	Canal Ichanmichen, Rio Sapuyo Mar
2. Santiago Nonualco	Silting Pond, Rio Jalponga, Estero De Jaltepeque
3. San Juan Nonualco	Rio Anayito
4. San Pedro Nonualco	Quebrada sin nombre, Rio Jiboa
5. Olocuilta	Rio Guayata, Rio Aguacula, Rio Comolapa -
6. San Juan Talpa	Rio Aguacula, Rio Comalapa - Mar
7. El Rosario	Rio Guazapa, Rio Jiboa
8. San Rafael Obrajuelo	Rio Huiscoyolapa, Estero de Jaltepeque

Department of Cabanas

MUNICIPALITY	DISCHARGE
1. Sensuntepeque	Rio Grande, Rio Marcos, Rio Lempa
2. Ilobasco	Rio El Molino, Rio Lempa, Rio Titihuapa Rio Lempa

Department of San Vicente

MUNICIPALITY	DISCHARGE
1. San Vicente	Rio Acahuapa, Rio Lempa
2. Apastepeque	Quebrada Seca, Rio Ismatico, Rio Acahuapa Rio Lempa
3. San Sebastian	Quebrada Las Gallinas, Quebrada La Vieja, Rio Titihuapa, Rio Lempa
4. Santo Domingo	Quebrada El Cementario, Rio Machaca, Rio Titihuapa, Rio Lempa

SOURCE: ANDA

APPENDIX III.E.1

MODULAR SYSTEM FOR 400 POPULATION WATER SUPPLY WELL WITH HAND PUMP COST ESTIMATES

No	CONCEPT	QUANTITY	UNIT COST $	TOTAL COST $	CURRENCY	
					FOREIGN	LOCAL
1	WELL DRILLING AND PREPARATION	1	11,000	11,000	4,070	6,930
2	PUMPING EQUIPMENT AND INSTALLATION	1	1,400	1,400	1,120	280
3	OTHER WORKS AND MISCELLANEOUS	S.G.		200	56	144
4	CONSTRUCTION COST			12,600	5,246	7,354
5	COST PER PERSON ($)			31.50	13.12	18.39

NOTE : AN ADDITIONAL 15% FOR ENGENEERING AND ADMINISTRATION AND 10% FOR CONTINGENCIES SHOULD BE ADDED TO ALL MODULAR SYSTEMS COSTS.

W A T E R S U P P L Y S Y S T E M F O R : 1 , 0 0 0 PERSONS

POPULATION DENSITY	-	FAM./Ha.
NUMBER OF 100 x 100 SQUARE BLOCKS/TOWN	-	BLOCKS
SOURCE	1.00	WELL
AVERAGE CONSUMPTION 100 L/P/D ==> Qa	1.16	L / S
DAILY MAXIMUM 1.2 x Qa	1.39	L / S
HOURLY MAXIMUM 2.0 x Qa	2.31	L / S
TOTAL DYNAMIC HEAD (TDH)	246.20	Meters
H.P. = (TDH x Qb) / (76 x e)	15.00	H.P.
STORAGE 0.3 x Qa x 86.4 x 1.3	39.00	M3
USE A TANK OF	40.00	M3
TRANSMISSION LINE	Km	Diam.
	0.50	3"
	0.50	2"
	1.00	1 1/2"
DISTRIBUTION LINE	Km	Diam.
	1.00	3"
	1.20	2"
	1.20	1 1/2"
	1.20	1"
HOUSE CONNECTIONS	167.00	UNITS

ELECTRICAL COMPONENTS : 30 % OF PUMPING EQUIPMENT

MODULAR SYSTEM FOR 1,000 POPULATION
WATER SUPPLY
COST ESTIMATES

No	CONCEPT	QUANTITY	UNIT COST $	TOTAL COST $	CURRENCY	
					FOREIGN	LOCAL
1	WELL DRILLING AND PREPARATION (M)	100	275	27,500	10,175	17,325
2	PUMPING EQUIPMENT AND INSTALLATION	1	9,000	9,000	7,200	1,800
3	TRANSMISSION PIPE					
	PIPE 3" (M)	500	10.3	5,150	2,524	2,627
	PIPE 2" (M)	500	4.9	2,450	1,201	1,250
	PIPE 1 1/2" (M)	1000	3.5	3,500	1,715	1,785
4	RESERVOIR :					
	CIVIL WORKS 40 M3	1	5,240	5,240	1,415	3,825
	MECHANIC WORKS	S.G.		300	186	114
5	DISTRIBUTION LINES					
	PIPE 3" (M)	1000	10.3	10,300	7,519	2,781
	PIPE 2" (M)	1200	4.9	5,880	4,292	1,588
	PIPE 1 1/2" (M)	1200	3.5	4,200	3,066	1,134
	PIPE 1" (M)	1200	2.6	3,120	2,278	842
6	HOUSE CONNECTIONS	167	10	1,670	1,286	384
7	ELECTRIC COMPONENT	S.G.		3,000	1,560	1,440
8	OTHER WORKS AND MISCELLANEOUS	S.G.		7,000	1,960	5,040
9	CONSTRUCTION COST			88,310	46,376	41,934
10	COST PER PERSON ($)			88.31	46.38	41.93

W A T E R S U P P L Y S Y S T E M F O R : 2 , 0 0 0 PERSONS

POPULATION DENSITY	-	FAM./Ha.
NUMBER OF 100 x 100 SQUARE BLOCKS/TOWN	-	BLOCKS
SOURCE	1.00	WELL
AVERAGE CONSUMPTION 100 L/P/D ==> Qa	2.31	L / S
DAILY MAXIMUM 1.2 x Qa	2.78	L / S
HOURLY MAXIMUM 2.0 x Qa	4.63	L / S
TOTAL DYNAMIC HEAD (TDH)	195.00	Meters
H.P. = (TDH x Qb) / (76 x e)	23.76	H.P.
STORAGE 0.3 x Qa x 86.4 x 1.3	78.00	M3
USE A TANK OF	80.00	M3
TRANSMISSION LINE	Km	Diam.
	2.00	3"
	1.20	2"
	0.80	1 1/2"
DISTRIBUTION LINE	Km	Diam.
	1.40	3"
	2.10	2"
	2.80	1 1/2"
	0.70	1"
HOUSE CONNECTIONS	334.00	UNITS

ELECTRICAL COMPONENTS : 30 % OF PUMPING EQUIPMENT

MODULAR SYSTEM FOR 2,000 POPULATION

WATER SUPPLY

COST ESTIMATES

No	CONCEPT	QUANTITY	UNIT COST $	TOTAL COST $	CURRENCY	
					FOREIGN	LOCAL
1	WELL DRILLING AND PREPARATION (M)	100	275	27,500	10,175	17,325
2	PUMPING EQUIPMENT AND INSTALLATION	1	13,600	13,600	10,880	2,720
3	TRANSMISSION PIPE					
	PIPE 3" (M)	2000	10.3	20,600	10,094	10,506
	PIPE 2" (M)	1200	4.9	5,880	2,881	2,999
	PIPE 1 1/2" (M)	800	3.5	2,800	1,372	1,428
4	RESERVOIR :					
	CIVIL WORKS 80 M3	1	7,820	7,820	2,111	5,709
	MECHANIC WORKS	S.G.		400	248	152
5	DISTRIBUTION LINES					
	PIPE 3" (M)	1400	10.3	14,420	10,527	3,893
	PIPE 2" (M)	2100	4.9	10,290	7,512	2,778
	PIPE 1 1/2" (M)	2800	3.5	9,800	7,154	2,646
	PIPE 1" (M)	700	2.6	1,820	1,329	491
6	HOUSE CONNECTIONS	334	10	3,340	2,572	768
7	ELECTRIC COMPONENT	S.G.		4,100	2,132	1,968
8	OTHER WORKS AND MISCELLANEOUS	S.G.		9,000	2,520	6,480
9	CONSTRUCTION COST			131,370	71,506	59,864
10	COST PER PERSON ($)			65.69	35.75	29.93

W A T E R S U P P L Y S Y S T E M F O R : 5 , 0 0 0 PERSONS

POPULATION DENSITY	10.00	FAM./Ha.
NUMBER OF 100 x 100 SQUARE BLOCKS/TOWN	9 x 9	BLOCKS
SOURCE	1.00	WELL
AVERAGE CONSUMPTION 175 L/P/D ==> Qa	10.12	L / S
DAILY MAXIMUM 1.2 x Qa	12.14	L / S
HOURLY MAXIMUM 2.0 x Qa	20.24	L / S
TOTAL DYNAMIC HEAD (TDH)	150.00	Meters
H.P. = (CDT x Qb) / (76 x e)	70.00	H.P.
STORAGE 0.3 x Qa x 86.4 x 1.3	341.00	M3
USE A TANK OF	400.00	M3
TRANSMISSION LINE	Km	Diam.
	2	6"
DISTRIBUTION LINE	Km	Diam.
(URBAN INSTALLATION REQUIRES RESTITUTION OF PAVEMENT AND OTHER UTILITIES)	6	4"
	7	2"
	7	1"
HOUSE CONNECTIONS	850.00	UNITS

ELECTRICAL COMPONENTS : 30 % OF PUMPING EQUIPMENT

MODULAR SYSTEM FOR 5,000 POPULATION
WATER SUPPLY
COST ESTIMATES

No	CONCEPT	QUANTITY	UNIT COST $	TOTAL COST $	CURRENCY FOREIGN	CURRENCY LOCAL
1	WELL DRILLING AND PREPARATION (M)	100	600	60,000	22,200	37,800
2	PUMPING EQUIPMENT AND INSTALLATION	2	18,000	36,000	28,800	7,200
3	TRANSMISSION PIPE LINE 6" (M)	2000	50	100,000	49,000	51,000
4	RESERVOIR :					
	CIVIL WORKS 400 M3	1	35,000	35,000	9,450	25,550
	MECHANIC WORKS	S.G.		12,000	7,440	4,560
5	DISTRIBUTION LINES					
	PIPE 4" (M)	6000	25	150,000	73,500	76,500
	PIPE 2" (M)	7000	17	119,000	86,870	32,130
	PIPE 1" (M)	7000	9	63,000	45,990	17,010
6	HOUSE CONNECTIONS	850	51	43,350	33,380	9,971
7	ELECTRIC COMPONENT	S.G.		10,800	5,616	5,184
8	OTHER WORKS AND MISCELLANEOUS	S.G.		75,000	21,000	54,000
9	CONSTRUCTION COST			704,150	383,246	320,905
10	COST PER PERSON ($)			140.83	76.65	64.18
11	EXPANSION COST			563,320	306,596	256,724
12	COST PER PERSON ($)			112.66	61.32	51.34

NOTE : OTHER MUST BE FULLY REPLACED

W A T E R S U P P L Y S Y S T E M F O R : 1 0 , 0 0 0 PERSONS

POPULATION DENSITY	12.00	FAM./Ha.
NUMBER OF 100 x 100 SQUARE BLOCKS/TOWN	12 x 12	BLOCKS
SOURCE	2.00	WELL
AVERAGE CONSUMPTION 200 L/P/D ==> Qa	23.10	L / S
DAILY MAXIMUM 1.2 x Qa	27.72	L / S
HOURLY MAXIMUM 2.0 x Qa	46.20	L / S
TOTAL DYNAMIC HEAD (TDH)	197.40	Meters
H.P. = (TDH x Qb) / (76 x e)	200.00	H.P.
STORAGE 0.3 x Qa x 86.4 x 1.:	778.38	M3
USE A TANK OF	900.00	M3
TRANSMISSION LINE	Km	Diam.
	3	6"
DISTRIBUTION LINE	Km	Diam.
	6	4"
	13.2	2"
	13.2	1"
HOUSE CONNECTIONS	1,700.00	UNITS

ELECTRICAL COMPONENTS : 30 % OF PUMPING EQUIPMENT

WITH WATER TREATMENT

MODULAR SYSTEM FOR 10,000 POPULATION
WATER SUPPLY
COST ESTIMATES

No	CONCEPT	QUANTITY	UNIT COST $	TOTAL COST $	CURRENCY	
					FOREIGN	LOCAL
1	WELL DRILLING AND PREPARATION (M)	150	600	90,000	33,300	56,700
2	PUMPING EQUIPMENT AND INSTALLATION	2	50,000	100,000	80,000	20,000
3	TRANSMISSION PIPE LINE 6" (M)	3000	50	150,000	73,500	76,500
4	RESERVOIR :					
	CIVIL WORKS 900 M3	1	48,000	48,000	12,960	35,040
	MECHANIC WORKS	S.G.		16,000	9,920	6,080
5	DISTRIBUTION LINES					
	PIPE 4" (M)	6000	25	150,000	73,500	76,500
	PIPE 2" (M)	13200	17	224,400	163,812	60,588
	PIPE 1" (M)	13200	9	118,800	86,724	32,076
6	HOUSE CONNECTIONS	1700	51	86,700	66,759	19,941
7	ELECTRIC COMPONENT	S.G.		30,000	15,600	14,400
8	OTHER WORKS AND MISCELLANEOUS	S.G.		133,000	37,240	95,760
9	CONSTRUCTION COST			1,146,900	653,315	493,585
10	COST PER PERSON ($)			114.69	65.33	49.36
11	EXPANSION COST			917,520	522,652	394,868
12	COST PER PERSON ($)			91.75	52.27	39.49
13	EXPAN. + TREATMENT			1,292,820		
14	COST PER PERSON ($)			129.28		

W A T E R S U P P L Y S Y S T E M F O R : 2 5 , 0 0 0 PERSONS

POPULATION DENSITY	15.00	FAM./Ha.
NUMBER OF 100 x 100 SQUARE BLOCKS/TOWN	16 x 16	BLOCKS
SOURCE	3.00	WELL
AVERAGE CONSUMPTION 250 L/P/D ==> Qa	72.34	L / S
DAILY MAXIMUM 1.2 x Qa	86.81	L / S
HOURLY MAXIMUM 2.0 x Qa	144.68	L / S
TOTAL DYNAMIC HEAD (TDH)	200.00	Meters
H.P. = (TDH x Qb) / (76 x e)	634.54	H.P.
STORAGE 0.3 x Qa x 86.4 x 1.3	2,437.50	M3
USE A TANK OF	2,600.00	M3
TRANSMISSION LINE	Km	Diam.
	2	12"
DISTRIBUTION LINE	Km	Diam.
	12	10"
	16	8"
	16	4"
	8	2"
	8	1"
HOUSE CONNECTIONS	4,500.00	UNITS

ELECTRICAL COMPONENTS : 30 % OF PUMPING EQUIPMENT

MODULAR SYSTEM FOR 25,000 POPULATION
WATER SUPPLY
COST ESTIMATES

No	CONCEPT	QUANTITY	UNIT COST $	TOTAL COST $	CURRENCY	
					FOREIGN	LOCAL
1	WELL DRILLING AND PREPARATION (M)	300	400	120,000	44,400	75,600
2	PUMPING EQUIPMENT AND INSTALLATION	4	80,000	320,000	256,000	64,000
3	TRANSMISSION PIPE LINE 12" (M)	2000	105	210,000	102,900	107,100
4	RESERVOIR :					
	CIVIL WORKS 2600 M3	1	300,000	300,000	81,000	219,000
	MECHANIC WORKS	S.G.		100,000	62,000	38,000
5	DISTRIBUTION LINES					
	PIPE 10" (M)	12000	85	1,020,000	499,800	520,200
	PIPE 8" (M)	16000	75	1,200,000	588,000	612,000
	PIPE 4" (M)	16000	25	400,000	196,000	204,000
	PIPE 2" (M)	8000	17	136,000	99,280	36,720
	PIPE 1" (M)	8000	9	72,000	52,560	19,440
6	HOUSE CONNECTIONS	4500	51	229,500	176,715	52,785
7	ELECTRIC COMPONENT	S.G.		80,000	41,600	38,400
8	OTHER WORKS AND MISCELLANEOUS	S.G.		420,000	117,600	302,400
9	CONSTRUCTION COST			4,607,500	2,317,855	2,289,645
10	COST PER PERSON ($)			184.30	92.71	91.59
11	EXPANSION COST		-	3,686,000	1,854,284	1,831,716
12	COST PER PERSON ($)			147.44	74.17	73.27
13	EXPAN. + TREATMENT			4,182,600		
14	COST PER PERSON ($)			167.30		

W A T E R S U P P L Y S Y S T E M F O R : 5 0 , 0 0 0 PERSONS

POPULATION DENSITY	20.00	FAM./Ha.
NUMBER OF 100 x 100 SQUARE BLOCKS/TOWN	20 x 20	BLOCKS
SOURCE	3.00	WELL
AVERAGE CONSUMPTION 250 L/P/D ==> Qa	144.68	L / S
DAILY MAXIMUM 1.2 x Qa	173.61	L / S
HOURLY MAXIMUM 2.0 x Qa	289.35	L / S
TOTAL DYNAMIC HEAD (TDH)	200.00	Meters
H.P. = (TDH x Qb) / (76 x e)	1,269.09	H.P.
STORAGE 0.3 x Qa x 86.4 x 1.3	4,875.00	M3
USE A TANK OF	5,000.00	M3
TRANSMISSION LINE	Km	Diam.
	6	16"
DISTRIBUTION LINE	Km	Diam.
	15	12"
	16	10"
	16	8"
	16	4"
	14	2"
	14	1"
HOUSE CONNECTIONS	9,000.00	UNITS

ELECTRICAL COMPONENTS : 30 % OF PUMPING EQUIPMENT

MODULAR SYSTEM FOR 50,000 POPULATION

WATER SUPPLY

COST ESTIMATES

No	CONCEPT	QUANTITY	UNIT COST $	TOTAL COST $	CURRENCY	
					FOREIGN	LOCAL
1	WELL DRILLING AND PREPARATION (M)	375	450	168,750	62,438	106,313
2	PUMPING EQUIPMENT AND INSTALLATION	4	100,000	400,000	320,000	80,000
3	TRANSMISSION PIPE LINE 16" (M)	6000	135	810,000	396,900	413,100
4	RESERVOIR :					
	CIVIL WORKS 5000 M3	2	225,000	450,000	121,500	328,500
	MECHANIC WORKS	S.G.		150,000	93,000	57,000
5	DISTRIBUTION LINES					
	PIPE 12" (M)	15000	105	1,575,000	771,750	803,250
	PIPE 10" (M)	16000	85	1,360,000	666,400	693,600
	PIPE 8" (M)	16000	75	1,200,000	588,000	612,000
	PIPE 4" (M)	16000	25	400,000	196,000	204,000
	PIPE 2" (M)	14000	17	238,000	173,740	64,260
	PIPE 1" (M)	14000	9	126,000	91,980	34,020
6	HOUSE CONNECTIONS	9000	51	459,000	353,430	105,570
7	ELECTRIC COMPONENT	S.G.		120,000	62,400	57,600
8	O. WORKS AND MISCEL	S.G.		794,000	222,320	571,680
9	CONSTRUCTION COST			8,250,750	4,119,858	4,130,893
10	COST PER PERSON ($)			165.02	82.40	82.62
11	EXPANSION COST			6,600,600	3,295,886	3,304,714
12	COST PER PERSON ($)			132.01	65.92	66.09
13	EXPAN. + TREATMENT			7,375,300		
14	COST PER PERSON ($)			147.51		

S E W E R A G E S Y S T E M F O R : 5 , 0 0 0 P E R S O N S

POPULATION DENSITY		10	FAM./Ha.
NUMBER OF 100 x 100 SQUARE BLOCKS/TOWN		9 x 9	BLOCKS
FLOW IN MAIN COLLECTOR : [0.8 x (DAILY MAX. WATER SUPPLY) + 0.2 L/S/Ha] x 1.5		54	L / S
MAIN COLLECTOR :		Diameter	Meters
		12"	1,000
PERIMETRAL COLLECTORS (2 x # OF BLOCKS x 100):		Diameter	Meters
		10"	1,800
STREET COLLECTORS		Diameter	Meters
		8"	16,200
HOUSE CONNECTIONS	UNITS	Diameter	Meters
	850	6"	5,100
MANHOLES		100	UNITS

MODULAR SYSTEM FOR 5,000 POPULATION

SEWER SYSTEM

COST ESTIMATES

No	CONCEPT	QUANTITY	UNIT COST $	TOTAL COST $	CURRENCY	
					FOREIGN	LOCAL
1	HOUSE CONNECTIONS 850 WITH 6" PIPE	5,100	18	91,800	9,180	82,620
2	STREET COLLECTORS PIPE 8" OF DIAMETER	16,200	20	324,000	184,680	139,320
3	PERIMETRAL COLLECTORS PIPE 10" OF DIAMETER	1,800	80	144,000	77,760	66,240
4	MAIN COLLECTOR PIPE 12" OF DIAMETER	1,000	105	105,000	56,700	48,300
5	MANHOLES	100	370	37,000	2,960	34,040
6	CONSTRUCTION COST PRICES AT SEPT / 89			701,800	331,280	370,520
7	CONSTRUCTION COST PRICES AT DEC / 88			631,620	298,152	333,468
8	COST PER PERSON ($)			126	60	67
9	LOCAL CONTRACTORS			101	48	53

S E W E R A G E S Y S T E M F O R : 1 0 , 0 0 0 P E R S O N S

POPULATION DENSITY		12	FAM./Ha.
NUMBER OF 100 x 100 SQUARE BLOCKS/TOWN		12 x 12	BLOCKS
FLOW IN MAIN COLLECTOR : [0.8 x (DAILY MAX. WATER SUPPLY) + 0.2 L/S/Ha] x 1.5		99	L / S
MAIN COLLECTOR :		Diameter	Meters
		14"	2,000
PERIMETRAL COLLECTORS (2 x # OF BLOCKS x 100):		Diameter	Meters
		12"	2,500
STREET COLLECTORS		Diameter	Meters
		8"	29,000
HOUSE CONNECTIONS	UNITS	Diameter	Meters
	1,700	6"	10,000
MANHOLES		144	UNITS

MODULAR SYSTEM FOR 10,000 POPULATION

SEWER SYSTEM

COST ESTIMATES

No	CONCEPT	QUANTITY	UNIT COST $	TOTAL COST $	CURRENCY	
					FOREIGN	LOCAL
1	HOUSE CONNECTIONS 1,700 WITH 6" PIPE	10,000	18	180,000	18,000	162,000
2	STREET COLLECTORS PIPE 8" OF DIAMETER	29,000	20	580,000	330,600	249,400
3	PERIMETRAL COLLECTORS PIPE 12" OF DIAMETER	2,500	80	200,000	108,000	92,000
4	MAIN COLLECTOR PIPE 14" OF DIAMETER	2,000	105	210,000	113,400	96,600
5	MANHOLES	144	420	60,480	4,838	55,642
6	CONSTRUCTION COST PRICES AT SEPT / 89			1,230,480	574,838	655,642
7	CONSTRUCTION COST PRICES AT DEC / 88			1,107,432	517,355	590,077
8	COST PER PERSON ($)			111	52	59
9	LOCAL CONTRACTORS			89	41	47
10	LOCAL CC. + TREATMENT			1,210,800		
11	COST PER PERSON ($)			121.08		

S E W E R A G E S Y S T E M F O R : 2 5 , 0 0 0 P E R S O N S

POPULATION DENSITY		15	FAM./Ha.
NUMBER OF 100 x 100 SQUARE BLOCKS/TOWN		16 x 16	BLOCKS
FLOW IN MAIN COLLECTOR : [0.8 x (DAILY MAX. WATER SUPPLY) + 0.2 L/S/Ha] x 1.5		249	L / S
MAIN COLLECTOR :		Diameter	Meters
		20"	2,000
PERIMETRAL COLLECTORS (2 x # OF BLOCKS x 100):		Diameter	Meters
		16"	3,200
STREET COLLECTORS		Diameter	Meters
		12"	26,000
		10"	26,000
HOUSE CONNECTIONS	Units	Diameter	Meters
	4200	6"	24,000
MANHOLES		256	UNITS

MODULAR SYSTEM FOR 25,000 POPULATION

SEWER SYSTEM

COST ESTIMATES

No	CONCEPT	QUANTITY	UNIT COST $	TOTAL COST $	CURRENCY	
					FOREIGN	LOCAL
1	HOUSE CONNECTIONS 4,200 WITH 6" PIPE	24,000	18	432,000	43,200	388,800
2	STREET COLLECTORS					
	PIPE 12" OF DIAMETER	26,000	30	780,000	444,600	335,400
	PIPE 10" OF DIAMETER	26,000	25	650,000	370,500	279,500
3	PERIMETRAL COLLECTORS PIPE 16" OF DIAMETER	3,200	120	384,000	207,360	176,640
4	MAIN COLLECTOR PIPE 20" OF DIAMETER	2,000	200	400,000	216,000	184,000
5	MANHOLES	256	435	111,360	8,909	102,451
6	CONSTRUCTION COST PRICES AT SEPT / 89			2,757,360	1,290,569	1,466,791
7	CONSTRUCTION COST PRICES AT DEC / 88			2,481,624	1,161,512	1,320,112
8	COST PER PERSON ($)			99	46	53
9	LOCAL CONTRACTORS			79	37	42
10	LOCAL CONT.+TREATMENT			2,652,400		
11	COST PER PERSON ($)			106.10		

S E W E R A G E S Y S T E M F O R : 5 0 , 0 0 0 P E R S O N S

POPULATION DENSITY		20	FAM./Ha.
NUMBER OF 100 x 100 SQUARE BLOCKS/TOWN		20 x 20	BLOCKS
FLOW IN MAIN COLLECTOR : [0.8 x (DAILY MAX. WATER SUPPLY) + 0.2 L/S/Ha] x 1.5		468	L / S
MAIN COLLECTOR :		Diameter	Meters
		26"	3,000
PERIMETRAL COLLECTORS (2 x # OF BLOCKS x 100):		Diameter	Meters
		20"	4,000
STREET COLLECTORS		Diameter	Meters
		14"	40,000
		10"	40,000
HOUSE CONNECTIONS	Units	Diameter	Meters
	8,400	6"	48,000
MANHOLES		400	UNITS

MODULAR SYSTEM FOR 50,000 POPULATION

SEWER SYSTEM

COST ESTIMATES

No	CONCEPT	QUANTITY	UNIT COST $	TOTAL COST $	CURRENCY	
					FOREIGN	LOCAL
1	HOUSE CONNECTIONS 8,400 WITH 6" PIPE	48,000	18	864,000	86,400	777,600
2	STREET COLLECTORS					
	PIPE 14" OF DIAMETER	40,000	35	1,400,000	798,000	602,000
	PIPE 10" OF DIAMETER	40,000	25	1,000,000	570,000	430,000
3	PERIMETRAL COLLECTORS PIPE 20" OF DIAMETER	4,000	125	500,000	270,000	230,000
4	MAIN COLLECTOR PIPE 26" OF DIAMETER	3,000	250	750,000	405,000	345,000
5	MANHOLES	400	505	202,000	16,160	185,840
6	CONSTRUCTION COST PRICES AT SEPT / 89			4,716,000	2,145,560	2,570,440
7	CONSTRUCTION COST PRICES AT DEC / 88			4,244,400	1,931,004	2,313,396
8	COST PER PERSON ($)			85	39	46
9	LOCAL CONTRACTORS			68	31	37
10	LOCAL CONT.+TREATMENT			4,544,600		
11	COST PER PERSON ($)			90.89		

MODULAR COST OF WATER TREATMENT

COST ESTIMATES

SIZE POPULATION	DISCHARGE (L/S) (1)	INVESTMENT COST		O. & M. COST	
		TOTAL $ 1,000	PER CAPITA $	TOTAL $ 1,000	PER CAPITA $
10,000	46.20	315.30	31.53	23.90	2.39
25,000	144.68	551.60	22.06	42.90	1.72
50,000	289.35	774.70	15.49	70.60	1.41

SOURCE : AMSA AND ISA CONSULTANTS
(1) MAXIMUN HOURLY DISCHARGE

MODULAR COST OF SEWER TREATMENT

COST ESTIMATES

SIZE POPULATION	TYPE	DISCHARGE (L/S)	INVESTMENT COST		O. & M. COST	
			TOTAL $ 1,000	PER CAPITA $	TOTAL $ 1,000	PER CAPITA $
10,000	A	99.00	324.90	32.49	66.70	6.67
25,000	B	249.00	667.10	26.68	95.50	3.82
50,000	B	468.00	1,149.10	22.98	174.40	3.49

SOURCE : AMSA AND ISA CONSULTANTS
A : AEROBIC POOL + OPTIONAL POOL
B : ACTIVATED LOAMS + AEROBIC STABILIZATION

APPENDIX III.E.2

SALVADORAN FUND FOR INVESTMENT STUDIES (FOSEP)

INTERAMERICAN DEVELOPMEN BANK (BID)

NATIONAL ADMINISTRATION OF AQUADUCTS AND SEWERGAE (ANDA)

Techincal & Economic Feasibility Study for Water Supply and Sewerage Master Plan for the Cities - Santa Ana, Sonsonate, & San Miguel

COST ANALYSIS

VOLUME 1

SEPTEMBER, 1989

BASIC WATER SUPPLY AND SEWERAGE INFRASTRUCTURE
REPUBLIC OF EL SALVADOR

CENTRAL AMERICA

AMSA CONSULTANTS, PERU

SANTA ANA: VALUE OF MATERIALS

DESCRIPTION	UNIT	PRICE $
1. 150 PSI PVC PRESSURE PIPE W/RING JOINTS & ACCESSORIES.		
DIAM (mm) 50	M	3.25
75	M	6.87
100	M	11.34
150	M	24.50
200	M	41.61
250	M	61.81
300	M	87.12
* 350	M	
400	M	140.00
* 450	M	
* 500	M	
2. UNREINFORCED CONCRETE PIPE		
DIAM (mm) 100	M	2.00
150	M	2.40
200	M	3.00
250	M	5.00
300	M	6.00
400	M	7.60
450	M	11.80
500	M	18.00
21" 525 *	M	
22" 525 *	M	
24" 600 *	M	
3. CENTRIFUGED WROUGHT IRON PIPE-150 PSI (IMPORTED)		
DIAM (mm) 100	M	16.04
150	M	20.05
200	M	31.35
250	M	44.11
300	M	57.23
350	M	71.81
400	M	87.49
450	M	102.07
500	M	116.80
550	M	132.87
600	M	165.68

DESCRIPTION	UNIT	PRICE $
4. REINFORCED CONCRETE PIPE FOR SEWERS.		
DIAM (mm) 16" 400 *	M	
18" 450 *	M	
20" 500 *	M	
21" 525 *	M	
22" 550 *	M	
600	M	22.00
26" 650 *	M	
750	M	38.00
32" 800 *	M	
900	M	46.00
1050	M	76.00
1200	M	116.00
5. VALVES FOR WATER PIPE		
DIAM (mm) 75	C/U	125.21
100	C/U	137.97
150	C/U	195.95
200	C/U	289.35
250	C/U	444.76
300	C/U	525.91
6. MATERIALS FOR REINFORCED CONCRETE		
CEMENT	BOLSA	2.90
SAND	M3	6.00
STONE	M3	10.00
WATER	M3	2.00
WOOD	PIE 2	0.70
IRON	qq	30.00
NAILS	qq	70.00
WIRE	qq	35.00
7.MISCELANEOUS MATERIALS		
BASEGRAVEL	M2	2.90
RC250 ASPHALT	GLN	1.05
HOT ASPHALT (1)	GLN	1.50
KEROSENE	C/U	1.30
1/2" CORPORATION	C/U	
100 mm BRACKETS	C/U	
PVC ELBOWS	C/U	0.50
WATER METER BOX	C/U	
CAST IRON WATER METER COVER	C/U	
1/2" PVC PIPE	C/U	0.75
D. FRAME AND TOP MANHOLE	C/U	80.00
D. FRAME AND TOP CONNECTOR	C/U	
CALAVERA BRICKS	C/U	0.12

* MATERIALS NON-EXISTANT IN THE NATIONAL MARKET.

(1) ASPHALT CONCRETE

SANTA ANA: VALUE OF EQUIPMENT (COST IN US$/HOUR)

ITEM	OPERATION COST			RENT	TOTAL
	LABOR	LUB/FUEL	TOTAL		
C.3.1. EQUIPMENT FOUND LOCALLY					
6 cy DUMP TRUCK	2.10	6.00	8.10	12.00	20.10
11 cf MIXER	1.45	1.20	2.65	5.00	7.65
COMPACTOR	1.20	0.80	2.00	5.00	7.00
TEST PUMP				1.00	1.00
5 Ton PULLEY				1.00	1.00
4" MOTOR PUMP	1.20	1.00	2.20	5.00	7.20
6" MOTOR PUMP	1.20	1.20	2.40	5.00	7.40
6 cf MIXER	1.45	0.90	2.35	4.00	6.35
C.3.2. EQUIPMENT FROM FOREIGN COUNTRIES					
125 cf/min COMPRESSOR	1.45	1.20	2.65	6.00	8.65
60 pounds PNEUMATIC HAMMER					2.00
5/8 Ton TANDEM STEAM ROLLER	2.10	1.50	3.60	15.00	18.60
9 HP VIB. STEAM ROLLER	1.20	0.80	2.00	6.50	8.50
13 HP VIB. STEAM ROLLER	1.20	1.00	2.20	8.00	10.20
VIBRATOR	1.20	0.80	2.00	2.00	4.00
3/4 cy BACKHOE	2.50	2.10	4.60	20.00	24.60
1 cy BACKHOE	2.50	3.00	5.50	25.00	30.50
1.5 cy FRONT LOADER	2.50	6.00	8.50	40.00	48.50
3/5 Ton CRANE	2.10	5.00	7.10	15.00	22.10
10 Ton CRANE	2.10	8.00	10.10	60.00	70.10
20 Ton CRANE	2.50	8.00	10.50	100.00	110.50
DC-6 TRACTOR	2.50	6.00	8.50	70.00	78.50
ASPHALT DISTRIBUTOR	2.10	6.00	8.10	32.00	40.10
GRADER	2.50	6.00	8.50	27.00	35.50

TRANSPORT COSTS

DESCRIPTION	TRANSPORT	DISTANCE	TRANSPORT
	US$/t	Km	US$/tKm
S. SALVADOR-SONSONATE	10	65	0.153
S. SALVADOR-SANTA ANA	10	66	0.152
S. SALVADOR-SAN MIGUEL	15	140	0.110

EARTHWORK PER METER

DESCRIPTION	UNIT	UNIT PRICE	DIAMETER in mm							
			75	100	150	200	300	400	500	600
EARTH WORK										
VOLUME EXCAVATED AND FILLED	(M3/M)		(0.66)	(0.66)	(0.69)	(0.72)	(0.91)	(1.12)	(1.35)	(1.60)
EXCAVATION COST	US$/M3	1.13	0.75	0.75	0.74	0.81	1.03	1.26	3.96	4.69
FILLING COST	US$/M3	3.90	2.56	2.56	2.57	2.81	3.55	4.37	2.21	2.62
VOLUMEN CLEARING	(M3/M)		(0.20)	(0.20)	(0.21)	(0.22)	(0.27)	(0.34)	(0.40)	(0.48)
COST OF CLEARING	US$/M	3.70	0.74	0.74	0.78	0.81	1.00	1.26	1.71	2.00
TOTAL EARTH WORK	US$/M		4.05	4.05	4.09	4.43	5.58	6.89	8.31	9.82
OVERHEAD AND PROFIT	US$/M		0.56	0.56	0.73	0.62	0.76	0.95	1.24	1.35
GENERAL TOTAL	US$/M		4.61	4.61	4.82	5.05	6.34	7.84	9.55	11.17

DITCH EXCAVATION AND FILLING

PIPE TRANSPORT

DESCRIPTION	UNIT	UNIT PRICE US$/M	DIAMETER in mm							
			75	100	150	200	300	400	500	600
	Kg/M	1 Kg	6.90	9.80	19.70	32.60	62.20	112.2	172.0	246.0
SONSONATE SANTA ANA SAN MIGUEL	US$/M	0.026	0.18	0.26	0.51	0.85	1.62	2.92	4.47	6.40

NOTE : THE PIPE TRANSPORT COST INCLUDES OVERHEAD AND PROFIT

EARTHWORK PER M3

DESCRIPTION	UNIT	UNIT PRICE US$	EXCAV. AND REFINING QUANTITY	EXCAV. AND REFINING US$/M3	FILLING QUANTITY	FILLING US$/M3	CLEARING QUANTITY	CLEARING US$/M3
A. LOCAL COMPONENT								
1. LABOR								
SKILLED	hh	1.10	0.04	0.04	1.00	1.10		
UNSKILLED	hh	0.70	0.04	0.03	2.00	1.40	0.04	0.04
TOTAL LABOR				0.07		2.50		0.04
2. MATERIAL								
3. EQUIPMENT								
4 HP COMPACTOR	hm	7.00			0.20	1.40		
6 M3 DUMPTRUCK	hm	20.10					0.11	2.21
TOTAL EQUIPMENT						1.40		2.21
LOCAL TOTAL				0.07		3.90		2.25
B. FOREIGN COMPONENT								
1. EQUIPMENT								
3/4 cy BACKHOE	hm	71.50	0.04	0.99				
5 cy FRONT LOADER	hm	51.00					0.03	1.45
FOREIGN TOTAL				0.99				1.45
TOTAL US$/M3				1.13		3.90		3.70

EXCAVATION, REFINING, FILLING AND CLEARING

Supply and installation of fire hydrants.

No.	Description	Unit	Unit Price US$	Quantity	Total US$
1	Installation				
	Local Component				
	Labor				
	- skilled	hh	1.10	4.00	4.40
	- unskilled	hh	0.70	12.00	8.40
2	Supplies				
	Fire hydrant	u	485.50	1.00	485.50
	100mm Valve	u	137.97	1.00	137.97
	Cement	bl	2.70	2.40	2.40
	Sand	m^3	6.00	0.15	0.90
	Stone	m^3	10.00	0.30	3.00
	Water	m^3	2.00	0.15	0.30
	Simple concrete pipe	m	4.00	1.00	4.00
	W.I. Valve Box	u	20.00	1.00	20.00
	Sub-Total				
	O & P	20%			134.19
	Total	US$ Faucet			805.14

1 hydrant installed every 200m of 100 to 300mm diameter pipe; the costs are:

$$\frac{330 \text{ US\$/ hydrant}}{200 \text{ m}} = 1.69 \text{ US\$/m of pipe}$$

Total pressure pipe supply and installation costs for Class A-10 W.I.

Item	Description	Diameter in mm						
		100	150	200	300	400	500	600
2	Earth works	4.61	4.82	5.05	6.34	7.84	8.67	11.17
4	Pipe S. & Inst.	26.77	40.61	56.71	92.77	132.02	171.60	212.96
3	Transport	0.26	0.51	0.85	1.62	2.92	4.47	6.40
	Total US$/m	31.14	45.94	62.64	100.73	143.58	184.74	230.53

Class A-10 W.I. water pipe, with excavation and filling, without valves or faucets, without pavement breaking and repaving.

Total supply and installation costs of Class A-10 PVC distribution pipe.

Item	Description	Diameter in mm					
		75	100	150	200	300	400
2	Earth works	4.61	4.61	4.82	5.05	6.34	7.84
4	Pipe supply & inst.	9.66	15.67	31.97	53.53	112.05	180.60
3	Transport	0.18	0.26	0.51	0.85	1.62	2.92
	Total US$/m	14.45	20.54	37.30	59.43	120.01	191.96

Class A-10 PVC waterpipe, with excavation and filling, without pavement breaking and reparing.

Total supply and installation costs of Class A-15 PVC pipe.

Description	Diameter in mm					
	75	100	150	200	300	400
Multiplication factor w/total from Table 2.1-11	1.17	1.20	1.24	1.29	1.39	1.48
Pipe cost Total US$/m	16.91	24.65	46.23	76.66	166.81	284.10

US $/m of 15 kg/cm2 pressure pipe, w/excavation & filling but w/out accounting for pavement breaking & reparing. Mult. factors acc. to AMSA.

Total supply and installation costs for Class A-10 ductile iron distribution pipes.

Item	Description	Diameter in mm							
		75	100	150	200	300	400	500	600
2	Earthworks	4.61	4.61	4.02	5.05	6.34	7.84	8.67	11.17
4	Pipe supply & inst	21.30	26.27	40.61	56.74	92.77	132.82	171.60	212.96
3	Transport	0.18	0.26	0.51	0.65	1.63	2.92	4.47	6.40
	Total US$/m	26.09	31.14	45.94	62.64	100.73	143.58	184.74	230.53

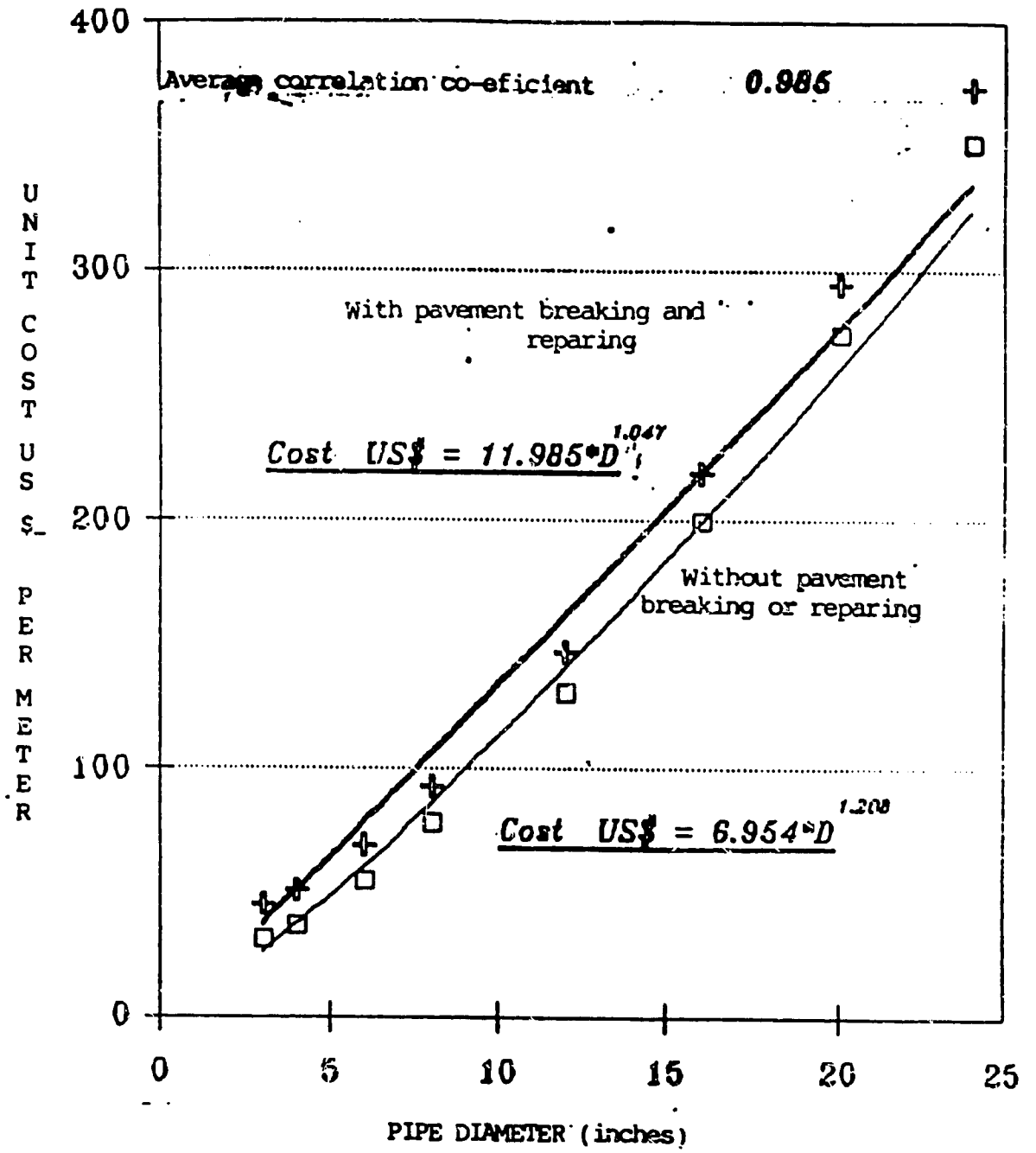
Class A-10 PVC water-supply pipes with excavation and filling, without pavement breaking and reparing.

Total supply and installation costs for Class A-15 ductile iron distribution pipes.

Description	Diameter in mm							
	75	100	150	200	300	400	500	600
Multiplication factor w/total from Table e.1-11	1.17	1.17	1.20	1.24	1.29	1.39	1.48	1.52
Pipe cost Total US$/m	30.53	36.43	55.12	77.67	129.94	199.58	273.42	350.41

U.S. $/m of 15 kg/cm2 pressure pipes, with excavation and filling but without accounting for pavement breaking and reparing Multiplication factors according to A.M.S.A.

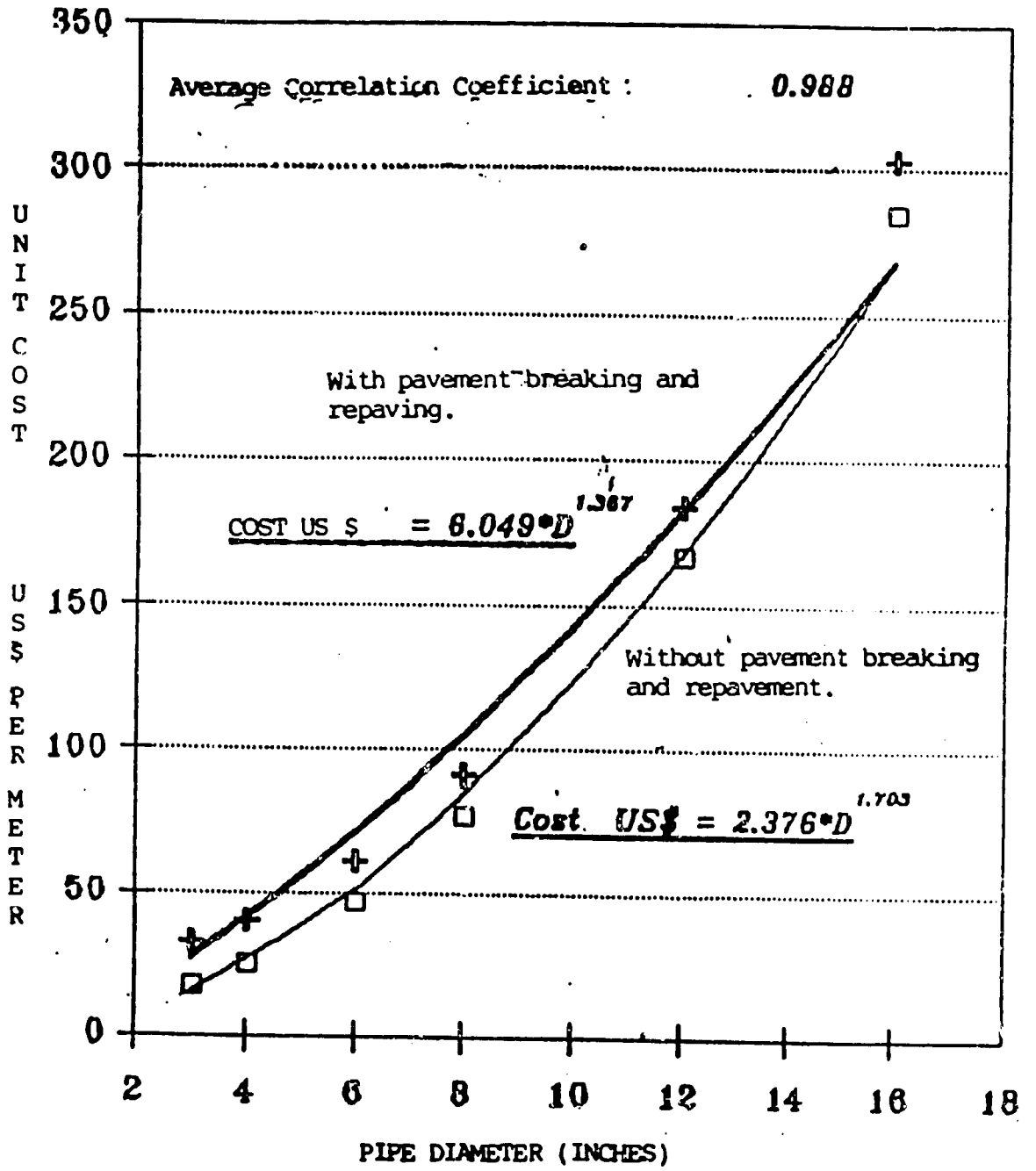
COST/DIAMETER SENSIBILITY ANALYSIS FOR
A-15 DUCTILE IRON PIPES
CURRENT TO SEPTEMBER 1989



This cost includes supply, installation, earthworks and utilities.

Prices CIF San Salvador

COST/DIAMETER SENSIBILITY ANALYSIS FOR A15
PVC PIPES - CURRENT TO SEPTEMBER 1988



his cost includes supply
installation, earthworks and
rofits

ile Prices (TECNOPLASTICOS)

TABLE 4. SUPPLY AND INSTALLATION OF SIMPLE CONCRETE PIPES PER UNIT (1.00m)

Description	Unit	Unit Price $	200		250		300		400		450	
			Quant.	$	Quant.	$	Quant.	$	Quant.	$	Quant.	$
A. Local Component												
1. Labor												
skilled	Pipe	Variable	1.000	0.79	1.000	1.19	1.000	1.19	1.000	2.20	1.000	2.20
unskilled	hh	0.70	0.290	0.20	0.320	0.22	0.500	0.35	0.790	0.55	0.990	0.69
Total:				1.00		1.42		1.54		2.76		2.90
2. Material												
pipe	Unit	Variable	1.000	3.00	1.000	5.00	1.000	6.00	1.000	7.60	1.000	11.80
concrete	m3	59.68	0.001	0.08	0.002	0.14	0.003	0.17	0.005	0.28	0.005	0.32
Total:				3.08		5.14		6.17		7.88		12.12
3. Equipment												
pulley	hm	1.00		0.00		0.00		0.00	0.180	0.18	0.360	0.36
4. Transport	$/kg	0.015	45.24	0.68	73.40	1.10	90.48	1.36	150.80	2.26	169.65	2.54
TOTAL				4.76		7.66		9.07		13.08		17.92

TABLE 5. SUPPLY AND INSTALLATION OF REINFORCED CONCRETE PIPES PER UNIT (1.00m)

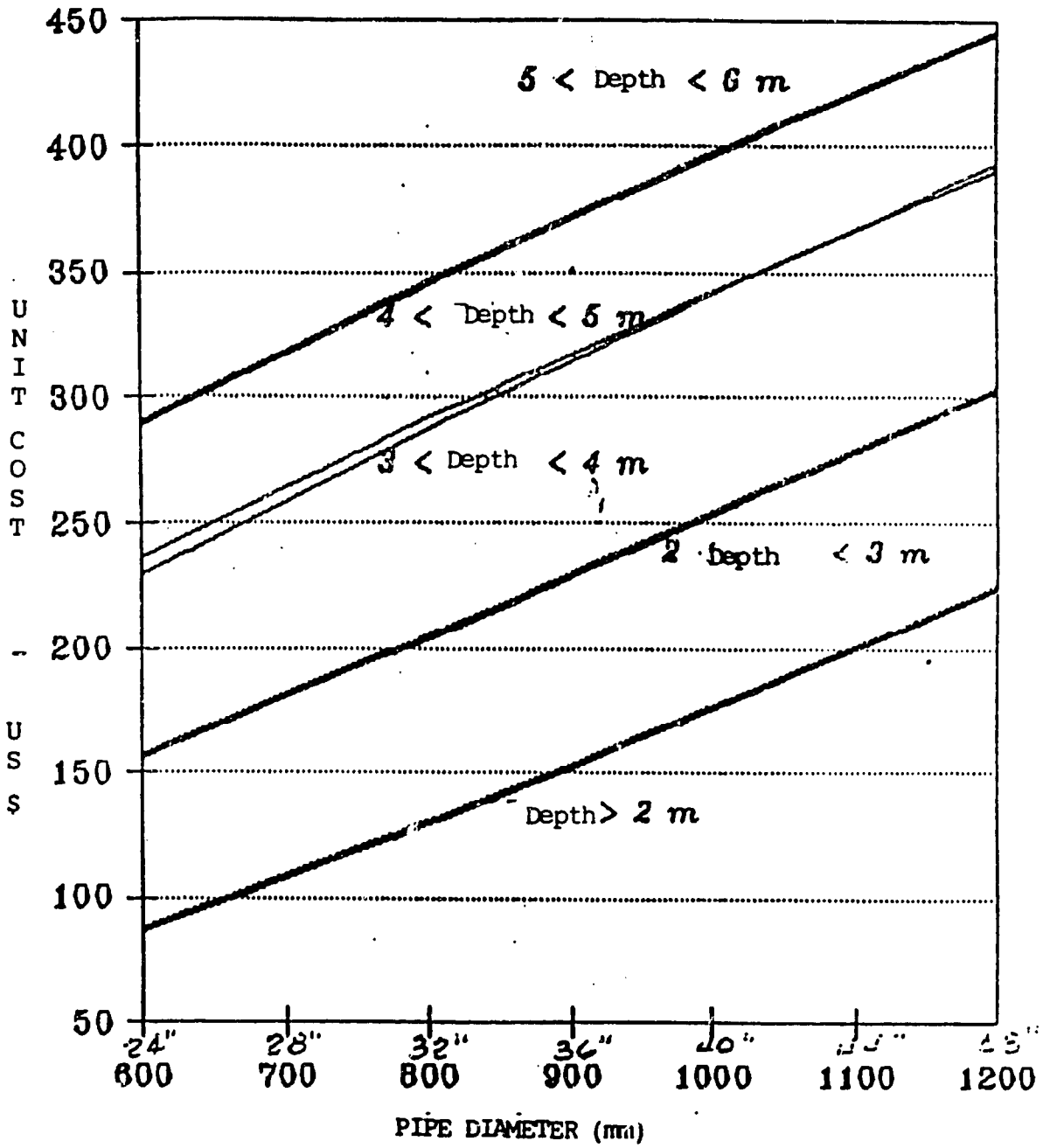
Description	Unit	Price	600		750		900		1050		1200	
			Quant.	$	Quant.	$	Quant.	$	Quant.	$	Quant.	$
A. Local Component												
1. labor												
skilled	pipe	Variable	1.000	3.53	1.000	3.53	1.000	5.28	1.000	2.20	1.000	10.57
unskilled	hh	0.70	0.980	0.69	1.740	1.22	1.740	1.22	1.930	1.35	1.930	1.35
Total				4.21		4.74		6.50		3.55		11.92
2. Material												
Pipe	Unit	Variable	1.000	22.00	1.000	38.00	1.000	46.00	1.000	76.00	1.000	116.00
Concrete	m3	59.68	0.007	0.42	0.013	0.79	0.021	1.27	0.025	1.47	0.034	0.02
Total				22.42		38.79		47.27		77.47		116.02
3. Transport	$/kg	0.015	226.19	3.39	424.12	6.36	678.58	10.18	791.68	11.88	1,357.16	20.36
TOTAL				30.03		49.89		63.94		92.90		148.31
B. Foreign Component												
1. Equipment												
10 ton crane	hm	70.10	0.200	14.02	0.230	16.12	0.230	16.12	0.270	18.93	0.270	0.19
Global Total				44.05		66.02		80.07		111.83		148.50

TABLE 6:

SUPPLY & INSTALLATION OF SEWER PIPES IN NORMAL GROUND, PER UNIT (1.00M)

Description	Unit	Unit Price $	200	250	300	400	450	600	750	900	1050	1200
			Simple normalized concrete					Re-enforced normalized concrete				
GG and Utility (20%)			27.66	28.19	28.71	29.76	30.29	31.87	32.66	33.45	35.81	38.18
Total			165.96	169.12	172.27	178.58	181.74	191.21	195.94	200.68	214.88	229.00
A.5. Depth from 5.0 to 6.0 M.												
Earthwork	$/M3	27.23	106.20	108.92	111.64	117.09	119.81	127.98	132.07	136.15	148.40	160.66
Propping	12M²/M	6.33	75.96	75.96	75.96	75.96	75.96	75.96	75.96	75.96	75.96	75.96
O&P (20%)			36.43	36.98	37.52	38.61	39.15	40.79	41.61	42.42	44.87	47.32
Total			218.59	221.86	225.12	231.66	234.93	244.73	249.63	254.53	269.24	283.94
B. Sand wedging & bedding												
Pipe	$/M	Variable	0.62	0.71	0.79	1.02	1.40	0.79	0.87	1.31	1.48	2.13
Supply and installation	$/M	Variable	4.76	7.66	9.07	13.06	17.92	44.05	66.02	80.07	111.83	148.50
O&P (20%)			1.08	1.67	1.97	2.82	3.86	8.97	13.38	16.28	22.66	30.13
			6.46	10.04	11.83	16.92	23.18	53.81	80.27	97.66	135.97	180.76
C. Summaries												
Depth less than 2.0 m			28.23	33.63	37.23	45.95	54.03	90.10	119.28	139.39	185.87	238.82
Depth from 2.0 to 3.0m			92.77	99.02	103.46	113.87	122.79	161.40	191.84	213.22	263.50	320.25
Depth from 3.0 to 4.0m			153.26	165.93	171.80	185.05	195.39	238.26	270.84	294.35	351.04	414.18
Depth from 4.0 to 5.0m			172.42	179.16	184.10	195.50	204.92	245.02	276.21	298.33	350.85	409.84
Depth from 5.0 to 6.0m			225.04	231.90	236.36	248.58	258.11	298.54	329.90	352.19	405.21	464.70

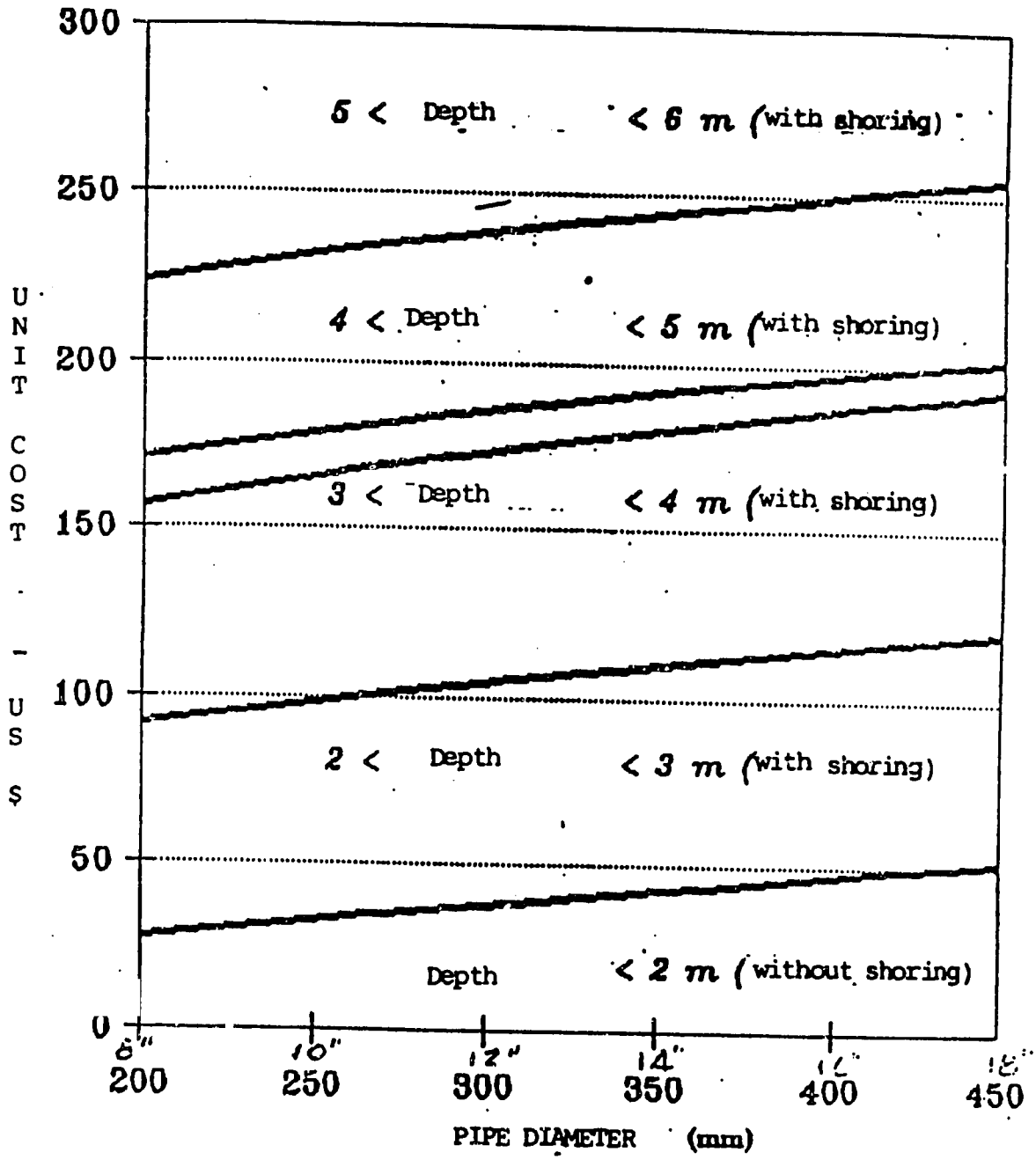
- COST/DIAMETER SENSIBILITY ANALYSIS FOR CONCRETE PIPES



Market Prices (Tubos S.A.)
September 1989.

This price includes supply, installation, earthworks, transport and utility.

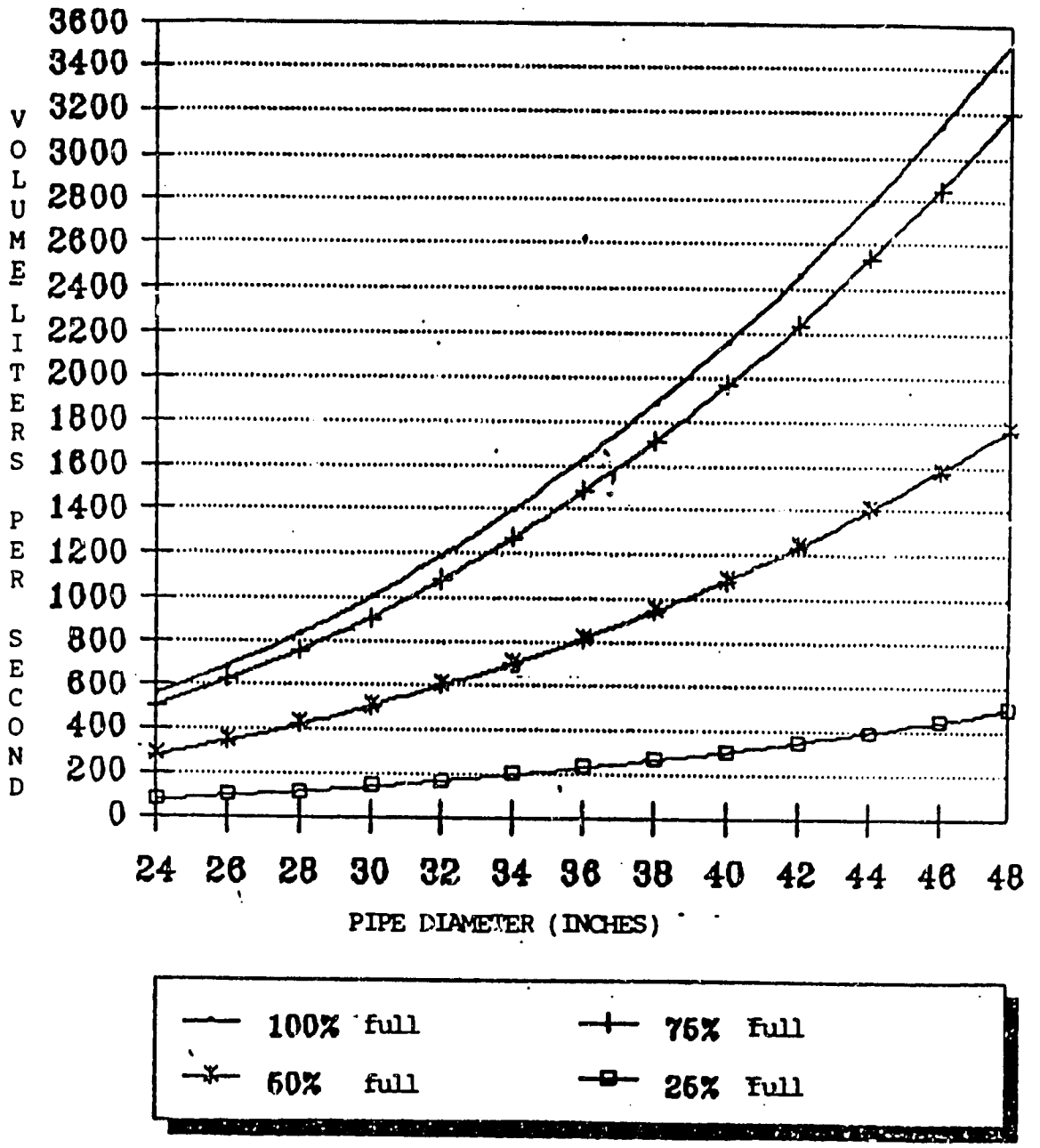
COST DIAMETER SENSIBILITY ANALYSIS FOR
SIMPLE CONCRETE PIPES



Market Prices (TUBOS, S.A.)
September 1989

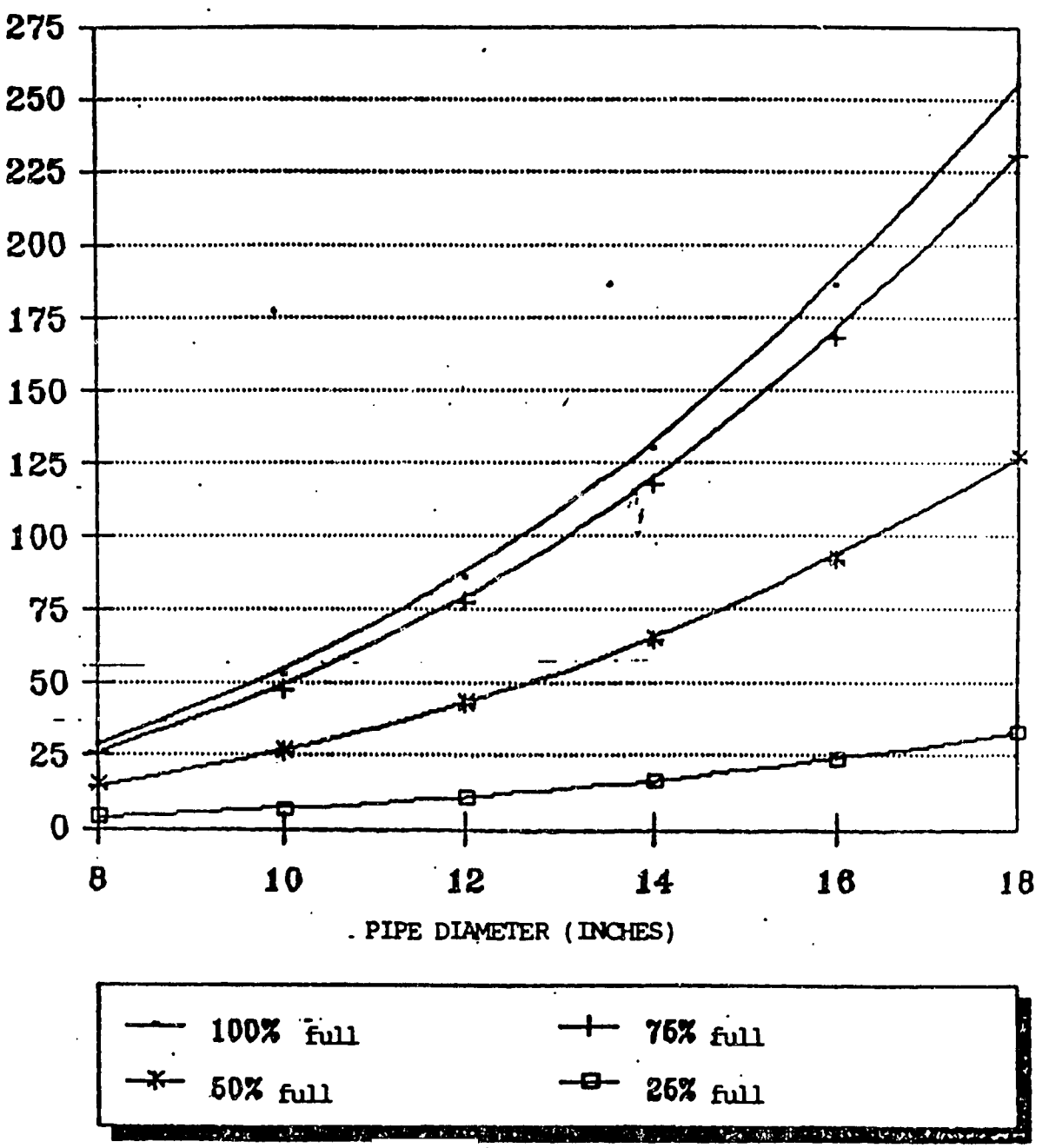
This price includes supply, installation, earthworks, transport and utility.

SEWER PIPES: VOLUME/DIAMETER RELATION
FOR DIFFERENT FLOW CONDITIONS



New Concrete Pipes (n = 0.013)
Grade Considered 0.008)

SEWERAGE PIPES: VOLUME/DIAMETER RELATION FOR DIFFERENT FLOW CONDITIONS



New concrete pipes $(n = 0.013)$

Gradient considered $(s = 0.008)$

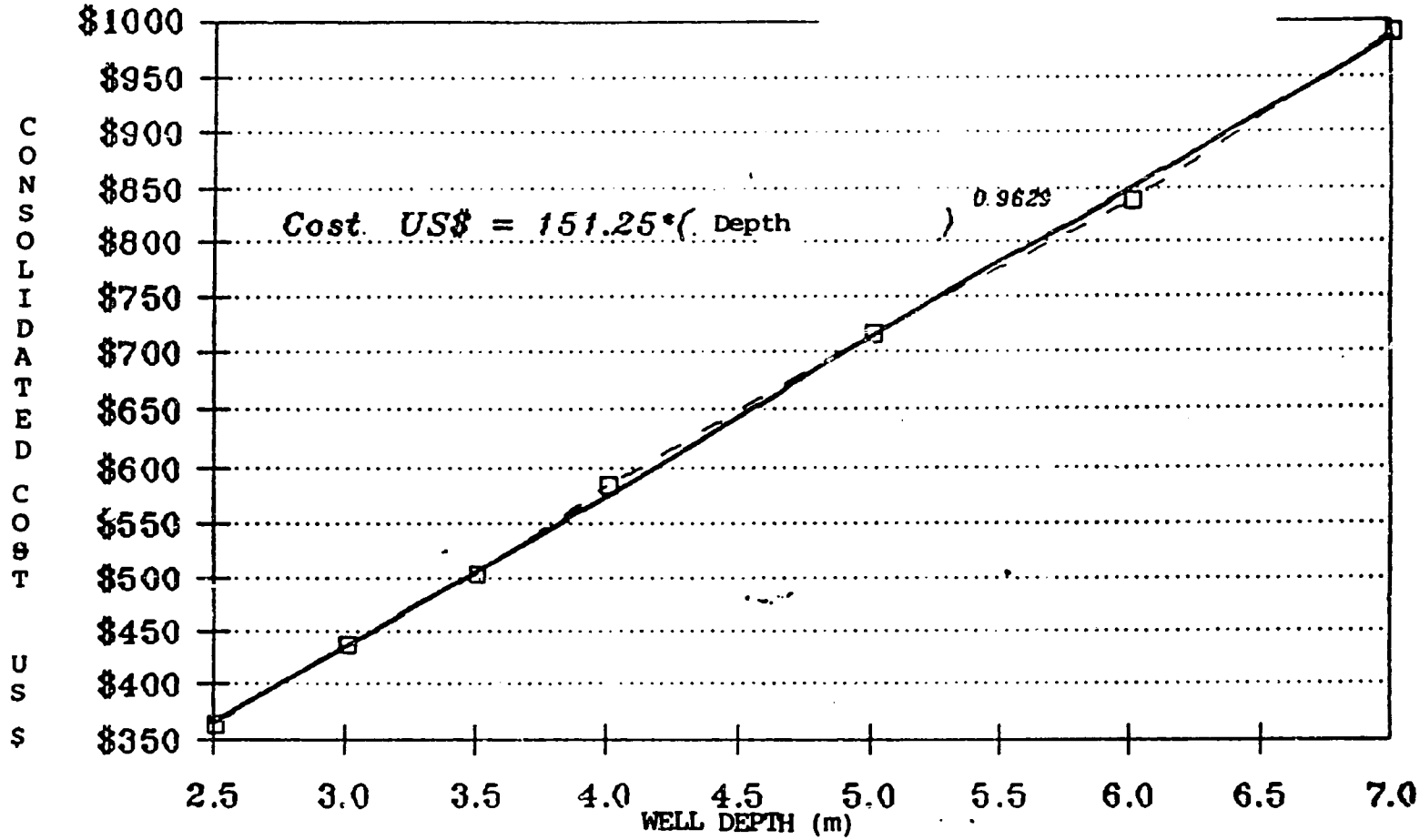
TABLE 7: STANDARD MANHOLES -ANDA TYPE DESIGNS
(INTERNAL DIAMETER 1.10M)

Description	Unit	Unit Price $	less than 2.50 m		2.5 - 3.0 m		3.0 - 3.5 m		3.5 - 4.0 m		
			Quant.	$	Quant.	$	Quant.	$	Quant.	$	
A. Local Component											
1. Labor											
Skilled	m	variable		69.71		81.63		93.07		104.51	
Unskilled	hh	0.70	13.67	9.57	19.31	13.52	47.09	32.96	47.09	32.96	
Total				79.28		95.15		126.03		137.47	
2. Materials											
Bricks	u	0.12	758.00	90.96	926.00	111.12	1094.00	131.28	1262.00	151.44	
Sand	m3	6.00	2.22	13.32	2.57	15.42	2.92	17.52	3.27	19.62	
Cement	bag	2.90	19.60	56.84	22.60	65.54	25.60	74.24	28.60	82.94	
Iron	qq	30.00	0.72	21.60	0.87	26.10	1.02	30.60	1.17	35.10	
Nails	qq	70.00	0.01	0.70	0.01	0.70	0.01	0.70	0.02	1.40	
Wire	qq	35.00	0.01	0.35	0.01	0.35	0.01	0.35	0.01	0.35	
Wood	p2	0.70	2.01	1.41	2.01	1.41	2.41	1.69	2.41	1.69	
Stone	m3	10.00	2.10	21.00	2.10	21.00	47.09	2.10	2.10	21.00	
Total				206.18		241.64		258.48		313.94	
3. Equipment											
Dump truck	hm	20.10	0.54	10.85	0.82	16.48	1.10	22.11	1.10	22.11	
Local Total				296.31		353.27		406.62		473.12	
B. Foreign Component											
11. Equipment, Front Loader	hm	48.50	0.14	6.79	0.21	10.19	0.25	12.13	0.28	13.58	
C. Foreign and Local Total				303.10		363.45		418.75		486.70	
D. O & P				60.62		72.69		83.75		97.34	
E. General Total				363.72		436.14		502.50		584.04	

TABLE 7. STANDARD MANHOLES -ANDA TYPE DESIGNS
(INTERNAL DIAMETER 1.10 M)

DESCRIPTION	UNIT	UNIT PRICE	4.0 - 5.0 m		5.0 - 6.0 m		6.0 - 7.0 m	
			QUANT.	$	QUANT.	$	QUANT.	$
A. Local Component								
1. Labor								
Skilled	m	variable		127.39		150.27		173.15
Unskilled	hh	0.70	58.33	40.83	63.30	44.31	91.27	63.89
Total				168.22		194.58		237.04
2. Materials								
Bricks	u	0.12	1598.00	191.76	1934.00	232.08	2270.00	272.40
Sand	m3	6.00	3.97	23.82	4.67	28.02	5.37	32.22
Cement	bag	2.90	34.60	100.34	40.60	117.74	46.60	135.14
Iron	qq	30.00	1.47	44.10	1.77	53.10	2.07	62.10
Nails	qq	70.00	0.02	1.40	0.02	1.40	0.02	1.40
Wire	qq	35.00	0.01	0.35	0.01	0.35	0.01	0.35
Wood	pe	0.70	2.41	1.69	2.41	1.69	2.41	1.69
Stone	m3	10.00	2.10	21.00	2.10	21.00	2.10	21.00
Total				384.46		455.38		526.30
3. Equipment								
Dump truck	hm	20.10	1.38	27.74	1.57	31.56	1.87	37.59
Local Total				580.42		681.52		800.92
B. Foreign Component								
1. Equipment								
Front Loader	hm	48.50	0.31	15.04	0.35	16.98	0.47	22.80
C. Local & Foreign - Total				595.45		698.49		823.72
D. P&O				119.09		139.70		164.74
E. General Total				714.54		838.19		988.46

COST/DEPTH SENSIBILITY ANALYSIS FOR
MANHOLES OF ANDA TYPE DESIGN

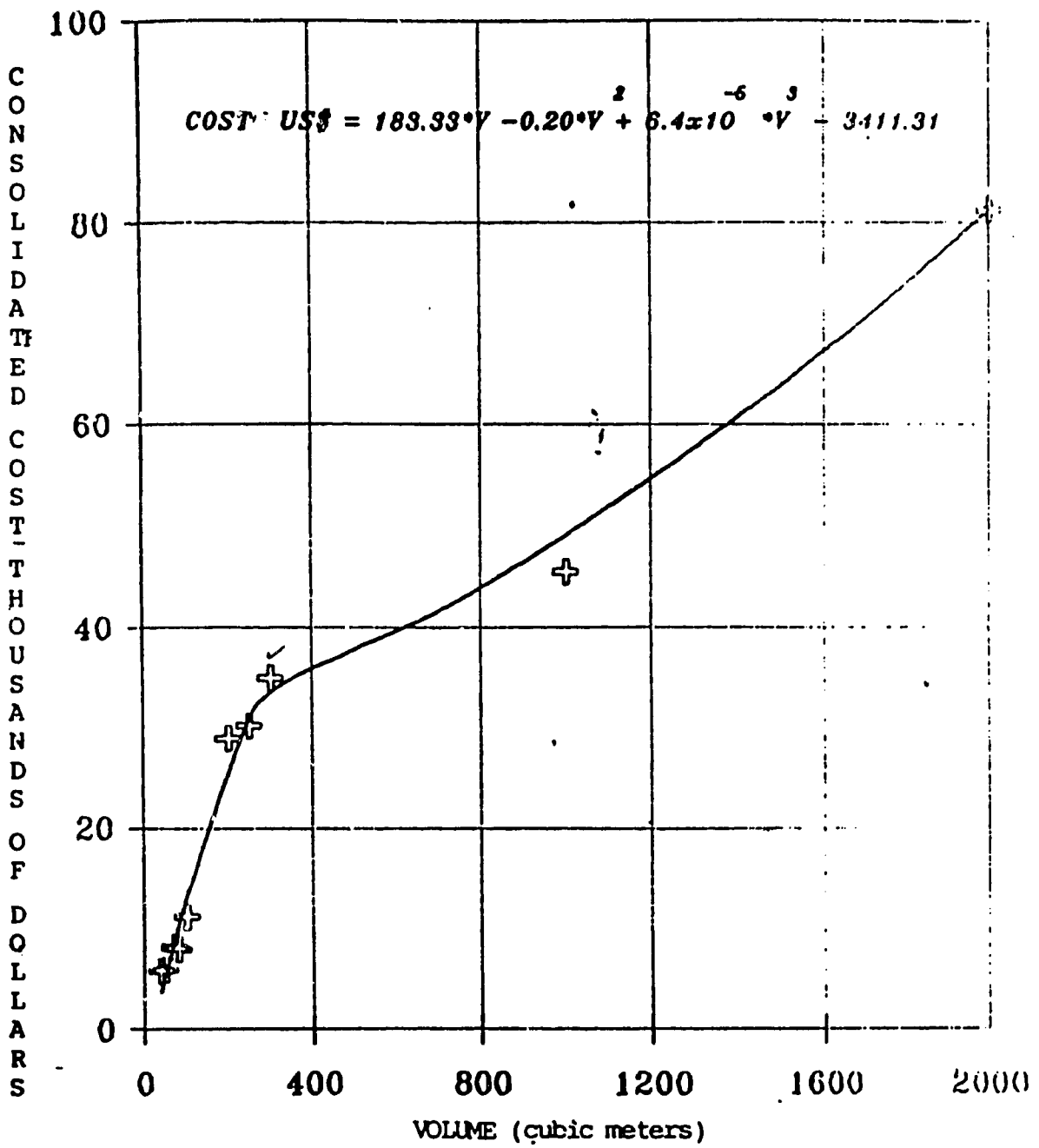


Internal Diameter 1.10 m

Current to Sept. 1989

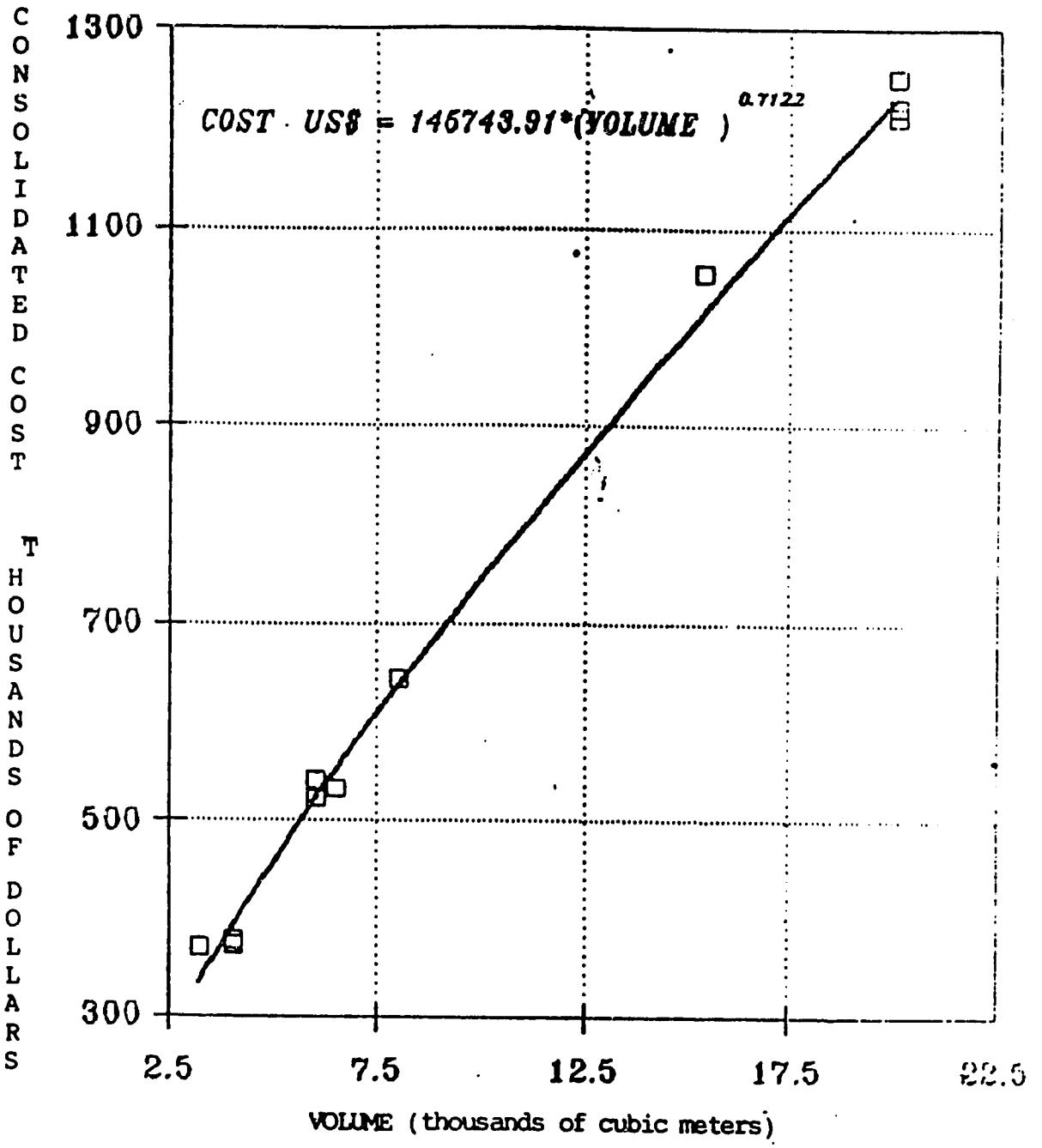
Correlation coefficient 0.999346

COST/VOLUME SENSIBILITY ANALYSIS
FOR BRICK AND RE-ENFORCED CONCRETE
RESERVOIRS



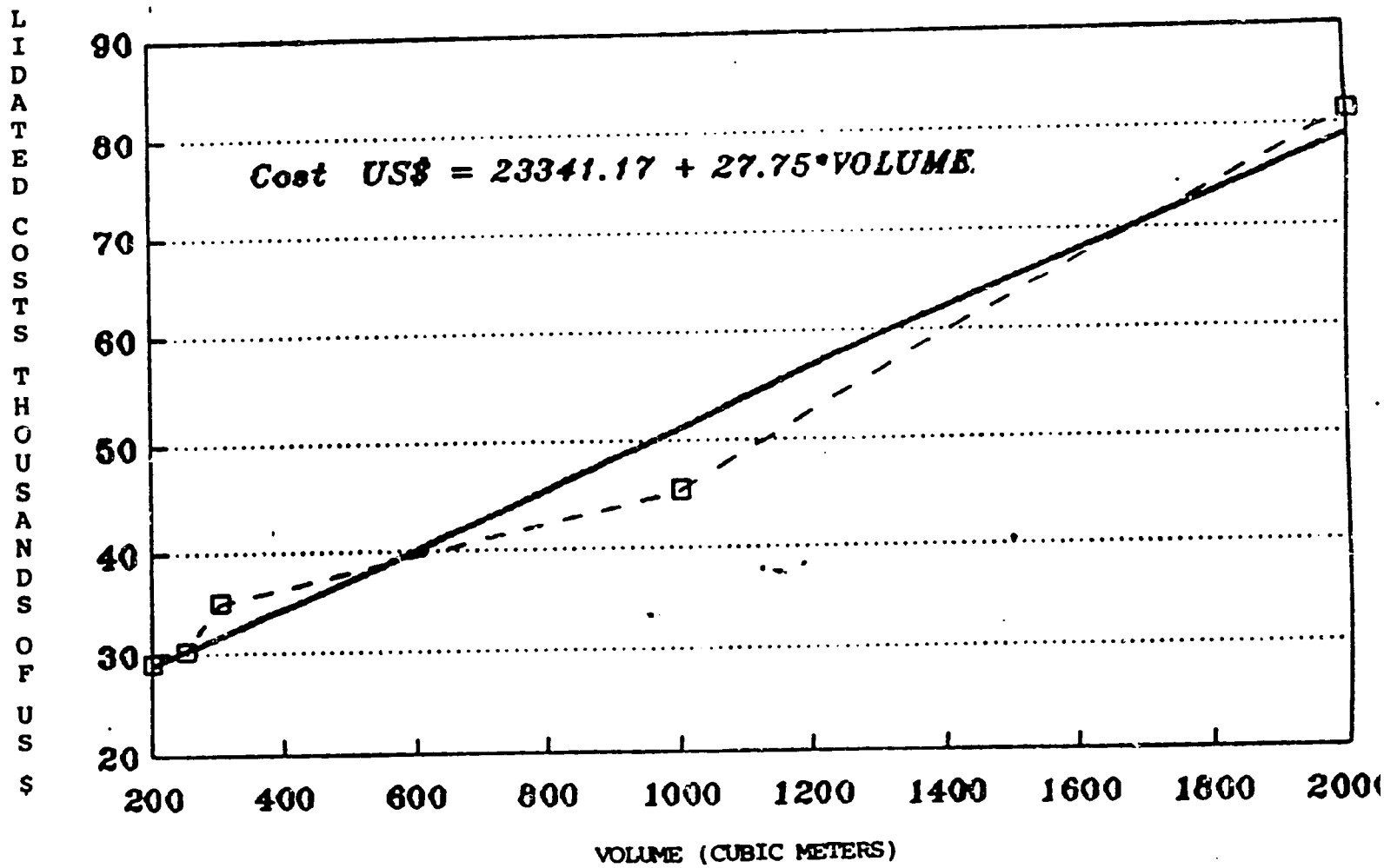
Costs current to August 1989
Correlation Coefficient 0.9976976

COST/VOLUME SENSIBILITY ANALYSIS FOR
PRE-STRESSED CONCRETE RESERVOIRS



Costs current to Sept., 1989
Correlation Co-efficient 0.993187

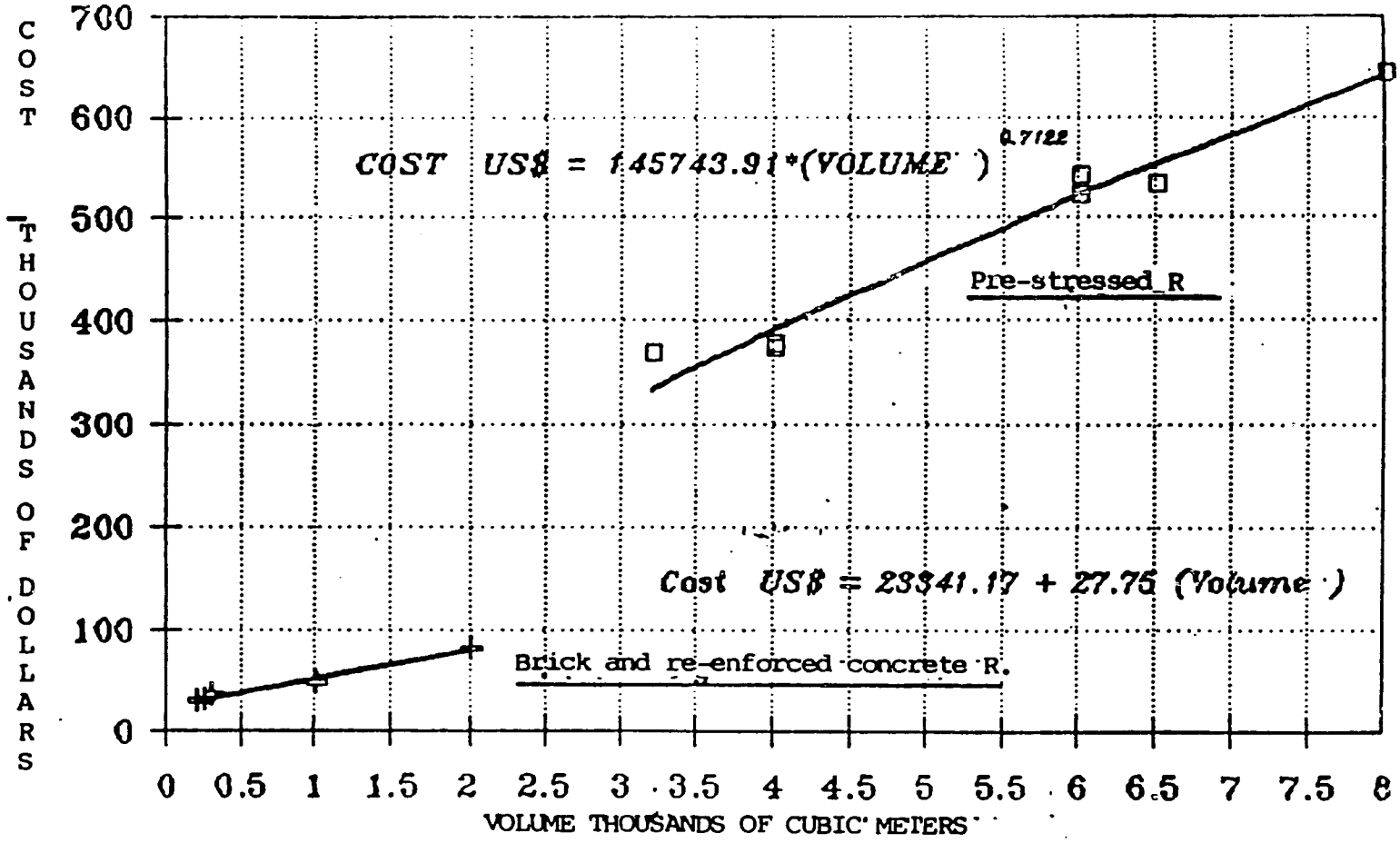
COST/VOLUME SENSIBILITY ANALYSIS
FOR BRICK AND RE-INFORCED
CONCRETE RESERVOIRES ANDA DESIGN TYPE



Costs current to August, 1989

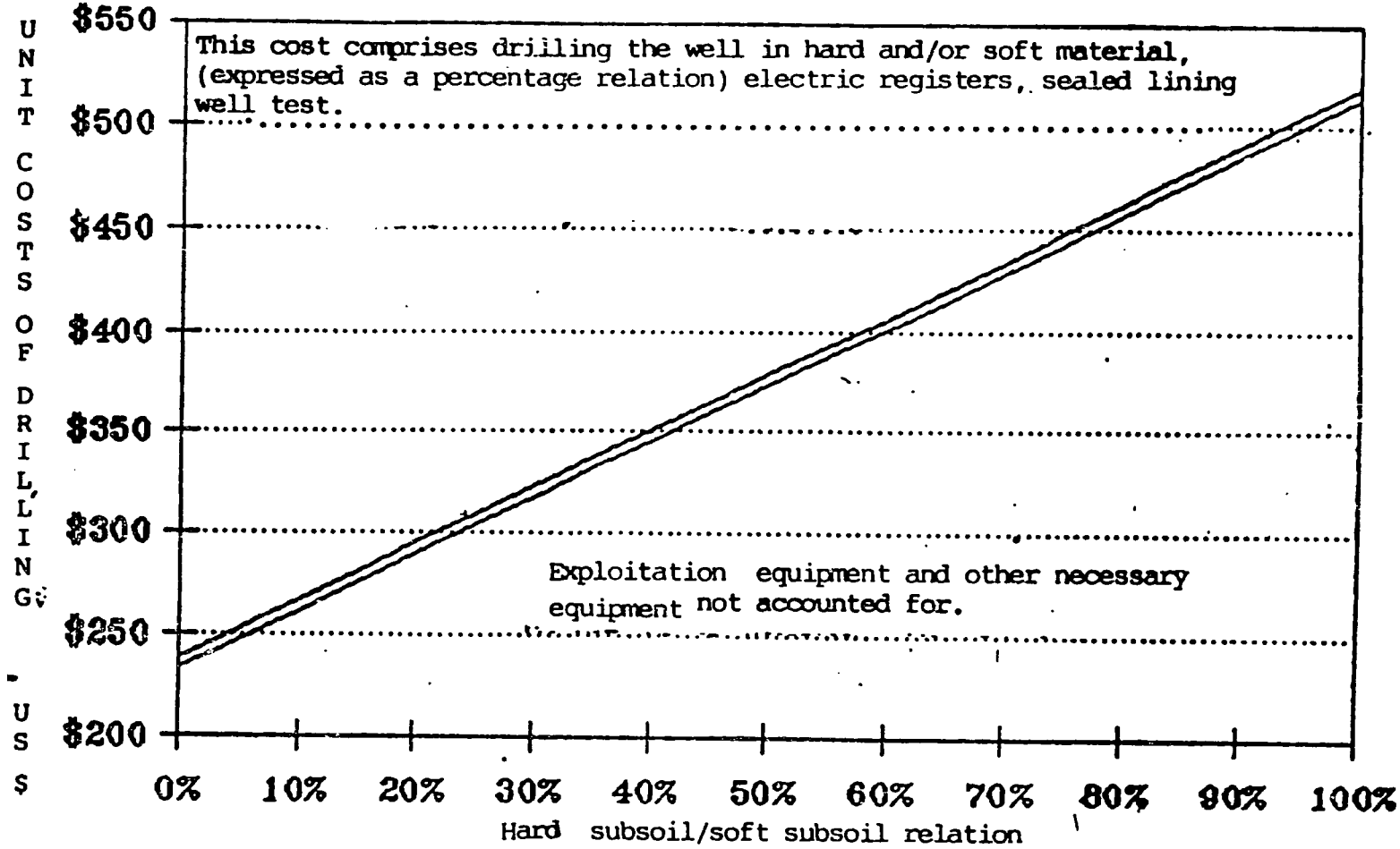
Correlation coefficient 0.973764

COST/VOLUME SENSIBILITY ANALYSIS FOR
RE-ENFORCED AND PRE-STRESSED CONCRETE RESERVOIRS



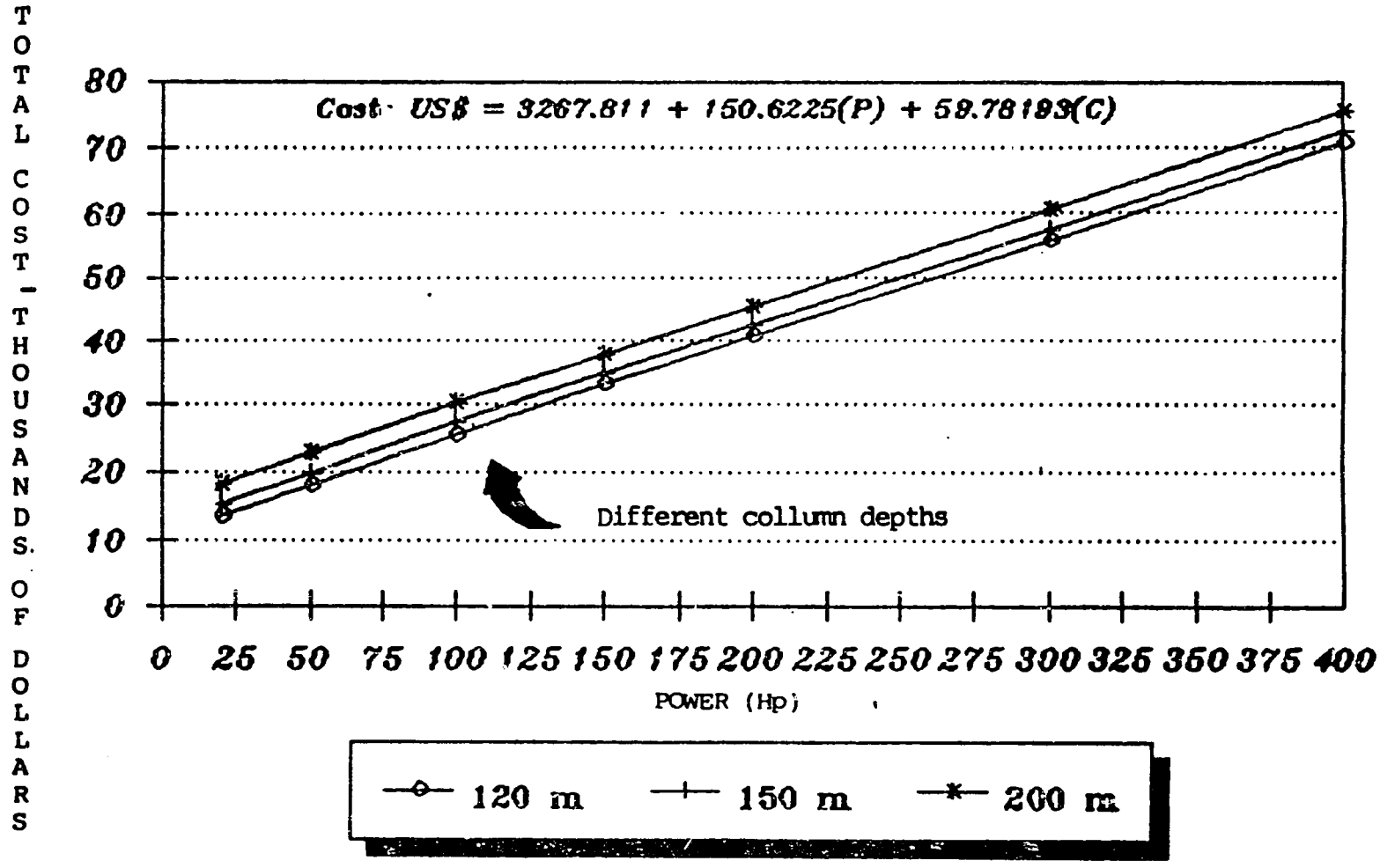
Costs current to September 1989
Correlation coefficient 0.993187

SENSIBILITY ANALYSIS OF WELL-SINKING COSTS FOR SPECIFIED SUBSOIL CONDITIONS



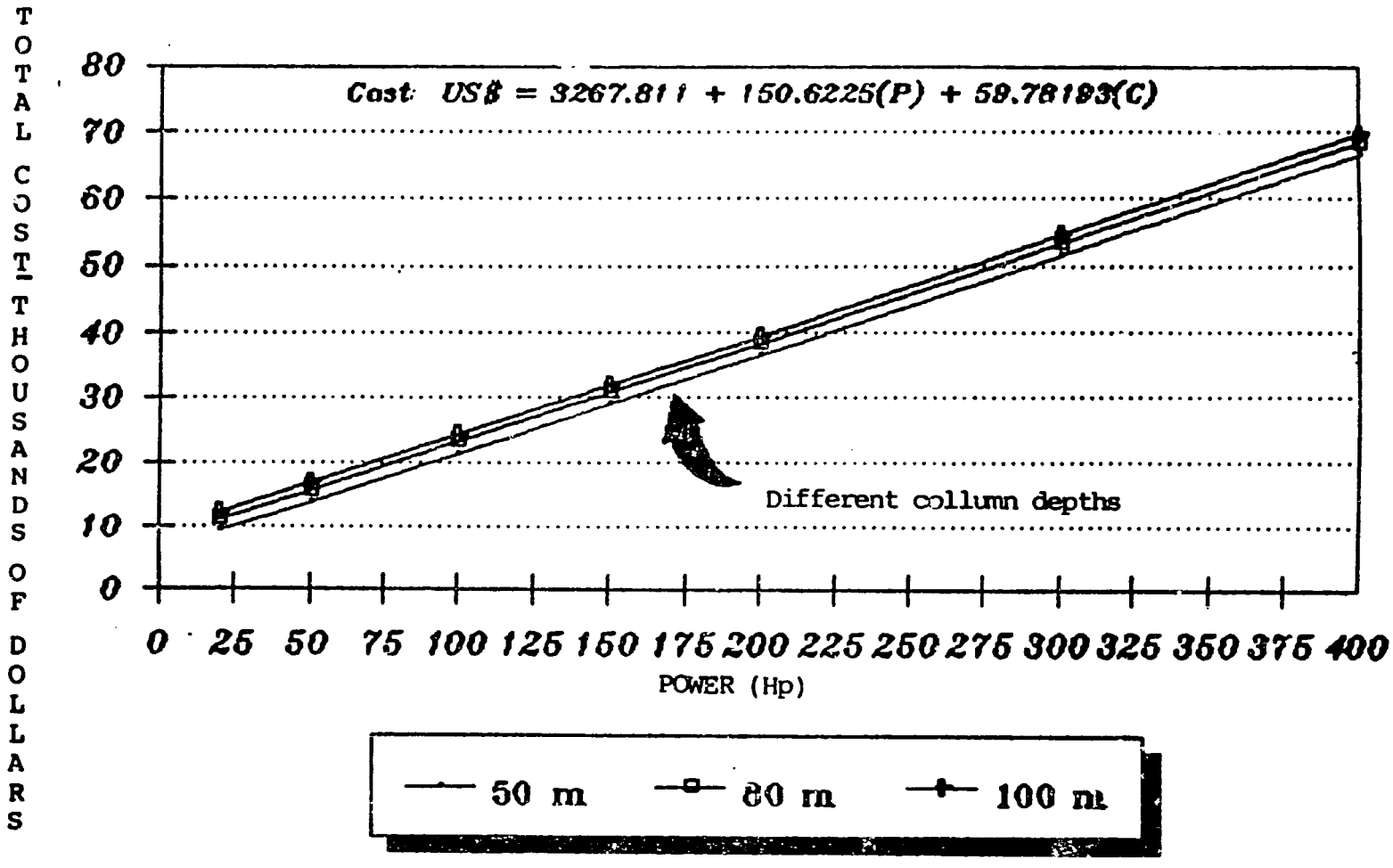
Drill-hole diameter: 16 inches
Metalic lining diameter: 10 inches
Mobilization costs not included

COST/POWER SENSIBILITY ANALYSIS OF TOTAL WELL EQUIPMENT COSTS FOR DIFFERENT DEPTHS



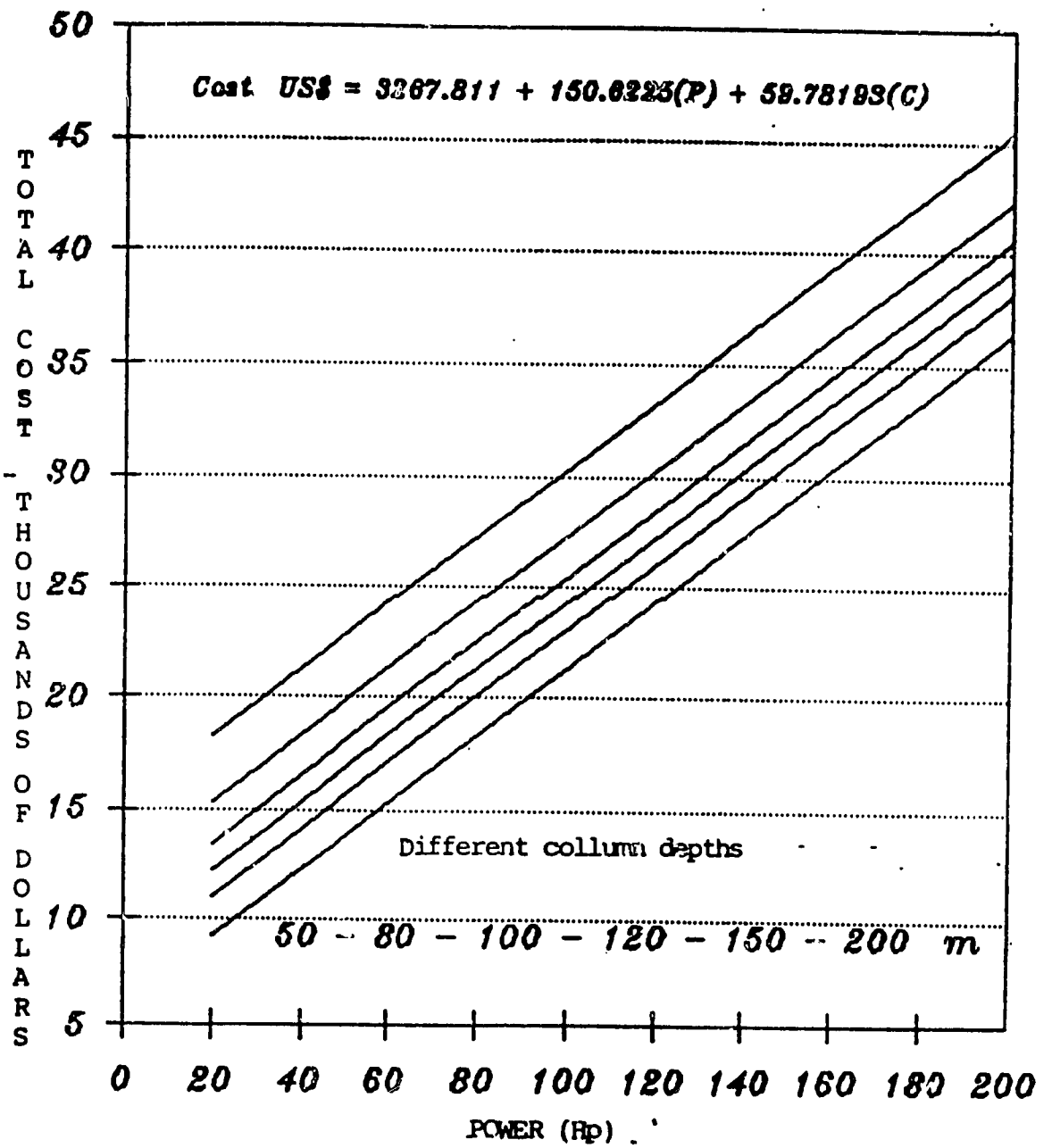
This cost includes pump, motor, discharge outlet collumn, controls, valves and accessories.

COST/POWER SENSIBILITY ANALYSIS OF TOTAL WELL EQUIPMENT COSTS, FOR DIFFERENT DEPTHS



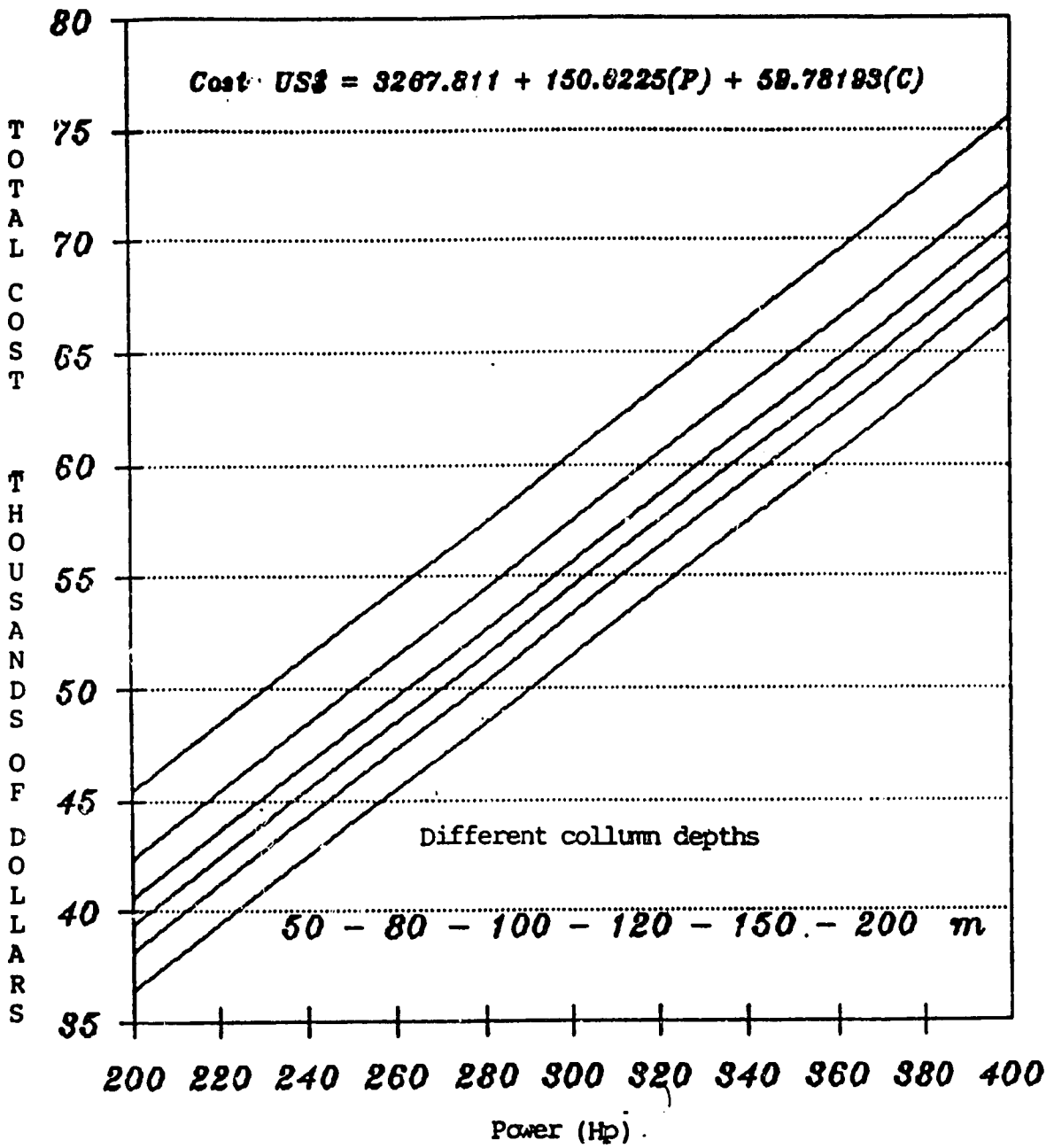
This cost includes pump, motor, discharge outlet collumn, controls, valves and accessories.

COST/POWER SENSIBILITY ANALYSIS OF TOTAL
WELL EQUIPMENT COSTS, FOR DIFFERENT DEPTHS



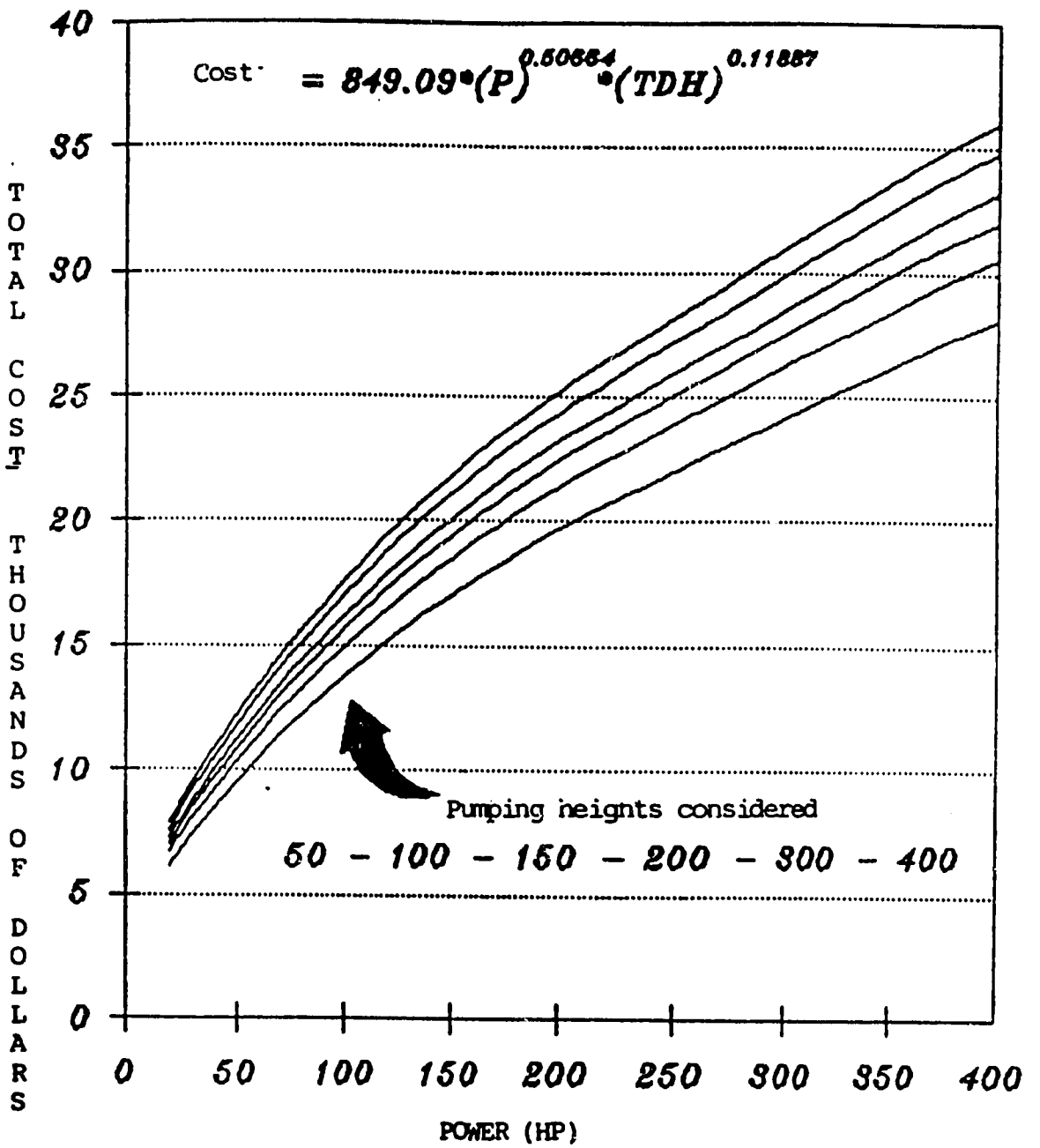
This cost includes pump, motors, discharge outlet, collumn controls, valves and accessories.

COST/POWER SENSIBILITY ANALYSIS OF TOTAL WELL EQUIPMENT COSTS, FOR DIFFERENT DEPTHS



This cost includes pump,motor, discharge outlet collumn, controls, valves and accessories.

COST/POWER SENSIBILITY ANALYSIS FOR CISTERN PUMPING EQUIPMENT FOR DIFFERENT DYNAMIC HEADS

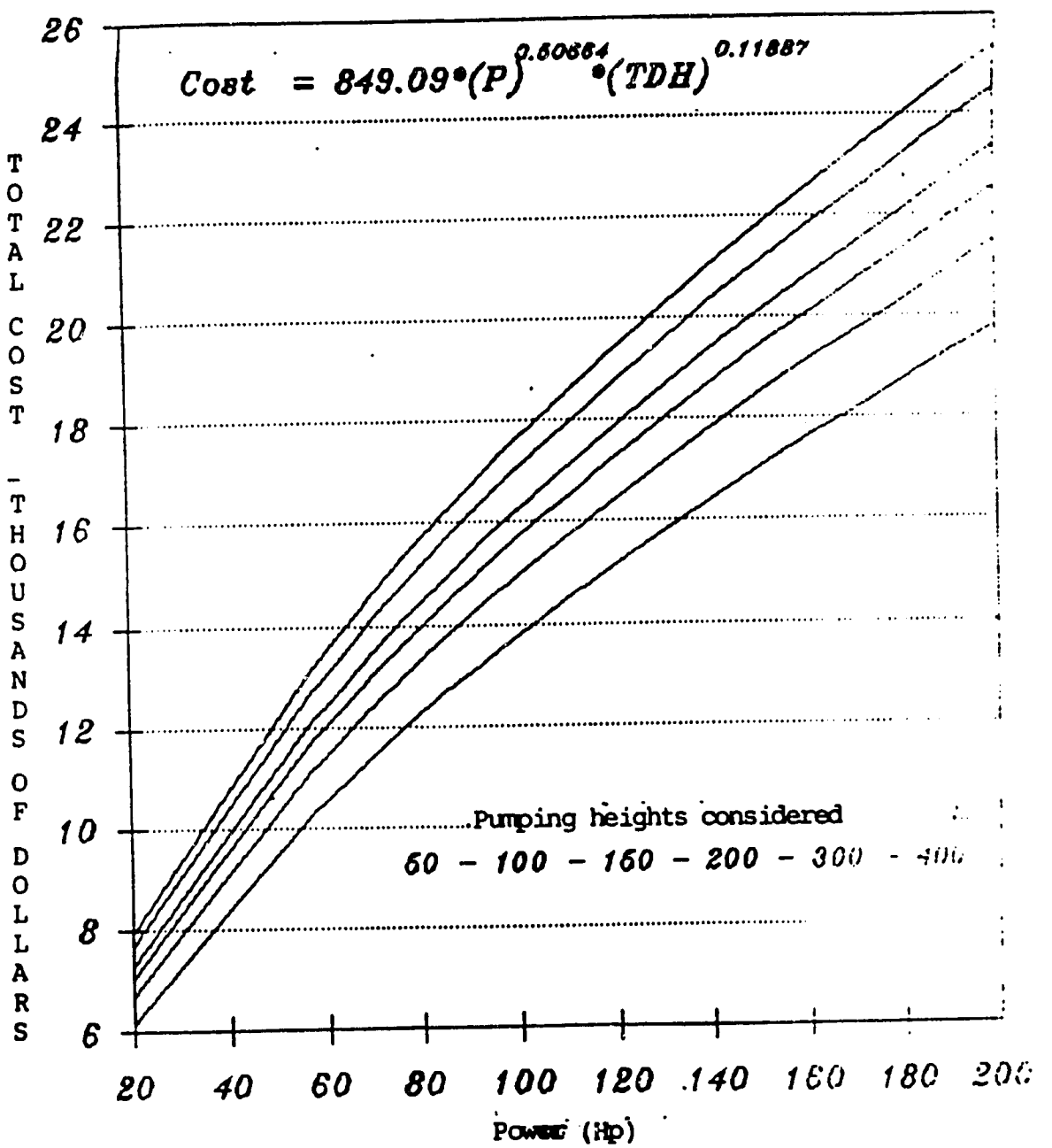


This cost includes: pump, motor, discharge outlet, valves and accessories.

Turbine pumps - Prices CIF SS, 89

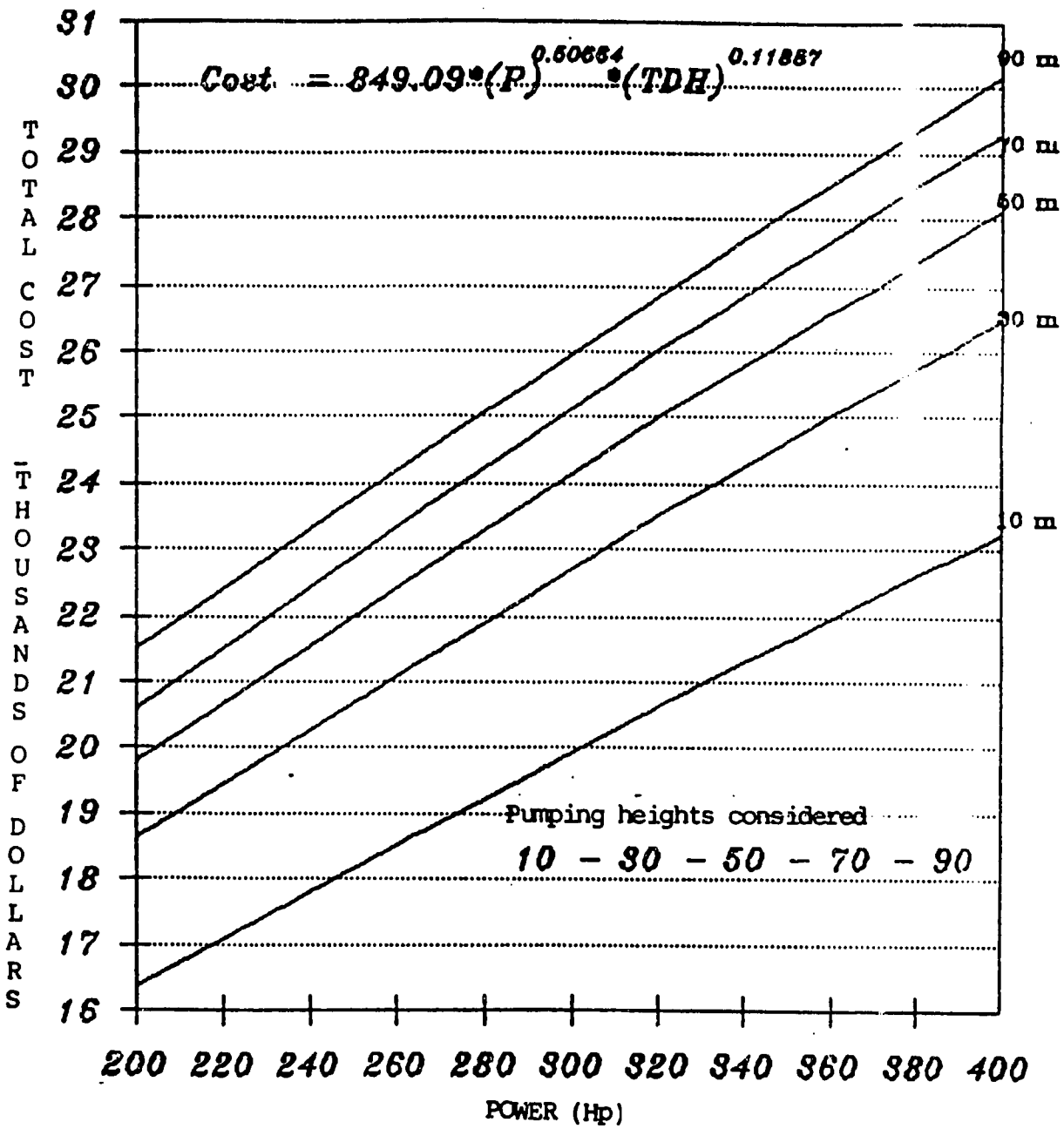
Water Pressure - 4.5. meters

COST/POWER SENSIBILITY ANALYSIS FOR CISTERN
PUMPING EQUIPMENT FOR DIFFERENT DYNAMIC HEADS



This cost includes: pump, motor
discharge outlet valves and
accessories.
Turbine pumps - prices CIF S.S. /89

COST/POWER SENSIBILITY ANALYSIS FOR CISTERN
PUMPING EQUIPMENT FOR DIFFERENT DYNAMIC HEADS



This cost includes: pump, motor
discharge outlet, valves and
accessories.
Turbine pumps - Prices CIF San Salv/89

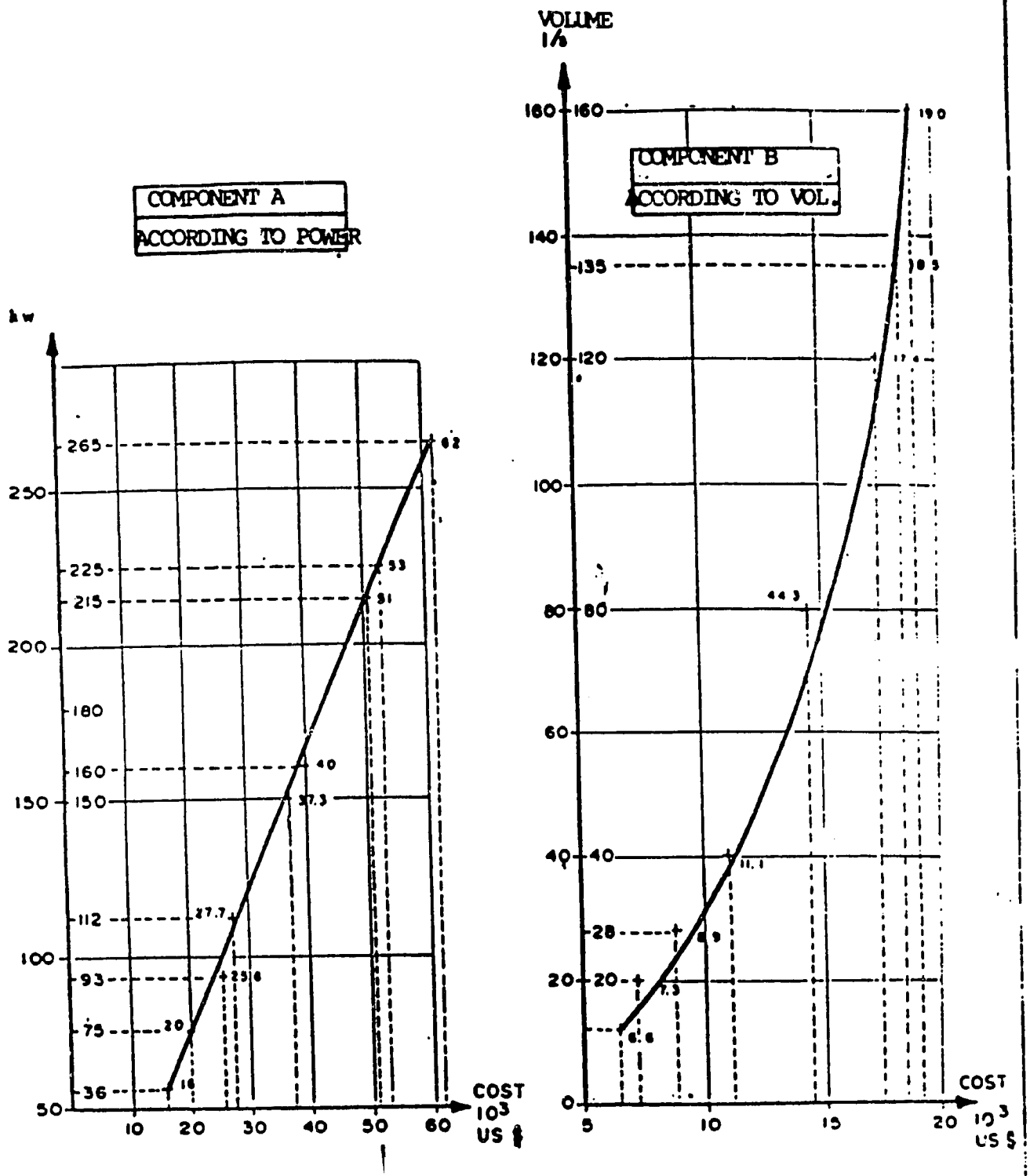


Figure T G 5.3-1 Equipment Cost

REFERENCES TO APPENDIX III.E.2

1. Hebert, Paul V. & Casan Yniguez, "Sensibility of Water Distribution Costs, Design and Sewer Standards".

2. "A Phillipine Case Study", UNDP/World Bank Technolgy Advisory Group, Technical Note No. 16, 1986.

3. Encuezta de Servicio Nacionales de INSFOPAL, Columbia, 1982

4. Plan de Majoramiento de Acuaductos y Aluantarillado para Ica, Piso y Trujillo (Peru), GITEC Consult GmbH/GTZ

5. Plan de Majoramiento de Acuaductos y Aluantarillado para Chancay (Peru)

APPENDIX III.G.1

Listing of persons used by ANDA for projects with UDI and inter-coordinated ANDA-AID. The classification does not include those pre-qualified firms, only firms who have won bids and are actually developing some type of contract with ANDA.

WELL PERFORATION

1. Pozos y Riegos, S.A.de C.V
2. AEROLUX, S.A. de C.V
3. Tecnolgia y Servicios S.A. de C.V
4. Ingenieria Duran, S.A de C.V
5. Comercial Financiera, S.A de C.V
6. ESTRADA y Cia. (EYCO)

WELL SUPERVISION

1. Ing. Raul Eduardo Menjivar
2. Ing. Jose Alfonso Estevez
3. Ing. Hector Martinez Alvarado
4. Ing. Guillermo Ciudad Real
5. Hidrodesarrollo

CONSTRUCTION

1. Ingeneria Integral, S.A. de C.V
2. Roberto Salazar y Asociados, S.A de C.V
3. Celsa de C.V
4. Ing. Carlos Felipe Galdamez
5. Ing. Wifredo Carias Pineda
6. CAMAR, S.A de C.V
7. Ing. Alfredo Antonio Gonzalez M.
8. Ing. Mauricio Rodriguez
9. Ing. Intergral, S.A de C.V
10. CONDISAL, C.A. de C.V
11. KAPRA, Constructora S.A de C.V
12. Ing. Jose Arnoldo Castellon
13. Ing. Gilberto Claro
14. Proyectos Hidraulicos, S.A de C.V
15. Pozos y Riegos S.A de C.V
16. Slepforma de Centro America, S.A de C.V
17. Vivendos e Inversiones
18. Constructora General, S.A
19. CONCAR, S.A. de C.V
20. CAMAR, S.A de C.V
21. Alvarenga Avila y Cia
22. S-C Ingenieros Contratistas, S.A de C.V
23. Ing. Niginio A. Cruz Coreas
24. Siman, S.A Empresa Constructora

1. Ing. Baltazar Vargas Flores
2. Ing. Samuel Alvarez
3. EYCO, S.A de C.V
4. Imery - Trabanino Ings., S.A de C.V
5. Ing. Francisco Guidos Gonzalez
6. Ing. Maximo Roberto Panagua
7. Ing. CArlos Humberto Moreno

SUPERVISION

1. Ing. Manuel Alberto Mejia Calderon
2. Ing. Francisco Lopez Quezada
3. Hidrodesarrollo, S.A de C.V
4. Imery - Trabanino Ings., S.A de C.V
5. CYSO Ings. Arquitectos, S.A
6. Rodriguez Melendez y Cia
7. Ing. Rene Mauricio Escobar y Escobar
8. Ing. Leon Rios Duran
9. Roberto Salazar y Asociados, S.A de C.V

FEASIBILITY STUDIES

1. Consorcio German Water Engineering y Atilio Garcia Prieto (GWE-AGP)
2. AMSA Consultora (Peruana)
3. Fredric R. Harris (U.S.A)

The following classification is only valid for the "Water Supply and Sanitation For San Salvador's Metropolitan Area Project".

a. Constructora Siman S.A
b. FESSIC, S.A
c. ARMCO
d. Ing. Roberto Nubio

SYSTEM TYPE: GRAVITY TYPE

PROJECT NAME: CANTON JUAN YAÑEZ

SYSTEM TYPE: GRAVITY

SAMPLE OF TARIFF COLLECTION LEVELS

PRICE TO PAY: ₡3.00 MENSUALES

SERVICE PERIOD: 12 MONTHS

PRICE TO PAY: ₡3.00 MENSUALES

INCOME					
	1	2	3	4	5
	No. of Undertakings.	Invoiced Income for Home Services	Real Income for home Services	Difference	% Charging Level
JANUARY	117	351	381	+ 30	108.54
FEBRUARY	117	351	516	+ 165	147.70
MARCH	117	351	330	- 21	94.01
APRIL	117	351	354	+ 3	100.85
MAY	117	351	372	+ 21	105.98
JUNE	117	351	312	- 39	88.88
JULY	117	351	321	- 30	91.45
AUGUST	117	351	309	- 42	88.03
SEPTEMBER	117	351	369	+ 18	105.12
OCTOBER	117	351	357	+ 6	101.70
NOVEMBER	117	351	282	- 69	80.34
DECEMBER	117	351	282	- 69	80.34
TOTAL		4,212	4,185	- 27	99.35

INVOICED INCOME= TOTAL AQUEDUCT UNDERTAKINGS

REAL INCOME= SUM ACTUALLY COLLECTED FOR SERVICE

X ₡5 ó 5 MONTHLY PASSAGE & HOUSE QUOTA

₡ 5 WHEN SERVICE IS BY GRAVITY

₡ 5 WHEN SERVICE IS PUMPED

APPENDIX III.H.1

APPENDIX III.I.1

1. Number & Rate of Deaths by Department & Area.....1-2

2. Number & Rate of Infant Deaths by Department & Area...3-4

3. Number & Rate of Births by Department & Area.....5-6

Direccion General de Estadistica y Censos: Anuario Estadistico 1984, Tomo II.

NUMBER AND RATE OF DEATHS BY DEPARTMENT AND AREA, 1981-1984

Departementes/ Urban/Rural	1980 NUMBER	1980 PERCENT	1981 NUMBER	1981 PERCENT	1982 NUMBER	1982 PERCENT	1983 NUMBER	1983 PERCENT	1984 NUMBER	1984 PERCENT
Total	38296	100	37468	100	33281	100	32697	100	28854	100
Urban	20293	52.1	19835	52.9	18192	54.7	18030	55.1	16304	56.5
Rural	18674	47.9	17633	47.1	15092	45.3	14667	44.9	12550	43.5
Ahauachapan	1893	4.9	1913	5.1	1831	5.5	1694	5.2	1436	5
Urban	585	1.5	557	1.5	548	1.6	498	1.5	424	1.5
Rural	1308	3.4	1356	3.6	1283	3.9	1196	3.7	1012	3.5
Santa Ana	4903	12.6	4675	12.5	3832	11.5	4039	12.4	3706	12.8
Urban	2898	7.4	2295	6.1	1755	5.3	1820	5.6	1624	5.6
Rural	2005	5.1	2380	6.4	2077	6.2	2219	6.8	2082	7.2
Sonsonate	2804	7.2	2708	7.2	2578	7.7	2816	8.6	2343	8.1
Urban	1206	3.1	1152	3.1	1152	3.5	1278	3.9	1079	3.7
Rural	1598	4.1	1556	4.2	1426	4.3	1538	4.7	1264	4.4
Chalatenango	1555	4	1476	3.9	1391	4.2	1138	3.5	1050	3.6
Urban	544	1.4	704	1.9	687	2.1	541	1.7	587	2
Rural	1011	2.6	772	2.1	704	2.1	597	1.8	463	1.6
La Libertad	3832	9.8	3960	10.6	3375	10.1	3292	10.1	2966	10.3
Urban	1690	4.3	1656	4.4	1412	4.2	1407	4.3	1326	4.6
Rural	2142	5.5	2304	6.1	1963	5.9	1885	5.8	1649	5.7
San Salvador	9122	23.4	8818	23.5	8273	24.9	8157	24.9	7367	25.5
Urban	7219	18.5	7038	18.8	6680	20.1	6647	20.3	6102	21.1
Rural	1903	4.9	1780	4.8	1593	4.8	1510	4.6	1265	4.4

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uscatlan	2011	5.2	1688	4.5	1463	4.4	1475	4.5	1227	4.3
Urban	709	1.8	721	1.9	667	2	721	2.2	583	2
Rural	1302	3.3	967	2.6	796	2.4	754	2.3	644	2.2
La Paz	2119	5.4	2099	5.6	1605	4.8	1822	5.6	1487	5.2
Urban	895	2.3	1014	2.7	810	2.4	938	2.9	795	2.8
Rural	1224	3.1	1085	2.9	795	2.4	884	2.7	692	2.4
Cabanas	949	2.4	755	2	625	1.9	670	2	509	1.8
Urban	301	0.8	279	0.7	250	0.8	270	0.8	215	0.7
Rural	648	1.7	476	1.3	375	1.1	400	1.2	294	1
San Vicente	1489	3.8	1219	3.3	1038	3.1	998	3.1	901	3.1
Urban	662	1.7	705	1.9	674	2	617	1.9	581	2
Rural	827	2.1	514	1.4	364	1.1	381	1.2	320	1.1
Usulutan	2523	6.5	2754	7.4	2367	7.1	2111	6.5	1939	6.7
Urban	1200	3.1	1321	3.5	1262	3.8	1103	3.4	996	3.5
Rural	1323	3.4	1433	3.8	1105	3.3	1008	3.1	943	3.3
San Miguel	3255	8.4	3153	8.1	2660	8	2530	7.7	2163	7.5
Urban	1575	4	1573	4.2	1360	4.1	1322	4	1295	4.5
Rural	1680	4.3	1580	4.2	1300	3.9	1208	3.7	868	3
Morazan	1252	3.2	1062	2.8	1088	3.1	792	2.4	677	2.3
Urban	369	0.9	400	1.1	493	1.5	380	1.2	259	0.9
Rural	883	2.3	662	1.8	545	1.6	412	1.3	418	1.4
La Union	1260	3.2	1188	3.2	1208	3.6	1163	3.6	1083	3.8
Urban	440	1.1	420	1.1	442	1.3	488	1.5	438	1.5
Rural	820	2.1	768	2	766	2.3	675	2.1	645	2.2

Source: Direccion General de Estadisstica y Censos: Anuario Estadistico 1984, Tomo II.

NUMBER AND RATE OF INFANT DEATHS BY DEPARTMENT AND AREA, 1981-1984

Departementes/ Rural/Urban	1980 NUMBER	1980 PERCENT	1981 NUMBER	1981 PERCENT	1982 NUMBER	1982 PERCENT	1983 NUMBER	1983 PERCENT	1984 NUMBER	1984 PERCENT
Total	7138	100	7183	100	6621	100	6313	100	4991	100
Urban	3365	47.1	3492	48.6	3134	47.3	2980	47.2	2413	48.3
Rural	3773	52.9	3691	51.4	3487	52.7	3333	52.8	2578	51.7
Ahauachapan	403	5.6	486	6.8	374	5.6	346	5.5	279	5.6
Urban	80	1.1	108	1.5	87	1.3	66	1.1	60	1.2
Rural	323	4.5	378	5.3	287	4.3	280	4.4	219	4.4
Santa Ana	1107	15.5	1131	15.7	913	13.8	890	14.1	793	15.9
Urban	562	7.9	478	6.7	339	5.1	292	4.6	281	5.6
Rural	545	7.6	653	9.1	574	8.7	598	9.5	512	10.3
Sonsonate	635	8.9	596	8.3	622	9.4	645	10.2	453	9.1
Urban	220	3.1	200	2.8	170	2.6	225	3.6	174	3.5
Rural	415	5.8	396	5.5	452	6.8	420	6.6	279	5.6
Chalatenango	201	2.8	202	2.8	174	2.6	140	2.2	127	2.5
Urban	67	0.9	92	1.3	64	1	62	1	62	1.2
Rural	134	1.9	110	1.5	110	1.7	78	1.2	65	1.3
La Libertad	1003	14	918	12.8	926	14	842	13.3	671	13.4
Urban	379	5.3	350	4.9	354	5.3	275	4.4	242	4.8
Rural	623	8.7	568	7.9	572	8.6	567	9	429	8.6
San Salvador	1522	21.3	1485	20.7	1506	22.7	1541	24.4	1221	24.5
Urban	1097	15.4	1120	15.6	1087	16.4	1127	17.9	898	18
Rural	425	6	365	5.1	419	6.3	414	6.6	326	6.5
Cuscatlan	367	5.1	372	5.2	318	4.8	267	4.2	281	5.6
Urban	129	1.8	162	2.3	139	2.1	107	1.7	111	2.2
Rural	238	3.3	210	2.9	179	2.7	160	2.5	170	3.4

La Paz	310	4.3	358	5	313	4.7	365	5.8	221	4.4
Urban	140	2	196	2.7	160	2.4	182	2.9	109	2.2
Rural	170	2.4	162	2.3	153	2.3	183	2.9	112	2.2
Cabanas	77	1.1	53	0.7	48	0.7	50	0.8	25	0.5
Urban	20	0.3	26	0.4	19	0.3	13	0.2	10	0.2
Rural	57	0.8	27	0.4	29	0.4	37	0.6	15	0.3
San Vicente	183	2.6	173	2.4	159	2.4	131	2.1	111	2.2
Urban	77	1.1	115	1.6	119	1.8	99	1.6	76	1.5
Rural	106	1.5	58	0.8	40	0.6	32	0.5	35	0.7
Usulutan	472	6.6	611	8.5	456	6.9	428	6.8	361	7.2
Urban	213	3	304	4.2	226	3.4	223	3.5	174	3.5
Rural	259	3.6	307	4.3	230	3.5	205	3.2	187	3.7
San Miguel	564	7.9	508	7.1	539	8.1	452	7.2	309	6.2
Urban	264	3.7	246	3.4	272	4.1	231	3.7	165	3.3
Rural	300	4.2	262	3.6	267	4	221	3.5	144	2.9
Morazan	128	1.8	101	1.4	85	1.3	59	0.9	38	0.8
Urban	48	0.7	34	0.5	35	0.5	20	0.3	13	0.3
Rural	80	1.1	67	0.9	50	0.8	39	0.6	25	0.5
La Union	167	2.3	189	2.6	188	2.8	157	2.5	98	2
Urban	69	1	61	0.8	63	1	58	0.9	38	0.8
Rural	98	1.4	128	1.8	125	1.9	99	1.6	60	1.2

Source: Direccion General de Estadistica y Censos: Anuario Estadistico 1984, Tomo II.

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NUMBER AND RATE OF BIRTHS BY DEPARTMENT AND AREA, 1981-1984

Departementes/ Rural/Urban	19 80 NUMBER	19 80 PERCENT	19 81 NUMBER	19 81 PERCENT	19 82 NUMBER	19 82 PERCENT	19 83 NUMBER	19 83 PERCENT	19 84 NUMBER	19 84 PERCENT
Total	169930	100	163305	100	156796	100	144193	100	142202	100
Urban	86530	50.9	83116	50.9	79796	50.9	73300	50.8	72537	51
Rural	83400	49.1	80189	49.1	77000	49.1	70893	49.2	69665	49
Ahnuachapan	9328	5.5	9004	5.5	8719	5.6	8284	5.7	8326	5.9
Urban	1874	1.1	1627	1	1558	1	1482	1	1357	1
Rural	7454	4.4	7377	4.5	7161	4.6	6802	4.7	6969	4.9
Santa Ana	15661	9.2	15037	9.2	14919	9.5	13971	9.7	12786	9
Urban	7702	4.5	7961	4.9	7869	5	7080	4.9	4973	3.5
Rural	7959	4.7	7076	4.3	7050	4.5	6891	4.8	7813	5.5
Sonsonate	12585	9.2	15037	9.2	14919	9.5	13971	9.7	12786	9
Urban	4612	2.7	4344	2.7	4277	2.7	3927	2.7	3839	2.7
Rural	7973	4.7	8225	5	8277	5.3	7827	5.4	7622	5.4
Chalatenango	7844	4.6	6956	4.3	6228	4	5314	3.7	5450	3.8
Urban	2281	1.3	2452	1.5	2317	1.5	1893	1.3	1938	1.4
Rural	5563	3.3	4504	2.8	3911	2.5	3421	2.1	3512	2.5
La Libertad	15417	9.1	15275	9.4	15393	9.8	14321	9.9	14749	10.4
Urban	5668	3.3	5615	3.4	5571	3.6	5328	3.7	5495	3.9
Rural	9749	5.7	9660	5.9	9822	6.3	8993	6.2	9254	6.5
San Salvador	34677	20.4	34927	21.4	34394	21.9	33188	23	33119	23.3
Urban	27434	16.1	28690	17.6	28255	18	27457	19	27486	19.3
Rural	7243	4.3	6237	3.8	6139	3.9	5731	4	5633	4
Cuscatlan	7271	4.3	6382	3.9	5965	3.8	5488	3.8	4769	3.4
Urban	2331	1.4	2512	1.5	2328	1.5	2164	1.5	2102	1.5
Rural	4940	2.9	3870	2.4	3637	2.3	3364	2.3	2667	1.9

La Paz	9034	5.3	8797	5.4	8341	5.3	8080	5.6	7823	5.5
Urban	3165	1.9	3347	2	3237	2.1	3214	2.2	3025	2.1
Rural	5869	3.5	5450	3.3	5104	3.3	4866	3.4	4798	3.4
Cabanas	6243	3.7	5243	3.2	5139	3.3	4694	3.3	4614	3.2
Urban	1249	0.7	1473	0.9	1277	0.8	1192	0.8	1203	0.8
Rural	4994	2.9	3770	2.3	3862	2.5	3502	2.4	3411	2.4
San Vicente	6276	3.7	4951	3	4107	2.6	3602	2.5	3781	2.7
Urban	1906	1.1	2343	1.4	2272	1.4	1951	1.4	1968	1.4
Rural	4370	2.6	2608	1.6	1835	1.2	1651	1.1	1813	1.3
Usulutan	13070	7.7	12610	7.7	11131	7.1	9536	6.6	9868	6.9
Urban	4403	2.6	4538	2.8	4157	2.7	3747	2.6	3688	2.6
Rural	8667	5.1	8027	4.9	6974	4.4	5789	4	6180	4.3
San Miguel	14294	8.4	14879	9	13871	8.8	12632	8.8	11898	8.4
Urban	4950	2.9	5068	3.1	4774	3	4541	3.1	4187	2.9
Rural	9344	5.5	9611	5.9	9097	5.8	8091	5.6	7711	5.4
Morazan	7504	4.4	6330	3.9	5887	3.8	4996	3.5	4981	3.5
Urban	1536	0.9	1723	1.1	1699	1.1	1328	0.9	1318	0.9
Rural	5968	3.5	4607	2.8	4188	2.7	3668	2.5	3663	2.6
La Union	10726	6.3	10545	6.5	10148	6.5	8333	5.8	8577	6
Urban	2549	1.5	2489	1.5	2383	1.5	2057	1.4	2232	1.6
Rural	8177	4.8	8056	4.9	7765	5	6276	4.4	6345	4.5

Source: Direccion General de Estadistica y Censos: Anuario Estadistico 1984, Tomo II

APPENDIX III.K.1

ECONOMIC COSTS OF MODULAR RURAL WATER SUPPLY AND SANITATION SYSTEMS

(Costs in Colones)

ACTIVITY	POPULATION						
	400	1,000	2,000	5,000	10,000	25,000	50,000
WATER SUPPLY							
1. Well Drilling/Preparation	58,018	145,046	145,046	253,171	379,757	506,342	712,044
2. Pumping Equip./Installation	7,551	48,540	73,349	155,327	431,464	1,380,686	1,725,857
3. Transmission	0	63,448	167,366	457,284	685,926	960,297	3,704,002
4. Reservoirs							
up to 2000 cu.m	0	29,408	43,635	199,595	271,789	0	0
over 2000 cu.m	0	0	0	0	0	1,731,293	2,596,940
5. Distribution Lines	0	134,327	207,664	1,518,184	2,255,326	12,931,998	22,402,355
6. House Connections	0	9,319	18,638	193,520	387,040	1,024,517	2,049,034
7. Electric Components	0	16,180	37,372	46,598	129,439	345,171	517,757
8. Other Works/Equipment	1,072	37,515	48,234	321,560	570,233	1,800,735	3,404,247
SEWERAGE							
1. House Connections	0	0	0	344,125	674,756	1,619,414	3,238,828
2. Street Collectors	0	0	0	1,214,561	2,174,213	5,360,561	8,996,745
3. Perimetral/Main Collectors	0	0	0	924,276	1,521,900	2,910,171	4,639,940
4. Manholes	0	0	0	144,130	235,594	433,793	786,873
5. Letrines	40,085	100,214	200,427	0	0	0	0
ENGINEERING, ADMIN. & CONSTRUCTION	15,505	108,669	176,545	1,314,971	2,219,230	6,978,740	12,300,589
a. Water Treatment Plant	0	0	0	0	1,695,153	2,965,577	4,165,033
b. Sewerage Treatment Plant	0	0	0	0	1,746,766	3,586,541	6,177,926
COSTS							
a. Water Supply	66,641	483,784	791,303	3,145,239	5,110,974	20,681,040	37,112,236
b. Sewerage	40,085	100,214	200,427	2,627,092	4,506,464	10,323,933	17,662,386
c. Water Supply + Treatment	66,641	483,784	791,303	3,145,239	6,806,126	23,646,616	41,277,269
d. Sewerage + Treatment	40,085	100,214	200,427	2,627,092	6,353,230	13,910,479	23,840,313
TOTAL COST WITH TREATMENT	122,231	692,666	1,168,272	7,087,302	15,378,586	44,535,836	77,418,171
COST/CAPITA	306	693	584	1,417	1,538	1,781	1,548
CONVERSION FACTOR (CF)	1.05	1.07	1.08	1.06	1.06	1.07	1.07

APPENDIX III.K.2

PLANSABAR BASELINE SURVEY
WATER USE BY SOURCE
(.51 * Projects, 1986)

TYPE	cu.m/person/yr	Colones/cu.m Average	No. Interviewed TOTAL
1. Home Delivery	40.09	5.43	2
2. Stream	8.42	6.67	48
3. Home Connection	4.58	3.81	8
4. Fill Containers	6.73	7.36	6
5. Public Well	-	-	-
6. Private Well	6.72	3.76	60
7. Others	12.43	6.99	7

SOURCE: MINISTRY OF PUBLIC HEALTH & WELFARE
National Rural Sanitation Project, Comparative annual Inspection
December, 1988

APPENDIX III.K.3
BENEFIT-COST CALCULATIONS
MODULE: 400

Year	Discounted Costs	Costs	Benefits	Net Benefits
1990	61116	61116		-61116
1991	54567	61116		-61116
1992	163	205	64601	64396
1993	150	210	65893	65683
1994	137	215	67211	66996
1995	125	221	68556	68335
1996	115	226	69927	69700
1997	105	232	71325	71093
1998	96	238	72752	72514
1999	88	244	74207	73963
2000	80	250	75691	75441
2001	2576	8961	77205	68244
2002	67	262	78749	78486
2003	62	269	80324	80055
2004	56	276	81930	81654
2005	52	283	83569	83286
2006	47	290	85240	84951
2007	43	297	86945	86648
2008	40	304	88684	88380
2009	36	312	90458	90146
2010	33	320	92267	91947
2011	30	328	94112	93784

nb/i	3.689297
irr	0.449204

Total discounted cost	119785
Total Water consumed	2.92E+05
Economic Price of Water	0.410221
Econ. Tariff/Month/Conn.	7.383988
Discounted cost/capita	299.4617
Price w/o project	7.9
Price Savings	7.489778

APPENDIX III.K.3
BENEFIT-COST CALCULATIONS
MODULE: 1000

2/7

Year	Discounted Costs	Costs	Benefits	Net Benefits
1990	346333	346333		-346333
1991	309226	346333		-346333
1992	36076	45254	142710	97456
1993	33016	46385	145564	99179
1994	30216	47545	148475	100931
1995	27653	48733	151445	102712
1996	25307	49952	154474	104522
1997	23160	51200	157563	106363
1998	21196	52480	160715	108234
1999	19398	53792	163929	110136
2000	17753	55137	167207	112070
2001	34371	119560	170552	50992
2002	14869	57929	173963	116034
2003	13608	59377	177442	118065
2004	12453	60861	180991	120129
2005	11397	62383	184611	122228
2006	10430	63942	188303	124360
2007	9546	65541	192069	126528
2008	8736	67179	195910	128731
2009	7995	68859	199828	130969
2010	7317	70580	203825	133245
2011	-2990	-32305	207901	240207
		0		

nb/i	1.078436
irr	0.132559

otal discounted cost	1017065
otal Water consumed	7.30E+05
conomic Price of Water	1.393239
con. Tariff/Month/Conn.	25.07830
iscounted cost/capita	1017.064
rice w/o project	7.9
rice Savings	6.506760

APPENDIX III.K.3
BENEFIT-COST CALCULATIONS
MODULE: 5000

4/7

Year	Discounted Costs	Costs	Benefits	Net Benefits
1990	3543651	3543651		-3543651
1991	3163974	3543651		-3543651
1992	216742	271881	955331	683449
1993	198358	278678	974437	695759
1994	181533	285645	993926	708281
1995	166135	292786	1013805	721018
1996	152043	300106	1034081	733975
1997	139147	307609	1054762	747154
1998	127344	315299	1075858	760559
1999	116542	323181	1097375	774193
2000	106657	331261	1119322	788061
2001	175533	610600	1141709	531108
2002	89331	348031	1164543	816512
2003	81754	356732	1187834	831102
2004	74819	365650	1211590	845940
2005	68473	374791	1235822	861031
2006	62665	384161	1260539	876378
2007	57350	393765	1285749	891984
2008	52485	403609	1311464	907855
2009	48033	413699	1337694	923994
2010	43959	424042	1364448	940406
2011	6168	66643	1391736	1325093

nb/i	0.791263
irr	0.083532

Total discounted cost	8872696
Total Water consumed	3.65E+06
Economic Price of Water	2.430875
Econ. Tariff/Month/Conn.	43.75576
Discounted cost/capita	1774.539
Price w/o project	9.2
Price Savings	6.769124

APPENDIX III.K.3
BENEFIT-COST CALCULATIONS
MODULE: 10000

5/7

Discounted Costs	Costs	Benefits	Net Benefits
7689293	7689293		-7689293
6865440	7689293		-7689293
958486	1202325	2792746	1590421
877186	1232383	2848600	1616217
802782	1263193	2905572	1642380
734689	1294773	2963684	1668911
672371	1327142	3022958	1695816
615340	1360320	3083417	1723096
563146	1394328	3145085	1750757
515379	1429187	3207987	1778800
471664	1464916	3272147	1807230
719244	2501925	3337589	835664
395043	1539078	3404341	1865264
361535	1577555	3472428	1894873
330869	1616993	3541877	1924883
302804	1657418	3612714	1955296
277120	1698854	3684968	1986115
253614	1741325	3758668	2017343
232102	1784858	3833841	2048983
212415	1829480	3910518	2081038
194398	1875217	3988728	2113512
56262	607847	4068503	3460656

nb/i	0.825414
irr	0.089774

Total discounted cost	24101181
Total Water consumed	1.28E+07
Economic Price of Water	1.8865895
Econ. Tariff/Month/Conn.	33.958611
Discounted cost/capita	2410.1181
Price w/o project	9.2
Price Savings	7.3134104

APPENDIX III.K.3
BENEFIT-COST CALCULATIONS
MODULE: 25000

6/7

Discounted Costs	Costs	Benefits	Net Benefits
22267918	22267918		-22267918
19882070	22267918		-22267918
1953947	2451031	10757781	8306750
1788211	2512307	10972937	8460630
1636532	2575115	11192395	8617281
1497719	2639493	11416243	8776751
1370680	2705480	11644568	8939088
1254417	2773117	11877459	9104343
1148016	2842445	12115009	9272564
1050639	2913506	12357309	9443803
961523	2986344	12604455	9618111
1604453	5581169	12856544	7275375
805325	3137527	13113675	9976148
737016	3215965	13375948	10159983
674501	3296365	13643467	10347103
617289	3378774	13916337	10537563
564930	3463243	14194664	10731421
517012	3549824	14478557	10928733
473158	3638570	14768128	11129558
433024	3729534	15063491	11333957
396294	3822772	15364760	11541988
168004	1815092	15672056	13856964

nb/i	1.3899913
irr	0.1791776

Total discounted cost	61802679
Total Water consumed	3.65E+07
Economic Price of Water	1.693224
Econ. Tariff/Month/Conn.	30.47803
Discounted cost/capita	2472.107
Price w/o project	11.4
Price Savings	9.706775

APPENDIX III.K.3
BENEFIT-COST CALCULATIONS
MODULE: 50000

Discounted Costs 50000	Costs 50000	Benefits	Net Benefits
			7/7
38709085	38709085		-38709085
34561683	38709085		-38709085
3783283	4745750	21884049	17138299
3462379	4864394	22321730	17457336
3168695	4986004	22768164	17782161
2899922	5110654	23223528	18112874
2653947	5238420	23687998	18449578
2428835	5369381	24161758	18792378
2222818	5503615	24644993	19141378
2034275	5641205	25137893	19496688
1861725	5782236	25640651	19858416
2645875	9203808	26153464	16949656
1559291	6074961	26676534	20601572
1427030	6226835	27210064	20983229
1305987	6382506	27754265	21371759
1195212	6542069	28309351	21767282
1093832	6705621	28875538	22169917
1001052	6873261	29453049	22579788
916141	7045093	30042110	22997017
838433	7221220	30642952	23421732
767316	7401750	31255811	23854060
397261	4291944	31880927	27588983

nb/i	1.6269312
irr	0.2116238

Total discounted cost	110934076
Total Water consumed	7.30E+07
Economic Price of Water	1.5196448
Econ. Tariff/Month/Conn.	27.353607
Discounted cost/capita	2218.6815
Price w/o project	11.4
Price Savings	9.8803551

APPENDIX III.L.1

COST TO IMPROVE WATER SUPPLY TO 120 COMMUNITIES
(Prices in Colones, as at December, 1988)

PROF.NO	PROJECT	LOCATION	TOTAL COST
1	Multiple System - El Tortuguero	Ahuachapan	3,219,332
2	Multiple System - Ahuachapan (EL Roble-El Tigre)	Ahuachapan	2,432,220
3	Multiple System - Tacuba	Ahuachapan	670,708
4	Multiple System - Chalchuapa	Santa Ana	1,644,033
5	Multiple System - San Miguelito-San Jacinto	Santa Ana	956,559
6	Multiple System - San Cristobel-Ayutica	Santa Ana	277,496
7	Multiple System - Sonsonate	Sonsonate	622,650
8	Multiple System - San Jose Los Sitios, San Antonio Buenu Vista - Los Guardados	Chalatenango	156,481
9	Multiple System - Asentamiento El Dorado I,II,III	Chalatenango	550,215
10	Multiple System - Closingo-Conacaste	Chalatenango	102,988
11	Multiple System - El Joyita-La Reforma	La Libertad	1,044,410
12	Multiple System - El Cafetalito-Santa Rosa	La Libertad	644,819
13	Canton Santa Lucia, Ciudad Arce	La Libertad	1,332,404
14	Multiple System - Curazao, La Labor-Las Flores	La Libertad	758,019
15	Multiple System - Opico	La Libertad	2,389,090
16	Multiple System - Zapotitan-Veracruz	La Libertad	2,605,536
17	Multiple System - Cerro Colarado-El Espinal J/San Rafeal Cedros/Agua Zarca J/Ilobasco	Cuscatlan/Cabanas	2,322,516
18	Multiple System - Valle Nuevo, Sante Fe, Sn Sabast. Planes De Las Delicias.Sn Juan Jayuca, and San Jose Buenavista	La Paz	3,113,058
19	Multiple System - San Vicente	San Vicente	737,140
20	CTM. Candelaria, San Cayetano Istepeque	San Vicente	372,830
21	Multiple System - El Jocotillo-El Caulote/Sna Anita	Usulutan	1,389,415
22	Multiple System - Las Charcas-Los Espinos/El Jicaro	Usulutan	1,702,198
23	Multiple System - El Jicaro, El Nacimiento/La Sincuya	La Union	864,716
24	CAS.Puente Arce, CTM Joctillo,San Francisco Menendez	Ahuachapan	1,311,655
25	CTM. Cara Sucia, San Fco. Menendez	Ahuachapan	623,069
26	San Antonio Pajonal	Santa Ana	1,650,105
27	CTM. Cutumay, Camones, Texistepeque	Santa Ana	385,324
Sub -Total			33,878,986

APPENDIX III.L.1

COST TO IMPROVE WATER SUPPLY TO 120 COMMUNITIES
(Prices in Colones, as at December, 1988)

PROF.NO	PROJECT	LOCATION	TOTAL COST
28	Candelaria De La Fronteria	Santa Ana	3,488,332
29	CTN.El Sunza, Izalco	Sonsonate	1,025,000
30	Santa Catarina Masahuat	Sonsonate	970,650
31	CTN.Laguna Seca, Nuevo Concepcion	Chalatenango	89,019
32	Cas.Sition De Las Flores,CTN.Potrero Sula Nueva Conc.	Chalatenango	512,754
33	CTN.Joya De Ceren, San Juan Opico	La Libertad	369,498
34	CAS.Sitio De Las Flores, CTN. San Isidro, San Pablo Tacachico	La Libertad	2,420,707
35	San Rafael Cedros	Cuscatlan	1,445,838
36	CAS.El Banadero CTN. El Banadero	Cabanas	489,649
37	Villa Victoria	Cabanas	1,969,299
38	San Pedro Masahuat	La Paz	4,571,896
39	San Luis La Herradura	La Paz	2,499,574
40	Cuyultitan	La Paz	2,258,819
41	Tepetitan	San Vicente	836,360
42	CNT.Tierra Blanca, Jiquilisco	Usulutan	1,790,038
43	Ereguayquin	Usulutan	1,334,550
44	San Dioniso	Usulutan	1,265,542
45	Villa El Triunfo	Usulutan	2,387,026
46	Nueva Granada	Usulutan	1,591,797
47	Canton Tierra Blanca, Chirilagua	San Miguel	335,118
48	CTN.El Palon, Lolotique	San Miguel	2,543,089
49	CTN.Olomega, El Carmen	La Union	2,273,841
50	El Carmen	La Union	2,468,584
51	CAS.El Carmen, CTN.Ciricuario	La Union	340,783
52	CTN.Julupe, Chiltiupan	La Libertad	1,678,879
53	CAS.San Pedro, CTN.San Pedro	San Miguel	1,216,091
54	Quelepa	San Miguel	1,032,524
GRAND TOTAL			77,084,243

APPENDIX III.L.2

ESTIMATES OF EQUIPMENT REPAIRS & REHABILITATION

Values Real Estate, Machinery, & Equipment, as at December 1986
(Prices in thousands of Colones)

COMPONENT	ACQUISITION COST	DEPRECIATION	PRESENT VALUE
AQUEDUCT PROPERTIES			
Catchments, Reservoirs & Dams	11,571	465	11,106
Wells	5,840	1,458	4,382
Lines and Conducting Pipes	111,323	5,935	105,388
Sub Total	128,734	9,781	120,876
DISTRIBUTION SYSTEMS			
Storage Tanks	58,919	5,808	53,111
Distribution Pipes (Water)	279,691	53,649	226,042
Pumping Equipment (Water)	115,758	23,361	92,397
Installations (Home & Other)	3,884	3,746	138
Meters	3,416	3,416	-
Filters & Other Equipment	5,314	1,573	3,741
Sub Total	595,716	101,334	496,305
SEWERAGE PROPERTIES IN SERVICE SEWERS			
Sewer Collection (networks)	69,769	12,561	57,208
Pumping Equipment (Sewers)	153	57	96
Home & Other Installations	3,500	1,089	2,411
Sewage Treatment Equipment	229	87	142
TOTAL	669,367	115,128	556,162

The values given for depreciation, in the Consultants opinion, are under-estimated. If this is the case, the value of equipment replacement would be higher that the one used as a basis for computations given the available information.

Since the values given above are "purchasing costs" , assets were revalued to December, 1988 prices (assuming they were acquired in 1979). The manufacturing industry price index according to the Central Bank, in December, 1988 was 430 percent. Therefore the assets are revalued as follows:

	REPLACEMENT COST	DEPRECIATION	PRESENT VALUE
EQUIPMENT (thousands Colones)	536,941	122,524	414,417
(Thousands Dollars)	107,388	24,505	82,883

Through to the year 2000 we conservatively estimate that 100 percent of the depreciated equipment and 10 percent of that not yet depreciated will be replaced. The balance of equipment will require repairs, estimated at 10 percent value of remaining equipment. (see below for estimates in thousands of Dollars US$).

Existing Depreciated Equipment to be replaced	24,505
10 % Value Existing Equipment to be Replaced	8,495
VALUE OF EQUIPMENT TO BE REPLACED	33,000
Repairs of Remaining Equipment	7,000
TOTAL ESTIMATED	40,000

APPENDIX III.L.3

COMMUNITIES WITH SEWERAGE REQUIREMENTS TO BALANCE
THEIR WATER SUPPLY SERVICES

DEPARTMENT OF AHUACHAPAN
(prices as at December, 1988)

No.	Municipality	Existing House Connections		Required Services		Cost of Building or Expansion - Sewerage System
		Water	Sewerage	No. House Connections	Future Population	
1	Ahuachapan	3,445	2,319	1,126	10,000	490,000
2	Atiquizaya	1,313	805	508	4,540	158,900
3	Concepcion de Ataco	405	212	193	1,730	60,550
4	Tacuba	379	115	264	2,350	82,250
5	San Pedro Puxtla	143	0	143	1,280	44,800
6	Apaneca	282	0	282	2,520	88,200
7	San Francisco Menendez	84	0	84	750	26,250
8	Guaymango	102	0	102	910	31,850
9	Jujutla	84	0	84	750	26,250
10	Turin	325	0	325	2,900	101,500
11	El Refugio	232	0	232	2,070	72,450
	TOTAL	6,794	3,451	3,343	29,800	1,183,000

SOURCE : ISA Consultants

APPENDIX III.L.3

COMMUNITIES WITH SEWERAGE REQUIREMENTS TO BALANCE
THEIR WATER SUPPLY SERVICES

DEPARTMENT OF CABANAS
(prices as at December, 1988)

No.	Municipality	Existing House Connections		Required Services		Cost of Building or Expansion
		Water	Sewerage	No. House Connections	Future Population	Sewerage System
1	Sensuntepeque	1,434	707	727	6,587	230,545
2	Ilobasco	1,291	989	302	2,736	95,760
3	Victoria	81	0	81	734	25,690
4	San Isidro	241	34	207	1,875	65,625
5	Tejutepeque	188	0	188	1,703	59,605
6	Jutiapa	68	0	68	616	21,560
	TOTAL	3,303	1,730	1,573	14,251	498,785

SOURCE : ISA Consultants

APPENDIX III.L.3

COMMUNITIES WITH SEWERAGE REQUIREMENTS TO BALANCE
THEIR WATER SUPPLY SERVICES

DEPARTMENT OF CHALATENANGO
(prices as at December, 1988)

No.	Municipality	Existing House Connections		Required Services		Cost of Building or Expansion
		Water	Sewerage	No. House Connections	Future Population	Sewerage System
1	Chalatenango	958	840	118	1,026	35,910
2	La Palma	349	177	172	1,496	52,360
3	Nueva Concepcion	809	505	304	2,608	91,280
4	Arcatao	130	0	130	1,115	39,025
5	San Miguel de Mercedes	102	0	102	875	30,625
6	Sn.Antonio Los Ranchos	124	0	124	1,064	37,240
7	San Luis Del Carmen	111	0	111	952	33,320
8	Cancasque	82	0	82	703	24,605
9	Ojos de Agua	55	0	55	472	16,250
10	La Laguna	117	0	117	1,004	35,140
11	Agua Caliente	138	0	138	1,184	41,440
12	El Paraiso	85	0	85	729	25,515
13	Comapala	142	0	142	1,218	42,630
14	San Fernando	0	0	0	0	0
15	Santa Rita	47	0	47	403	14,105
	TOTAL	3,249	1,522	1,727	14,849	519,445

SOURCE : ISA Consultants

APPENDIX III.L.3

COMMUNITIES WITH SEWERAGE REQUIREMENTS TO BALANCE
THEIR WATER SUPPLY SERVICES

DEPARTMENT OF CUSCATLAN
(prices as at December, 1988)

No.	Municipality	Existing House Connections		Required Services		Cost of Building or Expansion - Sewerage System
		Water	Sewerage	No. House Connections	Future Population	
1	Cojutepeque	2,881	1,993	888	7,725	278,100
2	San Rafael Cedros	245	132	113	983	34,405
3	Suchitoto	631	496	135	1,174	41,090
4	San Bartolome Perulapia	431	276	155	1,348	47,180
5	San Pedro Perulapan	109	3	106	922	32,270
6	Tenancingo	116	0	116	1,009	35,315
7	Candelaria	78	0	78	678	23,730
8	Santa Cruz Michapa	145	0	145	1,261	44,135
9	San Ramon	70	0	70	609	21,315
10	El Carmen	6	0	6	52	1,820
11	Santa Cruz Analquito	76	0	76	661	23,135
12	San Jose Guayabal	299	0	299	2,601	91,035
	TOTAL	5,087	2,900	2,187	19,023	673,530

SOURCE : ISA Consultants

APPENDIX III.L.3

COMMUNITIES WITH SEWERAGE REQUIREMENTS TO BALANCE
THEIR WATER SUPPLY SERVICES

DEPARTMENT OF LA LIBERTAD
(prices as at December, 1988)

No.	Municipality	Existing House Connections		Required Services		Cost of Building or Expansion - Sewerage System
		Water	Sewerage	No. House Connections	Future Population	
1	Nueva San Salvador *	10,773	10,637	0	0	0
2	La Libertad	1,057	392	665	5,706	199,710
3	Quezaltepeque	2,319	2,004	315	2,703	94,605
4	Opico	636	419	217	1,862	65,170
5	Ciudad Arce	747	480	767	2,291	80,185
6	Antiguo Cuscatlan *	9,258	9,186	0	0	0
7	Huizucar	117	0	117	1,004	35,140
8	Zaragoza	402	0	402	3,449	120,715
9	San Jose Villanueva	141	0	141	1,210	42,350
10	Colon	221	0	221	1,896	66,360
11	San Matias	91	0	91	781	27,335
12	Sacacoyo	95	0	95	815	28,525
13	Teotepeque	199	0	199	1,707	59,745
14	Jilape	13	0	13	111	3,885
	TOTAL	26,069	23,118	3,243	23,535	823,725

SOURCE : ISA Consultants

* Municipalities under ongoing San Salvador Metropolitan Area Project

APPENDIX III.L.3

COMMUNITIES WITH SEWERAGE REQUIREMENTS TO BALANCE
THEIR WATER SUPPLY SERVICES

DEPARTMENT OF LA PAZ
(prices as at December, 1988)

No.	Municipality	Existing House Connections		Required Services		Cost of Building or Expansion - Sewerage System
		Water	Sewerage	No. House Connections	Future Population	
1	Zacatecoluca	2,528	1,894	634	5,516	198,576
2	Santiago Nonualco	592	321	271	2,358	82,530
3	San Juan Nonualco	416	169	247	2,149	75,215
4	San Pedro Nonualco	315	103	212	1,844	64,540
5	Olocuilta	391	92	299	2,601	91,035
6	San Pedro Masahuat	285	0	285	2,480	86,300
7	San Juan Talpa	189	49	140	1,218	42,630
8	El Rosario	360	187	173	1,505	52,675
9	Santa Maria Ostuma	110	0	110	957	33,495
10	Sn.Miguel Tepezontes	97	0	97	844	29,540
11	San Rafael Obrajuelo	322	172	150	1,305	45,675
12	Tapalhuaca	0	0	0	0	0
13	San Luis	126	0	126	1,096	38,360
14	San Antonio Masahuat	108	0	108	940	32,900
15	Mercedes La Ceiba	23	0	23	200	7,000
16	Jerusalen	28	0	28	244	8,540
17	San Juan Tepezontes	0	0	0	0	0
18	San Emigdio	37	0	37	322	11,270
19	Paraiso de Osorio	93	0	93	809	28,315
	TOTAL	6,020	2,987	3,033	26,388	928,596

SOURCE : ISA Consultants

APPENDIX 111.L.3

COMMUNITIES WITH SEWERAGE REQUIREMENTS TO BALANCE
THEIR WATER SUPPLY SERVICES

DEPARTMENT OF LA UNION
(prices as at December, 1988)

No.	Municipality	Existing House Connections		Required Services		Cost of Building or Expansion - Sewerage System
		Water	Sewerage	No. House Connections	Future Population	
1	La Union	1,533	686	847	7,521	278,277
2	Santa Rosa de Lima	724	286	438	3,889	136,115
3	Intipuca	365	170	195	1,731	60,585
4	San Alejo	378	0	378	3,356	117,460
5	Anamoros	188	0	188	1,669	58,415
6	Nueva Esparta	202	0	202	1,794	62,790
7	Yucuaiquin	164	0	164	1,456	50,960
8	Yayantique	93	0	93	826	28,910
9	El Carmen	120	0	120	1,065	37,275
	TOTAL	3,767	1,142	2,625	23,307	830,787

SOURCE : ISA Consultants

APPENDIX III.L.3

COMMUNITIES WITH SEWERAGE REQUIREMENTS TO BALANCE
THEIR WATER SUPPLY SERVICES

DEPARTMENT OF MORAZAN
(prices as at December, 1988)

No.	Municipality	Existing House Connections		Required Services		Cost of Building or Expansion
		Water	Sewerage	No. House Connections	Future Population	Sewerage System
1	San Francisco	797	634	163	1,252	43,820
2	Jocoro	310	145	165	1,267	44,345
3	Jocoatique	89	0	89	683	23,905
4	Chilanga	116	0	116	891	31,185
5	Sensembra	40	0	40	307	10,745
6	Perquin	73	0	73	560	19,600
	TOTAL	1,425	779	646	4,960	173,600

SOURCE : ISA Consultants

APPENDIX III.L.3

COMMUNITIES WITH SEWERAGE REQUIREMENTS TO BALANCE
THEIR WATER SUPPLY SERVICES

DEPARTMENT OF SAN MIGUEL
(prices as at December, 1988)

No.	Municipality	Existing House Connections		Required Services		Cost of Building or Expansion
		Water	Sewerage	No. House Connections	Future Population	Sewerage System
1	San Miguel	11,717	10,800	917	8,143	325,770
2	Chinameca	862	507	355	3,152	110,320
3	San Rafael	343	124	219	1,944	68,040
4	El Transito	569	337	232	2,060	72,100
5	Sesori	148	0	148	1,314	45,990
6	Moncagua	213	0	213	1,891	66,185
7	Uluazapa	131	0	131	1,163	40,705
8	Quelepa	106	0	106	941	32,935
9	Lolotique	163	0	163	1,447	50,645
10	Carolina	113	0	113	1,003	35,105
11	San Gerardo	102	0	102	906	31,710
12	San Jorge	127	0	127	188	6,580
13	Chirilagua	374	0	347	3,081	107,835
	TOTAL	14,968	11,768	3,173	27,233	993,920

SOURCE : ISA Consultants

APPENDIX III.L.3

COMMUNITIES WITH SEWERAGE REQUIREMENTS TO BALANCE
THEIR WATER SUPPLY SERVICES

DEPARTMENT OF SAN SALVADOR
(prices as at December, 1988)

No.	Municipality	Existing House Connections		Required Services		Cost of Building or Expansion
		Water	Sewerage	No. House Connections	Future Population	Sewerage System
1	San Salvador *	71,430	67,065	0	0	0
2	Mejicanos *	12,772	10,185	0	0	0
3	Soyapango *	24,059	22,984	0	0	0
4	Delgado	4,955	2,412	0	0	0
5	Tonacatepeque	1,944	1,783	161	1,333	46,655
6	Ilopango	10,656	9,779	0	0	0
7	Guazapa	677	318	359	2,972	104,020
8	San Martin	1,763	1,307	656	3,775	132,125
9	Apopa	6,142	5,877	265	2,194	76,790
10	Nejapa	427	132	295	2,433	85,155
11	Aguilares	606	227	379	3,138	109,830
12	Ayutuxtepeque *	9,718	8,667	0	0	0
13	Panchimalco	208	81	127	1,051	36,785
14	San Marcos *	3,967	2,806	0	0	0
15	Cuscatancingo *	3,485	2,181	0	0	0
16	Santo Tomas	690	8	682	5,647	197,645
17	Santiago Texacuango	364	0	364	3,014	105,490
	TOTAL	153,863	135,812	3,088	25,557	894,495

SOURCE : ISA Consultants

* Municipalities under ongoing San Salvador Metropolitan Area Project

APPENDIX III.L.3

COMMUNITIES WITH SEWERAGE REQUIREMENTS TO BALANCE
THEIR WATER SUPPLY SERVICES

DEPARTMENT OF SANTA ANA
(prices as at December , 1988)

No.	Municipality	Existing House Connections		Required Services		Cost of Building or Expansion
		Water	Sewerage	No. House Connections	Future Population	Sewerage System
1	Santa Ana	19,651	16,077	3,544	33,881	1,185,835
2	Coatepeque	356	333	23	218	7,630
3	Chalchuapa	3,249	1,929	1,320	12,514	613,186
4	Metapan	1,419	982	437	4,143	145,005
5	El Congo	360	42	318	502	17,570
6	Calendaria de la Frontera	518	236	282	2,674	93,590
7	Texistepeque	357	5	352	3,334	116,690
8	San Sebastian Salitrillo	82	0	82	777	27,195
9	Santiago de la Frontera	131	0	131	1,242	43,470
10	Masahuat	60	0	60	569	19,915
11	Sta.Rosa Chachipilin	48	0	48	455	15,925
12	San Antonio Pajonal	216	0	216	2,048	71,680
	TOTAL	26,447	19,604	6,813	62,357	2,357,691

SOURCE : ISA Consultants

APPENDIX III.L.3

COMMUNITIES WITH SEWERAGE REQUIREMENTS TO BALANCE
THEIR WATER SUPPLY SERVICES

DEPARTMENT OF SONSONATE
(prices as at December, 1988)

No.	Municipality	Existing House Connections		Required Services		Cost of Building or Expansion
		Water	Sewerage	No. House Connections	Future Population	Sewerage System
1	Sonsonate	7,321	6,410	911	7,816	312,640
2	Nahuizalco	507	371	136	1,167	40,845
3	Acajutla	1,110	804	306	2,625	105,000
4	Izalco	1,301	645	656	5,628	196,980
5	Armenia	1,075	679	396	3,398	118,930
6	San Julian	266	194	72	618	21,630
7	Juayua	637	539	98	840	29,400
8	Sonzacate	942	568	374	3,209	112,315
9	San Antonio del Monte	389	167	222	1,905	66,675
10	Santa Isabel Ishuatan	85	0	85	729	25,515
11	Caluco	51	0	51	438	15,330
12	Salcoatitan	119	62	57	489	17,415
	TOTAL	13,803	10,439	3,364	28,862	1,062,675

SOURCE : ISA Consultants

APPENDIX III.L.3

COMMUNITIES WITH SEWERAGE REQUIREMENTS TO BALANCE THEIR WATER SUPPLY SERVICES

DEPARTMENT OF USULUTAN

(Prices as at December, 1988)

No.	Municipality	Existing House Connections		Required Services		Cost of Building or Expansion - Sewerage System
		Water	Sewerage	No. House Connections	Future Population	
1	Usulutan	2,480	2,061	419	3,670	128,450
2	Jiquilisco	463	331	137	1,200	42,000
3	Santa Elena	679	99	580	5,080	187,960
4	Jucuapa	902	627	275	401	14,035
5	Santiago de Maria	1,067	909	158	1,384	48,440
6	Berlin	552	274	278	2,435	85,225
7	Puerto El Triunfo	660	634	26	228	7,980
8	Estanzuela	240	0	240	2,102	73,570
9	Alegria	144	0	144	1,261	44,135
10	Jucuaran	119	0	119	1,042	36,470
11	El Triunfo	262	0	262	2,295	0
12	Nueva Granada	91	0	91	797	27,895
13	Tecapan	124	0	124	1,086	38,010
14	Mercedes Umana	222	0	222	1,944	68,040
15	Santa Maria	72	0	72	630	22,050
16	San Buenaventura	202	0	202	1,769	61,915
17	California	74	0	74	648	22,680
18	Concepcion Baires	58	0	58	508	17,780
19	Ozatlan	328	0	328	2,873	100,555
	TOTAL	8,739	4,935	3,809	31,353	1,027,190

SOURCE : ISA Consultants