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VOLUME II

ANALYTICAL ANNEXES

CANAL CITIES WATER AND WASTEWATER

PHASE II

PROJECT NO. 263-0174

TECHNICAL ANNEX

CANAL CITIES WATER AND WASTEWATER PROJECT
PHASE II

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CANAL CITIES WATER AND WASTEWATER -- PHASE II
PROJECT 263-0174

TECHNICAL ANNEX

I. CURRENT STATUS

A. Introduction

Most of the inhabitants of the three Canal Cities of Port Said, Ismailia, and Suez, were evacuated during the 1967-1973 hostilities. In 1974, a resettlement effort began and the populations in the cities soared and continue to grow. It is anticipated that the combined populations of the three cities will exceed 1 1/2 million persons by the Year 2000.

The existing water supply and wastewater systems in these cities were damaged during the 1967 and 1973 wars, and since the war years, the Government of Egypt (GOE) has not been able to provide adequate funds for their repair and expansion. Many of the new facilities that have been built since 1974 are poorly constructed and do not operate at acceptable levels of efficiency. The problem is further exacerbated by inadequate operation and maintenance practices at many facilities, especially wastewater facilities.

B. Project History

The existing Canal Cities Water and Sewerage Project is one of the major components in AID's program to improve water and wastewater services in Egypt's major urban centers. This $169 million project finances the most urgently needed improvements to water treatment plants, water distribution systems, and wastewater collection systems in the cities of Port Said, Ismailia, and Suez.

The project evolved in 1977 when the Government of Egypt's Ministry of Housing and Reconstruction contracted with four U.S. consulting engineering firms to prepare master plans for water and wastewater facilities in each of the three cities. In May 1978, before the master plans were completed, the consultants submitted special reports identifying top priority projects to meet the needs of the cities' 1982 populations. After a review of these reports, the GOE formally requested AID's assistance in financing the foreign exchange costs of the most urgently needed improvements. These improvements included:

- Minor rehabilitation and expansion of water treatment facilities;
- Repair and expansion of water distribution systems;
- Cleaning, repair, and expansion of wastewater collection systems; and
- Minor repairs and expansion of existing wastewater treatment facilities.

These top priority projects formed the basis of the current project which was authorized in September 1978.

The two implementing agencies for the original project, the General Organization for Sewerage and Sanitary Drainage (now the National Organization for Potable Water and Sanitary Drainage) and the Suez Canal Authority, signed a contract with Canal Cities Consultants (a joint venture of the four consulting firms that prepared the master plans) for the design of the top priority (Phase I) projects. The wastewater design contract also called for the preparation of design reports for other high priority (Phase II) projects required to complete wastewater improvements in the three cities. A major component of Phase II was the construction of the new wastewater treatment facilities that would be required once wastewater flows increased due to the expansion of the service areas resulting from the Phase I improvements.

As design proceeded, the mix of wastewater projects changed. The original Project Paper included funds for various improvements to the existing wastewater treatment plants in each city. When the project was amended in August 1983, improvements to existing wastewater treatment plants were deleted. As project funding limitations became apparent, a decision was made to focus all project wastewater activities on wastewater collection and the elimination of the greatest public health risk in the Canal Cities -- the ponding of raw sewage in inhabited areas. Wastewater treatment improvements were postponed for consideration as a Phase II activity.

Construction of the water projects and the more complex elements of the wastewater collection system began in early 1984. Construction of the less complex elements of the wastewater collection systems began in January 1985.

The U.S. contractor responsible for the construction of eight major wastewater pump stations, 20 kilometres of force main, and 16 kilometres of gravity interceptors, completed these Phase I activities in mid 1986. Canal Cities Consultants (CCC) is currently in the process of providing operation and maintenance assistance to the three wastewater departments. The operation and maintenance assistance includes the development of operation and maintenance manuals for the pump stations, standard operation procedures, standard maintenance procedures, standard safety procedures, standard forms, and other training materials including video tapes. An extensive program of classroom and on-the-job training is being provided in each of the cities.

Unfortunately, the Egyptian contractors responsible for the construction of 5 other wastewater pump stations, the rehabilitation of 7 pump stations, the installation of 5 kilometres of force main, the installation of 11 kilometres of gravity interceptors, and 66 kilometres of gravity sewers, are substantially behind schedule. About 43% of the total value of the work was completed by the end of 1986; it is not anticipated that the work will be completed until the latter part of 1988.

In related non-project activities, NOPWASD has filled in a portion of Lake Manzala in order to create a site for a new wastewater treatment plant to serve Port Said. NOPWASD has also constructed a new 3 kilometre bypass channel which permits the wastewater flow from Port Said

to bypass the existing treatment plant. At Ismailia, NOPWASD has rehabilitated the existing plant and has plans to improve the existing bypass channels. The Governor of Ismailia has issued a decree reserving about 333 feddans for the new wastewater treatment facilities. At Suez, a new discharge channel has been built to receive flows from the new AID-financed Zarier Pump Station until such time as new treatment facilities can be provided. Also in Suez, NOPWASD has been adding oxidation ponds to the existing treatment plant; however, this work has stopped due to financial problems.

The upgrading by Egyptian contractors of the existing water treatment plants has progressed extremely well and was approximately 96% complete at the end of 1986. Expansion of the water distribution system in Port Said was completed in mid 1986. In Ismailia and Suez, expansion of the distribution systems was over 98% complete at the end of 1986.

C. Identified Needs

1. Wastewater

The major wastewater facilities (pump stations, force mains, and interceptors) financed by the original project are designed to handle flows of their projected service areas up to the Year 2000. These new major facilities plus the laterals constructed under the original project will substantially increase the quantities of wastewater flows to the existing treatment facilities. Since these existing facilities provide virtually no treatment, significantly larger quantities of raw wastewater will be discharged to the surface waters that are used for fishing, boating, and swimming. The GOE has requested USAID's assistance in funding new wastewater treatment facilities that would treat Year 2020 flows for the entire population of each city [USAID/Cairo proposes to provide facilities to meet the Year 2000 flow for the projected service area].

During the design of the original project, it was recognized that the existing treatment facilities in Port Said and Ismailia would not have the hydraulic capacity to receive the increased flows resulting from the improvements to the collection and transmission systems. Flooding of the communities adjacent to the existing plants can reasonably be anticipated as the existing discharge and bypass channels are already dangerously close to capacity. Expansion of the treatment plant headworks, discharge channels, and by-pass channels were part of the original project; however, these elements were eliminated in 1983. Since that time NOPWASD has constructed a new bypass channel at Port Said which diverts wastewater from the existing treatment facilities directly to Lake Manzala. At Ismailia, NOPWASD has completed some minor rehabilitation of the existing plant and provided a new channel to divert flow from the plant. These new bypass channels can only be considered as temporary measures to meet an emergency need; their prolonged use will have serious, adverse environmental impacts on surface water bodies adjacent to these cities.

Observations in all three cities indicate that there is

virtually no capacity within the local governments to operate and maintain the wastewater treatment facilities at an acceptable level of operation.

The original project financed improvements to the wastewater collection systems in the three cities which will serve as the backbone for future expansions of the systems; however, the rapid growth in each of these cities has severely hampered the ability of the GOE to extend the collection systems to meet new demands for service.

The new wastewater facilities that have been constructed to meet the rapid population growth in each city have strained the capacity of the existing institutions to provide a skilled staffs for the operation and maintenance of these systems.

2. Water

The current maximum day water demand for Port Said is estimated to be in excess of 130,000 m^3/d. It is projected that the maximum day demand will increase to 276,000 m^3/d by the Year 2000 with an average daily demand of 221,000 m^3/d. AID-financed improvements to the city's water treatment plants have increased their capacity to 220,000 m^3/d; however, the source of supply, the Port Said Sweetwater Canal, can only deliver between 90,000 m^3/d and 125,000 m^3/d.

The Port Said Sweetwater Canal reportedly was designed for 270,000 m^3/d, but its carrying capacity has been reduced along the Qantara-El Raswa segment by aquatic growth, war damage, structural constrictions, and seepage.

The GOE has requested USAID's assistance in funding a new raw water transmission system that would replace the existing Port Said Sweetwater Canal from Qantara to Port Said (a distance of approximately 46 kilometres). The proposed system would meet Port Said's water supply needs up to the Year 2000.

II. TECHNICAL ALTERNATIVES

A. General

Master Plans were previously prepared for each of the cities in the summer of 1979. These Master Plans were followed by Design Reports No. 1 in 1981 and Design Reports No. 2 in 1982. In addition, there were a number of updates and amendments to same. These various studies examined a number of alternatives for serving each of the three cities. The major alternatives remaining after extensive screening exercises are presented in the following sections.

B. Sizing of Facilities

Prior to addressing the various alternatives for processing wastewater flows or transporting raw water, it is necessary to define the quantities of flows to be treated or transported. Flow quantities are primarily dependent upon two factors -- the first is the flow generated or

consumed per capita and the second is the extent of the service area.

There is a strong tendency for engineers to overdesign facilities both with regard to per capita flow figures and the size of the area to be served. The Master Plans for Port Said and Suez are based upon Year 2000 per capita domestic/commercial/institutional wastewater flows of about 250 litres per day and the Master Plan for Ismailia is based upon per capita domestic/commercial/institutional wastewater flows of about 150 litres per day. The per capita domestic/commercial/institutional water demand for Port Said is based upon 300 litres per day. The consultants assumed that the wastewater service areas would serve 83% of the Year 2000 population in Port Said, 95% in Ismailia, and 99%+ in Suez. It was assumed that 96% of the Year 2000 population in Port Said would have full water service.

Our review of the limited available data indicates that the Year 1987 per capita domestic/commercial/institutional wastewater flows for Port Said are probably between 150 and 200 litres per day, between 200 and 250 litres per day for Suez, and between 125 and 150 litres per day for Ismailia. We estimate that between 55% and 75% of the populations in each of the cities are in the wastewater service areas.

The Master Plans indicate that large quantities of water delivered to the consumers in each of the cities is wasted; the order of magnitude of this wastage is about 30% of the output of the water treatment facilities. Infiltration of groundwater into the sewers is excessive and accounts for a major portion of the flow received at the wastewater treatment facilities.

It is extremely important not to oversize major plant components. Oversized facilities do not usually operate in an efficient manner, and can represent a gross misapplication of resources. Sizing a facility for needs thirty years hence in a rapidly growing area can result in a large portion of the plant capacity sitting idle with substantial deterioration in materials and equipment prior to the first demand upon that portion of the plant capacity.

Facilities are generally sized to meet future requirements; normally, the designer allows appropriate time for the completion of construction as well as a sufficient period for the planning, design, and construction of the next expansion. In our case, we envision a period of approximately three to five years for the design and construction of the proposed facilities and another six to eight years for the planning, design, and construction of the future expansion. Accordingly, facilities based upon Year 2000 flows are appropriate. All facilities will include multiple flow streams or compartmentalized units to permit maximum operation flexibility and to facilitate staging of construction for future additions.

As a result of our technical assessment, we have lowered the recommended per capita design flows for wastewater in Port Said for the Year 2000 from 250 litres per day to 200 litres per day; we concur with the consultant's per capita design flow of 150 litres per day for Ismailia; and we concur with the consultant's per capita design flow of

WASTEWATER FLOW PROJECTIONS

PORT SAID

Year	Design Basis as Reconstructed from Consultants' Reports 1985	1990	2000	Mission's Recommended Design Basis 2000
Total Population	443,800	545,900	750,000	683,541*
Service Area Population	330,400	425,000	613,700	546,833
% of Population Served	74	78	83	80
Per Capita Domestic/ Commercial/Institutional Flow (l/d)	250	250	250	200
Domestic/Commercial/ Institutional Flow (m^3/d)	82,600	106,300	153,400	109,400
Industrial Allowance (m^3/d)	22,800	29,400	42,400	21,900
Infiltration (m^3/d)	12,700	16,300	23,500	21,900
TOTAL AVERAGE FLOW (m^3/d)	118,100	152,000	219,300	153,200

Recommended size for the first stage of the treatment facilities is 150,000 m^3/d (PID was based on a 200,000 m^3/d plant at Lake Manzala plus a 25,000 m^3/d plant for Port Fouad).

The average daily flows (March 1987) to the existing treatment facilities are primarily via the newly constructed Pump Station Numbers 4D and 8D which pump a combined total of approximately 43,000 m^3/d. The newly constructed Pump Station Number 1S pumps about 6,000 m^3/d directly to the Manzala Canal. Small quantities of flow are also pumped to the existing treatment plant by the older pump stations.

* Excludes Port Fouad population.

WASTEWATER FLOW PROJECTIONS

ISMAILIA

Year	Design Basis as Reconstructed from Consultants' Reports 1985	1990	2000	Mission's Recommended Design Basis 2000
Total Population	306,000	382,500	560,000	513,550
Service Area Population	200,000	301,800	532,000	410,840
% of Population Served	65	79	95	80
Per Capita Domestic/ Commercial/Institutional Flow (l/d)	141	147	150	150
Domestic/Commercial/ Institutional Flow (m^3/d)	28,100	44,400	79,800	61,600
Industrial Allowance (m^3/d)	2,800	5,700	11,600	6,200
Infiltration (m^3/d)	10,700	15,100	21,300	12,300
TOTAL AVERAGE FLOW (m^3/d)	41,600	65,200	112,700	80,100

Recommended size for the first stage of the treatment facilities is 90,000 m^3/d (PID was based on a 150,000 m^3/d plant).

It is further recommended that the establishment of a system to ensure the enforcement of satisfactory pre-treatment of industrial wastes discharged to public sewers be a pre-condition to the award of a grant.

Two of the existing older pump stations pump wastewater directly to Lake Timsah; however, it is estimated that this quantity is limited and that the bulk of the flow is via the newly constructed Abu Atwa Pump Station which currently delivers an average daily flow of about 19,000 m^3/d (March 1987) to the existing treatment plant.

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WASTEWATER FLOW PROJECTIONS

SUEZ

Year	Design Basis as Reconstructed from Consultants' Reports 1985	1990	2000	Mission's Recommended Design Basis 2000
Total Population	473,000	692,000	990,000	678,294
Service Area Population	463,000	686,000	987,000	542,635
% of Population Served	98	99	99+	80
Per Capita Domestic/ Commercial/Institutional Flow (l/d)	207	213	246	250
Domestic/Commercial/ Institutional Flow (m^3/d)	95,700	146,000	242,500	135,700
Industrial Allowance (m^3/d)	29,900	34,400	46,400	40,700
Infiltration (m^3/d)	12,200	18,000	28,900	27,100
TOTAL AVERAGE FLOW (m^3/d)	137,800	198,400	317,800	203,500

Recommended size for the first stage of the treatment facilities is 200,000 m^3/d based on two 100,000 m^3/d plants (PID was based on two 200,000 m^3/d plant).

It is further recommended that the establishment of a system to ensure the enforcement of satisfactory pre-treatment of industrial wastes discharged to public sewers be a pre-condition to the award of a grant.

Northerly Plant will serve primarily the areas of future development and the Southerly Plant will serve primarily the existing areas.

Reports indicate that not more than 70% of the average daily flows will be discharged to the existing treatment plant even after completion of Phase I.

All of the flow from Suez goes through the newly constructed Zarb and Zarier Pump Stations. The combined average daily flows (March 1987) from these two stations is about 80,000 m^3/d.

WATER DEMAND PROJECTIONS

PORT SAID

Year	Design Basis as Reconstructed from Consultants' Reports 1985	1990	2000	Mission's Recommended Design Basis 2000
Total Population	443,800	545,900	750,000	720,022
Service Area Population	363,900	469,500	720,000	612,019
% of Population Served	82	86	96	85
Per Capita Domestic/ Commercial/Institutional Demand (l/d)	308	298	285	250 use 60 l/d per capita for unserved population
Domestic/Commercial/ Institutional Demand (m^3/d)	111,900	140,000	205,900	153,000 6,500
Industrial Allowance (m^3/d)	23,600	36,000	47,400	30,600
Losses (m^3/d)	19,300	22,400	32,900	30,600
TOTAL AVERAGE DEMAND (m^3/d)	154,800	198,400	286,200	220,700
MAXIMUM DAY DEMAND (m^3/d)	194,000	248,000	356,000	275,900

Recommended size for the first stage of the raw water transmission facilities is 300,000 m^3/d (PID was based on a 400,000 m^3/d system).

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WASTEWATER FLOW PROJECTIONS

PORT SAID

Year	Design Team Estimates 1987	Moderate 2000	High 2000
Total Population	396,100*	614,354*	683,541*
Service Area Population	237,700	430,048	581,010
% of Population Served	60	70	85
Per Capita Domestic/ Commercial/Institutional Flow (l/d)	180	180	220
Domestic/Commercial/ Institutional Flow (m^3/d)	42,800	77,400	127,800
Industrial Allowance (m^3/d)	8,600	15,500	25,600
Infiltration (m^3/d)	8,600	15,500	25,600
TOTAL AVERAGE FLOW (m^3/d)	60,000	108,400	179,000

* Excludes Port Fouad population.

WASTEWATER FLOW PROJECTIONS

ISMAILIA

	Design Team Estimates		
Year	1987	Moderate 2000	High 2000
Total Population	265,899	430,409	513,550
Service Area Population	181,154	322,807	436,518
% of Population Served	65	75	85
Per Capita Domestic/ Commercial/Institutional Flow (l/d)	138	150	175
Domestic/Commercial/ Institutional Flow (m^3/d)	25,000	48,400	76,400
Industrial Allowance (m^3/d)	2,500	4,800	7,600
Infiltration (m^3/d)	5,000	9,700	15,300
TOTAL AVERAGE FLOW (m^3/d)	32,500	62,900	99,300

WASTEWATER FLOW PROJECTIONS

SUEZ

	Design Team Estimates		
Year	1987	Moderate 2000	High 2000
Total Population	344,318	529,022	678,294
Service Area Population	241,023	423,218	576,550
% of Population Served	70	80	85
Per Capita Domestic/ Commercial/Institutional Flow (l/d)	225	250	275
Domestic/Commercial/ Institutional Flow (m3/d)	54,200	105,800	158,600
Industrial Allowance (m3/d)	16,300	31,700	47,600
Infiltration (m3/d)	10,800	21,200	31,700
TOTAL AVERAGE FLOW (m3/d)	81,300	158,700	237,900

WATER DEMAND PROJECTIONS

PORT SAID

Year	Design Team Estimates 1987	Moderate 2000	High 2000
Total Population	416,952	647,143	720,022
Service Area Population	333,562	550,072	648,020
% of Population Served	80	85	90
Per Capita Domestic/ Commercial/Institutional Demand (l/d) for full service	220	240	275
Per Capita Domestic/ Commercial/Institutional Demand (l/d) for unserved	40	50	60
Domestic/Commercial/ Institutional Demand (m^3/d)	73,400 3,300	132,000 4,900	178,200 4,300
Industrial Allowance (m^3/d)	14,700	26,400	35,600
Losses (m^3/d)	14,700	26,400	35,600
TOTAL AVERAGE DEMAND (m^3/d)	106,100	189,700	253,700
MAXIMUM DAY DEMAND (m^3/d)	132,600	237,100	317,100

250 litres per day for Suez. We are recommending a per capita water demand in Port Said for the Year 2000 of 250 litres per day. Each of these per capita flows includes an appropriate allowance for wastage. A separate allowance for industrial flow of 20%, 10%, and 30% of the domestic/commercial/institutional flow has been included for Port Said, Ismailia, and Suez respectively. An infiltration allowance of 20% of the domestic/commercial/institutional flow has been included for each city.

Our proposed design flows will require each of the three cities to discourage water wastage and to take at least minimal measures to maintain the integrity of the wastewater collection system. It is anticipated that water wastage in all three cities will be reduced moderately as user charges for water consumption increase and slightly as a result of user education programs proposed for each city.

Future consideration should be given to the use of flow limiting devices at all residential connections. Such limiting devices would make it difficult for the consumer to use excessive quantities of water. This can be a very important consideration in a society where the minimum needs of the public are guaranteed. Restriction of water usage would permit a more equitable distribution of available treated water. Potential benefits would be the reduced size of both water and wastewater facilities and the reduced costs of construction, operation, and maintenance of these facilities.

Due to the massive funds that would be required to provide central service to all areas of the cities by the Year 2000, we are of the opinion that each city will find it extremely difficult to extend its infrastructure sufficiently to maintain even the current levels of service on a percentage of population basis. Accordingly, we recommend that the design basis for percentage of population served by the wastewater system be 80% for each of the three cities. We would estimate that the size of the facilities proposed for the Year 2000 represent a design flow roughly 2 and one-half times current flows. We are assuming that 85% of the population in Port Said will have full water service in the Year 2000 and that the remainder of the population will be served by public fountains. We would estimate that on a percentage basis there will be no significant change from the current extent of full water service coverage in Port Said, but that the total population served will roughly double.

C. Port Said Wastewater Treatment

The U.S. firm of Hazen and Sawyer prepared the Master Plan for Port Said; this plan was the successor to the 1976 Master Plan prepared by a group of British consultants. In April 1981, the joint venture of Canal Cities Consultants released the final of Design Report No. 1 which identified the new facilities to be built to meet the Year 2000 needs of the city. Design Report No. 2 released in March 1982 updated the first design report.

As a result of these various studies, four potential areas for disposal of wastewater effluent were identified. These were land disposal by irrigation, discharge to the Mediterranean Sea, discharge to the Suez

Canal, and discharge to Lake Manzala. Land disposal was rejected because of inadequate suitable land near Port Said and the high levels of dissolved solids in the wastewater which would require fresh water dilution. The Advisory Committee on Reconstruction rejected the concept of an outfall to the Mediterranean Sea due to the potential harm to bathing beaches. Detailed studies of the assimilative capacities of the Suez Canal and Lake Manzala performed by Hazen and Sawyer indicate that the shallow water of Lake Manzala could serve the entire city through the Year 2000, whereas the Suez Canal could safely serve only a small portion of the city.

The following major technical alternatives have been identified for the treatment of wastewater in Port Said:

1. Alternative P-1 - No action. This alternative would involve no improvements to the existing wastewater treatment facilities and no new construction of alternative facilities. This would result in secondary level treatment to about 19,400 m^3/d of wastewater and primary level treatment to an additional 42,300 m^3/d if the existing facilities were fully functional.

2. Alternative P-2 - Abandonment of the existing treatment facilities and construction of new primary treatment facilities with a design capacity of 150,000 m^3/d in the vicinity of the existing plant with discharge to the Mediterranean Sea via a 10 kilometre outfall of approximately 2400 mm diameter with a 400 metre diffuser. This alternative is being included in this analysis even though rejected in the original studies.

3. Alternative P-3 - Abandonment of the existing treatment facilities and construction of new primary treatment facilities with a design capacity of 150,000 m^3/d at a new site created in Lake Manzala with discharge to the lake via a 1000 metre outfall of approximately 2000 mm diameter with a 500 metre diffuser.

This is being presented as the preferred alternative for Port Said. A 150,000 m^3/d wastewater treatment plant capable of providing primary level treatment will be built on the reclaimed land at Lake Manzala. The plant will consist of screening facilities, grit chambers, primary clarifiers, and chlorination facilities. This alternative includes a 1.5 kilometre outfall with diffuser into the lake. A transmission system consisting of a new pump station at the site of the existing treatment facilities will deliver the raw wastewater to the new treatment plant site via 3.8 kilometres of 1500 mm diameter force main. Sludge handling facilities will be an integral part of the treatment facilities. These sludge facilities will consist of sludge thickeners and on-site drying beds.

4. Alternative P-4 - Abandonment of the existing treatment facilities and construction of new secondary treatment facilities with a design capacity of 150,000 m^3/d at a new site created in Lake Manzala with discharge to the lake via an open channel.

5. Alternative P-5 - Abandonment of the existing treatment facilities and construction of anaerobic lagoons and oxidation ponds with a design capacity of 150,000 m^3/d in Lake Manzala.

6. Alternative P-6 - Rehabilitation and conversion of the existing treatment plant to a primary only facility with a design capacity of 80,000 m^3/d and construction of a new primary plant with a design capacity of 70,000 m^3/d at a new site created in Lake Manzala with discharge for both plants to the lake via a 1000 metre outfall of approximately 2000 mm diameter with a 500 metre diffuser.

D. Ismailia Wastewater Treatment

The U.S. firm of Metcalf and Eddy, Inc., prepared the Master Plan for Ismailia. In April 1981, the joint venture of Canal Cities Consultants released the final of Design Report No. 1 which identified the new facilities to be built to meet the Year 2000 needs of the city. Design Report No. 2 released in March 1982 updated the first design report.

As a result of these various studies, four potential areas for disposal of wastewater effluent were identified. These were land disposal by irrigation, discharge to the Suez Canal, discharge to Lake Timsah, and discharge to El Mahsama Drain. Detailed studies of the assimilative capacities of the Suez Canal, Lake Timsah, and El Mahsama Drain performed by Metcalf & Eddy indicate that all three surface water bodies under consideration could safely assimilate the entire wastewater flow from the city through the Year 2000 if secondary treatment is provided. Primary treatment was not judged to be suitable for use before discharge to any of the surface water bodies due to the adverse affect of such discharge on Lake Timsah. The Suez Canal Authority has indicated its opposition to any discharge to the canal system.

The following major technical alternatives have been identified for the treatment of wastewater in Ismailia:

1. Alternative I-1 - No action. This alternative would involve no improvements to the existing wastewater treatment facilities and no new construction of alternative facilities. This would result in secondary level treatment to about 24,000 m^3/d of wastewater.

2. Alternative I-2 - Rehabilitation of the existing treatment plant to a secondary plant with a design capacity of 55,000 m^3/d with discharge to El Mahsama Drain and construction of new land disposal facility with a design capacity of 35,000 m^3/d.

3. Alternative I-3 - Rehabilitation and expansion of the existing treatment plant to a secondary plant with a design capacity of 90,000 m^3/d with discharge to El Mahsama Drain.

4. Alternative I-4 - Rehabilitation and expansion of the existing treatment plant to a primary plant with a design capacity of 90,000 m^3/d with discharge to a land application system at the southerly

site.

5. Alternative I-5 - Abandonment of the existing treatment facilities and construction of a new land disposal system with a design capacity of 90,000 m^3/d at the southerly site.

This is being presented as the preferred alternative for Ismailia. A 90,000 m^3/d wastewater treatment plant will be built to the south of the city. The treatment plant will include screening facilities, grit chambers, and primary clarifiers. Rapid infiltration basins will be used for land disposal of the primary effluent. It is anticipated that the Government of Egypt will eventually withdraw the treated effluent from the ground via shallow wells for agricultural reuse. Approximately 4,000 feddans are required for the treatment facilities. This alternative includes modifications to the new Abu Atwa Pump Station and 7.1 kilometres of dual force main (1200 mm diameter) to transport the raw wastewater to the new treatment plant site. Sludge handling facilities will be an integral part of the treatment facilities. These sludge facilities will consist of sludge thickeners and on-site drying beds. Construction of a shallow well system for monitoring groundwater quality and for irrigation of site landscaping will be considered, but it is not anticipated that a well system to serve new agricultural lands will be provided as part of the wastewater project. A primary treatment facility using anaerobic lagoons is a possible variation of this alternative.

E. Suez Wastewater Treatment

The U.S. firm of Pirnie-Harris International prepared the Master Plan for Suez. In April 1981, the joint venture of Canal Cities Consultants released the final of Design Report No. 1 which identified the new facilities to be built to meet the Year 2000 needs of the city. Design Report No. 2 released in March 1982 updated the first design report.

As a result of these various studies, six potential areas for disposal of wastewater effluent were identified. These were land disposal by irrigation, discharge to the Suez Canal, discharge to Suez Creek, discharge to Suez Bay, discharge to the Gulf of Suez, and discharge to the air via evaporation. Detailed studies of the assimilative capacities of the Suez Canal, Suez Creek, Suez Bay, and the Gulf of Suez performed by Pirnie-Harris indicate that only the Gulf of Suez could safely assimilate the entire wastewater flow from the city through the Year 2000 with primary treatment. The Suez Bay could assimilate up to 185,000 m^3/d with secondary treatment. Discharges to the Suez Canal or Suez Creek would require sophisticated treatment facilities.

The following major technical alternatives have been identified for the treatment of wastewater in Suez:

1. Alternative S-1 - No action. This alternative would involve no improvements to the existing wastewater treatment facilities and no new construction of alternative facilities. This would result in primary level treatment to about 48,000 m^3/d of wastewater.

2. Alternative S-2 - Abandonment of the existing treatment facilities and construction of a new primary plant with a design capacity of 200,000 m^3/d at the southerly site with discharge to the Gulf of Suez via a 2.8 kilometre outfall of approximately 2400 mm diameter.

3. Alternative S-3 - Abandonment of the existing treatment facilities and construction of a new primary plant with a design capacity of 100,000 m^3/d at the southerly site with discharge to the Gulf of Suez via a 2.8 kilometre outfall of approximately 1800 mm diameter and construction of a new land disposal system with a design capacity of 100,000 m^3/d at the northerly site.

4. Alternative S-4 - Abandonment of the existing treatment facilities and construction of a new land disposal system with a design capacity of 200,000 m^3/d at the northerly site.

This is being presented as the preferred alternative for Suez. A 200,000 m^3/d wastewater treatment plant will be built at a site to the north of the city and west of the Sweetwater Canal. The plant will consist of screening facilities and anaerobic lagoons. Rapid infiltration basins will be used for land disposal of the primary effluent. It is estimated that 4,000 feddans are required for the treatment facilities. The potential exists for the withdrawal of the treated effluent from the ground via shallow wells and the use of same in future agricultural lands; however, this will be dependent upon the success of the sewer rehabilitation program which is necessary to reduce the infiltration of highly saline water. Construction of a shallow well system for monitoring groundwater quality and for irrigation of site landscaping will be considered, but it is not anticipated that a well system to serve new agricultural lands will be provided as part of the wastewater project. Sludge storage will be provided in the anaerobic lagoons; a multiple cell lagoon system will permit taking one lagoon out of service for de-sludging. Partially dewatered sludge would be landfilled at the treatment plant site; landfill area for 20 years of sludge accummulation would be provided. A primary treatment facility using conventional clarifiers is a possible variation of this alternative.

5. Alternative S-5 - Abandonment of the existing treatment facilities and construction of a new evaporation system with a design capacity of 200,000 m^3/d at the southerly site.

F. Port Said Raw Water Supply

The U.S. firm of Hazen and Sawyer prepared the Master Plan for Port Said; this plan was the successor to the 1976 Master Plan prepared by a group of British consultants. In April 1981, the joint venture of Canal Cities Consultants released the final of Design Report No. 1 which identified the new facilities to be built to meet the Year 2000 needs of the city. Design Report No. 2 released in March 1982 updated the first design report.

As a result of these various studies, it became clearly evident that the Nile River is clearly the best source of raw water for the city.

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Local surface and underground sources are brackish or saline and would require sophisticated treatment facilities. Since 1862, Port Said has received water from the Nile River via canal; today, the Ismailia Sweetwater Canal carries water from the Cairo to Ismailia and then branches to both Suez and Port Said.

The following major technical alternatives have been identified for the supply of raw water to Port Said:

1. Alternative W-1 - No action. This alternative would involve no improvements to the existing raw water supply and no new construction of alternative facilities, thus limiting the water supply to approximately 120,000 m^3/d.

3. Alternative W-2 - Construction of a 370,000 m^3/d booster station and installation of 48 kilometres of dual 1500 mm diameter pipeline to replace the existing canal. It is assumed that the existing canal would be capable of delivering 120,000 m^3/d.

4. Alternative W-3 - Construction of a 370,000 m^3/d booster station and installation of 48 kilometres of dual 1200 mm diameter pipeline from Qantara to El Raswa. The existing canal would be abandoned from Qantara northward.

5. Alternative W-4 - Installation of four low lift pump stations with a nominal capacity of 370,000 m^3/d along the existing canal. These stations would lift the flow as needed to overcome the hydraulic resistance of the existing canal. They would be spaced to keep the water surface below the present canal banks in so far as possible. Relatively minor canal excavation and canal bank extensions would be required in critical sections.

6. Alternative W-5 - Installation of one low lift pump station with a nominal capacity of 370,000 m^3/d at the Rayah Barrage near Qantara. In many places, the water level in the canal would be above existing banks, requiring extension of the banks to higher elevations. Concrete retaining walls would be built along both sides of the canal. No canal excavation is anticipated.

7. Alternative W-6 - Installation of a concrete lining in the existing canal from Qantara to Port Said. The lined canal would be designed to deliver at least 370,000 m^3/d. The cross section would be trapezoidal with a bottom width of 8.5 metres, side slopes of 1.5:1 and an overall depth of at least 1.75 metres.

This is being presented as the preferred alternative for a raw water supply for Port Said. This alternative could be designed to provide at least 370,000 m^3/d.

[raw water storage facilities near El Raswa would be desirable for any system lacking an adequate backup system]

III. EVALUATION OF TECHNICAL ALTERNATIVES

A. Port Said Wastewater Treatment

1. Treatment Options

a. PRIMARY - CONVENTIONAL CLARIFIERS

Primary treatment facilities typically consist of screening facilities, grit chambers, primary clarifiers, sludge handling facilities, and often a chlorination system.

Primary facilities have the capability of removing most of the grit and floating solids from the wastewater. A substantial portion of the suspended matter can be removed and the bio-chemical oxygen demand (BOD) can be reduced moderately.

The major advantages of a primary treatment facility in Port Said would be the low cost and the ease of operation and maintenance. It could realistically be anticipated that the wastewater department staff could achieve in a short time frame the necessary level of skills for the proper operation and maintenance of such a facility.

The major disadvantage of this treatment option is the disdain that government officials have for the process. It is not required as a suitable option by the National Organization for Potable Water and Sanitary Drainage. Primary effluent cannot meet existing standards for discharge to surface water bodies.

Primary clarifiers are the major initial element of many secondary treatment processes, thus they can form the first stage of a staged construction program for secondary treatment facilities.

Adequate sludge handling facilities are required if the clarifiers are to be properly operated and maintained. Typically, such sludge facilities would consist of thickeners to concentrate the sludge and drying beds to dewater the sludge.

Advantages

- Ease of operation and maintenance.
- Good degree of reliability in performance.
- Low construction cost.
- Low operation and maintenance costs.
- Can be incorporated into future secondary treatment facilities.

Disadvantages

- Cannot meet existing standards for effluent discharged to surface water bodies.
- Not perceived as an acceptable treatment process by government officials.

- Marine outfalls with diffusers are required if primary effluent is to be safely assimilated by the Mediterranean Sea or Lake Manzala.

b. SECONDARY - TRICKLING FILTERS

A trickling filter process would involve the addition of trickling filter units and secondary clarifiers to the previously described primary treatment process. Trickling filters have the capability of substantially improving the degree of treatment.

The exact degree of removal obtainable by this process is dependent upon numerous factors such as filter area and depth, number of stages, media type, recirculation rates, and wastewater characteristics. Trickling filter plants are typically designed to provide BOD removals of anywhere from 65% to 85%.

This treatment option requires skilled operators. The existing trickling filter facilities in Port Said have not been properly operated and maintained. Considerable training would be required to upgrade the skills of the existing staff if satisfactory levels of performance are to be achieved.

The major advantage of this process is that it is consistent with the desires of government officials.

Advantages

- Easier to operate and maintain than most other secondary treatment processes.
- Lower operating cost than most secondary treatment processes.
- Relatively high levels of treatment are obtainable on a consistent basis if properly operated and maintained.
- Process is generally acceptable to government officials.
- Port Said already has a treatment plant which utilizes this process.
- Would not require a marine outfall or diffuser for discharge of the treated effluent to Lake Manzala.

Disadvantages

- Skilled operators are required. Improper operation can drastically reduce effectiveness. Port Said has not demonstrated that it can properly operate and maintain the existing trickling filter facilities.
- Higher construction cost than primary facilities.
- Significantly higher cost for operation and maintenance as compared with primary facilities.

c. SECONDARY - ACTIVATED SLUDGE

An activated sludge process would involve the addition of activated sludge basins and secondary clarifiers to the previously

described primary treatment process. An activated sludge plant has the capability of providing high levels of wastewater treatment.

The exact degree of removal obtainable by this process is dependent upon numerous factors such as detention time, sludge return rates, and wastewater characteristics. Activated sludge plants are typically designed to provide BOD removals of anywhere from 85% to over 95%.

This treatment option requires very skilled operators. It is doubtful that the existing activated sludge units at Port Said have ever been operated for extended periods. Considerable training would be required to upgrade the skills of the existing staff if satisfactory levels of performance are to be achieved.

The major advantage of this process is that it is capable of providing a level of treatment consistent with the desires of government officials.

Advantages

- Higher levels of treatment are obtainable than with many secondary processes if properly operated and maintained.
- Process is generally acceptable to government officials.
- Port Said already has a treatment plant which utilizes this process.
- Would not require a marine outfall or diffuser for discharge of the treated effluent to Lake Manzala.

Disadvantages

- Very skilled operators are required. Improper operation can drastically reduce effectiveness. Port Said has not demonstrated that it can properly operate and maintain the existing activated sludge facilities.
- Efficiency of treatment process is very susceptible to variations in the characteristics of the influent wastewater.
- Higher construction cost than primary facilities.
- Higher cost for operation and maintenance as compared with trickling filter facilities.

d. SECONDARY - ANAEROBIC LAGOONS AND OXIDATION PONDS

Unlike the trickling filter and activated sludge plants which would consist primarily of concrete units, the anaerobic lagoon/oxidation pond plant would be constructed primarily of earth. It would be possible to segment portions of Lake Manzala with earth dikes to create the basins required for this process.

This process would consist of screening facilities followed by deep anaerobic lagoons which in turn are followed by shallow

oxidation ponds which are then followed by polishing ponds; chlorination may or may not be included as part of the treatment scheme.

The degree of treatment is primarily dependent upon the retention time in the basins. For our evaluation of this process, we have assumed a retention time of 5 days in the anaerobic lagoons and 7 days each in the oxidation ponds and polishing ponds. These retention times should result in a BOD removal efficiency of greater than 95%.

The major advantage of this process is the high level of treatment that can be achieved at low cost.

Advantages

- High levels of treatment are obtainable with minimal operation and maintenance requirements.
- Low capital cost compared to other secondary treatment alternatives.
- Low operation and maintenance costs compared to conventional primary and secondary treatment options.
- Process is well able to withstand both organic and hydraulic shock loads.
- Majority of construction techniques required are well within local capabilities.

Disadvantages

- A large portion of Lake Manzala would be devoted to the treatment process (approximately 400 feddans).
- Process is considered an unacceptable technology by many government officials.

2. Disposal Options

a. MEDITERRANEAN SEA

Disposal of the wastewater into the Mediterranean was not studied in any detail by Hazen and Sawyer; however, if we assume that conditions are similar to those found in Alexandria, approximately 10 kilometres of outfall will be required to safely dispose of the treated effluent.

The main disadvantage of this disposal option is the public perception that it will contribute to pollution of the bathing beaches of Port Said.

Advantages

- Primary level of treatment will be adequate for safe disposal of the treated effluent.
- Low operation and maintenance cost associated with outfall.

Disadvantages

- Public perception that beaches will be polluted.
- High construction cost of outfall.

b. LAKE MANZALA

Lake Manzala is a large salt water lake with a connection to the Mediterranean Sea. Water movement is limited and depths are less than 1.5 metres.

With a 1500 metre combination diffuser/outfall, adverse impacts of primary effluent on the lake would be minimal. The benefits of higher treatment levels would be marginal at best.

Government officials have identified the lake as their preferred point of disposal and have reclaimed a site for a wastewater treatment plant within the lake.

Advantages

- Preferred disposal option of government officials.
- Lake Manzala is the current disposal point for the existing wastewater treatment facilities.
- Low construction cost associated with this disposal option. A 1500 metre combination diffuser/outfall would be adequate for primary effluent and a 500 metre combination diffuser/outfall would be adequate for secondary effluent.
- NOPWASD has already reclaimed a portion of the lake to serve as a treatment plant site.

Disadvantages

- None identified.

3. Integrated Schemes

a. ALTERNATIVE P-1

Existing treatment facilities are virtually non-functional. A no action scheme will result in the continued discharge of raw sewage to Lake Manzala. Without the benefit of an outfall and diffuser, it can be expected that visible pollution will result along the shore of Lake Manzala.

b. ALTERNATIVE P-2

The major advantage of a discharge to the Mediterranean Sea is the large assimilative capacity of that body of water; facilities constructed under this scheme could be expanded to serve the needs of Port Said well beyond the Year 2000.

Essential elements of this scheme are as follows:

Element	Construction Cost
New Primary Treatment Plant (150,000 m^3/d)	$ 22,136,000
Land Outfall (4 km of 2400 mm)	$ 3,040,000
Marine Outfall to Mediterranean (10 km of 2400 mm)	$ 30,000,000
Mazrah Pump Station	$ 4,950,000
Force Main (3.8 km of 1500 mm)	$ 5,852,000

The construction cost for this alternative is estimated at $ 65,978,000 and the annual operation and maintenance cost is estimated at $ 1,350,000.

c. ALTERNATIVE P-3

As previously mentioned, this scheme is being presented as the preferred alternative. This scheme could adequately handle the needs of Port Said at least until the Year 2000; beyond that point in time it may be necessary to upgrade the treatment facilities to secondary treatment.

Essential elements of this scheme are as follows:

Element	Construction Cost
New Primary Treatment Plant (150,000 m^3/d)	$ 22,136,000
Outfall to Lake Manzala (1.5 km of 2000 mm)	$ 3,900,000
Mazrah Pump Station	$ 4,950,000
Force Main (3.8 km of 1500 mm)	$ 5,852,000

The construction cost for this alternative is estimated at $ 36,838,000 and the annual operation and maintenance cost is estimated at $ 1,350,000.

d. ALTERNATIVE P-4

There are no compelling technical reasons to justify the provision of secondary treatment at Port Said; however, political considerations may require the construction of secondary treatment facilities.

Essential elements of this scheme are as follows:

Element	Construction Cost
Secondary Treatment Plant (150,000 m^3/d)	$ 48,013,000

Mazrah Pump Station	$ 4,950,000
Force Main (3.8 km of 1500 mm)	$ 5,852,000

The construction cost for this alternative is estimated at $ 58,815,000 and the annual operation and maintenance cost is estimated at $ 2,188,000.

e. ALTERNATIVE P-5

Though there are no compelling technical reasons to provide secondary treatment, the use of a lagoon system constructed in Lake Manzala itself compares favorably on a cost basis with the construction of a conventional primary treatment plant.

Essential elements of this scheme are as follows:

Element	Construction Cost
Anaerobic Lagoons & Oxidation Ponds (150,000 m^3/d)	$ 27,736,000
Mazrah Pump Station	$ 4,950,000
Force Main (3.8 km of 1500 mm)	$ 5,852,000

The construction cost for this alternative is estimated at $ 38,538,000 and the annual operation and maintenance cost is estimated at $ 1,438,000.

f. ALTERNATIVE P-6

This scheme would utilize existing civil works to the maximum extent possible; however, the conversion of the existing facilities to a primary plant would result in a multitude of different size and design units with varying degrees of effectiveness.

Essential elements of this scheme are as follows:

Element	Construction Cost
Conversion of Existing Plant (80,000 m^3/d)	$ 4,897,000
New Primary Treatment Plant (70,000 m^3/d)	$ 12,175,000
Outfall to Lake Manzala (1.5 km of 2000 mm)	$ 3,900,000
Mazrah Pump Station (Dual System)	$ 5,940,000
Force Main (3.8 km of dual 1200 mm)	$ 8,200,000

The construction cost for this alternative is estimated at $ 35,112,000 and the annual operation and maintenance cost is estimated at $ 1,731,000.

SUMMARY COST-EFFECTIVENESS EVALUATION OF ALTERNATIVES

Criteria	Multiplier	Alternatives P-1	P-2	P-3	P-4	P-5	P-6
Performance Level	1	1x1=1	4x1=4	4x1=4	5x1=5	5x1=5	5x1=4
Complexity of O&M	2	2x2=4	4x2=8	4x2=8	1x2=2	3x2=6	3x2=6
Construction Complexity	1	5x1=5	3x1=3	4x1=4	1x1=1	2x1=2	2x1=2
Sludge Handling Requirements	2	3x2=6	3x2=6	3x2=6	2x2=4	4x2=8	3x2=6
Local Acceptiveness	3	1x3=3	1x3=3	3x3=9	5x3=15	2x3=6	1x3=3
Environmental Impact	2	1x2=4	4x2=8	4x2=8	5x2=10	5x2=10	4x2=8
Land Requirements	2	5x2=10	4x2=8	4x2=8	3x2=6	2x2=4	5x2=10
Reliability	3	0x3=0	5x3=15	5x3=15	3x3=9	4x3=12	4x3=12
Cost (Present Worth)	5	5x5=25	1x5=5	4x5=20	1x5=5	3x5=15	3x5=15
TOTALS		58	60	82	57	68	66
RANKING		6	4	1	5	2	3

g. CONCLUSION

The cost-effectiveness evaluation indicates that Alternative P-3 is the most appropriate scheme for wastewater treatment and disposal in Port Said. In terms of 1987 U.S. dollars, the average cost per user for the capital works project would be $ 225 for the current population; this figure reduces to $ 124 if we use the Year 2000 population (moderate growth). The annual operation and maintenance cost per user would be $ 5.68 for the current population and $ 3.14 for the Year 2000 population.

B. Ismailia Wastewater Treatment

1. Treatment Options

a. PRIMARY - CONVENTIONAL CLARIFIERS

This treatment option was discussed in detail for Port Said. This option would not satisfy treatment requirements for safe disposal of the effluent to the surface water bodies adjacent to Ismailia; however, it would satisfy requirements for treatment of

wastewater prior to land disposal via rapid infiltration basins.

b. PRIMARY - ANAEROBIC LAGOONS

Unlike the conventional primary clarifiers which would consist primarily of concrete units, the anaerobic lagoons would be constructed primarily of earth.

This process would consist of screening facilities followed by deep anaerobic lagoons.

Approximately 70% BOD removal would be accomplished by the anaerobic lagoons with their retention time of 5 days.

The major advantage of this process is the low operation and maintenance cost.

Advantages

- High levels of treatment are obtainable with minimal operation and maintenance requirements.
- Low operation and maintenance costs compared to conventional primary treatment options.
- Process is well able to withstand both organic and hydraulic shock loads.
- Majority of construction techniques required are well within local capabilities.
- Sludge handling problems are significantly simplified.

Disadvantages

- Large land area required (approximately 30 feddans) as compared with conventional clarifiers.
- Treatment option is considered an unacceptable technology by many government officials.

c. SECONDARY - TRICKLING FILTERS

This treatment option was discussed in detail for Port Said. This option would satisfy treatment requirements for safe disposal of the effluent to the surface water bodies adjacent to Ismailia.

As with Port Said, Ismailia already has existing trickling filter facilities. Like Port Said, Ismailia has not demonstrated that it can properly operate and maintain such facilities.

2. Disposal Options

a. EL MAHSAMA DRAIN

El Mahsama Drain is the current disposal point for the existing wastewater treatment facilities serving Ismailia.

Metcalf & Eddy has concluded that the drain can safely handle secondary effluent, but that primary effluent would have an adverse impact on Lake Timsah.

Advantages

- El Mahsama Drain is the current disposal point for Ismailia.
- Minimal construction cost associated with disposal facilities.

Disadvantages

- Secondary level effluent is required for safe disposal.
- Government officials are opposed to continued discharges to Lake Timsah.

b. LAND APPLICATION

Pilot studies have previously been performed to assess the effectiveness of rapid infiltration basins for the disposal of wastewater effluent. It was concluded that primary level treatment would be required to prepare the wastewater for disposal via rapid infiltration basins if the operation was to be efficient. The existing groundwater is of poor quality and would not be adversely impacted by the introduction of a relatively high quality wastewater effluent.

Advantages

- Potential exists for reclaiming effluent from existing shallow groundwater table and utilizing on new agricultural lands.
- No discharge to surface water body, thus health risks to the general public are greatly reduced.
- The city has acquired approximately 333 feddans for the proposed land application site.

Disadvantages

- High cost associated with infiltration basins.
- Extensive monitoring of groundwater should be incorporated into program.
- Potential exists for significant impacts on adjacent properties due to a raising of the existing groundwater table. This would be particularly true if the wastewater is not reclaimed for the irrigation of new agricultural lands.
- An extremely large area of land would be required for a land disposal system. Estimates vary between 2,000 and 4,000 feddans for a system with a design flow of 90,000 m^3/d. Only 333 feddans have been acquired by the city, and there are indications that the land acquired may be unsuitable for land application due to an extremely high groundwater table.

- Hydraulic loading rates for infiltration basins may decrease with time, especially with ineffective operation of treatment facilities.

3. Integrated Schemes

a. ALTERNATIVE I-1

Existing treatment facilities are inadequate to meet the present needs of Ismailia. A no action scheme will result in the continued discharge of partially treated sewage to El Mahsama Drain, thus resulting in the visible pollution of Lake Timsah.

b. ALTERNATIVE I-2

This scheme would utilize existing civil works to the maximum extent possible; however, the conversion of the existing facilities to an upgraded secondary treatment facility would result in a plant which is only marginally efficient and construction of a new plant would be required to supplement the capacity of the upgraded plant.

Essential elements of this scheme are as follows:

Element	Construction Cost
Upgrading of Existing Plant (55,000 m^3/d)	$ 12,359,000
Outfall to El Mahsama Drain (1.8 km of 900 mm)	$ 612,000
Land Application System (35,000 m^3/d)	$ 10,275,000
Force Main (7.1 km of 900 mm)	$ 5,822,000

The construction cost for this alternative is estimated at $ 29,068,000 and the annual operation and maintenance cost is estimated at $ 1,683,000.

c. ALTERNATIVE I-3

This scheme, like I-2 above, would make maximum use of the existing civil works. A new secondary facility would be constructed adjacent to the existing plant.

Element	Construction Cost
Upgrading of Existing Plant (55,000 m^3/d)	$ 12,359,000
New Secondary Treatment Plant (35,000 m^3/d)	$ 13,204,000
Outfall to El Mahsama Drain (1.8 km of 1500 mm)	$ 963,000

The construction cost for this alternative is estimated

250 litres per day for Suez. We are recommending a per capita water demand in Port Said for the Year 2000 of 250 litres per day. Each of these per capita flows includes an appropriate allowance for wastage. A separate allowance for industrial flow of 20%, 10%, and 30% of the domestic/commercial/institutional flow has been included for Port Said, Ismailia, and Suez respectively. An infiltration allowance of 20% of the domestic/commercial/institutional flow has been included for each city.

Our proposed design flows will require each of the three cities to discourage water wastage and to take at least minimal measures to maintain the integrity of the wastewater collection system. It is anticipated that water wastage in all three cities will be reduced moderately as user charges for water consumption increase and slightly as a result of user education programs proposed for each city.

Future consideration should be given to the use of flow limiting devices at all residential connections. Such limiting devices would make it difficult for the consumer to use excessive quantities of water. This can be a very important consideration in a society where the minimum needs of the public are guaranteed. Restriction of water usage would permit a more equitable distribution of available treated water. Potential benefits would be the reduced size of both water and wastewater facilities and the reduced costs of construction, operation, and maintenance of these facilities.

Due to the massive funds that would be required to provide central service to all areas of the cities by the Year 2000, we are of the opinion that each city will find it extremely difficult to extend its infrastructure sufficiently to maintain even the current levels of service on a percentage of population basis. Accordingly, we recommend that the design basis for percentage of population served by the wastewater system be 80% for each of the three cities. We would estimate that the size of the facilities proposed for the Year 2000 represent a design flow roughly 2 and one-half times current flows. We are assuming that 85% of the population in Port Said will have full water service in the Year 2000 and that the remainder of the population will be served by public fountains. We would estimate that on a percentage basis there will be no significant change from the current extent of full water service coverage in Port Said, but that the total population served will roughly double.

C. Port Said Wastewater Treatment

The U.S. firm of Hazen and Sawyer prepared the Master Plan for Port Said; this plan was the successor to the 1976 Master Plan prepared by a group of British consultants. In April 1981, the joint venture of Canal Cities Consultants released the final of Design Report No. 1 which identified the new facilities to be built to meet the Year 2000 needs of the city. Design Report No. 2 released in March 1982 updated the first design report.

As a result of these various studies, four potential areas for disposal of wastewater effluent were identified. These were land disposal by irrigation, discharge to the Mediterranean Sea, discharge to the Suez

Canal, and discharge to Lake Manzala. Land disposal was rejected because of inadequate suitable land near Port Said and the high levels of dissolved solids in the wastewater which would require fresh water dilution. The Advisory Committee on Reconstruction rejected the concept of an outfall to the Mediterranean Sea due to the potential harm to bathing beaches. Detailed studies of the assimilative capacities of the Suez Canal and Lake Manzala performed by Hazen and Sawyer indicate that the shallow water of Lake Manzala could serve the entire city through the Year 2000, whereas the Suez Canal could safely serve only a small portion of the city.

The following major technical alternatives have been identified for the treatment of wastewater in Port Said:

1. Alternative P-1 - No action. This alternative would involve no improvements to the existing wastewater treatment facilities and no new construction of alternative facilities. This would result in secondary level treatment to about 19,400 m^3/d of wastewater and primary level treatment to an additional 42,300 m^3/d if the existing facilities were fully functional.

2. Alternative P-2 - Abandonment of the existing treatment facilities and construction of new primary treatment facilities with a design capacity of 150,000 m^3/d in the vicinity of the existing plant with discharge to the Mediterranean Sea via a 10 kilometre outfall of approximately 2400 mm diameter with a 400 metre diffuser. This alternative is being included in this analysis even though rejected in the original studies.

3. Alternative P-3 - Abandonment of the existing treatment facilities and construction of new primary treatment facilities with a design capacity of 150,000 m^3/d at a new site created in Lake Manzala with discharge to the lake via a 1000 metre outfall of approximately 2000 mm diameter with a 500 metre diffuser.

This is being presented as the preferred alternative for Port Said. A 150,000 m^3/d wastewater treatment plant capable of providing primary level treatment will be built on the reclaimed land at Lake Manzala. The plant will consist of screening facilities, grit chambers, primary clarifiers, and chlorination facilities. This alternative includes a 1.5 kilometre outfall with diffuser into the lake. A transmission system consisting of a new pump station at the site of the existing treatment facilities will deliver the raw wastewater to the new treatment plant site via 3.8 kilometres of 1500 mm diameter force main. Sludge handling facilities will be an integral part of the treatment facilities. These sludge facilities will consist of sludge thickeners and on-site drying beds.

4. Alternative P-4 - Abandonment of the existing treatment facilities and construction of new secondary treatment facilities with a design capacity of 150,000 m^3/d at a new site created in Lake Manzala with discharge to the lake via an open channel.

5. Alternative P-5 - Abandonment of the existing treatment facilities and construction of anaerobic lagoons and oxidation ponds with a design capacity of 150,000 m^3/d in Lake Manzala.

6. Alternative P-6 - Rehabilitation and conversion of the existing treatment plant to a primary only facility with a design capacity of 80,000 m^3/d and construction of a new primary plant with a design capacity of 70,000 m^3/d at a new site created in Lake Manzala with discharge for both plants to the lake via a 1000 metre outfall of approximately 2000 mm diameter with a 500 metre diffuser.

D. Ismailia Wastewater Treatment

The U.S. firm of Metcalf and Eddy, Inc., prepared the Master Plan for Ismailia. In April 1981, the joint venture of Canal Cities Consultants released the final of Design Report No. 1 which identified the new facilities to be built to meet the Year 2000 needs of the city. Design Report No. 2 released in March 1982 updated the first design report.

As a result of these various studies, four potential areas for disposal of wastewater effluent were identified. These were land disposal by irrigation, discharge to the Suez Canal, discharge to Lake Timsah, and discharge to El Mahsama Drain. Detailed studies of the assimilative capacities of the Suez Canal, Lake Timsah, and El Mahsama Drain performed by Metcalf & Eddy indicate that all three surface water bodies under consideration could safely assimilate the entire wastewater flow from the city through the Year 2000 if secondary treatment is provided. Primary treatment was not judged to be suitable for use before discharge to any of the surface water bodies due to the adverse affect of such discharge on Lake Timsah. The Suez Canal Authority has indicated its opposition to any discharge to the canal system.

The following major technical alternatives have been identified for the treatment of wastewater in Ismailia:

1. Alternative I-1 - No action. This alternative would involve no improvements to the existing wastewater treatment facilities and no new construction of alternative facilities. This would result in secondary level treatment to about 24,000 m^3/d of wastewater.

2. Alternative I-2 - Rehabilitation of the existing treatment plant to a secondary plant with a design capacity of 55,000 m^3/d with discharge to El Mahsama Drain and construction of new land disposal facility with a design capacity of 35,000 m^3/d.

3. Alternative I-3 - Rehabilitation and expansion of the existing treatment plant to a secondary plant with a design capacity of 90,000 m^3/d with discharge to El Mahsama Drain.

4. Alternative I-4 - Rehabilitation and expansion of the existing treatment plant to a primary plant with a design capacity of 90,000 m^3/d with discharge to a land application system at the southerly

site.

5. Alternative I-5 - Abandonment of the existing treatment facilities and construction of a new land disposal system with a design capacity of 90,000 m^3/d at the southerly site.

This is being presented as the preferred alternative for Ismailia. A 90,000 m^3/d wastewater treatment plant will be built to the south of the city. The treatment plant will include screening facilities, grit chambers, and primary clarifiers. Rapid infiltration basins will be used for land disposal of the primary effluent. It is anticipated that the Government of Egypt will eventually withdraw the treated effluent from the ground via shallow wells for agricultural reuse. Approximately 4,000 feddans are required for the treatment facilities. This alternative includes modifications to the new Abu Atwa Pump Station and 7.1 kilometres of dual force main (1200 mm diameter) to transport the raw wastewater to the new treatment plant site. Sludge handling facilities will be an integral part of the treatment facilities. These sludge facilities will consist of sludge thickeners and on-site drying beds. Construction of a shallow well system for monitoring groundwater quality and for irrigation of site landscaping will be considered, but it is not anticipated that a well system to serve new agricultural lands will be provided as part of the wastewater project. A primary treatment facility using anaerobic lagoons is a possible variation of this alternative.

E. Suez Wastewater Treatment

The U.S. firm of Pirnie-Harris International prepared the Master Plan for Suez. In April 1981, the joint venture of Canal Cities Consultants released the final of Design Report No. 1 which identified the new facilities to be built to meet the Year 2000 needs of the city. Design Report No. 2 released in March 1982 updated the first design report.

As a result of these various studies, six potential areas for disposal of wastewater effluent were identified. These were land disposal by irrigation, discharge to the Suez Canal, discharge to Suez Creek, discharge to Suez Bay, discharge to the Gulf of Suez, and discharge to the air via evaporation. Detailed studies of the assimilative capacities of the Suez Canal, Suez Creek, Suez Bay, and the Gulf of Suez performed by Pirnie-Harris indicate that only the Gulf of Suez could safely assimilate the entire wastewater flow from the city through the Year 2000 with primary treatment. The Suez Bay could assimilate up to 185,000 m^3/d with secondary treatment. Discharges to the Suez Canal or Suez Creek would require sophisticated treatment facilities.

The following major technical alternatives have been identified for the treatment of wastewater in Suez:

1. Alternative S-1 - No action. This alternative would involve no improvements to the existing wastewater treatment facilities and no new construction of alternative facilities. This would result in primary level treatment to about 48,000 m^3/d of wastewater.

2. Alternative S-2 - Abandonment of the existing treatment facilities and construction of a new primary plant with a design capacity of 200,000 m^3/d at the southerly site with discharge to the Gulf of Suez via a 2.8 kilometre outfall of approximately 2400 mm diameter.

3. Alternative S-3 - Abandonment of the existing treatment facilities and construction of a new primary plant with a design capacity of 100,000 m^3/d at the southerly site with discharge to the Gulf of Suez via a 2.8 kilometre outfall of approximately 1800 mm diameter and construction of a new land disposal system with a design capacity of 100,000 m^3/d at the northerly site.

4. Alternative S-4 - Abandonment of the existing treatment facilities and construction of a new land disposal system with a design capacity of 200,000 m^3/d at the northerly site.

This is being presented as the preferred alternative for Suez. A 200,000 m^3/d wastewater treatment plant will be built at a site to the north of the city and west of the Sweetwater Canal. The plant will consist of screening facilities and anaerobic lagoons. Rapid infiltration basins will be used for land disposal of the primary effluent. It is estimated that 4,000 feddans are required for the treatment facilities. The potential exists for the withdrawal of the treated effluent from the ground via shallow wells and the use of same in future agricultural lands; however, this will be dependent upon the success of the sewer rehabilitation program which is necessary to reduce the infiltration of highly saline water. Construction of a shallow well system for monitoring groundwater quality and for irrigation of site landscaping will be considered, but it is not anticipated that a well system to serve new agricultural lands will be provided as part of the wastewater project. Sludge storage will be provided in the anaerobic lagoons; a multiple cell lagoon system will permit taking one lagoon out of service for de-sludging. Partially dewatered sludge would be landfilled at the treatment plant site; landfill area for 20 years of sludge accummulation would be provided. A primary treatment facility using conventional clarifiers is a possible variation of this alternative.

5. Alternative S-5 - Abandonment of the existing treatment facilities and construction of a new evaporation system with a design capacity of 200,000 m^3/d at the southerly site.

F. Port Said Raw Water Supply

The U.S. firm of Hazen and Sawyer prepared the Master Plan for Port Said; this plan was the successor to the 1976 Master Plan prepared by a group of British consultants. In April 1981, the joint venture of Canal Cities Consultants released the final of Design Report No. 1 which identified the new facilities to be built to meet the Year 2000 needs of the city. Design Report No. 2 released in March 1982 updated the first design report.

As a result of these various studies, it became clearly evident that the Nile River is clearly the best source of raw water for the city.

Local surface and underground sources are brackish or saline and would require sophisticated treatment facilities. Since 1862, Port Said has received water from the Nile River via canal; today, the Ismailia Sweetwater Canal carries water from the Cairo to Ismailia and then branches to both Suez and Port Said.

The following major technical alternatives have been identified for the supply of raw water to Port Said:

1. Alternative W-1 - No action. This alternative would involve no improvements to the existing raw water supply and no new construction of alternative facilities, thus limiting the water supply to approximately 120,000 m^3/d.

3. Alternative W-2 - Construction of a 370,000 m^3/d booster station and installation of 48 kilometres of dual 1500 mm diameter pipeline to replace the existing canal. It is assumed that the existing canal would be capable of delivering 120,000 m^3/d.

4. Alternative W-3 - Construction of a 370,000 m^3/d booster station and installation of 48 kilometres of dual 1200 mm diameter pipeline from Qantara to El Raswa. The existing canal would be abandoned from Qantara northward.

5. Alternative W-4 - Installation of four low lift pump stations with a nominal capacity of 370,000 m^3/d along the existing canal. These stations would lift the flow as needed to overcome the hydraulic resistance of the existing canal. They would be spaced to keep the water surface below the present canal banks in so far as possible. Relatively minor canal excavation and canal bank extensions would be required in critical sections.

6. Alternative W-5 - Installation of one low lift pump station with a nominal capacity of 370,000 m^3/d at the Rayah Barrage near Qantara. In many places, the water level in the canal would be above existing banks, requiring extension of the banks to higher elevations. Concrete retaining walls would be built along both sides of the canal. No canal excavation is anticipated.

7. Alternative W-6 - Installation of a concrete lining in the existing canal from Qantara to Port Said. The lined canal would be designed to deliver at least 370,000 m^3/d. The cross section would be trapezoidal with a bottom width of 8.5 metres, side slopes of 1.5:1 and an overall depth of at least 1.75 metres.

This is being presented as the preferred alternative for a raw water supply for Port Said. This alternative could be designed to provide at least 370,000 m^3/d.

[raw water storage facilities near El Raswa would be desirable for any system lacking an adequate backup system]

III. EVALUATION OF TECHNICAL ALTERNATIVES

A. Port Said Wastewater Treatment

1. Treatment Options

a. PRIMARY - CONVENTIONAL CLARIFIERS

Primary treatment facilities typically consist of screening facilities, grit chambers, primary clarifiers, sludge handling facilities, and often a chlorination system.

Primary facilities have the capability of removing most of the grit and floating solids from the wastewater. A substantial portion of the suspended matter can be removed and the bio-chemical oxygen demand (BOD) can be reduced moderately.

The major advantages of a primary treatment facility in Port Said would be the low cost and the ease of operation and maintenance. It could realistically be anticipated that the wastewater department staff could achieve in a short time frame the necessary level of skills for the proper operation and maintenance of such a facility.

The major disadvantage of this treatment option is the disdain that government officials have for the process. It is not required as a suitable option by the National Organization for Potable Water and Sanitary Drainage. Primary effluent cannot meet existing standards for discharge to surface water bodies.

Primary clarifiers are the major initial element of many secondary treatment processes, thus they can form the first stage of a staged construction program for secondary treatment facilities.

Adequate sludge handling facilities are required if the clarifiers are to be properly operated and maintained. Typically, such sludge facilities would consist of thickeners to concentrate the sludge and drying beds to dewater the sludge.

Advantages

- Ease of operation and maintenance.
- Good degree of reliability in performance.
- Low construction cost.
- Low operation and maintenance costs.
- Can be incorporated into future secondary treatment facilities.

Disadvantages

- Cannot meet existing standards for effluent discharged to surface water bodies.
- Not perceived as an acceptable treatment process by government officials.

- Marine outfalls with diffusers are required if primary effluent is to be safely assimilated by the Mediterranean Sea or Lake Manzala.

b. SECONDARY - TRICKLING FILTERS

A trickling filter process would involve the addition of trickling filter units and secondary clarifiers to the previously described primary treatment process. Trickling filters have the capability of substantially improving the degree of treatment.

The exact degree of removal obtainable by this process is dependent upon numerous factors such as filter area and depth, number of stages, media type, recirculation rates, and wastewater characteristics. Trickling filter plants are typically designed to provide BOD removals of anywhere from 65% to 85%.

This treatment option requires skilled operators. The existing trickling filter facilities in Port Said have not been properly operated and maintained. Considerable training would be required to upgrade the skills of the existing staff if satisfactory levels of performance are to be achieved.

The major advantage of this process is that it is consistent with the desires of government officials.

Advantages

- Easier to operate and maintain than most other secondary treatment processes.
- Lower operating cost than most secondary treatment processes.
- Relatively high levels of treatment are obtainable on a consistent basis if properly operated and maintained.
- Process is generally acceptable to government officials.
- Port Said already has a treatment plant which utilizes this process.
- Would not require a marine outfall or diffuser for discharge of the treated effluent to Lake Manzala.

Disadvantages

- Skilled operators are required. Improper operation can drastically reduce effectiveness. Port Said has not demonstrated that it can properly operate and maintain the existing trickling filter facilities.
- Higher construction cost than primary facilities.
- Significantly higher cost for operation and maintenance as compared with primary facilities.

c. SECONDARY - ACTIVATED SLUDGE

An activated sludge process would involve the addition of activated sludge basins and secondary clarifiers to the previously

described primary treatment process. An activated sludge plant has the capability of providing high levels of wastewater treatment.

The exact degree of removal obtainable by this process is dependent upon numerous factors such as detention time, sludge return rates, and wastewater characteristics. Activated sludge plants are typically designed to provide BOD removals of anywhere from 85% to over 95%.

This treatment option requires very skilled operators. It is doubtful that the existing activated sludge units at Port Said have ever been operated for extended periods. Considerable training would be required to upgrade the skills of the existing staff if satisfactory levels of performance are to be achieved.

The major advantage of this process is that it is capable of providing a level of treatment consistent with the desires of government officials.

Advantages

- Higher levels of treatment are obtainable than with many secondary processes if properly operated and maintained.
- Process is generally acceptable to government officials.
- Port Said already has a treatment plant which utilizes this process.
- Would not require a marine outfall or diffuser for discharge of the treated effluent to Lake Manzala.

Disadvantages

- Very skilled operators are required. Improper operation can drastically reduce effectiveness. Port Said has not demonstrated that it can properly operate and maintain the existing activated sludge facilities.
- Efficiency of treatment process is very susceptible to variations in the characteristics of the influent wastewater.
- Higher construction cost than primary facilities.
- Higher cost for operation and maintenance as compared with trickling filter facilities.

d. SECONDARY - ANAEROBIC LAGOONS AND OXIDATION PONDS

Unlike the trickling filter and activated sludge plants which would consist primarily of concrete units, the anaerobic lagoon/oxidation pond plant would be constructed primarily of earth. It would be possible to segment portions of Lake Manzala with earth dikes to create the basins required for this process.

This process would consist of screening facilities followed by deep anaerobic lagoons which in turn are followed by shallow

oxidation ponds which are then followed by polishing ponds; chlorination may or may not be included as part of the treatment scheme.

The degree of treatment is primarily dependent upon the retention time in the basins. For our evaluation of this process, we have assumed a retention time of 5 days in the anaerobic lagoons and 7 days each in the oxidation ponds and polishing ponds. These retention times should result in a BOD removal efficiency of greater than 95%.

The major advantage of this process is the high level of treatment that can be achieved at low cost.

Advantages

- High levels of treatment are obtainable with minimal operation and maintenance requirements.
- Low capital cost compared to other secondary treatment alternatives.
- Low operation and maintenance costs compared to conventional primary and secondary treatment options.
- Process is well able to withstand both organic and hydraulic shock loads.
- Majority of construction techniques required are well within local capabilities.

Disadvantages

- A large portion of Lake Manzala would be devoted to the treatment process (approximately 400 feddans).
- Process is considered an unacceptable technology by many government officials.

2. Disposal Options

a. MEDITERRANEAN SEA

Disposal of the wastewater into the Mediterranean was not studied in any detail by Hazen and Sawyer; however, if we assume that conditions are similar to those found in Alexandria, approximately 10 kilometres of outfall will be required to safely dispose of the treated effluent.

The main disadvantage of this disposal option is the public perception that it will contribute to pollution of the bathing beaches of Port Said.

Advantages

- Primary level of treatment will be adequate for safe disposal of the treated effluent.
- Low operation and maintenance cost associated with outfall.

Disadvantages

- Public perception that beaches will be polluted.
- High construction cost of outfall.

b. LAKE MANZALA

Lake Manzala is a large salt water lake with a connection to the Mediterranean Sea. Water movement is limited and depths are less than 1.5 metres.

With a 1500 metre combination diffuser/outfall, adverse impacts of primary effluent on the lake would be minimal. The benefits of higher treatment levels would be marginal at best.

Government officials have identified the lake as their preferred point of disposal and have reclaimed a site for a wastewater treatment plant within the lake.

Advantages

- Preferred disposal option of government officials.
- Lake Manzala is the current disposal point for the existing wastewater treatment facilities.
- Low construction cost associated with this disposal option. A 1500 metre combination diffuser/outfall would be adequate for primary effluent and a 500 metre combination diffuser/outfall would be adequate for secondary effluent.
- NOPWASD has already reclaimed a portion of the lake to serve as a treatment plant site.

Disadvantages

- None identified.

3. Integrated Schemes

a. ALTERNATIVE P-1

Existing treatment facilities are virtually non-functional. A no action scheme will result in the continued discharge of raw sewage to Lake Manzala. Without the benefit of an outfall and diffuser, it can be expected that visible pollution will result along the shore of Lake Manzala.

b. ALTERNATIVE P-2

The major advantage of a discharge to the Mediterranean Sea is the large assimilative capacity of that body of water; facilities constructed under this scheme could be expanded to serve the needs of Port Said well beyond the Year 2000.

Essential elements of this scheme are as follows:

Element	Construction Cost
New Primary Treatment Plant (150,000 m^3/d)	$ 22,136,000
Land Outfall (4 km of 2400 mm)	$ 3,040,000
Marine Outfall to Mediterranean (10 km of 2400 mm)	$ 30,000,000
Mazrah Pump Station	$ 4,950,000
Force Main (3.8 km of 1500 mm)	$ 5,852,000

The construction cost for this alternative is estimated at $ 65,978,000 and the annual operation and maintenance cost is estimated at $ 1,350,000.

c. ALTERNATIVE P-3

As previously mentioned, this scheme is being presented as the preferred alternative. This scheme could adequately handle the needs of Port Said at least until the Year 2000; beyond that point in time it may be necessary to upgrade the treatment facilities to secondary treatment.

Essential elements of this scheme are as follows:

Element	Construction Cost
New Primary Treatment Plant (150,000 m^3/d)	$ 22,136,000
Outfall to Lake Manzala (1.5 km of 2000 mm)	$ 3,900,000
Mazrah Pump Station	$ 4,950,000
Force Main (3.8 km of 1500 mm)	$ 5,852,000

The construction cost for this alternative is estimated at $ 36,838,000 and the annual operation and maintenance cost is estimated at $ 1,350,000.

d. ALTERNATIVE P-4

There are no compelling technical reasons to justify the provision of secondary treatment at Port Said; however, political considerations may require the construction of secondary treatment facilities.

Essential elements of this scheme are as follows:

Element	Construction Cost
Secondary Treatment Plant (150,000 m^3/d)	$ 48,013,000

Mazrah Pump Station	$ 4,950,000
Force Main (3.8 km of 1500 mm)	$ 5,852,000

The construction cost for this alternative is estimated at $ 58,815,000 and the annual operation and maintenance cost is estimated at $ 2,188,000.

e. ALTERNATIVE P-5

Though there are no compelling technical reasons to provide secondary treatment, the use of a lagoon system constructed in Lake Manzala itself compares favorably on a cost basis with the construction of a conventional primary treatment plant.

Essential elements of this scheme are as follows:

Element	Construction Cost
Anaerobic Lagoons & Oxidation Ponds (150,000 m^3/d)	$ 27,736,000
Mazrah Pump Station	$ 4,950,000
Force Main (3.8 km of 1500 mm)	$ 5,852,000

The construction cost for this alternative is estimated at $ 38,538,000 and the annual operation and maintenance cost is estimated at $ 1,438,000.

f. ALTERNATIVE P-6

This scheme would utilize existing civil works to the maximum extent possible; however, the conversion of the existing facilities to a primary plant would result in a multitude of different size and design units with varying degrees of effectiveness.

Essential elements of this scheme are as follows:

Element	Construction Cost
Conversion of Existing Plant (80,000 m^3/d)	$ 4,897,000
New Primary Treatment Plant (70,000 m^3/d)	$ 12,175,000
Outfall to Lake Manzala (1.5 km of 2000 mm)	$ 3,900,000
Mazrah Pump Station (Dual System)	$ 5,940,000
Force Main (3.8 km of dual 1200 mm)	$ 8,200,000

The construction cost for this alternative is estimated at $ 35,112,000 and the annual operation and maintenance cost is estimated at $ 1,731,000.

SUMMARY COST-EFFECTIVENESS EVALUATION OF ALTERNATIVES

Criteria	Multiplier	Alternatives P-1	P-2	P-3	P-4	P-5	P-6
Performance Level	1	1x1=1	4x1=4	4x1=4	5x1=5	5x1=5	5x1=4
Complexity of O&M	2	2x2=4	4x2=8	4x2=8	1x2=2	3x2=6	3x2=6
Construction Complexity	1	5x1=5	3x1=3	4x1=4	1x1=1	2x1=2	2x1=2
Sludge Handling Requirements	2	3x2=6	3x2=6	3x2=6	2x2=4	4x2=8	3x2=6
Local Acceptiveness	3	1x3=3	1x3=3	3x3=9	5x3=15	2x3=6	1x3=3
Environmental Impact	2	1x2=4	4x2=8	4x2=8	5x2=10	5x2=10	4x2=8
Land Requirements	2	5x2=10	4x2=8	4x2=8	3x2=6	2x2=4	5x2=10
Reliability	3	0x3=0	5x3=15	5x3=15	3x3=9	4x3=12	4x3=12
Cost (Present Worth)	5	5x5=25	1x5=5	4x5=20	1x5=5	3x5=15	3x5=15
TOTALS		58	60	82	57	68	66
RANKING		6	4	1	5	2	3

g. CONCLUSION

The cost-effectiveness evaluation indicates that Alternative P-3 is the most appropriate scheme for wastewater treatment and disposal in Port Said. In terms of 1987 U.S. dollars, the average cost per user for the capital works project would be $ 225 for the current population; this figure reduces to $ 124 if we use the Year 2000 population (moderate growth). The annual operation and maintenance cost per user would be $ 5.68 for the current population and $ 3.14 for the Year 2000 population.

B. Ismailia Wastewater Treatment

1. Treatment Options

a. PRIMARY - CONVENTIONAL CLARIFIERS

This treatment option was discussed in detail for Port Said. This option would not satisfy treatment requirements for safe disposal of the effluent to the surface water bodies adjacent to Ismailia; however, it would satisfy requirements for treatment of

wastewater prior to land disposal via rapid infiltration basins.

b. PRIMARY - ANAEROBIC LAGOONS

Unlike the conventional primary clarifiers which would consist primarily of concrete units, the anaerobic lagoons would be constructed primarily of earth.

This process would consist of screening facilities followed by deep anaerobic lagoons.

Approximately 70% BOD removal would be accomplished by the anaerobic lagoons with their retention time of 5 days.

The major advantage of this process is the low operation and maintenance cost.

Advantages

- High levels of treatment are obtainable with minimal operation and maintenance requirements.
- Low operation and maintenance costs compared to conventional primary treatment options.
- Process is well able to withstand both organic and hydraulic shock loads.
- Majority of construction techniques required are well within local capabilities.
- Sludge handling problems are significantly simplified.

Disadvantages

- Large land area required (approximately 30 feddans) as compared with conventional clarifiers.
- Treatment option is considered an unacceptable technology by many government officials.

c. SECONDARY - TRICKLING FILTERS

This treatment option was discussed in detail for Port Said. This option would satisfy treatment requirements for safe disposal of the effluent to the surface water bodies adjacent to Ismailia.

As with Port Said, Ismailia already has existing trickling filter facilities. Like Port Said, Ismailia has not demonstrated that it can properly operate and maintain such facilities.

2. Disposal Options

a. EL MAHSAMA DRAIN

El Mahsama Drain is the current disposal point for the existing wastewater treatment facilities serving Ismailia.

Metcalf & Eddy has concluded that the drain can safely handle secondary effluent, but that primary effluent would have an adverse impact on Lake Timsah.

Advantages

- El Mahsama Drain is the current disposal point for Ismailia.
- Minimal construction cost associated with disposal facilities.

Disadvantages

- Secondary level effluent is required for safe disposal.
- Government officials are opposed to continued discharges to Lake Timsah.

b. LAND APPLICATION

Pilot studies have previously been performed to assess the effectiveness of rapid infiltration basins for the disposal of wastewater effluent. It was concluded that primary level treatment would be required to prepare the wastewater for disposal via rapid infiltration basins if the operation was to be efficient. The existing groundwater is of poor quality and would not be adversely impacted by the introduction of a relatively high quality wastewater effluent.

Advantages

- Potential exists for reclaiming effluent from existing shallow groundwater table and utilizing on new agricultural lands.
- No discharge to surface water body, thus health risks to the general public are greatly reduced.
- The city has acquired approximately 333 feddans for the proposed land application site.

Disadvantages

- High cost associated with infiltration basins.
- Extensive monitoring of groundwater should be incorporated into program.
- Potential exists for significant impacts on adjacent properties due to a raising of the existing groundwater table. This would be particularly true if the wastewater is not reclaimed for the irrigation of new agricultural lands.
- An extremely large area of land would be required for a land disposal system. Estimates vary between 2,000 and 4,000 feddans for a system with a design flow of 90,000 m^3/d. Only 333 feddans have been acquired by the city, and there are indications that the land acquired may be unsuitable for land application due to an extremely high groundwater table.

- Hydraulic loading rates for infiltration basins may decrease with time, especially with ineffective operation of treatment facilities.

3. Integrated Schemes

a. ALTERNATIVE I-1

Existing treatment facilities are inadequate to meet the present needs of Ismailia. A no action scheme will result in the continued discharge of partially treated sewage to El Mahsama Drain, thus resulting in the visible pollution of Lake Timsah.

b. ALTERNATIVE I-2

This scheme would utilize existing civil works to the maximum extent possible; however, the conversion of the existing facilities to an upgraded secondary treatment facility would result in a plant which is only marginally efficient and construction of a new plant would be required to supplement the capacity of the upgraded plant.

Essential elements of this scheme are as follows:

Element	Construction Cost
Upgrading of Existing Plant (55,000 m^3/d)	$ 12,359,000
Outfall to El Mahsama Drain (1.8 km of 900 mm)	$ 612,000
Land Application System (35,000 m^3/d)	$ 10,275,000
Force Main (7.1 km of 900 mm)	$ 5,822,000

The construction cost for this alternative is estimated at $ 29,068,000 and the annual operation and maintenance cost is estimated at $ 1,683,000.

c. ALTERNATIVE I-3

This scheme, like I-2 above, would make maximum use of the existing civil works. A new secondary facility would be constructed adjacent to the existing plant.

Element	Construction Cost
Upgrading of Existing Plant (55,000 m^3/d)	$ 12,359,000
New Secondary Treatment Plant (35,000 m^3/d)	$ 13,204,000
Outfall to El Mahsama Drain (1.8 km of 1500 mm)	$ 963,000

The construction cost for this alternative is estimated

at $ 26,526,000 and the annual operation and maintenance cost is estimated at $ 1,466,000.

d. ALTERNATIVE I-4

Conversion and expansion of the existing plant to a primary facility would efficiently utilize existing works, but would result in only a marginally efficient treatment facility that would require greater operational skills and maintenance requirements than a new facility.

Element	Construction Cost
Upgrading of Existing Plant (90,000 m^3/d)	$ 13,312,000
Land Application System (90,000 m^3/d)	$ 10,204,000
Old Plant Pump Station	$ 4,950,000
Force Main (7.1 km of dual 1200 mm)	$ 15,322,000

The construction cost for this alternative is estimated at $ 43,788,000 and the annual operation and maintenance cost is estimated at $ 1,085,000.

e. ALTERNATIVE I-5

The construction of a new land application system is the preferred alternative. It will result in virtually no environmental impacts to Lake Timsah and has the added benefit of providing irrigation water for adjacent agricultural lands.

Element	Construction Cost
Land Application System (90,000 m^3/d)	$ 37,365,000
Force Main (7.1 km of dual 1200 mm)	$ 15,322,000

The construction cost for this alternative is estimated at $ 52,687,000 and the annual operation and maintenance cost is estimated at $ 1,515,000.

f. CONCLUSION

The cost-effectiveness evaluation indicates that Alternative I-5 is the most appropriate scheme for wastewater treatment and disposal in Ismailia. In terms of 1987 U.S. dollars, the average cost per user for the capital works project would be $ 422 for the current population; this figure reduces to $ 236 if we use the Year 2000 population (moderate growth). The annual operation and maintenance cost per user would be $ 8.36 for the current population and $ 4.69 for the Year 2000 population.

SUMMARY COST-EFFECTIVENESS EVALUATION OF ALTERNATIVES

Criteria	Multiplier	Alternatives I-1	I-2	I-3	I-4	I-5
Performance Level	1	1x1=1	4x1=4	4x1=4	5x1=5	5x1=5
Complexity of O&M	2	2x2=4	4x2=8	3x2=6	4x2=8	5x2=10
Construction Complexity	1	5x1=5	2x1=2	2x1=2	3x1=3	5x1=5
Sludge Handling Requirements	2	3x2=6	2x2=4	2x2=4	3x2=6	4x2=8
Local Acceptiveness	3	0x3=0	2x3=6	2x3=6	4x3=12	5x3=15
Environmental Impact	2	0x2=0	3x2=6	2x2=4	5x2=10	5x2=10
Land Requirements	2	5x2=10	3x2=6	4x2=8	2x2=4	2x2=4
Reliability	3	0x3=0	2x3=6	2x3=6	4x3=12	5x3=15
Cost (Present Worth)	5	5x5=25	3x5=15	4x5=20	2x5=10	1x5=5
TOTALS		51	57	60	70	77
RANKING		5	4	3	2	1

C. Suez Wastewater Treatment

1. Treatment Options

a. PRIMARY - CONVENTIONAL CLARIFIERS

This treatment option was discussed in detail for Port Said. The major disadvantage of this option for Suez is that it would not provide adequate levels of treatment for discharge of the treated effluent to Suez Bay; it would be necessary to transport the primary effluent to the Gulf of Suez via a long and expensive outfall if the environmental impact is to be negligible.

b. PRIMARY - ANAEROBIC LAGOONS

This treatment option was discussed in detail for Ismailia.

c. SECONDARY - TRICKLING FILTERS

This treatment option was discussed in detail for Port Said. This option would satisfy treatment requirements for safe disposal of up to 185,000 m^3/d of wastewater effluent to Suez Bay.

Unlike Port Said and Ismailia, Suez has no experience with trickling filter facilities.

d. SECONDARY - ACTIVATED SLUDGE

This treatment option was discussed in detail for Port Said. As with the trickling filter option, this would permit the discharge of effluent to Suez Bay.

e. SECONDARY - ANAEROBIC LAGOONS AND OXIDATION PONDS

This treatment option was discussed in detail for Port Said.

2. Disposal Options

a. SUEZ BAY

The existing treatment facilities discharge to Suez Bay via a drain.

Pirnie-Harris International has concluded that Suez Bay could handle up to 185,000 m^3/d if secondary level treatment is provided.

Advantages

- Suez Bay is the current disposal point for Suez.

Disadvantages

- Secondary level effluent is required for safe disposal.
- Local officials are adamantly opposed to continued discharges to Suez Bay.

b. GULF OF SUEZ

Pirnie-Harris International has concluded that the Gulf of Suez could safely handle primary effluent.

Advantages

- Primary effluent can be safely discharged to the Gulf of Suez.
- A treatment plant site has already been dedicated to the south of the City of Suez which could be used with this option.

Disadvantages

- The outfall associated with this disposal option has a high construction cost.
- Local officials are adamantly opposed to any proposed discharges to the Gulf of Suez.

c. LAND APPLICATION

Canal Cities Consultants prepared a brief feasibility report in 1981 regarding land application for disposal of the wastewater from Suez. The report was able to identify only one area of land suitable for disposal of wastewater in the quantities estimated to be generated by the city's population in the Year 2000; the potential land application area consists of over 33,000 feddans of land to the north of the city along the west bank of the Sweetwater Canal. The proposed rapid infiltration system would result in an indirect discharge to the Sweetwater Canal.

Advantages

- Potential exists for reclaiming effluent from existing shallow groundwater table and utilizing on new agricultural lands.
- No direct discharge to surface water body, thus health risks to the general public are greatly reduced.

Disadvantages

- The only suitable land available for disposal of any significant quantities of wastewater is to the north of the city, whereas the existing wastewater system is designed to transport the collected wastewaters to the south of the city.

- The proposed disposal site is in close proximity to the Sweetwater Canal and could potentially affect this source of raw water for the city's water treatment plant.
- High salinity of wastewater from existing service areas may significantly hamper any potential agricultural reuse of the treated effluent.
- High cost associated with infiltration basins.
- Extensive monitoring of groundwater and the nearby Sweetwater Canal should be incorporated into program.
- Potential exists for impacts on adjacent properties due to a raising of the existing groundwater table. This would be particularly true if the wastewater is not reclaimed for the irrigation of new agricultural lands.
- An extremely large area of land would be required for a land disposal system. Estimates vary between 2,000 and 4,000 feddans for a system with a design flow of 100,000 m^3/d.
- Hydraulic loading rates for infiltration basins may decrease with time, especially with ineffective operation of treatment facilities.

d. EVAPORATION

The annual net evaporative losses in the Suez area are approximately 2 metres per year. Due to seasonal fluctuations in the evaporative rate, storage facilities would be required. Primary treatment facilities would be desirable to minimize deposition of solids in the disposal beds and to reduce noxious odors.

Advantages

- Potential adverse impacts to the public health are less for this disposal option than any other option.
- Primary treatment would be sufficient to prepare wastewater for discharge to the evaporation basins.

Disadvantages

- An extremely large area of land would be required for this option. For the Year 2000 design flow of 200,000 m^3/d, over 9,000 feddans of land would be required for the surface area of the evaporation basins alone; storage ponds, primary treatment facilities, sludge management facilities, buffer zones, and other requirements would increase the total land requirement to at least 14,000 feddans.
- Alterations in relative humidity and air temperature are likely in the areas adjacent to the evaporation basins.

3. Integrated Schemes

a. ALTERNATIVE S-1

A no action scheme will result in the continued discharge of raw sewage from Zarier Pump Station and primary effluent from the ineffective, existing treatment facilities. The Year 2000 discharge can be expected to have an adverse environmental impact on the Suez Bay.

b. ALTERNATIVE S-2

The major advantages of this scheme are that it fully utilizes the treatment plant site acquired by the government and the assimilative capacity of the Gulf of Suez is more than adequate for primary effluent for many years to come. This scheme requires a major new collector to intercept the discharges from the new Zarb and Zarier Pump Stations and to transport this wastewater to a major new pump station to be constructed south of the city. The new pump station would transport the wastewater to the new southerly treatment plant site.

Essential elements of this scheme are as follows:

Element	Construction Cost
New Primary Treatment Plant (200,000 m^3/d)	$ 28,777,000
Effluent Pump Station	$ 1,989,000
Land Outfall (11 km of 2400 mm)	$ 8,360,000
Marine Outfall to Gulf of Suez (2.8 km of 2400 mm)	$ 8,400,000
Pump Station No. 11 (six 900 l/s pumps)	$ 6,188,000
Force Main (3.3 km of 1200 mm)	$ 3,561,000
SW Main Trunk Sewer (5.5 km of 1800 mm)	$ 3,135,000

The construction cost for this alternative is estimated at $ 60,410,000 and the annual operation and maintenance cost is estimated at $ 1,755,000.

If the cost of providing the backbone for service to the Northerly Main Trunk Sewer area is factored in to create an equivalent service area for the various alternatives, the construction cost is increased to $ 80,622,000.

d. ALTERNATIVE S-3

This scheme is somewhat of a compromise between Alternative S-2 which would transport all wastewater to the south for discharge to the Gulf and Alternative S-4 which would transport all wastewater to the north for discharge to the ground. In this scheme, wastewater from the existing service areas would go primarily to the south for discharge to the Gulf whereas wastewater from the new service areas in

the north would go to a land application system near the service areas. This scheme has the greatest potential for reuse of the treated wastewater in the irrigation of agricultural lands.

Essential elements of this scheme are as follows:

Element	Construction Cost
New Primary Treatment Plant (100,000 m^3/d)	$ 15,938,000
Effluent Pump Station	$ 1,591,000
Land Outfall (11 km of 1800 mm)	$ 6,270,000
Marine Outfall to Gulf of Suez (2.8 km of 1800 mm)	$ 6,720,000
Pump Station No. 11 (four 900 l/s pumps)	$ 4,950,000
Force Main (3.3 km of 1200 mm)	$ 3,561,000
SW Main Trunk Sewer (5.5 km of 1200 mm)	$ 2,062,000
Land Application (100,000 m^3/d)	$ 26,903,000
Influent Pump Station	$ 1,989,000
Northerly Main Trunk Sewer (5.5 km of 2100 mm)	$ 3,658,000
Force Main (2.5 km of 750 mm)	$ 1,708,000
Force Main (2.5 km of 900 mm)	$ 2,050,000

The construction cost for this alternative is estimated at $ 77,400,000 and the annual operation and maintenance cost is estimated at $ 2,406,000.

e. ALTERNATIVE S-4

This alternative would require re-routing of the wastewater collection/transmission system which currently directs the collected sewage to the south of the city. Due to the high salinity levels of the wastewater in many of the existing service areas, the reuse of the treated wastewater for agricultural purposes may be extremely limited.

Essential elements of this scheme are as follows:

Element	Construction Cost
Land Application (200,000 m^3/d)	$ 48,574,000
Influent Pump Station	$ 1,989,000
Northerly Main Trunk Sewer (5.5 km of 2400 mm)	$ 4,180,000
Force Main (2.5 km of 750 mm)	$ 1,708,000
Force Main (2.5 km of 900 mm)	$ 2,050,000
Pump Station No. 11 (four 900 l/s pumps)	$ 4,950,000
Force Main (7 km of 1500 mm)	$ 10,780,000
SW Main Trunk Sewer (5.5 km of 1200 mm)	$ 2,062,000

The construction cost for this alternative is estimated at $ 76,293,000 and the annual operation and maintenance cost is estimated at $ 2,588,000.

f. ALTERNATIVE S-5

The high costs associated with both construction and maintenance of this system as well as the extremely large land area required make it unattractive. It is difficult to predict just what environmental changes would occur in the immediate facility of the evaporation basins.

Essential elements of this scheme are as follows:

Element	Construction Cost
New Evaporation Facility (200,000 m^3/d)	$128,999,000
Pump Station No. 11 (six 900 l/s pumps)	$ 6,188,000
Force Main (3.3 km of 1200 mm)	$ 3,561,000
SW Main Trunk Sewer (5.5 km of 1800 mm)	$ 3,135,000

The construction cost for this alternative is estimated at $ 141,883,000 and the annual operation and maintenance cost is estimated at $ 4,330,000.

If the cost of providing the backbone for service to the Northerly Main Trunk Sewer area is factored in to create an equivalent service area for the various alternatives, the construction cost is increased to $ 162,095,000.

g. CONCLUSION

The cost-effectiveness evaluation indicates that Alternative S-4 is the most appropriate scheme for wastewater treatment and disposal in Suez. In terms of 1987 U.S. dollars, the average cost per user for the capital works project would be $ 459 for the current population; this figure reduces to $ 261 if we use the Year 2000 population (moderate growth). The annual operation and maintenance cost per user would be $ 10.74 for the current population and $ 6.12 for the Year 2000 population.

SUMMARY COST-EFFECTIVENESS EVALUATION OF ALTERNATIVES

Criteria	Multiplier	Alternatives S-1	S-2	S-3	S-4	S-5
Performance Level	1	1x1=1	4x1=4	4x1=4	5x1=5	5x1=5
Complexity of O&M	2	2x2=4	4x2=8	8x2=8	5x2=10	5x2=10
Construction Complexity	1	5x1=5	4x1=4	2x1=2	3x1=3	5x1=10
Sludge Handling Requirements	2	3x2=6	2x2=4	3x2=6	4x2=8	4x2=8
Local Acceptiveness	3	1x3=3	0x3=0	3x3=9	5x3=15	3x3=9
Environmental Impact	2	0x2=0	3x2=6	4x2=8	5x2=10	3x2=6
Land Requirements	2	5x2=10	5x2=10	2x2=4	1x2=2	0x2=0
Reliability	3	0x3=0	4x3=12	4x3=12	5x3=15	5x3=15
Cost (Present Worth)	5	5x5=25	4x5=20	3x5=15	3x5=15	0x5=0
TOTALS		54	63	68	83	63
RANKING		5	3	2	1	3

D. Port Said Raw Water Supply

1. Source Options

As previously noted, the Nile River is the only practical source of water supply for Port Said.

2. Transmission Options

a. PIPELINE

The Suez Canal Authority and the Ministry of Irrigation have both indicated their preference for replacing the existing canal with a dual pipeline system. Preliminary indications are that a dual pipeline between 1200 mm and 1500 mm diameter would be the most appropriate size for a design flow of 370,000 m^3/d.

Advantages

- The preferred alternative of the GOE.
- Does not restrict the widening of the Qantara-Port Said road.
- Leakage and other losses are minimal.
- Construction could be staged to provide a first stage system of 275,000 m^3/d to meet anticipated Year 2000 requirements.

Disadvantages

- Highest capital cost.
- Highest annual operation and maintenance costs.
- Future expandability is limited.

b. OPEN CHANNELS

Water is currently supplied to Port Said via an open channel from the Nile River at Cairo. The final 46 km section of the canal is deemed inadequate to meet Port Said's current maximum day water demand.

The Master Plan attributes transmission problems with the existing canal to the following:

- Aquatic plant growth;
- Canal section irregularities;
- Structural constrictions such as bridges;
- Diversion of water for uses other than the dedicated use;
- Seepage (estimated at 25% of channel flow).

Advantages

- An open channel is the current source of supply.
- The existing canal could be improved to meet future needs to the Year 2000 and beyond at the lowest capital cost and the lowest annual operation and maintenance cost.
- Operation and maintenance requirements for a lined canal would be minimal.
- Carrying capacity of a lined canal could be greatly increased in the future by the addition of a series of low lift pump stations.

Disadvantages

- Restricts the widening of the existing Qantara-Port Said road.
- Some evaporative losses will occur in the open channel.
- Lining of the channel is required to reduce seepage losses and stabilize banks.
- Unauthorized draw-offs of water could be difficult to monitor.
- Construction cannot be effectively staged below a design capacity of 370,000 m^3/d.

3. Integrated Schemes

For the purposes of assessing the costs of the various alternatives, a design flow of 370,000 m^3/d was used as this represents the potential carrying capacity of the existing canal assuming lining and minor rehabilitation.

a. ALTERNATIVE W-1

The existing open channel is inadequate to meet current maximum day demands in Port Said. A no action alternative will require a major water conservation program in the city and will result in severe restrictions on future growth.

b. ALTERNATIVE W-2

This scheme calls for the abandonment of the existing canal and replacement of same with a booster station and dual transmission lines.

Essential elements of this scheme are as follows:

Element	Construction Cost
Booster Station (370,000 m^3/d)	$ 8,500,000
Raw Water Transmission Main (48 km of dual 1500 mm)	$ 51,702,000

The construction cost for this alternative is estimated at $ 59,702,000 and the annual operation and maintenance cost is estimated at $ 894,000. Pipe costs are based on the use of local prestressed concrete cylinder pipe; the use of U.S. ductile iron pipe would substantially increase the cost of this scheme.

c. ALTERNATIVE W-3

This scheme is similar to W-2 above except that the line size is reduced and a second booster station is required.

Essential elements of this scheme are as follows:

Element	Construction Cost
Two Booster Stations (each 370,000 m^3/d)	$ 16,000,000
Raw Water Transmission Main (48 km of dual 1200 mm)	$ 35,797,000

The construction cost for this alternative is estimated at $ 51,797,000 and the annual operation and maintenance cost is estimated at $ 2,391,000.

d. ALTERNATIVE W-4

In this scheme, four low lift pump stations would be installed in the existing canal to increase the flow.

Essential elements of this scheme are as follows:

Element	Construction Cost
Four Low Lift Stations (each 370,000 m^3/d)	$ 19,446,000
Minor Excavation & Rehabilitation	$ 595,000

The construction cost for this alternative is estimated at $ 20,041,000 and the annual operation and maintenance cost is estimated at $ 1,004,000.

e. ALTERNATIVE W-5

In this scheme, a single low lift pump station would be used to increase the flow within the existing canal. Concrete retaining walls would be required to prevent the canal water from overflowing the banks in many locations.

Essential elements of this scheme are as follows:

Element	Construction Cost
Low Lift Station ($370,000\ m^3/d$)	$ 5,835,000
Concrete Retaining Walls	$ 23,235,000
Minor Excavation & Rehabilitation	$ 595,000

The construction cost for this alternative is estimated at $ 29,665,000 and the annual operation and maintenance cost is estimated at $ 400,000.

f. ALTERNATIVE W-6

This scheme makes the maximum use of the existing canal and has the lowest operation and maintenance requirements.

Essential elements of this scheme are as follows:

Element	Construction Cost
Lining of Canal ($600,000\ m^2$)	$ 29,136,000
Excavation & Rehabilitation	$ 2,976,000

The construction cost for this alternative is estimated at $ 32,112,000 and the annual operation and maintenance cost is estimated at $ 57,000.

g. CONCLUSION

The cost-effectiveness evaluation indicates that Alternative W-6 is the most appropriate scheme for providing Port Said with an adequate supply of raw water. In terms of 1987 U.S. dollars, the average cost per user for the capital works project would be $ 99 for the current population; this figure reduces to $ 60 if we use the Year 2000 population (moderate growth). The annual operation and maintenance cost per user would be $ 0.17 for the current population and $ 0.10 for the Year 2000 population.

SUMMARY COST-EFFECTIVENESS EVALUATION OF ALTERNATIVES

Criteria	Multiplier	Alternatives W-1	W-2	W-3	W-4	W-5	W-6
Performance Level	4	1x4=4	4x4=16	4x4=16	3x4=12	4x4=16	4x4=16
Complexity of O&M	2	4x2=8	3x2=6	2x2=4	3x2=6	3x2=6	5x2=10
Construction Complexity	1	5x1=5	3x1=3	2x1=2	2x1=2	2x1=2	5x1=5
Local Acceptiveness	4	0x4=0	5x4=20	5x4=20	2x4=8	2x4=8	3x4=12
Environmental Impact	2	3x2=6	3x2=6	3x2=6	4x2=8	4x2=8	5x2=10
Land Requirements	2	5x2=10	3x2=6	3x2=6	4x2=8	4x2=8	5x2=10
Reliability	3	3x3=9	3x3=9	3x3=9	4x3=12	4x3=12	5x3=15
Cost (Present Worth)	4	5x4=20	1x4=4	0x4=0	4x4=16	3x4=12	4x4=16
TOTALS		62	70	63	72	72	94
RANKING		6	4	5	2	2	1

IV. NEEDS AND PROPOSED ACTIONS

A. Port Said Wastewater System

The existing Port Said wastewater treatment facilities are not operated properly. Available personnel are years away from being able to develop the necessary skills to properly operate and maintain such facilities. Therefore, it is extremely important that, to the extent possible, "appropriate technology" be used for all new facilities. Sophisticated equipment such as motorized valves and computer-operated controls should be avoided. Complex processes such as activated sludge processes should not be used. Systems should be simple, durable, and highly reliable. Emphasis should be placed upon a realistically consistent reliability rather than a theoretical capability.

In regard to the wastewater treatment facilities for Port Said, it is suggested that screening facilities, grit chambers, conventional primary settling tanks, and chlorination facilities would provide an appropriate level of treatment considering the level of skills realistically obtainable in the near future and the large assimilative capacity of Lake Manzala. Of course, it must be recognized that primary treatment will not meet the requirements of Law 48 in regard to the quality of the plant effluent. The provision of sludge thickeners and adequate sand drying beds are necessary to ensure that sludge is frequently removed from the settling tanks. It should be realized that the provision of sludge handling facilities will require additional skills for their proper operation. Chlorination facilities are proposed even though the original Master Plan concluded that they are not necessary to protect the water quality of the lake; the reasoning behind this is that they will serve as a safety precaution in the event that the primary facilities are not operated at a satisfactory level.

The proposed 150,000 m^3/d capacity of the wastewater treatment plant should adequately serve the needs of the city to at least the Year 2000 without expansion, and may likely serve the city to the Year 2010 or beyond if the rate of population growth tapers off or the GOE is unable to provide sufficient funds for expansion of the collection system.

Essential facilities related to the proposed treatment plant at the new site reclaimed from Lake Manzala are a new pump station at the existing plant site and approximately 3.8 kilometres of force main to transport the raw sewage from the existing plant site to the new site. A 1.5 kilometre outfall with diffuser into Lake Manzala is also an essential element of the plan.

NOPWASD has reportedly reclaimed approximately 21 hectares (about 52 feddans) of land in Lake Manzala for the proposed wastewater treatment plant site. Our assessment indicates that this site has sufficient area for the proposed primary treatment plant including the sludge handling facilities.

It should be realized that the construction of a treatment plant of this size on reclaimed land in the middle of a lake may result in

significant construction problems due to groundwater and soil conditions. Accordingly, it is recommended that extensive soils investigation survey be completed prior to contracting for any major design or construction work.

It is suggested that 2 to 3 years of operation and maintenance assistance be provided in order to ensure that the personnel of the wastewater department have sufficient time to adequately develop the skills necessary for satisfactory operation and maintenance of the AID-financed facilities. On-the-job training would be an integral element of the operation and maintenance assistance program. A series of graphic standard procedures would be developed for all major operation and maintenance tasks; these standard procedures would be supplemented with professional quality video tapes demonstrating the performance of key tasks. Operation and maintenance manuals would be prepared for each major physical plant; these manuals would include detailed descriptions of the operation of each major system as well as troubleshooting guides and manufacturers' submittals for major equipment systems.

An appropriate administration building with offices, laboratory, and classrooms would be an integral part of the treatment facilities. Such a building would help to focus work efforts at the treatment plant site itself and would encourage greater day-to-day involvement in plant facilities by managerial personnel.

It is recommended that a substantial inventory of spare parts and expendables be provided in a new warehouse to be constructed at the wastewater treatment plant site. This is in recognition that the city does not have access to the foreign exchange necessary for the procurement of many items. The proposed on-site warehouse would be a subsidiary store to the governorate's main warehouse, and would ensure ready and efficient access to those items needed in the day-to-day operation and maintenance of the wastewater system. An inventory control system would integrate into the governorate's main system of inventory control as well as the preventative maintenance system for the wastewater facilities; both a card system and a personal computer based system are envisioned.

Workshop facilities capable of first echelon maintenance should be located at the wastewater treatment plant site to serve the needs of the Wastewater Department; it is not envisioned that these facilities would replace central shop facilities at the governorate level, but would complement same.

In order to promote the efficient utilization of limited water and wastewater facilities, a flow conservation program should be initiated in Port Said. This program would include a public education component promoting the wise use of water. Surveys would be conducted to identify unusually large quantities of wastewater entering the public sewer system.

B. Ismailia Wastewater System

As is the case in Port Said, the existing Ismailia wastewater treatment facilities are not operated properly. Available personnel are

years away from being able to develop the necessary skills to properly operate and maintain such facilities.

In regard to the wastewater treatment facilities for Ismailia, it is suggested that screening facilities and anaerobic lagoons would provide an appropriate level of treatment considering the level of skills realistically obtainable in the near future and the proposed use of a land application system. The land application system would consist of a number of rapid infiltration beds for discharging the wastewater to the existing groundwater table. Several years of sludge storage could be accomplished within the anaerobic lagoons; a multiple cell lagoon system would permit taking one lagoon out of service for de-sludging. Partially dewatered sludge would be landfilled on the treatment plant site; landfill area for 20 years accummulation of sludge would be provided. An alternate concept would be to use conventional primary clarifiers in lieu of anaerobic lagoons; such an alternative would require the use of somewhat more sophisticated sludge handling facilities.

The proposed 90,000 m^3/d capacity of the wastewater treatment plant should adequately serve the needs of the city to at least the Year 2000 without expansion, and may likely serve the city to the Year 2010 or beyond if the rate of population growth tapers off or the GOE is unable to provide sufficient funds for expansion of the collection system.

Essential facilities related to the proposed treatment plant at the new site are approximately 7 kilometres of dual force main to re-route the discharge from the Abu Atwa Pump Station from the existing treatment plant site to the new site. The original design of the pump station took this proposed re-routing into consideration when the pump units were selected.

There are indications that the 333 feddans of land previously acquired for the proposed treatment facilities are unacceptable for the proposed land application system. Therefore, it is imperative that additional land be acquired. The location and nature of the land to be acquired should be consistent with previous engineering reports on the proposed land application system.

The treatment facilities as proposed do not include an extensive well system for reclaiming the treated effluent from the existing groundwater table and delivering same to new agricultural lands; however, it is strongly recommended that a system of monitoring wells be installed in a "green" area surrounding the new treatment plant site and that these wells be used for monitoring groundwater quality, groundwater levels, and irrigating the landscaping on the plant site.

Due to the limited experience with wastewater disposal facilities of this type, the project should include an extensive monitoring program by an outside consultant for a period of at least 3 years. This monitoring program would include the use of a substantial number of monitoring wells beyond those previously mentioned in the "green" area. Particular emphasis would be place upon monitoring the effect of the proposed discharge on groundwater levels and the travel rates and routes

of the treated effluent. This program would be of special importance if agricultural reuse of the effluent fails to occur.

Ismailia should be required to present a plan for the proposed reuse of the treated effluent. It is suggested that the plan include provisions for metering the flows withdrawn from the groundwater by agricultural users in the vicinity of the treatment plant site.

Due to the potential reuse of the treated effluent, it is suggested that a survey of industrial users be performed and that a program be established for monitoring the characteristics of industrial waste entering the public sewer system. Consideration should also be given to establishing pre-treatment standards for industrial discharges to the public sewer system.

It is suggested that 2 to 3 years of operation and maintenance assistance be provided in order to ensure that the personnel of the wastewater department have sufficient time to adequately develop the skills necessary for satisfactory operation and maintenance of the AID-financed facilities. The 2-year period should be sufficient for an anaerobic lagoon system; however, if a conventional primary settling tank system is selected, it is suggested that the period of O&M assistance be approximately 3 years. Standard procedures, video tapes, manuals, equipment mock-ups, and other operational and training aids would be developed as previously presented for Port Said.

An appropriate administration building would be included as part of the proposed treatment plant.

As was previously recommended for Port Said, a substantial inventory of spare parts and expendables should be provided in a new warehouse to be constructed at the wastewater treatment plant site. An inventory control system would integrate into the governorate's main system of inventory control as well as the preventative maintenance system for the wastewater facilities; both a card system and a personal computer based system are envisioned.

Workshop facilities capable of first echelon maintenance should be located at the wastewater treatment plant site to serve the needs of the Wastewater Department; it is not envisioned that these facilities would replace central shop facilities at the governorate level, but would complement same.

In order to promote the efficient utilization of limited water and wastewater facilities, a flow conservation program should be initiated in Suez. This program would include a public education component promoting the wise use of water. Surveys would be conducted to identify unusually large quantities of wastewater entering the public sewer system.

C. Suez Wastewater System

As is the case in Port Said and Ismailia, the existing wastewater treatment facilities are not operated properly. Available personnel are

years away from being able to develop the necessary skills to properly operate and maintain such facilities.

The wastewater treatment facilities and disposal system proposed for Suez are identical to those previously presented for Ismailia. Screening facilities, anaerobic lagoons, and rapid infiltration beds would compose the main elements of the treatment plant.

The proposed 200,000 m^3/d capacity of the wastewater treatment plant should adequately serve the needs of the city to at least the Year 2000 without expansion, and may likely serve the city to the Year 2010 or beyond if the rate of population growth tapers off or the GOE is unable to provide sufficient funds for expansion of the collection system.

Essential facilities related to the proposed treatment plant at the new site are a screw type influent pump station at the head of the treatment plant, approximately 5.5 kilometres of Northerly Trunk Sewer from the treatment plant site towards the outskirts of the city center, and approximately 5 kilometres of force main to re-route the discharge from two existing major pump stations. In addition, if satisfactory service is to be provided to that region to the south of the city, it is recommended that a new Southwest Trunk Sewer about 5.5 kilometres long be constructed from the vicinity of the existing treatment plant towards the industrial area to the south; a new major pump station would be located at the downstream end of the collector to receive the wastewater from the collector and transport this wastewater to the new Northerly Trunk Sewer via approximately 7 kilometres of force main.

The land reportedly reserved for a wastewater treatment plant site is to the south of the city and would not be acceptable for the proposed land disposal alternative. The city should take immediate steps to acquire a suitable site in to the northwest of the city.

As is the case for Ismailia, the treatment facilities as proposed do not include an extensive well system for reclaiming the treated effluent from the existing groundwater table and delivering same to new agricultural lands; however, it is strongly recommended that a system of monitoring wells be installed in a "green" area surrounding the new treatment plant site and that these wells be used for monitoring groundwater quality, groundwater levels, and irrigating the landscaping on the plant site.

The recommendations made for Ismailia regarding monitoring wells, a "green" area, a plan for proposed reuse of the treated effluent, a survey of industrial users, monitoring of industrial waste, an operation and maintenance assistance element to the construction contract, an administration building, an inventory control system, a warehouse at the treatment plant site, a first echelon workshop at the plant site, and a flow conservation program would all be valid for Suez.

It is extremely important to note that, due to the high salinities encountered in the raw sewage flows of Suez, the re-use of the treated wastewater effluent for agricultural purposes may be severely

restricted if not impossible.

Due to the salinity problems that have been attributed to sewer line infiltration, it is recommended that sewer infiltration studies be conducted in Suez to be followed by a program of sewer rehabilitation. An extensive salinity survey should be conducted of the sewer system, the Sweetwater Canal, the existing groundwater, and the potable water supply to complement the sewer infiltration studies.

D. Port Said Water System

In regard to the proposed raw water supply for Port Said, it is recommended that the existing Sweetwater Canal from Qantara to El Raswa be dressed up and lined with concrete.

The 1978 Master Plan indicated that the existing canal could be improved to provide a carrying capacity of approximately 370,000 m^3/d; this would be adequate to meet the maximum day demand of Port Said until the Year 2013 if growth is moderate.

Operation and maintenance requirements for the proposed facilities are extremely limited.

No additional land requirements are anticipated for the canal system. However, it is suggested that the Suez Canal Authority may wish to consider the acquisition of land in the vicinity of the El Raswa Water Treatment Plant to serve as a site for a raw water reservoir with a volume of about 1,000,000 m^3. Such a reservoir would provide several days of emergency water supply in the event of problems encountered with the raw water transmission system.

E. Institutional Development

The long-term viability of the physical facilities to be constructed is not likely without parallel improvements in the institutional capacities of the operating agencies. The main focus of the institutional support effort will be at the staff level of the physical plants themselves; however, a number of complementary activities are recommended at the managerial level of the wastewater departments.

Project elements related to the immediate requirements of the proposed physical facilities were previously discussed for each of the four major construction activities. Though it would be beyond the scope of this project to institute a complete overhaul of the existing institutions, a number of areas have been identified for improvement which would substantially contribute to the overall effectiveness of the wastewater departments and the SCA. Illustrative of those types of project activities that would contribute to fulfilling the long-term goal of effective, self-sufficient organizations are upgrading of the personnel systems, installation of data management systems within each organization, development of an improved cost accounting system in each governorate as well as SCA, establishment of a water leak detection program, and development of a public relations program. In addition, it is proposed

that a training capacity be developed within SCA to supply skilled personnel for the water and wastewater facilities in the Canal Zone.

V. RECOMMENDED IMPLEMENTATION PLAN

A. General

Due to the fact that each of the four major construction projects involve rather basic design concepts and construction techniques, it is suggested that this project lends itself to the use of a design/build contracting mode. In recognization of the large size of each of the four systems, it is further suggested that four different design/build contracts be used; however, it would be feasible to use a single firm for the construction monitoring. Preliminary engineering and preparation of design/build contract documents could either be done as part of the construction monitoring contract or possibly as an amendment to the existing engineering contract of the Phase I project.

The total cost of the recommended implementation plan in terms of 1987 prices is estimated at $ 284,473,000 and LE 196,190,000.

B. Port Said Wastewater System

The following table is illustrative of those project elements required for the Port Said Wastewater System and indicates under which contract each element will fall:

Task No.	Element	1987 $ Component		1987 LE Component	
Design/Build Contract					
1	150,000 m^3/d Primary Treatment Plant	$	19,922,000	LE	13,946,000
2	Outfall to Lake Manzala (1.5 km of 2000 mm)	$	3,510,000	LE	2,457,000
3	Mazrah Pump Station (four 900 l/s pumps)	$	4,455,000	LE	3,118,000
4	Force Main (3.8 km of 1500 mm)	$	5,267,000	LE	3,686,000
5	Spare Parts Allowance	$	663,000	LE	232,000
6	Administration Building	$	315,000	LE	220,000
7	Warehouse	$	722,000	LE	504,000
8	Maintenance Shop	$	1,890,000	LE	1,323,000
9	Tools & Equipment	$	995,000	LE	348,000

10	O&M Manuals, Standard Procedures, Video Tapes, & Mock-ups	$	750,000	LE	525,000
11	O&M Assistance	$	1,584,000	LE	1,109,000
12	Inventory Control Program	$	446,000	LE	312,000
13	Flow Conservation Program	$	396,000	LE	277,000
14	Design Engineering	$	2,175,000	LE	1,523,000
15	Quality Control Program	$	3,217,000	LE	2,252,000
Construction Monitor Contract					
16	Monitoring of Design/ Build Contract	$	1,485,000	LE	1,040,000
17	Claims Assistance	$	132,000	LE	92,000
Preliminary Engineering & Development of Contract Documents Contract					
18	Environmental Assessment	$	66,000	LE	46,000
19	Soils Investigations	$	157,000	LE	110,000
20	Surveying	$	15,000	LE	30,000
21	Preparation of IFB for Design/Build	$	450,000	LE	315,000
Sub-Total		$	48,612,000	LE	33,465,000
Contingencies @ 15%		$	7,292,000	LE	5,020,000
BUDGET TOTAL FOR PORT SAID		$	55,904,000	LE	38,485,000

C. Ismailia Wastewater System

The following table is illustrative of those project elements required for the Ismailia Wastewater System and indicates under which contract each element will fall:

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Task No.	Element	1987 $ Component		1987 LE Component	
Design/Build Contract					
1	90,000 m^3/d Land Application System	$	33,629,000	LE	23,539,000
2	Force Main (14.2 km of 1200 mm)	$	13,790,000	LE	9,652,000
3	Spare Parts Allowance	$	1,264,000	LE	332,000
4	Administration Building	$	315,000	LE	220,000
5	Warehouse	$	722,000	LE	504,000
6	Maintenance Shop	$	1,890,000	LE	1,323,000
7	Tools & Equipment	$	1,195,000	LE	418,000
8	O&M Manuals, Standard Procedures, Video Tapes, & Mock-ups	$	750,000	LE	525,000
9	O&M Assistance	$	2,376,000	LE	1,663,000
10	Inventory Control Program	$	446,000	LE	312,000
11	Flow Conservation Program	$	198,000	LE	138,000
12	Groundwater Monitoring Program	$	891,000	LE	624,000
13	Industrial Users Survey	$	99,000	LE	69,000
14	Industrial Waste Monitoring	$	224,000	LE	157,000
15	Design Engineering	$	2,573,000	LE	1,801,000
16	Quality Control Program	$	3,217,000	LE	2,252,000
Construction Monitor Contract					
17	Monitoring of Design/ Build Contract	$	1,485,000	LE	1,040,000

18	Claims Assistance	$	132,000	LE	92,000

Preliminary Engineering & Development of Contract Documents Contract

19	Environmental Assessment	$	99,000	LE	69,000
20	Soils Investigations	$	260,000	LE	182,000
21	Surveying	$	15,000	LE	35,000
22	Preparation of IFB for Design/Build	$	450,000	LE	315,000
Sub-Total		$	66,020,000	LE	45,262,000
Contingencies @ 15%		$	9,903,000	LE	6,789,000
BUDGET TOTAL FOR ISMAILIA		$	75,923,000	LE	52,051,000

D. Suez Wastewater System

The following table is illustrative of those project elements required for the Suez Wastewater System and indicates under which contract each element will fall:

Task No.	Element	1987 $ Component		1987 LE Component	
Design/Build Contract					
1	200,000 m^3/d Land Application System	$	33,629,000	LE	23,539,000
2	Influent Pump Station (five 1400 l/s screw pumps)	$	1,790,000	LE	1,254,000
3	Northerly Main Trunk Sewer (5.5 km of 2400 mm PCCP)	$	3,762,000	LE	2,633,000
4	Force Main (2.5 km of 750 mm)	$	1,538,000	LE	1,075,000
5	Force Main (2.5 km of 900 mm)	$	1,845,000	LE	1,292,000
6	Pump Station No. 11 (four 900 l/s pumps)	$	4,455,000	LE	3,119,000

7	Force Main (7 km of 1500 mm)	$	9,702,000	LE	6,791,000
8	Southwest Main Trunk Sewer (5.5 km of 1200 mm PCCP)	$	1,856,000	LE	1,298,000
9	Spare Parts Allowance	$	1,562,000	LE	410,000
10	Administration Building	$	315,000	LE	220,000
11	Warehouse	$	722,000	LE	504,000
12	Maintenance Shop	$	1,890,000	LE	1,323,000
13	Tools & Equipment	$	1,500,000	LE	525,000
14	O&M Manuals, Standard Procedures, Video Tapes, & Mock-ups	$	850,000	LE	595,000
15	O&M Assistance	$	2,970,000	LE	2,079,000
16	Inventory Control Program	$	446,000	LE	312,000
17	Flow Conservation Program	$	396,000	LE	277,000
18	Groundwater Monitoring Program	$	891,000	LE	624,000
19	Industrial Users Survey	$	198,000	LE	276,000
20	Industrial Waste Monitoring	$	448,000	LE	314,000
21	Sewer Infiltration Survey	$	500,000	LE	350,000
22	Sewer Rehabilitation	$	5,000,000	LE	3,500,000
23	Salinity Survey	$	99,000	LE	69,000
24	Design Engineering	$	3,955,000	LE	2,769,000
25	Quality Control Program	$	3,564,000	LE	2,495,000

Construction Monitor Contract

26	Monitoring of Design/ Build Contract	$	1,782,000	LE	1,247,000
27	Claims Assistance	$	198,000	LE	138,000

Preliminary Engineering & Development of Contract Documents Contract

28	Environmental Assessment	$	99,000	LE	69,000
29	Soils Investigations	$	300,000	LE	210,000
30	Surveying	$	20,000	LE	70,000
31	Pilot Plant Study of Land Application	$	446,000	LE	312,000
32	Preparation of IFB for Design/Build	$	500,000	LE	350,000
Sub-Total		$	87,228,000	LE	60,039,000
Contingencies @ 15%		$	13,084,000	LE	9,006,000
BUDGET TOTAL FOR SUEZ		$	100,312,000	LE	69,045,000

E. Port Said Raw Water Supply

The following table is illustrative of those project elements required for the Port Said Raw Water Supply and indicates under which contract each element will fall:

Task No.	Element	1987 $ Component		1987 LE Component	
Design/Build Contract					
1	Excavation & Rehabilation of Existing Canal	$	2,232,000	LE	1,562,000
2	Concrete Lining of Existing Canal (600,000 m^2)	$	21,852,000	LE	15,296,000
3	Lined Reservoir (1,000,000 m^3)	$	9,712,000	LE	6,798,000
4	Tools & Equipment	$	300,000	LE	210,000
5	Design Engineering	$	2,478,000	LE	1,735,000

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6	Quality Control Program	$	743,000	LE	520,000

Construction Monitor Contract

7	Monitoring of Design/ Build Contract	$	1,188,000	LE	832,000
8	Claims Assistance	$	66,000	LE	46,000

Preliminary Engineering & Development of Contract Documents Contract

9	Environmental Assessment	$	33,000	LE	23,000
10	Soils Investigations	$	300,000	LE	210,000
11	Feasibility Study	$	100,000	LE	70,000
12	Surveying	$	20,000	LE	60,000
13	Preparation of IFB for Design/Build	$	150,000	LE	105,000
Sub-Total		$	39,174,000	LE	27,467,000
Contingencies @ 15%		$	5,876,000	LE	4,120,000
BUDGET TOTAL FOR RAW WATER		$	45,050,000	LE	31,587,000

F. Institutional Support

The following table is illustrative of those project elements suggested for inclusion in a special institutional support contract:

Task No.	Element		1987 $ Component		1987 LE Component
Institutional Support Contract					
1	Needs Assessment for Personnel System	$	75,000	LE	52,000
2	Program for Upgrading Personnel System	$	792,000	LE	554,000
3	Data Management Systems	$	1,268,000	LE	888,000
4	Cost Accounting Systems	$	1,253,000	LE	877,000

5	Water Leak Detection Program	$	546,000	LE	381,000
6	Public Relations Program	$	464,000	LE	325,000
7	Equipment for SCA Mini Training Center	$	250,000	LE	175,000
8	Establish SCA Capacity to Develop Training Materials	$	694,000	LE	486,000
9	Training of Trainers Program	$	892,000	LE	624,000
10	Study Tours in U.S.	$	100,000	LE	5,000
Sub-Total		$	6,334,000	LE	4,367,000
Contingencies @ 15%		$	950,000	LE	655,000
BUDGET TOTAL FOR INSTITUTIONAL		$	7,284,000	LE	5,022,000

G. Special Notes

If the implementation of the project is to progress smoothly, there are a number of items that should be given special attention.

It is recommended that Environmental Assessments be initiated for each of the four major construction activities at the earliest possible moment; no IFBs for construction activities can be released until after the Environmental Assessments have been reviewed and cleared.

It is strongly suggested that no preliminary engineering work be performed in either Ismailia or Suez until after the acquisition of suitable treatment plant sites and rights-of-way. It is extremely important that the plant sites acquired be suitable for the proposed land disposal system and include adequate buffer zones. In the case of Suez, any significant relocation of the treatment plant site from what was conceived in the Master Plan and used in this analysis could drastically alter the feasibility of the land disposal alternative.

A pilot study of a rapid infiltration disposal system in Suez should be initiated at the earliest possible moment. The results of this study should be incorporated into the IFB prepared for the Suez Wastewater Treatment Facilities.

In the preparation of the IFB for Suez, special attention should be given to the re-routing of the Zarier and Zarb Pump Stations. Though force main lengths will be equivalent to current conditions, it may well

be that the pump stations will require modifications due to a change in static head conditions.

A feasibility study is recommended for the proposed lining of the Sweetwater Canal to confirm that the carrying capacity would be increased to approximately 370,000 m^3/d. The study should also address alternative construction techniques for lining the canal while maintaining current flow levels.

It is extremely important that the special institutional support contract coordinate training efforts and other institutional building activities under the various design/build contracts. This will ensure that consistent quality is maintained throughout the Canal Zone and will also ensure that these activities mesh with the data management systems, cost accounting systems, and other activities aimed at long-term needs.

VI. SUMMARY

A. Identified Needs

The major wastewater facilities (pump stations, force mains, and interceptors) financed by the original project are designed to handle flows of their projected service areas up to the Year 2000. These new major facilities plus the laterals constructed under the original project will substantially increase the quantities of wastewater flows to the existing treatment facilities. Since these existing facilities provide virtually no treatment, significantly larger quantities of raw wastewater will be discharged to the surface waters that are used for fishing, boating, and swimming.

The current maximum day water demand for Port Said is estimated to be in excess of 130,000 m^3/d. It is projected that the maximum day demand will increase to 276,000 m^3/d by the Year 2000 with an average daily demand of 221,000 m^3/d. AID-financed improvements to the city's water treatment plants have increased their capacity to 220,000 m^3/d; however, the source of supply, the Port Said Sweetwater Canal, can only deliver between 90,000 m^3/d and 125,000 m^3/d.

B. Basis of Technical Evaluation

Master Plans were previously prepared for each of the three canal cities in the summer of 1979. These Master Plans were followed by Design Reports No. 1 in 1981 and Design Reports No. 2 in 1982 for the wastewater facilities. In addition, there were a number of updates and amendments to same as well as various supplemental reports. These various studies examined a number of alternatives for serving each of the three cities. The major alternatives which remainded after extensive screening exercises were reviewed and updated as a part of the technical evaluation prepared for the Canal Cities Water and Wastewater Project -- Phase II. Where appropriate, the Mission has included additional alternatives that developed as part of the joint GOE/Mission project design process.

As part of the Mission technical review, sizing of facilities was revised to reflect preliminary information obtained from the 1986 census. Per capita flows were revised as appropriate based upon the limited data available in the three cities. Percentage of population served was also reviewed and modified as appropriate. This technical review has resulted in proposed facilities which will be approximately 2/3 the size of those facilities recommended in the Master Plans for the Year 2000 population in each city. The sizing will remain somewhat conservative as it is based upon a continued high rate of growth in each of the cities; however, we believe that there is a strong likelihood that growth will moderate during the coming years.

Cost estimates were reviewed and updated. For the purposes of evaluating alternatives, costs were presented in terms of 1987 U.S. dollars. Original costs were escalated using appropriate cost indices for dollar and pound components. A number of these escalated costs were then compared to new cost estimates prepared in-house, and adjusted as appropriate.

C. Evaluation of Technical Alternatives

1. Port Said Wastewater

Four potential areas for disposal of wastewater effluent in Port Said were identified. These were land disposal by irrigation, discharge to the Mediterranean Sea, discharge to the Suez Canal, and discharge to Lake Manzala. Land disposal was rejected because of inadequate suitable land near Port Said and the high levels of dissolved solids in the wastewater which would require fresh water dilution. The Advisory Committee on Reconstruction rejected the concept of an outfall to the Mediterranean Sea due to the potential harm to bathing beaches. Detailed studies of the assimilative capacities of the Suez Canal and Lake Manzala performed by Hazen and Sawyer indicate that the shallow water of Lake Manzala could serve the entire city through the Year 2000, whereas the Suez Canal could safely serve only a small portion of the city.

The following major alternatives were evaluated:

P-1 NO ACTION;
P-2 NEW PRIMARY TREATMENT PLANT WITH DISCHARGE TO THE MEDITERRANEAN SEA;
P-3 NEW PRIMARY TREATMENT PLANT WITH DISCHARGE TO LAKE MANZALA;
P-4 NEW SECONDARY TREATMENT PLANT WITH DISCHARGE TO LAKE MANZALA;
P-5 ANAEROBIC LAGOONS AND OXIDATION PONDS TO BE BUILT IN LAKE MANZALA;
P-6 CONVERSION OF EXISTING PLANT TO PRIMARY PLANT AS WELL AS THE CONSTRUCTION OF A NEW PRIMARY PLANT WITH DISCHARGE FROM BOTH PLANTS TO LAKE MANZALA.

A cost-effectiveness analysis indicates that Alternative P-3 is the most appropriate alternative for Port Said. The main advantages of this alternative were that it has the lowest present worth other than no action, the proposed facilities have a high degree of reliability, minimal operation and maintenance skills are required, land requirements are reasonable, and the environmental impact upon the lake is minimal.

The major disadvantage of Alternative P-3 is that the requirements of Law 48 will not be met in regard to the quality of the plant effluent; however, there is no technical justification for the provision of secondary level treatment as the lake has sufficient assimilative capacity to handle primary effluent for the projected Year 2000 service area.

2. Ismailia Wastewater

Four potential areas for disposal of wastewater effluent in Ismailia were identified. These were land disposal by irrigation, discharge to the Suez Canal, discharge to Lake Timsah, and discharge to El Mahsama Drain. Detailed studies of the assimilative capacities of the Suez Canal, Lake Timsah, and El Mahsama Drain performed by Metcalf & Eddy indicate that all three surface water bodies under consideration could safely assimilate the entire wastewater flow from the city through the Year 2000 if secondary treatment is provided. Primary treatment was not judged to be suitable for use before discharge to any of the surface water bodies due to the adverse affect of such discharge on Lake Timsah. The Suez Canal Authority has indicated its opposition to any discharge to the canal system.

The following major alternatives were evaluated:

I-1 NO ACTION;
I-2 REHABILITATION OF EXISTING PLANT TO SECONDARY PLANT WITH DISCHARGE TO EL MAHSAMA DRAIN AND CONSTRUCTION OF NEW LAND APPLICATION SYSTEM FOR REMAINDER OF FLOW;
I-3 REHABILITATION AND EXPANSION OF EXISTING PLANT TO SECONDARY PLANT WITH DISCHARGE TO EL MAHSAMA DRAIN;
I-4 REHABILITATION AND EXPANSION OF EXISTING PLANT TO PRIMARY PLANT WITH DISCHARGE TO A NEW LAND APPLICATION SYSTEM;
I-5 NEW LAND DISPOSAL SYSTEM.

A cost-effectiveness analysis indicates that Alternative I-5 is the most appropriate alternative for Ismailia. The main advantages of this alternative were that it would have virtually no impact on surface water bodies, reliability is extremely high, construction is relatively simple, potential exists for re-use of treated wastewater on agricultural lands, public acceptance is high, and operation and maintenance requirements are relatively simple.

The major disadvantages of this alternative are that it has the highest present worth and the large area of land required.

3. Suez Wastewater

Six potential areas for disposal of wastewater effluent in Suez were identified. These were land disposal by irrigation, discharge to the Suez Canal, discharge to Suez Creek, discharge to Suez Bay, discharge to the Gulf of Suez, and discharge to the air via evaporation. Detailed studies of the assimilative capacities of the Suez Canal, Suez Creek, Suez Bay, and the Gulf of Suez performed by Pirnie-Harris indicate that only the Gulf of Suez could safely assimilate the entire wastewater flow from the city through the Year 2000 with primary treatment. The Suez Bay could assimilate up to 185,000 m^3/d with secondary treatment. Discharges to the Suez Canal or Suez Creek would require sophisticated treatment facilities.

The following major alternatives were evaluated:

S-1 NO ACTION;
S-2 NEW PRIMARY PLANT IN SOUTH WITH DISCHARGE TO GULF OF SUEZ;
S-3 NEW PRIMARY PLANT IN SOUTH WITH DISCHARGE TO GULF OF SUEZ AND NEW LAND APPLICATION SYSTEM IN NORTH;
S-4 NEW LAND APPLICATION SYSTEM IN NORTH;
S-5 NEW EVAPORATION SYSTEM IN SOUTH.

A cost-effectiveness analysis indicates that Alternative S-4 is the most appropriate alternative for Suez. The main advantages of this alternative were that it has a low present worth compared to the other alternatives, there is virtually no impact on surface water bodies, reliability is extremely high, construction is relatively simple, some limited potential exists for re-use of treated wastewater on agricultural lands, public acceptance is high, and operation and maintenance requirements are relatively simple.

The major disadvantages of the proposed alternative are the large land requirements, major re-routing of the existing wastewater collection/transmission system is required, and the limited technical studies available regarding the use of land application in Suez.

4. Port Said Raw Water

As a result of various studies prepared by others, it has become clearly evident that the Nile River is clearly the best source of raw water for the city. Local surface and underground sources are brackish or saline and would require sophisticated treatment facilities. Since 1862, Port Said has received water from the Nile River via canal; today, the Ismailia Sweetwater Canal carries water from the Cairo to Ismailia and then branches to both Suez and Port Said.

The following major alternatives were evaluated:

W-1 NO ACTION;
W-2 DUAL 1500 mm PIPELINE WITH BOOSTER STATION;
W-3 DUAL 1200 mm PIPELINE WITH TWO BOOSTER STATIONS;

W-4 FOUR LOW LIFT STATIONS IN EXISTING CANAL;
W-5 LOW LIFT STATION WITH RETAINING WALLS IN EXISTING CANAL;
W-6 LINING AND REHABILIATION OF EXISTING CANAL.

A cost-effectiveness analysis indicates that Alternative W-6 is the most appropriate alternative for raw water for Port Said. The main advantages of this alternative were that it has a low present worth compared to the other alternatives, operation and maintenance is extremely simple, and system reliability is high.

The major disadvantages of the proposed alternative are that the Suez Canal Authority have indicated a strong preference for a dual pipeline with booster stations alternative and that additional feasibility studies are required to confirm the viability of the lining alternative.

D. Proposed Actions

1. Port Said Wastewater

It is recommended that a 150,000 m^3/d wastewater treatment plant be constructed in Port Said. It is suggested that screening facilities, grit chambers, conventional primary settling tanks, and chlorination facilities would provide an appropriate level of treatment considering the level of skills realistically obtainable in the near future and the large assimilative capacity of Lake Manzala. The provision of sludge thickeners and adequate sand drying beds are necessary to ensure that sludge is frequently removed from the settling tanks. Chlorination facilities are proposed even though the original Master Plan concluded that they are not necessary to protect the water quality of the lake; the reasoning behind this is that they will serve as a safety precaution in the event that the primary facilities are not operated at a satisfactory level.

Essential facilities related to the proposed treatment plant at the new site reclaimed from Lake Manzala are a new pump station at the existing plant site and approximately 3.8 kilometres of force main to transport the raw sewage from the existing plant site to the new site. A 1.5 kilometre outfall with diffuser into Lake Manzala is also an essential element of the plan.

Complementary project elements necessary to ensure the effective and efficient utilization of the proposed facilities are as follows:

- Spare Parts;
- Warehouse;
- Maintenance Shop;
- Tools and Equipment;
- O&M Manuals, Standard Procedures, Video Tapes, and Equipment Mock-Ups;
- 2 Years of O&M Assistance;
- Inventory Control Program;
- Flow Conservation Program.

2. Ismailia Wastewater

It is recommended that a 90,000 m^3/d wastewater treatment plant be constructed in Ismailia. It is suggested that screening facilities and anaerobic lagoons would provide an appropriate level of treatment considering the level of skills realistically obtainable in the near future and the proposed use of a land application system. The land application system would consist of a number of rapid infiltration beds for discharging the wastewater to the existing groundwater table. Several years of sludge storage could be accomplished within the anaerobic lagoons; a multiple cell lagoon system would permit taking one lagoon out of service for de-sludging. Partially dewatered sludge would be landfilled on the treatment plant site; landfill area for 20 years accummulation of sludge would be provided. An alternate concept would be to use conventional primary clarifiers in lieu of anaerobic lagoons; such an alternative would require the use of somewhat more sophisticated sludge handling facilities.

Essential facilities related to the proposed treatment plant at the new site are approximately 7 kilometres of dual force main to re-route the discharge from the Abu Atwa Pump Station from the existing treatment plant site to the new site. The original design of the pump station took this proposed re-routing into consideration when the pump units were selected.

Complementary project elements necessary to ensure the effective and efficient utilization of the proposed facilities are as follows:

- Spare Parts;
- Warehouse;
- Maintenance Shop;
- Tools and Equipment;
- O&M Manuals, Standard Procedures, Video Tapes, and Equipment Mock-Ups;
- 3 Years of O&M Assistance;
- Inventory Control Program;
- Flow Conservation Program;
- Groundwater Monitoring Program;
- Industrial Users Survey;
- Industrial Waste Monitoring.

3. Suez Wastewater

It is recommended that a 200,000 m^3/d wastewater treatment plant be constructed in the northwest area of Suez. The wastewater treatment facilities and disposal system proposed for Suez are identical to those previously presented for Ismailia. Screening facilities, anaerobic lagoons, and rapid infiltration beds would compose the main elements of the treatment plant.

Essential facilities related to the proposed treatment plant at the new site are a screw type influent pump station at the head of the

treatment plant, approximately 5.5 kilometres of Northerly Trunk Sewer from the treatment plant site towards the outskirts of the city center, and approximately 5 kilometres of force main to re-route the discharge from two existing major pump stations. In addition, if satisfactory service is to be provided to that region to the south of the city, it is recommended that a new Southwest Trunk Sewer about 5.5 kilometres long be constructed from the vicinity of the existing treatment plant towards the industrial area to the south; a new major pump station would be located at the downstream end of the collector to receive the wastewater from the collector and transport this wastewater to the new Northerly Trunk Sewer via approximately 7 kilometres of force main.

Complementary project elements necessary to ensure the effective and efficient utilization of the proposed facilities in Suez are identical to those presented for Ismailia with the following additions:

- Sewer Infiltration Survey;
- Sewer Rehabilitation;
- Salinity Survey.

4. Port Said Raw Water

It is recommended that the existing Sweetwater Canal from Qantara to El Raswa be dressed up and lined with concrete. The anticipated carrying capacity of the canal after the improvements are completed is 370,000 m^3/d. It is also recommended that a raw water reservoir with a volume of about 1,000,000 m^3 be constructed in the vicinity of El Raswa to serve as a source of emergency supply.

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TABLE 1

PRESENT WORTH ANALYSIS

RAW WATER TRANSMISSION SYSTEM

370,000 m^3/d

Alternative	Construction Cost+ (1987 $)	Annual O&M Cost (1987 $)	Present Worth 30 years @ 6% (1987 $)
W-1 No Action	0	0	0
W-2 Dual 1500 mm Pipeline w/ Booster Station - U.S. DIP	158,390,000	894,000	170,696,000
W-2 Dual 1500 mm Pipeline w/ Booster Station - local PCCP	74,628,000*	894,000	86,934,000*
W-3 Dual 1200 mm Pipeline w/ Two Booster Stations - U.S. DIP	123,942,000	2,391,000	156,854,000
W-3 Dual 1200 mm Pipeline w/ Two Booster Stations - local PCCP	64,746,000*	2,391,000	97,658,000*
W-4 Low Lift Stations (4)	25,051,000	1,004,000	38,871,000
W-5 Low Lift Station w/ Retaining Walls	37,081,000	400,000	42,587,000
W-6 Lining and Rehabilitation of Existing Canal	40,140,000	57,000	40,925,000

Notes: * $1.00 = LE 2.100
+ Includes 25% for engineering and contingency.

TABLE 2

PRESENT WORTH ANALYSIS

WASTEWATER ALTERNATIVES

Alternative	Construction Cost# (1987 $)	Annual O&M Cost (1987 $)	Present Worth 30 years @ 6% (1987 $)
P-1	0	0	0
P-2	95,668,000	1,350,000	114,251,000
P-3	53,415,000	1,350,000	71,998,000
P-4	85,282,000	2,188,000	115,399,000
P-5	55,880,000	1,438,000	75,674,000
P-6	50,912,000	1,731,000	74,739,000
I-1	0	0	0
I-2	42,149,000	1,683,000	65,315,000
I-3	38,463,000	1,466,000	58,642,000
I-4	63,493,000	1,085,000	78,428,000
I-5	76,396,000	1,515,000	97,250,000
S-1	0	0	0
S-2	87,594,000	1,755,000	111,751,000
S-2*	116,902,000	1,755,000	141,059,000
S-3	112,230,000	2,406,000	145,348,000
S-4	110,625,000	2,588,000	146,248,000
S-5	205,730,000	4,330,000	265,331,000
S-5*	235,038,000	4,330,000	294,640,000

Includes 45% for profit, overhead, engineering, and contingency.
* Includes cost of backbone service to Northerly Main Trunk Sewer area.

TABLE 3

PER CAPITA COSTS
FOR PROPOSED FACILITIES

System	Capital Cost			Annual O&M Cost		
	A	B	C	A	B	C
Port Said - Wastewater	$ 225	$ 124	$ 92	$ 5.68	$ 3.14	$ 2.32
Ismailia - Wastewater	$ 422	$ 236	$ 175	$ 8.36	$ 4.69	$ 3.47
Suez - Wastewater	$ 459	$ 261	$ 192	$10.74	$ 6.12	$ 4.49
Port Said - Water	$ 99	$ 60	$ 51	$ 0.17	$ 0.10	$ 0.09

A - Cost per user based upon current population.

B - Cost per user based upon Year 2000 population assuming moderate rate of growth.

C - Cost per user based upon Year 2000 population assuming high rate of growth.

TABLE 4

WASTEWATER TREATMENT ALTERNATIVES

200,000 m^3/d

Process	Construction Cost (1987 $)	Annual O&M Cost (1987 $)
Primary	28,777,000	1,755,000
Anaerobic Lagoons (primary)	11,387,000	1,495,000
Activated Sludge	53,726,000	3,100,000
Trickling Filter	62,417,000	2,844,000
Lagoons (secondary)	36,057,000	1,869,000
Land Application	48,574,000	2,588,000

TABLE 5

WASTEWATER TREATMENT ALTERNATIVES

150,000 m^3/d

Process	Construction Cost (1987 $)	Annual O&M Cost (1987 $)
Primary	22,136,000	1,350,000
Anaerobic Lagoons (primary)	8,759,000	1,150,000
Activated Sludge	41,328,000	2,385,000
Trickling Filter	48,013,000	2,188,000
Lagoons (secondary)	27,736,000	1,438,000
Land Application	37,365,000	1,991,000

TABLE 6

WASTEWATER TREATMENT ALTERNATIVES

100,000 m^3/d

Process	Construction Cost (1987 $)	Annual O&M Cost (1987 $)
Primary	15,938,000	972,000
Anaerobic Lagoons (primary)	6,306,000	828,000
Activated Sludge	29,756,000	1,717,000
Trickling Filter	34,569,000	1,575,000
Lagoons (secondary)	19,970,000	1,035,000
Land Application	26,903,000	1,434,000

TABLE 7

WASTEWATER TREATMENT ALTERNATIVES

90,000 m^3/d

Process	Construction Cost (1987 $)	Annual O&M Cost (1987 $)
Primary	14,831,000	904,000
Anaerobic Lagoons (primary)	5,869,000	770,000
Activated Sludge	27,690,000	1,598,000
Trickling Filter	32,169,000	1,466,000
Lagoons (secondary)	18,583,000	963,000
Land Application	25,035,000	1,334,000

TABLE 8

UNIT PRICES FOR MARINE OUTFALLS

Pipe Diameter mm	Installed Cost per Linear Metre (1987 $)
1800	2400
2100	2600
2400	3000

TABLE 9

UNIT PRICES FOR LAND OUTFALLS (PCCP)

Pipe Diameter mm	Installed Cost per Linear Metre (1987 $)
900	340
1200	375
1500	535
1800	570
2100	665
2400	760

TABLE 10

UNIT PRICES FOR FORCE MAIN (DIP)

Pipe Diameter mm	Installed Cost per Linear Metre (1987 $)
900	820
1200	1079
1500	1540
1800	1641
2100	1914
2400	2188

TABLE 11

CONSTRUCTION PRICES FOR BUILDINGS

Building Type	Proposed Area in sq m	Unit Cost 1987$ per sq m	Building Cost 1987$
Administration	600	$ 700	$ 420,000
Warehouse	2,600	$ 370	$ 962,000
Maintenance Shop	4,200	$ 600	$ 2,520,000

DESIGN TEAM POPULATION PROJECTIONS VERSUS MASTER PLAN PROJECTIONS

CANAL CITIES WATER AND WASTEWATER PROJECT PAPER -- PHASE II

Port Said (includes Port Fouad)

	1976	1986	1990	2000	
Master Plan Projection	262,620*	462,565	545,900	750,000	variable rate
High Projection	262,620*	399,793*	472,975	720,022	4.3% annual rate
Moderate Projection	262,620*	399,793*	458,722	647,143	3.5% annual rate

Port Said (without Port Fouad)

	1976	1986	1990	2000	
Master Plan Projection	--	431,365	507,889	712,000	variable rate
High Projection	249,314	379,537	449,011	683,541	4.3% annual rate
Moderate Projection	249,314	379,537	435,480	614,354	3.5% annual rate

Ismailia

	1976	1986	1990	2000	
Master Plan Projection	166,160*	319,966	382,500	560,000	variable rate
High Projection	166,160*	265,899*	320,917	513,550	4.8% annual rate
Moderate Projection	166,160*	265,899*	305,125	430,409	3.5% annual rate

Suez

	1976	1986	1990	2000	
Master Plan Projection	194,000*	510,399	692,000	990,000	variable rate
High Projection	194,000*	326,820*	402,635	678,294	5.4% annual rate
Moderate Projection	194,000*	326,820*	375,033	529,022	3.5% annual rate

based on census figures

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PROJECT IMPLEMENTATION SCHEDULE

CANAL CITIES WATER AND WASTEWATER PROJECT -- PHASE II

I. START-UP ACTIVITIES

Develop Scope of Work for Construction Monitor (CM)	01SEP87-30SEP87
Advertise for Construction Monitor (CM)	01NOV87-15DEC87
Sign Grant Agreement	01OCT87
Meet Initial CPs	01DEC87
Receive CM Qualifications	16DEC87
Shortlist CM Firms	16DEC87-31DEC87
Issue RFTP for CM	15JAN88
Receive Technical Proposals for CM	15MAR88
Evaluate Technical Proposals for CM	16MAR88-31MAR88
Interview CM Firms	15APR88-30APR88
Rank Order Shortlisted CM Firms	01MAY88
Negotiate/Execute CM Contract	01JUN88-30JUN88
Establish L/Comm	01JUL88-15JUL88
CM Mobilization	16JUL88-15AUG88

II. PRELIMINARY ENGINEERING

Develop Pre-Qualification Questionnaire for Design/Build Contractors	16AUG88-15SEP88
Soils Investigations	16AUG88-15FEB89
Surveying	01JAN89-30AUG89
Pilot Plant Study at Suez	16OCT88-15NOV89
Environmental Assessments	01DEC88-31MAY89
Feasibility Study for Sweetwater Canal	16OCT88-29FEB89
Preparation of IFBs for Design/Build -	
Port Said Wastewater	01OCT88-31MAY89
Ismailia Wastewater	01APR89-30SEP89
Suez Wastewater	01AUG89-28FEB90
Port Said Water	01OCT89-31MAR90
Advertise for Design/Build Pre-Qualifications	01NOV88-31DEC88
Shortlist Design/Build Firms	01JAN89-31MAR89
Review & Approve IFBs for Design/Build -	
Port Said Wastewater	01JUN89-31JUL89
Ismailia Wastewater	01OCT89-31NOV89
Suez Wastewater	01MAR90-30APR90
Port Said Water	01APR90-31MAY90

III. PORT SAID WASTEWATER

Issue IFB to Pre-Qualified Firms	01AUG89
Receive Technical Bids	31DEC89
Evaluate Technical Bids	01JAN90-29FEB90
Bid Equalization Period	01MAR90-31MAY90

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Request Commercial Bids	01JUN90
Receive Commercial Bids	15JUL90
Analyze Commercial Bids	16JUL90-31JUL90
Award Design/Build Contract	15SEP90
Mobilization of Design/Build Contractor	16OCT90-15NOV90
Design and Build Port Said Wastewater Facilities	16NOV90-15JUN94
Monitoring of Design/Build Activities	16OCT90-15JUL94
Claims Assistance	15FEB91-15DEC94
O&M Assistance	16JUN94-15JUN96

IV. ISMAILIA WASTEWATER

Issue IFB to Pre-Qualified Firms	01DEC89
Receive Technical Bids	30APR90
Evaluate Technical Bids	01MAY90-30JUN90
Bid Equilization Period	01JUL90-30SEP90
Request Commercial Bids	01OCT90
Receive Commercial Bids	15NOV90
Analyze Commercial Bids	16NOV90-30NOV90
Award Design/Build Contract	15JAN91
Mobilization of Design/Build Contractor	16FEB91-15MAR91
Design and Build Ismailia Wastewater Facilities	16MAR91-15SEP94
Monitoring of Design/Build Activities	16FEB91-15OCT94
Claims Assistance	16JUN91-15MAR95
O&M Assistance	16SEP94-15SEP97

V. SUEZ WASTEWATER

Issue IFB to Pre-Qualified Firms	01MAY90
Receive Technical Bids	31SEP90
Evaluate Technical Bids	01OCT90-31JAN91
Bid Equalization Period	01FEB91-30APR91
Request Commercial Bids	01MAY91
Receive Commercial Bids	15JUN91
Analyze Commercial Bids	16JUN91-30JUN91
Award Design/Build Contract	15SEP91
Mobilization of Design/Build Contractor	16OCT91-15NOV91
Design and Build Suez Wastewater Facilities	16NOV91-15MAY95
Monitoring of Design/Build Activities	16OCT91-15JUN95
Claims Assistance	16FEB92-15OCT95
O&M Assistance	16MAY95-15MAY98

VI. PORT SAID RAW WATER SUPPLY

Issue IFB to Pre-Qualified Firms	01JUN90
Receive Technical Bids	31OCT90
Evaluate Technical Bids	01DEC90-31JAN91
Bid Equalization Period	01FEB91-30APR91
Request Commercial Bids	01MAY91

Receive Commercial Bids	15JUN91
Analyze Commercial Bids	16JUN91-30JUN91
Award Design/Build Contract	15AUG91
Mobilization of Design/Build Contractor	16SEP91-15OCT91
Design and Build Port Said Raw Water Supply	16OCT91-15OCT94
Monitoring of Design/Build Activities	16SEP91-15NOV94
Claims Assistance	16JAN92-15APR95

VII. INSTITUTIONAL SUPPORT

Develop Scope of Work for Institutional Support (IS) Contractor	01SEP88-30SEP88
Advertise for Institutional Support (IS) Contractor	01NOV88-31DEC88
Receive IS Firms Qualifications	15JAN89
Shortlist IS Firms	16JAN89-30JAN89
Issue RFTP for IS	15FEB89
Receive Technical Proposals for IS	15APR89
Evaluate Technical Proposals for IS	16APR89-30APR89
Interview IS Firms	16MAY89-31MAY89
Rank Order Shortlisted IS Firms	01JUN89
Negotiate/Execute IS Contract	01JUL89-31JUL89
Establish L/Comm	01AUG89-31AUG89
IS Contractor Mobilization	01OCT89-30NOV89
Provide Institutional Support to SCA and the Three Cities	01DEC89-30SEP95

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CASH FLOW PROJECTION AND ANNUAL OBLIGATIONS
(thousands of $ and LE)

Canal Cities Water and Wastewater Project — Phase II

Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	TOTAL
Inflation Rate — $	BASE	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	
Inflation Rate — LE	BASE	15%	12%	10%	8%	8%	8%	8%	8%	8%	8%	8%	
Cash Flow $	0	1,561	2,447	3,373	48,084	94,489	108,250	85,112	25,022	5,055	3,561	1,051	378,004
Cash Flow LE	0	1,196	2,216	2,889	42,369	85,616	99,203	78,139	24,001	5,129	3,716	1,129	345,602
Annual Obligation $	5,000	20,000	310,000	45,000									380,000
Annual Obligation LE	10,000	40,000	250,000	50,000									350,000

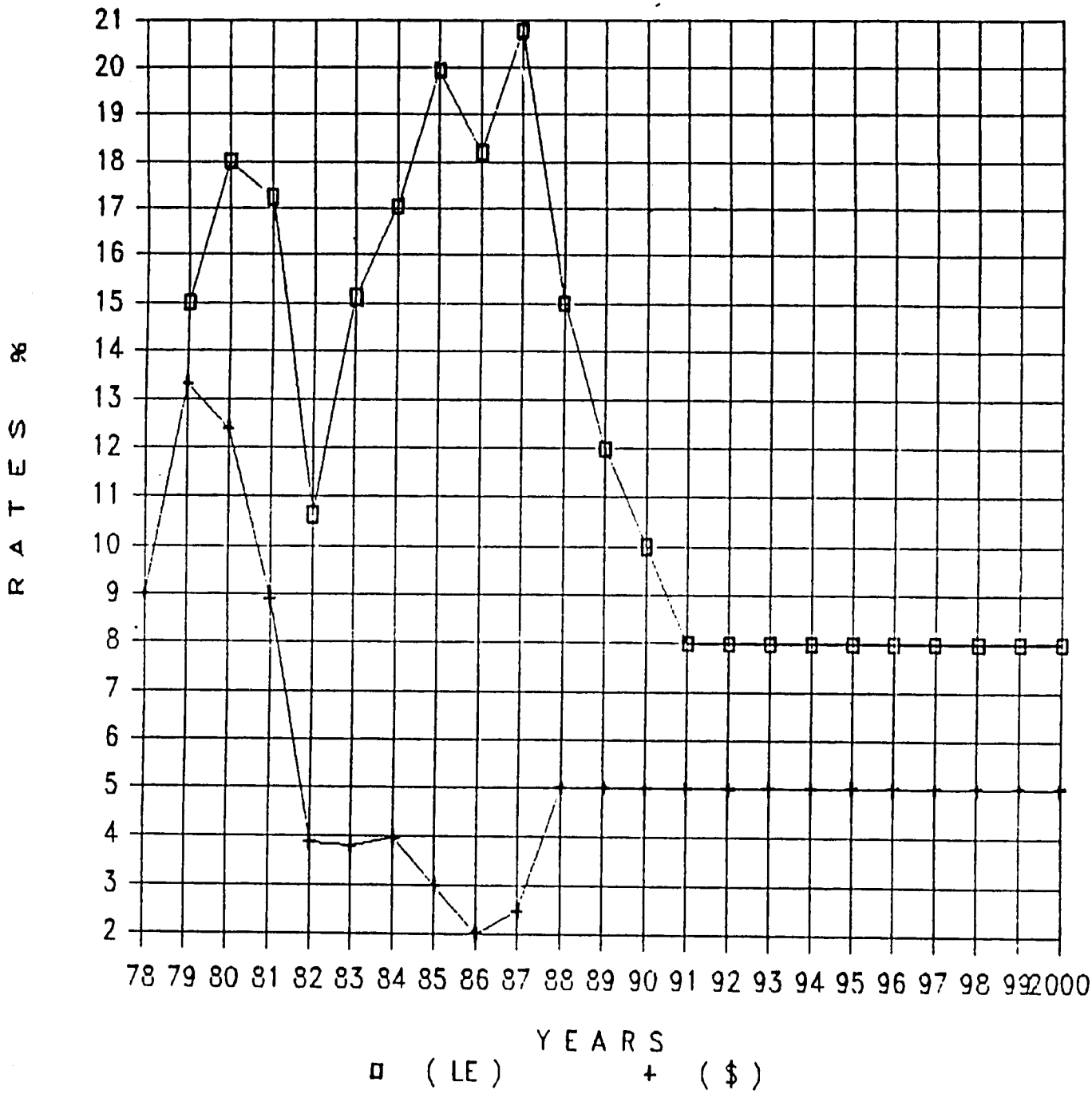
TOTAL DOLLAR EQUIVALENT PROJECT COST — $ 500,000,000 (based upon a life of project average exchange rate of $ 1.00 = LE 2.916501)

$ 1.00 Year 1987 = $ 1.3288 LOP
LE 1.000 Year 1987 = LE 1.7616 LOP

$ 284,473,000 Year 1987
+ = $ 373,650,000 Year 1987 = $ 496,502,000 LOP SAY $ 500,000,000
LE 196,190,000 Year 1987

DR/PS:JStarnes:28JUL87

INFLATION RATES



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5C(2) - PROJECT CHECKLIST

Listed below are statutory criteria applicable to projects. This section is divided into two parts. Part A includes criteria applicable to all projects. Part B applies to projects funded from specific sources only: B(1) applies to all projects funded with Development Assistance; B(2) applies to projects funded from Development Assistance loans; and B(3) applies to projects funded from ESF.

CROSS REFERENCES:	IS COUNTRY CHECKLIST UP TO DATE?	Yes
	HAS STANDARD ITEM CHECKLIST BEEN REVIEWED FOR THIS PROJECT?	Yes

A. GENERAL CRITERIA FOR PROJECT

1.	FY 1987 Continuing Resolution Sec. 523; FAA Sec. 634A. Describe how authorization and appropriations committees of Senate and House have been or will be notified concerning the project.	Formal Congressional Notification (CN) will be submitted.
2.	FAA Sec. 611(a)(1). Prior to obligation in excess of $500,000, will there be (a) engineering, financial or other plans necessary to carry out the assistance, and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?	Yes Yes
3.	FAA Sec. 611(a)(2). If legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?	None Required
4.	FAA Sec. 611(b); FY 1987 Continuing Resolution Sec. 501. If project is for water or water-related land resource construction, have benefits and costs been computed to the extent practicable in accordance with the principles, standards, and procedures established pursuant to the Water Resources Planning Act (42 U.S.C. 1962, et seq.)? (See A.I.D. Handbook 3 for guidelines.)	Yes

5. **FAA Sec. 611(e).** If project is capital assistance (e.g., construction), and total U.S. assistance for it will exceed $1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project?	Yes
6. FAA Sec. 209. Is project susceptible to execution as part of regional or multilateral project? If so, why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.	No
7. FAA Sec. 601(a). Information and conclusions on whether projects will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.	Project will strengthen Egyptian private sector by providing consulting and construction sub-contracting opportunities.
8. FAA Sec. 601(b). Information and conclusions on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).	Project funds will have a major impact on US trade through procurement of US source and origin goods and services provided by US private sector firms and suppliers.
9. FAA Secs. 612(b), 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized in lieu of dollars.	The GOE is contributing the equivalent of $119 million in local currency.
10. FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release?	No

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11. FY 1987 Continuing Resolution Sec. 521. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity? N/A

12. FY 1987 Continuing Resolution Sec. 558 (as interpreted by conference report). If assistance is for agricultural development activities (specifically, any testing or breeding feasibility study, variety improvement or introduction, consultancy, publication, conference, or training), are such activities (a) specifically and principally designed to increase agricultural exports by the host country to a country other than the United States, where the export would lead to direct competition in that third country with exports of a similar commodity grown or produced in the United States, and can the activities reasonably be expected to cause substantial injury to U.S. exporters of a similar agricultural commodity; or (b) in support of research that is intended primarily to benefit U.S. producers? N/A

13. FY 1987 Continuing Resolution Sec. 559. Will the assistance (except for programs in Caribbean Basin Initiative countries under U.S. Tariff Schedule "Section 807," which allows reduced tariffs on articles assembled abroad from U.S.-made components) be used directly to procure feasibility studies, prefeasibility studies, or project profiles of potential investment in, or to assist the establishment of facilities specifically designed for, the manufacture for export to the United States or to third country markets in direct competition with U.S. exports, of textiles, apparel, footwear, handbags, flat goods (such as wallets or coin purses worn on the person), work gloves or leather wearing apparel? No

14. **<u>FAA Sec. 118(c)</u>. Does the assistance comply with the environmental procedures set forth in A.I.D. Regulation 16? Does the assistance place a high priority on conservation and sustainable management of tropical forests? Specifically, does the assistance, to the fullest extent feasible: (a) stress the importance of conserving and sustainably managing forest resources; (b) support activities which offer employment and income alternatives to those who otherwise would cause destruction and loss of forests, and help countries identify and implement alternatives to colonizing forested areas; (c) support training programs, educational efforts, and the establishment or strengthening of institutions to improve forest management; (d) help end destructive slash-and-burn agriculture by supporting stable and productive farming practices; (e) help conserve forests which have not yet been degraded, by helping to increase production on lands already cleared or degraded; (f) conserve forested watersheds and rehabilitate those which have been deforested; (g) support training, research, and other actions which lead to sustainable and more environmentally sound practices for timber harvesting, removal, and processing; (h) support research to expand knowledge of tropical forests and identify alternatives which will prevent forest destruction, loss, or degradation; (i) conserve biological diversity in forest areas by supporting efforts to identify, establish, and maintain a representative network of protected tropical forest ecosystems on a worldwide basis, by making the establishment of protected areas a condition of support for activities involving forest clearance or degradation, and by helping to identify tropical forest ecosystems and species in need of protection and establish and maintain appropriate protected areas; (j) seek to increase the awareness of**

Yes

N/A

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U.S. government agencies and other donors of the immediate and long-term value of tropical forests; and (k) utilize the resources and abilities of all relevant U.S. government agencies?

15. FAA Sec. 119(g)(4)-(6). Will the assistance (a) support training and education efforts which improve the capacity of recipient countries to prevent loss of biological diversity; (b) be provided under a long-term agreement in which the recipient country agrees to protect ecosystems or other wildlife habitats; (c) support efforts to identify and survey ecosystems in recipient countries worthy of protection; or (d) by any direct or indirect means significantly degrade national parks or similar protected areas or introduce exotic plants or animals into such areas? — No

16. FAA 121(d). If a Sahel project, has a determination been made that the host government has an adequate sysem for accounting for and controlling receipt and expenditure of project funds (either dollars or local currency generated therefrom)? — N/A

17. FY 1987 Continuing Resolution Sec. 532 Is disbursement of the assistance conditioned solely on the basis of the policies of any multilateral institution? — No

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria — N/A

a. FAA Secs. 102(b), 111, 113, 281(a). Describe extent to which activity will (a) effectively involve the poor in development by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, dispersing investment from cities to small towns and rural areas, and

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insuring wide participation of the poor in the benefits of development on a sustained basis, using appropriate U.S. institutions; (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries.

b. FAA Secs. 103, 103A, 104, 105, 106, 120-21. Does the project fit the criteria for the source of funds (functional account) being used?

c. FAA Sec. 107. Is emphasis placed on use of appropriate technology (relatively smaller, cost-saving, labor-using technologies that are generally most appropriate for the small farms, small businesses, and small incomes of the poor)?

d. FAA Secs. 110, 124(d). Will the recipient country provide at least 25 percent of the costs of the program, project, or activity with respect to whch the assistance is to be furnished (or is the latter cost-sharing requirement being waived for a "relatively least developed" country)?

e. FAA Sec. 128(b). If the activity attempts to increase the institutional capabilities of private organizations or the government of the country, or if it attempts to stimulate scientific and technological research, has it been designed and will it be monitored to ensure that the ultimate beneficiaries are the poor majority?

f. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civil education and training in skills required for effective participation in governmental processes essential to self-government.

g. FY 1987 Continuing Resolution Sec. 540. Are any of the funds to be used for the performance of abortions as a method of family planning or to motivate or coerce any person to practice abortions?

Are any of the funds to be used to pay for the performance of involuntary sterilization as a method of family planning or to coerce or provide any financial incentive to any person to undergo sterilizations?

Are any of the funds to be used to pay for any biomedical research which relates, in whole or in part, to methods of, or the performance of, abortions or involuntary sterilization as a means of family planning?

h. FY 1987 Continuing Resolution. Is the assistance being made available to any organization or program which has been determined to support or participate in the management of a program of coercive abortion or involuntary sterilization?

If assistance is from the population functional account, are any of the funds to be made available to voluntary family planning projects which do not offer, either directly or through referral to or information about access to, a broad range of family planning methods and services?

i. FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?

j. FY 1987 Continuing Resolution. How much of the funds will be available only for activities of economically and socially disadvantaged enterprises, historically black colleges and universities, and private and voluntary organizations which are controlled by individuals who are black Americans, Hispanic Americans, or Native Americans, or who are economically or socially disadvantaged (including women)?

k. FAA Sec. 118(c)(13). If the assistance will support a program or project significantly affecting tropical forests (including projects involving the planting of exotic plant species), will the program or project (a) be based upon careful analysis of the alternatives available to achieve the best sustainable use of the land, and (b) take full account of the environmental impacts of the proposed activities on biological diversity?

l. FAA Sec. 118(c)(14). Will assistance be used for (a) the procurement or use of logging equipment, unless an environmental assessment indicates that all timber harvesting operations involved will be conducted in an environmentally sound manner and that the proposed activity will produce positive economic benefits and sustainable forest management systems; or (b) actions which significantly degrade national parks or similar protected areas which contain tropical forests, or introduce exotic plants or animals into such areas?

m. FAA Sec. 118(c)(15). Will assistance be used for (a) activities which would result in the conversion of forest lands to the rearing of livestock; (b) the construction, upgrading, or maintenance of roads (including temporary haul roads for logging or other extractive industries) which pass through relatively undegraded forest lands; (c) the colonization of forest lands; or (d) the construction of dams or other water

control structures which flood relatively undegraded forest lands, unless with respect to each such activity an environmental assessment indicates that the activity will contribute significantly and directly to improving the livelihood of the rural poor and will be conducted in an environmentally sound manner which supports sustainable development?

2. Development Assistance Project Criteria (Loans Only) N/A

a. FAA Sec. 122(b). Information and conclusion on capacity of the country to repay the loan at a reasonable rate of interest.

b. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete with U.S. enterprises, is there an agreement by the recipient country to prevent export to the U.S. of more than 20 percent of the enterprise's annual production during the life of the loan, or has the requirement to enter into such an agreement been waived by the President because of a national security interest?

c. FY 1987 Continuing Resolution. If for a loan to a private sector institution from funds made available to carry out the provisions of FAA Sections 103 through 106, will loan be provided, to the maximum extent practicable, at or near the prevailing interest rate paid on Treasury obligations of similar maturity at the time of obligating such funds?

d. FAA Sec. 122(b). Does the activity give reasonable promise of assisting long-range plans and programs designed to develop economic resources and increase productive capacities?

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3. Economic Support Fund Project Criteria

a.	FAA Sec. 531(a). Will this assistance promote economic and political stability? To the maximum extent feasible, is this assistance consistent with the policy directions, purposes, and programs of Part I of the FAA?	Yes Yes
b.	FAA Sec. 531(e). Will this assistance be used for military or paramilitary purposes?	No
c.	ISDCA of 1985 Sec. 207. Will ESF funds be used to finance the construction, operation or maintenance of, or the supplying of fuel for, a nuclear facility? If so, has the President certified that such country is a party to the Treaty on the Non-Proliferation of Nuclear Weapons or the Treaty for the Prohibition of Nuclear Weapons in Latin America (the "Treaty of Tlatelolco") cooperates fully with the IAEA, and pursues nonproliferation policies consistent with those of the United States?	No
d.	FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made?	N/A

5C(3) - STANDARD ITEM CHECKLIST

Listed below are the statutory items which normally will be covered routinely in those provisions of an assistance agreement dealing with its implementation, or covered in the agreement by imposing limits on certain uses of funds.

These items are arranged under the general headings of (A) Procurement, (B) Construction, and (C) Other Restrictions.

A. PROCUREMENT

1.	FAA Sec. 602(a). Are there arrangements to permit U.S. small business to participate equitably in the furnishing of commodities and services financed?	Yes
2.	FAA Sec. 604(a). Will all procurement be from the U.S. except as otherwise determined by the President or under delegation from him?	Yes
3.	FAA Sec. 604(d). If the cooperating country discriminates against marine insurance companies authorized to do business in the U.S., will commodities be insured in the United States against marine risk with such a company?	N/A
4.	FAA Sec. 604(e); ISDCA of 1980 Sec. 705(a). If non-U.S. procurement of agricultural commodity or product thereof is to be financed, is there provision against such procurement when the domestic price of such commodity is less than parity? (Exception where commodity financed could not reasonably be procured in U.S.)	N/A
5.	FAA Sec. 604(g). Will construction or engineering services be procured from firms of advanced developing countries which are otherwise eligible under Code 941 and which have attained a competitive capability in international markets in one of these areas? (Exception for those	N/A

countries which receive direct economic assistance under the FAA and permit United States firms to compete for construction or engineering services financed from assistance programs of these countries.)

6. FAA Sec. 603. Is the shipping excluded from compliance with the requirement in section 901(b) of the Merchant Marine Act of 1936, as amended, that at least 50 percent of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners, and tankers) financed shall be transported on privately owned U.S. flag commercial vessels to the extent such vessels are available at fair and reasonable rates? No

7. FAA Sec. 621(a). If technical assistance is financed, will such assistance be furnished by private enterprise on a contract basis to the fullest extent practicable? Yes

   will the facilities and resources of other Federal agencies be utilized, when they are particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs? Yes

8. International Air Transportation Fair Competitive Practices Act, 1974. If air transportation of persons or property is financed on grant basis, will U.S. carriers be used to the extent such service is available? Yes

9. FY 1987 Continuing Resolution Sec. 504. If the U.S. Government is a party to a contract for procurement, does the contract contain a provision authorizing termination of such contract for the convenience of the United States? Yes

10. FY 1987 Continuing Resolution Sec. 524. If assistance is for consulting service through procurement contract pursuant to 5 U.S.C. 3109, are contract expenditures a matter of public record and available for public inspection (unless otherwise provided by law or Executive order)? Yes

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B. CONSTRUCTION

1. FAA Sec. 601(d). If capital (e.g., construction) project, will U.S. engineering and professional services be used? — Yes

2. FAA Sec. 611(c). If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable? — Yes

3. FAA Sec. 620(k). If for construction of productive enterprise, will aggregate value of assistance to be furnished by the U.S. not exceed $100 million (except for productive enterprises in Egypt that were described in the CP), or does assistance have the express approval of Congress? — N/A

C. OTHER RESTRICTIONS

1. FAA Sec. 122(b). If development loan repayable in dollars, is interest rate at least 2 percent per annum during a grace period which is not to exceed ten years, and at least 3 percent per annum thereafter? — N/A

2. FAA Sec. 301(d). If fund is established solely by U.S. contributions and administered by an international organization, does Comptroller General have audit rights? — N/A

3. FAA Sec. 620(h). Do arrangements exist to insure that United States foreign aid is not used in a manner which, contrary to the best interests of the United States, promotes or assists the foreign aid projects or activities of the Communist-bloc countries? — Yes

4. **Will arrangements preclude use of financing:**

a. FAA Sec. 104(f); FY 1987 Continuing Resolution Secs. 525, 540. (1) To pay for performance of abortions as a method of family planning or to motivate or coerce persons to practice abortions; (2) to pay for performance of involuntary sterilization as method of family planning, or to coerce or provide financial incentive to any person to undergo sterilization; (3) to pay for any biomedical research which relates, in whole or part, to methods or the performance of abortions or involuntary sterilizations as a means of family planning; or (4) to lobby for abortion? N/A

b. FAA Sec. 483. To make reimburse- bursements, in the form of cash payments, to persons whose illicit drug crops are eradicated? N/A

c. FAA Sec. 620(g). To compensate owners for expropriated or nationalized property, except to compensate foreign nationals in accordance with a land reform program certified by the President? N/A

d. FAA Sec. 660. To provide training, advice, or any financial support for police, prisons, or other law enforcement forces, except for narcotics programs? N/A

e. FAA Sec. 662. For CIA activities? N/A

f. FAA Sec. 636(i). For purchase, sale, long-term lease, exchange or guaranty of the sale of motor vehicles manufactured outside U.S., unless a waiver is obtained? N/A

g. FY 1987 Continuing Resolution Sec. 503. To pay pensions, annuities, retirement pay, or adjusted service compensation for military personnel? N/A

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h. FY 1987 Continuing Resolution Sec. 505. To pay U.N. assessments, arrearages or dues? N/A

i. FY 1987 Continuing Resolution Sec. 506. To carry out provisions of FAA section 209(d) (transfer of FAA funds to multilateral organizations for lending)? N/A

j. FY 1987 Continuing Resolution Sec. 510. To finance the export of nuclear equipment, fuel, or technology? N/A

k. FY 1987 Continuing Resolution Sec. 511. For the purpose of aiding the efforts of the government of such country to repress the legitimate rights of the population of such country contrary to the Universal Declaration of Human Rights? N/A

l. FY 1986 Continuing Resolution Sec. 516. To be used for publicity or propaganda purposes within U.S. not authorized by Congress? N/A

FINANCIAL (RECURRENT COSTS) ANALYSIS
CANAL CITIES WATER AND WASTEWATER PHASE II
(PROJECT NO. 263-0174)

1. Introduction

The financial viability of the Canal Cities II Water and Wastewater Project depends upon adequate coverage of operation and maintenance (O&M) costs. In order to assess the viability of the four discrete projects in this Project, this paper describes the current coverage of O&M for the three wastewater systems and one water supply system, estimates the increment in O&M costs that would result from the proposed projects and discusses alternatives for covering recurrent costs.

2. Current Situation

Table 1 describes the current coverage of O&M costs for the existing wastewater and water systems. As the table shows, the coverage is significantly differ between the water and wastewater systems. In the case of water, the sale of water and fees and charges almost cover O&M costs in Port Said. Only six percent of O&M costs are covered by subsidies from the central government. (Local coverage of O&M costs for the water systems in the other two Canal Cities is comparable.) In the case of wastewater, a 10 percent surcharge on water users connected to the collector system, listed in the table under sale of water, generates between 10 and 23 percent local coverage of O&M costs. Transfer of funds from the central government is primary source of revenue.

The difference in local coverage of water and wastewater O&M costs is partially explained by the fact that the Suez Canal Authority (SCA) manages the water supply systems and the Governorates manage the wastewater systems. The SCA has a good record of securing adequate funding for maintenance. The

TABLE 1

EXPENDITURES AND INCOME IN 1985 AND 1995 FOR THE FOUR SYSTEMS

INCLUDED IN CANAL CITIES II PROJECT

(LE 85-87)

City/System	Expenditures: Debt Services*	O&M Cost	Income: Sale of Water	Fees and Charges	Total Revenue	Operating Defecit Govt Transfer	Coverage Ratio (%)
			1985				
Port Said WW	0	805,000	83,592	N/A	83,592	721,408	10.4 %
Ismailia WW	0	651,360	68,572	N/A	68,572	582,792	10.5 %
Suez WW	0	845,250	194.572	N/A	194,752	650,499	23.0 %
Port Said W	0	1,958,650	1,436,959	404,272	1,841,231	117,424	94.0 %
Ismailia W	0	2,498,628	1,131,524	250,000	1,381,526	1,117,100	55.0 %
Suez W	0	1,791,443	1,871,994	278,686	2,150,680	359,237	120 %
			1995				
Port Said WW	9,150,000	3,640,000	N/A	N/A	N/A	N/A	
Ismailia WW	15,363,000	3,832,000	N/A	N/A	N/A	N/A	
Suez WW	20,319,000	6,280,000	N/A	N/A	N/A	N/A	
Port Said W	1,968,000	2,156,550	N/A	N/A	N/A	N/A	

W = Water System WW = Wastewater System

* Debt Service is listed for 1995 just to indicate its magnitude and not with the expectation that it will be covered.

Source: USAID/Cairo (April 1987) "Financial Viability Assessment of USAID Assisted Water and Wastewater Systems in Egypt" and USAID/Cairo (May 1987), "Technical Annex," Canal Cities Water and Wastewater Project - Phase II

Governorates are in an awkward situation because they do not control the water supply systems, which would give them an opportunity to increase local O&M coverage of wastewater system costs. Instead, they are dependent upon SCA to collect revenues for them, and they must rely on the central government for coverage of most of the O&M costs. The SCA has been asked to accept management responsibility for the wastewater systems, but have turned down the request.

Local coverage of O&m costs for wastewater systems may actually decrease in 1986. Preliminary O&M costs estimates, based on funding requests from the Governorates, indicate that O&M costs will almost double in the three cities as the U.S. financial pumping stations come into operation. If the surcharge revenues increase as a result of expanded wastewater collection, then the percentage of local coverage may remain constant. However, if the surcharge revenues do not increase, then local coverage may actually decline and additional subsidy from the central government will be necessary.

The doubling of O&M costs between 1985 and 1986 raises the issue of whether the current level of expenditure is adequate to maintain the systems and the handle routine capital replacement. The available information shows funds requested, but there is no documentation whether the funding requests are based on an engineering assessment of needs or on an understanding political reality. A detailed engineering assessment of the existing O&M needs is necessary to answer the question.

3. Future Situation

Table 1 also describes the future O&M costs that are associated with the new wastewater treatment plants in the three cities and the expanded water supply system in Port Said. The water supply system O&M costs will increase trivial amount. However, the wastewater system costs will increase between a factor of 5 and a factor of 7, as a result of the proposed projects.

Even though the O&M costs are only 1.5 to 2.0% rather than 3% of capital costs, they appear to be reasonable estimates for adequate maintenance and routine capital replacement. First, the type of technology recommended for wastewater treatment is not complex. In the case of Ismailia and Suez, the technology is holding ponds and rapid infiltration and in Port Said it is basic primary treatment. Second, the O&M costs take into account significant price level adjustments that may come from the new economic reform program. The costs include a five year allowance for spare parts and are based on a shadow price of electricity (12.6 piasters per KWH), rather than the current rate of 2.2 piasters per KWH.

Admittedly, the future cost increases do not include any contribution to capital reserves or to capital funds needed for the anticipated GOE completion of the wastewater collection system in the three cities. As seen in Table 1, full cost recovery, which would include coverage of debt service, would result in a very large increase in system expenditures and is not within the bounds of economic reality.

The significant increase in wastewater system costs raises the issue of the ability of the consumers of the service to pay. The usual way of addressing this issue is to determine the per capita or per household cost and compare the cost with the annual income. If the cost is 5 percent or less, the cost is considered acceptable according to World Bank guidelines.

Table 2 shows the per household costs for wastewater alone and combined water and wastewater O&M costs. The combined costs are compared with annual income because previous analyses have compared the combined costs with income and because the costs of water and wastewater services are essentially one service.

Household expenditure surveys conducted by the GOE provide a basis for estimating household income. These surveys suggest that 15-20 percent of all households live below minimal acceptable standards, with expenditures at a

Table 2 - Operation and Maintenance Costs for Water and Wastewater Per Household in the Year 2000

(LE 1987)

City/System	Year 2000 Population (000)	Total O&M (LE 000)	O&M Costs Per Household (LE)
Port Said			
Wastewater*	430-581	3,640	41-30
Water & Wastewater**	614-683	5,599	44-39
Ismailia			
Wastewater*	323-437	3,832	57-42
Water & Wastewater**	430-513	6,331	70-59
Suez			
Wastewater*	423-577	6,280	71-52
Water & Wastewater**	529-678	8,071	73-57

* Assumes 70-85 percent population served in Port Said, 75-85 percent population served in Ismailia and 80-85 percent population served in Suez.

** Assumes 100 percent population served with water as well as wastewater.

*** Assumes 4.8 people per household.

Sources: USAID/Cairo (May 1987), "Technical Annex", Phase II and Table 1.

level of less than LE 1,100 per year. An additional 40 percent exist at the minimal acceptable level with disposable income of LE 2,000 per household. For the three Canal Cities, the percentage income would be higher than the normal averages.

According to a survey in Ismailia in 1982, most household income is spent on food, housing, clothing, transportation and other incidentals. Relatively little, i.e. less than 5 percent, is spent on public utility services, which includes electricity and water. The lowest 15-20 percent of all households in Ismailia have a household income higher than the national average mentioned above, perhaps LE 1,500 per year, and an additional 40 percent have a disposable income of LE 2,500. An independent estimate of the combined water and wastewater tariff in Ismailia, based on Table 1, suggests an expenditure of LE 26 per household per year (LE 5.5 per person times 4.8 people per household). This independent estimate is consistent with the household survey in Ismailia.

The income level and expenditure on water and wastewater in Ismailia is representative of the the Canal Cities. (They are somewhat lower in Port Said and somewhat higher in Suez). The projected expenditure on water and wastewater, is between LE 60 - LE 70 (LE 1987). This level is slightly less than 5 percent of the income of the households in the lowest 20 percent of the income distribution and is slightly less than 2.5 percent of the income of households within the next 40 percent of the income distribution. Assuming that the situation in Ismailia is representative, then most households and some households in the lowest 20 percent of the income distribution would be able to pay for the increased costs of water and wastewater management. The lowest income households would not pay because they use public standpipes rather than outlets in houses.

4. Alternative Financing Approaches

Several approaches are possible for financing the anticipated increase in recurrent costs. The current approach for water supply systems consists primarily of local financing (the beneficiary pays), whereas the approach for

wastewater systems consists primarily of central government financing (the state pays). The generally positive track record of the three cities in securing local coverage of the recurrent costs of water systems suggests that they will continue to use self financing in the future. The generally poor track record in securing local coverage for wastewater systems suggests that accelerated efforts will be necessary to achieve complete self financing of recurrent costs.

The most obvious approach for achieving complete self financing is a surcharge on water charges. An adequate water surcharge for all households connected to the collection system would meet the USAID objective of moving the GOE towards self financing of recurrent costs of local services. USAID should monitor the progress of the local governments in meeting current O&M costs for wastewater collection as an indicator of how effective they will be in securing coverage of much higher O&M costs for wastewater treatment

A second approach is a flat tax per household as an increment to the local property tax. This approach is not as desirable as a surcharge because it does not reflect household use of services, but it is a local charge. If it were a percentage of the property tax, and if water use increases with property value (income), then those who use more water would be paying more for the service. The major limitation of this approach is that local property taxes are not properly assessed and are not regularly collected.

A third approach would combine water/wastewater fees with charges for electic consumption. The approach recognizes that there is a lack of water meters in the three cities and frequent tampering of existing meters to keep estimates of water consumption low. This approach requires establishing a relationship between electricity and water consumption, which may be possible. This approach could increase local financing of recurrent costs, so it is worth considering.

A fourth approach, new to USAID, is to recognize that a rapid acceleration of tariffs is impossible in Egypt and to assume limited responsibility for coverage of the recurrent costs of the new wastewater treatment plants. The basic scheme would require USAID to purchase an annuity, such as a long term U.S. bond, that would cover as much as 75 percent of the projected recurrent costs for 30 years. The GOE and the U.S. would jointly control the disbursement of the annual payment with the amount of payment dependent upon system performance. This innovative approach should be given serious consideration if the primary objective of USAID in funding wastewater systems is to secure environmental improvements.

5. Summary

The local coverage of O&M costs for water systems is high, but is low for wastewater systems. Whereas there is almost complete local coverage of recurrent costs for water systems, there is only between 10 and 23 percent local coverage for recurrent costs for wastewater systems.

The requirements for local coverage will increase significantly, by a factor of 5 to 7, when the new wastewater treatment plants come into operation. Most households, if they are required to, should have the ability to pay for the improved service. And, the lowest income households will not pay because most do not have household connections.

The financing approach most consistent with securing local coverage of O&M costs would be an adequate water surcharge. Other approaches consistent with the principle of local coverage are property taxes and a surcharge related to electricity consumption. all of these approaches will require the GOE to accelerate its effort to implement full self-financing of local services.

Administrative Analysis

Canal Cities Water and Wastewater Phase II

Project 263-0174

The Canal Cities Water and Sewerage Phase II Project proposes to develop three types of outputs: design and construction of wastewater treatment plants, expansion of the Port Said raw water supply, and strengthening of institutional capabilities of the Governorates in support of their local wastewater departments and of the SCA in support of water operation and maintenance. This analysis is designed to assess the capacity of various agencies with regard to functions considered critical to successful implementation of the Project. It is also intended to assess the adequacy of the proposed implementation arrangements given the relative strengths and weakness of the involved GOE agencies.

The Phase I Project used separate implementing agencies for the water and wastewater components. For the Phase II Project the possibility of using a single implementation agency was assessed, but was fount not to be feasible. The government entities considered for the role of implementing agency for the wastewater component include local government wastewater departments, the National Organization for Potable Water and Sanitary Drainage (NOPWASD), and the Canal Zone Water and Wastewater Organization (CZWWO). The Suez Canal Authority was considered for the much smaller water supply component of the Project. Each of these will be discussed in terms of its organization structure, management experience, contracting capabilities, and financial management.

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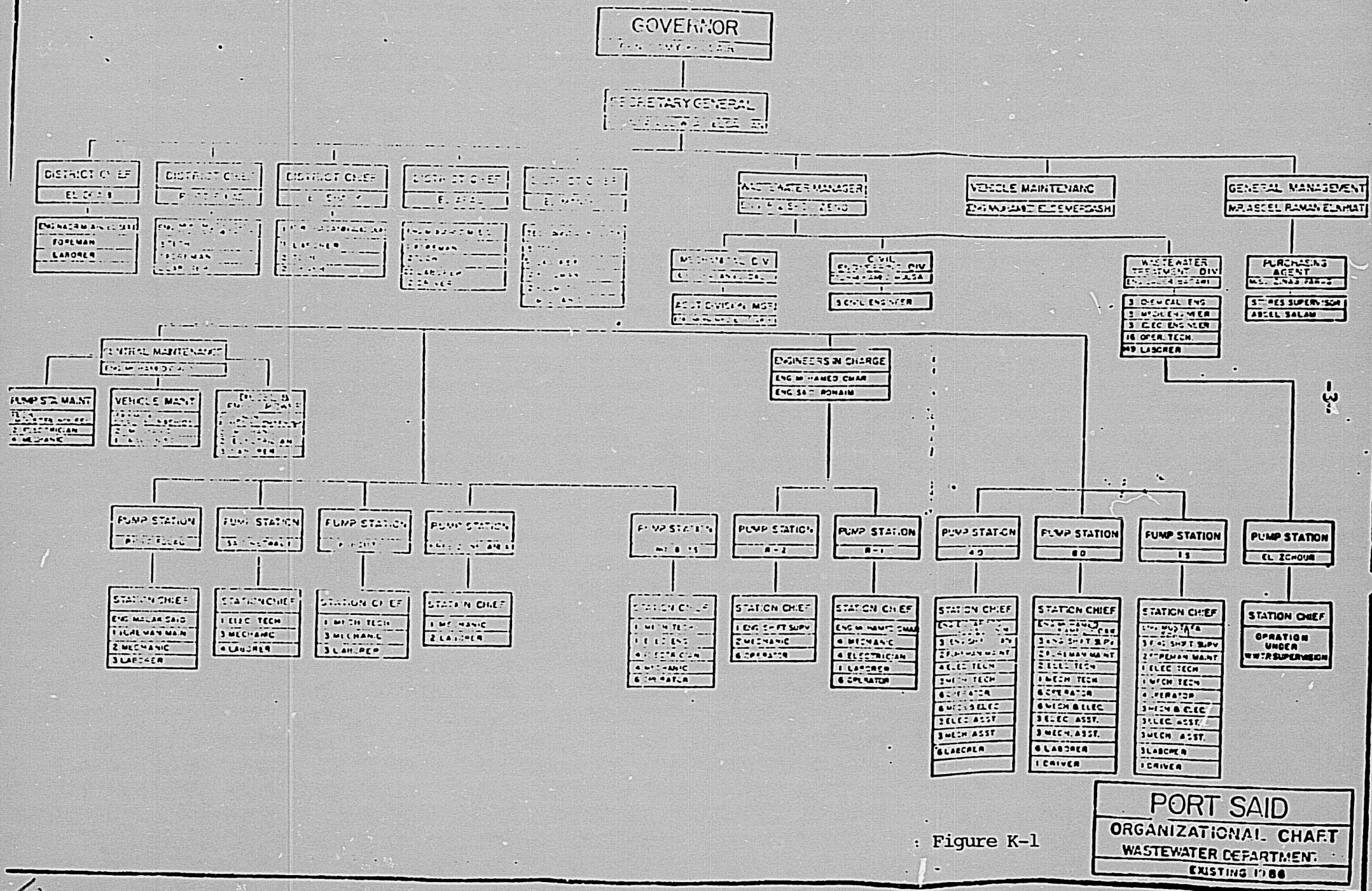
A. Local Government Wastewater Departments

1. Organization Structure and Authority

The Governorates have very limited design and construction experience or capability to manage large scale infrastructure projects. The most likely candidate at the local government level is the wastewater department located in each of the three Canal Cities. The administrative structures of these wastewater departments differ slightly, although their responsibilities are identical. In Port Said (see Figure J-1) the Wastewater Manager reports to the Secretary General of the Governorate. He is responsible for operation and maintenance of wastewater treatment plants and pumping stations, but the collector system is maintained under the supervision of political Districts Chiefs. In Ismailia (Figure J-2) the Wastewater Manager reports to the City Council Chairman, and is responsible for the operation and maintenance of all wastewater collection, pumping, and treatment facilities. In Suez City (Figure J-3) the Wastewater Manager reports to the Secretary General of the Governorate, and is responsible for the entire wastewater system.

In all three cities the Wastewater Manager has very little authority for implementation of large projects. Their work is restricted to supervision of neighborhood sewer installations, replacement of sewers, maintenance of existing facilities, and small-scale rehabilitation projects. Even to conduct their specified O&M mission it is reported that wastewater managers in all three cities must go "hat in hand" to higher authority for any required part or item not in inventory. Thus under the present administrative structure it is not likely that the local government wastewater departments or any other Governorate agency could serve a primary implementing role for the construction of large-scale water and wastewater facilities.


GOVERNOR
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DISTRICT CHIEF
DISTRICT CHIEF
DISTRICT CHIEF
DISTRICT CHIEF
FOREMAN
LABORER
VEHICLE MAINTENANC
GENERAL MANAGEMENT
CIVIL
WASTEWATER TREATMENT DIV
PURCHASING AGENT
STORES SUPERVISOR
ABDEL SALAM
3 CHEMICAL ENG
3 MECHANICAL ENGINEER
3 ELEC ENGINEER
16 OPER. TECH.
49 LABORER
CENTRAL MAINTENANCE
PUMP STA. MAINT
3 ELECTRICIAN
4 MECHANIC
VEHICLE MAINT
ENGINEERS IN CHARGE
PUMP STATION
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4 ELECTRICIAN
1 LABORER
6 OPERATOR
4 OPERATOR
6 MECH & ELEC
3 ELEC ASST.
3 MECH. ASST.
6 LABORER
1 DRIVER
OPERATION UNDER WWTP SUPERVISION
PORT SAID
ORGANIZATIONAL CHART
WASTEWATER DEPARTMENT
EXISTING 1988

Figure K-1

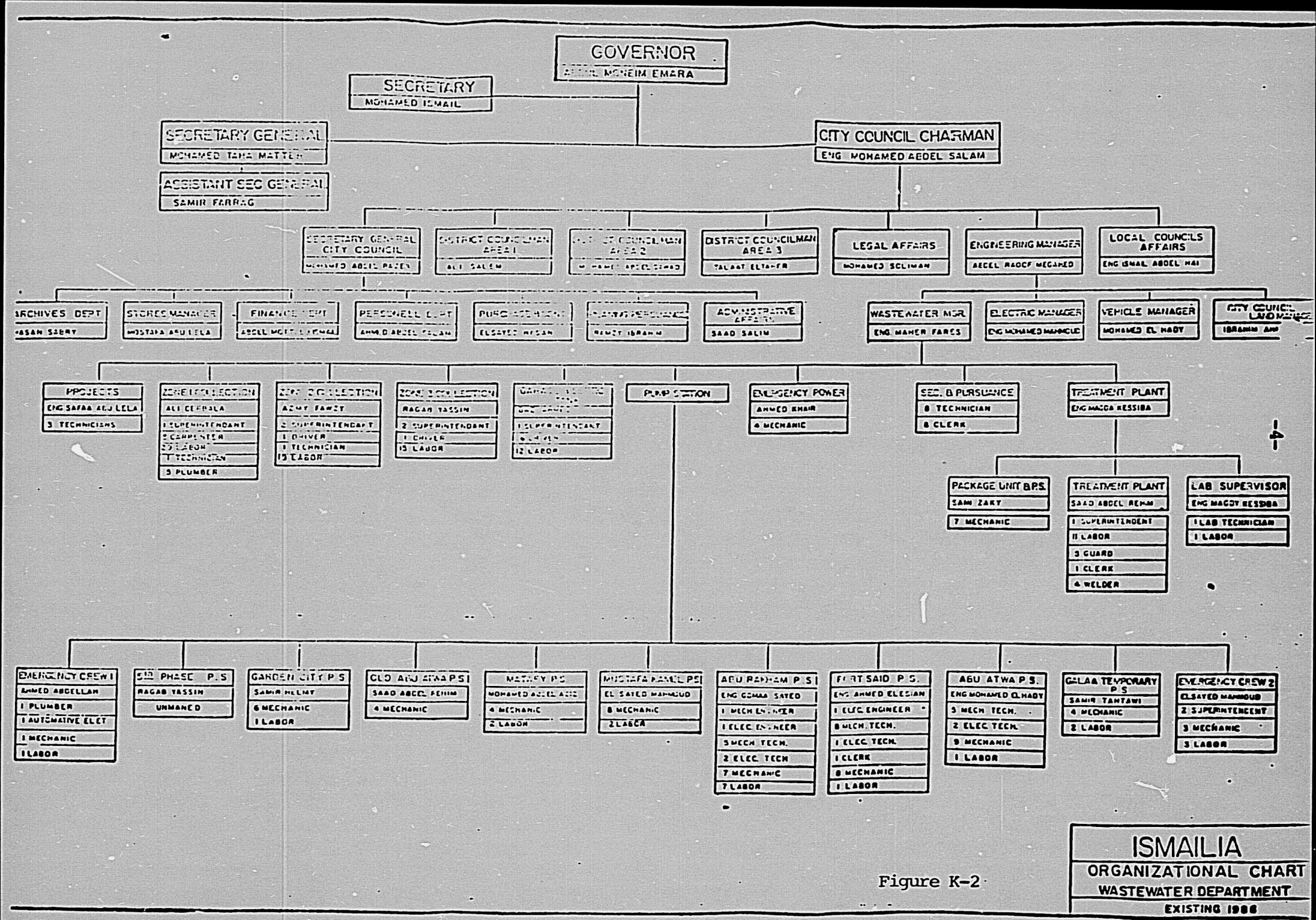

Figure K-2

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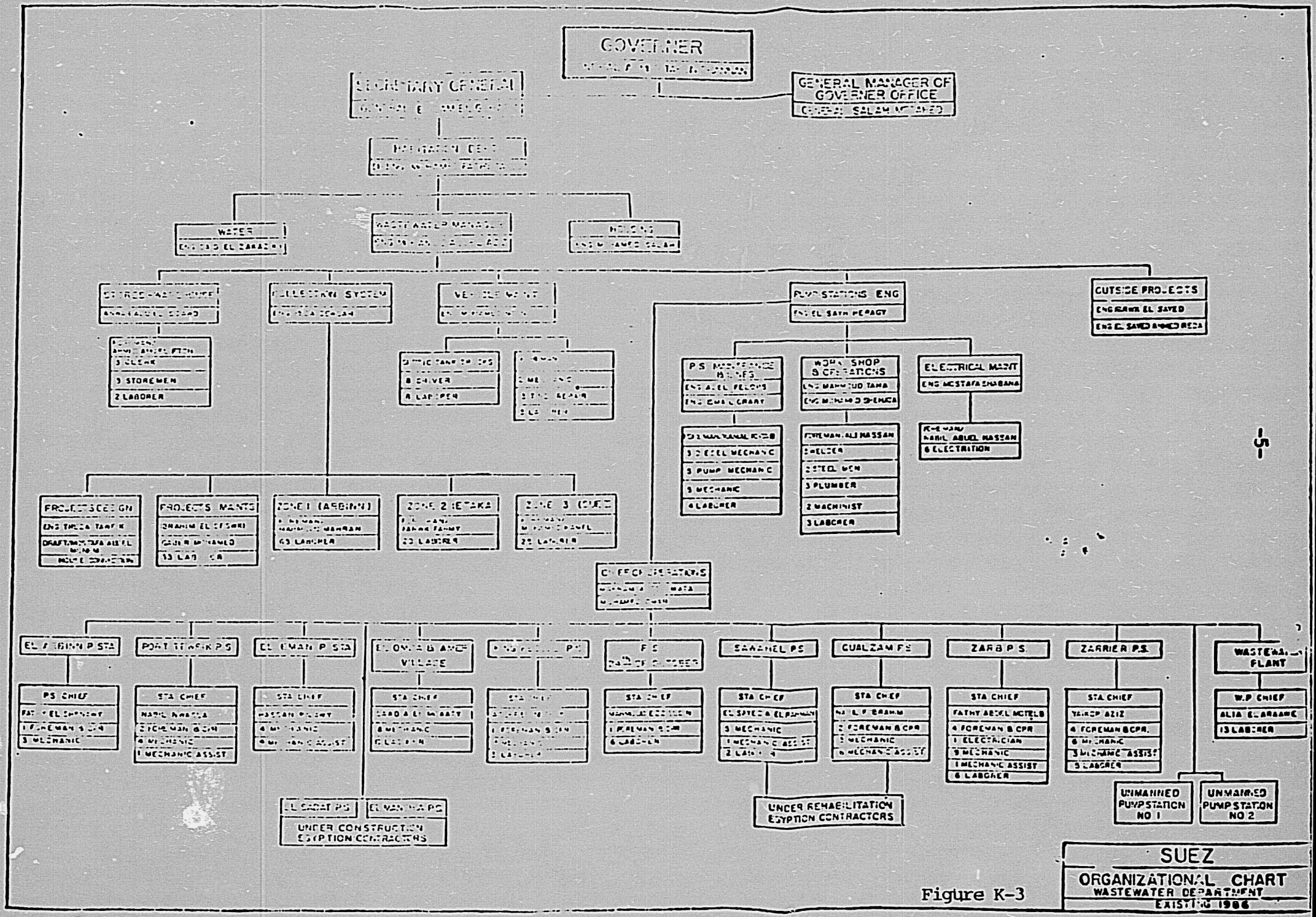

GOVERNER
GENERAL MANAGER OF GOVERNER OFFICE
SECRETARY GENERAL
WATER
WASTEWATER MANAGER
HOUSING
STORE HOUSE
COLLECTION SYSTEM
VEHICLE MAINT
PUMP STATIONS ENG
OUTSIDE PROJECTS
3 CLERK
3 STOREMEN
2 LABORER
8 DRIVER
8 LABORER
PS MAINTENANCE MINES
WORK SHOP & OPERATIONS
ELECTRICAL MAINT
ENG MOSTAFA SHABANA
6 ELECTRITION
3 PUMP MECHANIC
3 MECHANIC
4 LABORER
3 WELDER
3 PLUMBER
2 MACHINIST
3 LABORER
PROJECT DESIGN
PROJECTS MAINTS
ZONE 1 (ARBIN)
ZONE 2 (ETAKA)
ZONE 3 (SUEZ)
63 LABORER
CHIEF OF OPERATIONS
EL ARBIN P STA
PORT TAWFIK P S
EL EMAN P STA
EL OMRANIA & AMER VILLAGE
P S
SAAANEL PS
GUALZAM PS
ZARB P S
ZARRIER P.S.
WASTEWATER PLANT
PS CHIEF
STA CHIEF
W.P CHIEF
ALIA EL ARABANE
13 LABORER
3 MECHANIC
1 MECHANIC ASSIST
6 LABORER
5 LABORER
4 FOREMAN & CPR
1 ELECTRICIAN
9 MECHANIC
1 MECHANIC ASSIST
6 LABORER
UNDER REHABILITATION EGYPTION CONTRACTORS
UNMANNED PUMPSTATION NO 1
UNMANNED PUMPSTATION NO 2
EL SADAT PS
EL MAN HA PS
UNDER CONSTRUCTION EGYPTION CONTRACTORS
SUEZ
ORGANIZATIONAL CHART
WASTEWATER DEPARTMENT
EXISTING 1986

Figure K-3

2. Management Capabilities

The wastewater departments in each of the three Canal Cities are responsible for operation and maintenance for operation and maintenance of wastewater facilities. Routine operations are carried out by on-site managers as specified in standard procedures. All significant decisions are referred to the Wastewater Manager, who generally will consult with higher authority in all but the most routine cases. Management is generally adequate for present operations, and problems of operation and maintenance are being addressed by the Phase I Project. The reporting system is rudimentary, and its improvement will be a focus of Phase II technical assistance.

For the past 20 years many of the Canal Cities wastewater facilities were inoperable, and the Phase I Project has just recently rehabilitated them. Operation of the newly provided pumping stations and maintenance of the expanded collector system is very demanding for the wastewater departments in all three cities. Their staffs are generally adequate in numerical terms, but require considerable training. This has been provided under the Phase I Project, and will be continued under Phase II. The wastewater treatment facilities proposed under the Phase II Project will require further training of the present treatment plant operators, and may call for hiring and training of additional staff. Detailed provisions are being made in the Phase II Project for O&M support, training, and institutional strengthening.

It is evident that the local government wastewater departments are fully engaged with an uphill struggle to enhance their capacity for managing their present and anticipated O&M loads. They have no capacity or interest in managing the construction of facilities proposed by the Phase II Project. They have indicated a strong interest in being consulted more closely during the design and implementation phase, but are satisfied that this can be accomplished through their involvement in the Project Steering Committee.

3. Contracting

The wastewater departments in each of the three Canal Cities are responsible for operation and maintenance of wastewater infrastructure. They have never been involved in contracting for the design or construction of major facilities, which has always been the responsibility of national agencies such as NOPWASD. It has been USAID experience that local government organizations tend to be more alert and responsive as project managers than national government agencies, but that they lack experience and technical expertise. In the case of the Canal Cities Phase II Project, the complexity and magnitude of the construction activity is beyond the contracting capability of local government wastewater departments. They indicated that their contracting authority is limited to contracts of less than LE 100,000, with NOPWASD handling contracts over that amount. Their interest in design and implementation is strong, since they are most aware of local water/ wastewater requirements and specifications, and must operate and maintain the facilities. Each of the three organizations noted that in the past they have not been consulted adequately during design and implementation of facilities, and expressed the hope that they could provide more input on local needs. However, none of them has the capability to take a leading role in contracting for design or construction of major facilities. The wastewater departments are in complete agreement with this assessment.

4. Financial Management

As noted previously, the wastewater managers have very little fiscal autonomy. Most purchases must be approved by higher authority. All three wastewater departments have a financial section, but it is concerned with voucher processing and timekeeping. Payment is made by financial departments at the City Council or governorate level. Due to their lack of experience and capacity, it would not be feasible to utilize any of the wastewater departments for processing vouchers or making payments to major construction contractors.

B. National Organization for Potable Water and Sanitary Drainage (NOPWASD)

1. Organization Structure and Authority

NOPWASD was the implementing agency for the wastewater component of the Canal Cities Phase I Project. The analysis of its administrative strengths and weaknesses is based on our experience with this agency over the life of Phase I Project. Given the detailed analysis of NOPWASD conducted in the design of Institutional Support Project, another systematic review of its contracting, voucher examination and other processes was considered relatively unimportant and, therefore, was not undertaken.

NOPWASD is the primary GOE entity concerned with water and wastewater infrastructure in Egypt. It is a department or "general organization" of the Ministry of Housing and Public Works (MHPU). It was created by Presidential Decree No. 197 of April 1981 to develop national policies and plans for potable water and sanitary drainage. It also prepares feasibility studies and project designs, and supervises the construction of national projects which exceeds the capacity of local authority or serve more than one governorate.

NOPWASD has legal responsibility for supervision of design and construction of major urban wastewater facilities in Egypt, with a number of exceptions. In Cairo, an implementing organization, CWO, was created specifically to administer major construction contracts for rehabilitation and expansion of the Cairo wastewater system. In Alexandria, a similar organization was developed to administer the rehabilitation of the wastewater system. In the Canal Zone, Suez Canal Authority is responsible for the expansion of water facilities.

The administrative structure of NOPWASD is depicted in Figure J-4. It is evident that authority is highly centralized in the Chairman. In fact the power of the Chairman is even more concentrated than it appears, since the department directors are delegated authority for only the most routine actions and inconsequential decisions. This centralization of authority delays even

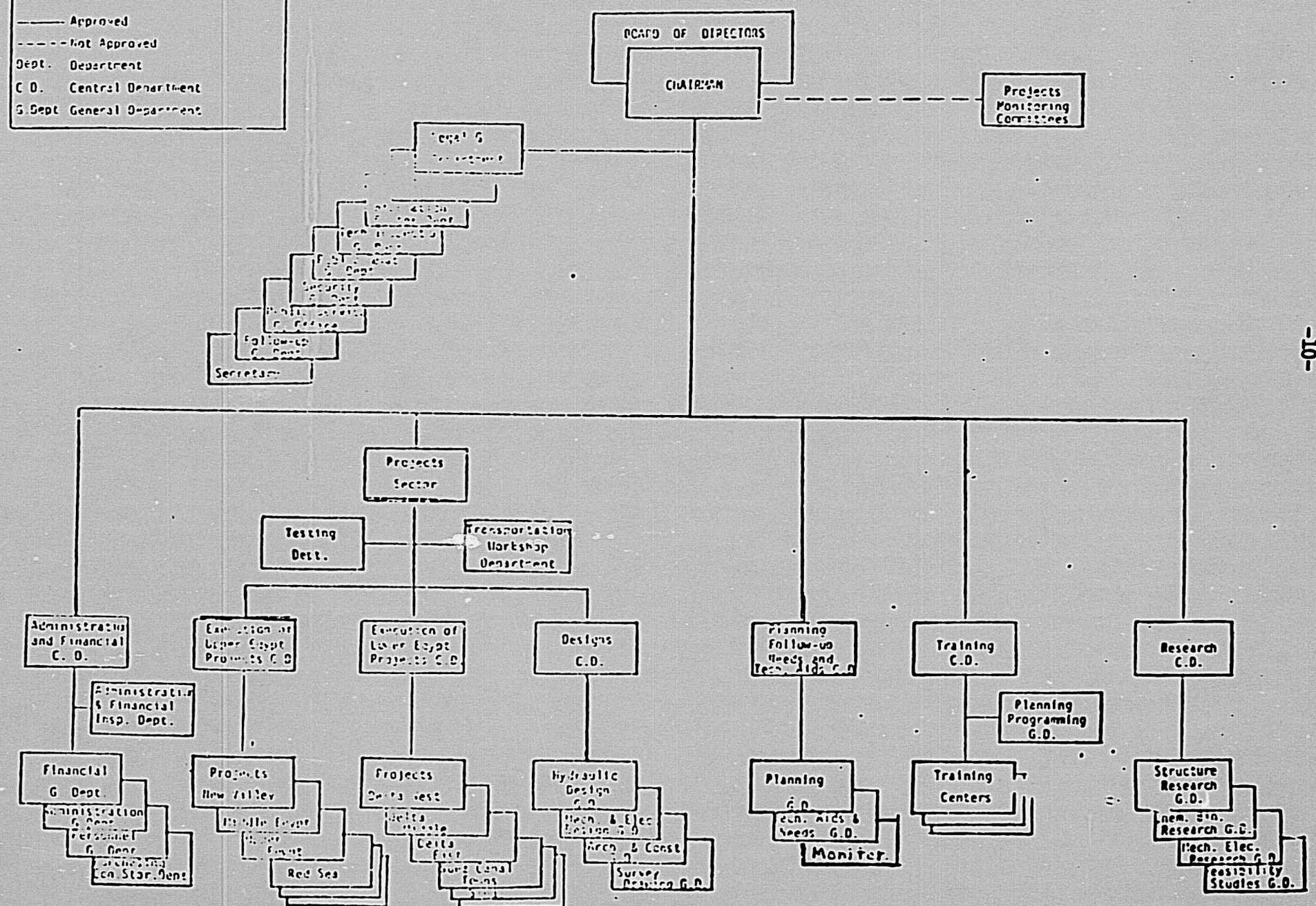
the simplist decisions and impedes implementation of projects under NOPWASD's supervision.

NOPWASD's performance as implementing agency during the Phase I was not impressive, with laborious decisions and delayed approvals impeding project implementation, and inadequate supervision of local contractors' construction activities. Toward the end of the project NOPWASD's ability to administer contracts deteriorated. The High Procurement Committee took 18 months to approve Work Order 3 for training services, and has been unable to agree on approval of Work Order 4 for feasibility studies after two years. They arbitrarily withheld payments from suppliers, contractors, and consultants, although these were clearly allowable under the contract. They have displayed similar inability to make decisions on other projects in USAID's Water/Wastewater portfolio. In spite of all of these activities, in all fairness to NOPWASD, AID financed major activities under Phase I were completed with the exceptions, within the project completion date.

2. Management Capabilities

In terms of its human and financial resources, NOPWASD might be expected to have adequate management capabilities. It has the engineers, the accountants, and the contract administrators. It has considerable experience in the wastewater sector. However, project implementation requires timely decisions and positive action, and NOPWASD has not been able to provide either of these in the past few years. NOPWASD uses interdepartmental committees to conduct its more important business, such as policy decisions, project design, or approval of donor-assisted projects. This "management by consensus" assures that all viewpoints are considered, avoids any suggestion of impropriety, and widely spreads any liability for negligence, a genuine concern for public decision-makers. However, this organizational structure impedes decision-making in NOPWASD, with consensus often difficult to achieve. In the case of NOPWASD's High Procurement Committee, major decisions and required approvals for contracting and procurement have delayed AID-sponsored projects for two to three years. The governorates have joined USAID in complaining about the continuing inaction and repeated delays and expressed a strong desire to work with an implementation entity other than NOPWASD.

Figure K-4: National Organization for Potable Water and Drainage



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During the past month, Minister Kafrawi has designated a new Chairman and two key assistants with a mandate to strengthen NOPWASD and provide leadership to its staff and operations. AID financed Institutional Support Project, designed to strengthen NOPWASD's operations, which has experienced delays of its own of over two years, is about to get underway and may prove to be crucial in strengthening the new management hands in improving project implementation at NOPWASD. It, however, remains questionable if NOPWASD's management will improve soon enough to be useful in the implementation of Phase II Project.

3. Contracting

NOPWASD was the manager of the Host Country Contract for wastewater infrastructure on the Canal Cities Phase I Project. Their management was characterized by hesitancy and delay, lackadaisical monitoring of contractors, and contravention of contract provisions. NOPWASD took months to approve IFBs, needlessly delaying construction. Their lack of vigor in dealing with Egyptian contractors allowed faulty construction of collectors and delays of three years. Their dealings with U.S. engineering consultants and construction contractors were contentious and heavey-handed. They consistently ministerpreted contracts and did not manage in accord with their provisions. The procurement of spare parts and for the factory representatives' services, considered critical by USAID project management and engineering staff, to ensure smooth start-up and operation of the facilities, was ruled as unimportant risking millions of dollars of equipment and construction. This inaction resulted in numerous operation and maintenance problems later. The execution of change orders during construction and the settlement of claims upon the completion of construction was a time consuming and an excruciating experience. It was only USAID's continuous interventions that expensive litigations were avoided. NOPWASD's Higher Procurement Committee even refused to recognize the Bilateral Agreement, which specifies that U.S. law will prevail on AID-supported project activities when it contradicts Egyptian law. These difficulties and delays have also plagued other USAID-supported projects involving NOPWASD as contract manager.

A number of masures are being proposed to improve contract management during the Phase II. These include design/build (turnkey) approach to construction in which a single contractor is responsible for the design, procurement of equipment, construction, initial start-up and operational services, and O&M assistance to the wastewater departments for a period up to three years. In addition, the A&E contract to monitor construction and the TA contract in support of the institutional development will be procured under AID Direct Contracting procedures. During Phase I, the advisory services were performed under Host Country contracting arrangements. NOPWASD frequently challenged the professional and contractual authority of its consultant and hampered his ability to negotiate and make decisions on behalf of NOPWASD. The proposed modifications, should considerably reduce the number of procurement and contracting problems.

4. Financial Management

In early 1985 a detailed institutional analysis of NOPWASD was conducted as a part of the Water/Wastewater Institutional Support Project (263-0176), and a brief administrative analysis was also carried out. Assessing NOPWASD's performance as host country implementing agency on the Canal Cities I Project, it reported that there were no significant delays in voucher processing. The amounts authorized for payment were consistent with the actual costs incurred by the consultants, and did not include any arbitrary deductions made by the agency.

Since that time, however, there have been considerable difficulties with NOPWASD's ability to process vouchers accurately and make payments on time. Items have been deducted from the Canal Cities Consultant's vouchers despite contract provisions clearly allowing them. Large payments were disapproved from AID financed construction contract for no discernable reason. There is hardly any contract for services or equipment which did not experience a payment dispute of one kind or another. Although it probably has the financial mechanism and controls to manage the voucher and payment process, it appears that internal paralysis or intertia is preventing NOPWASD from performing a financial management role of satisfactory speed or accuracy on AID-supported projects.

C. Canal Zone Water and Wastewater Organization (CZWWO)

1. Organization Structure and Authority

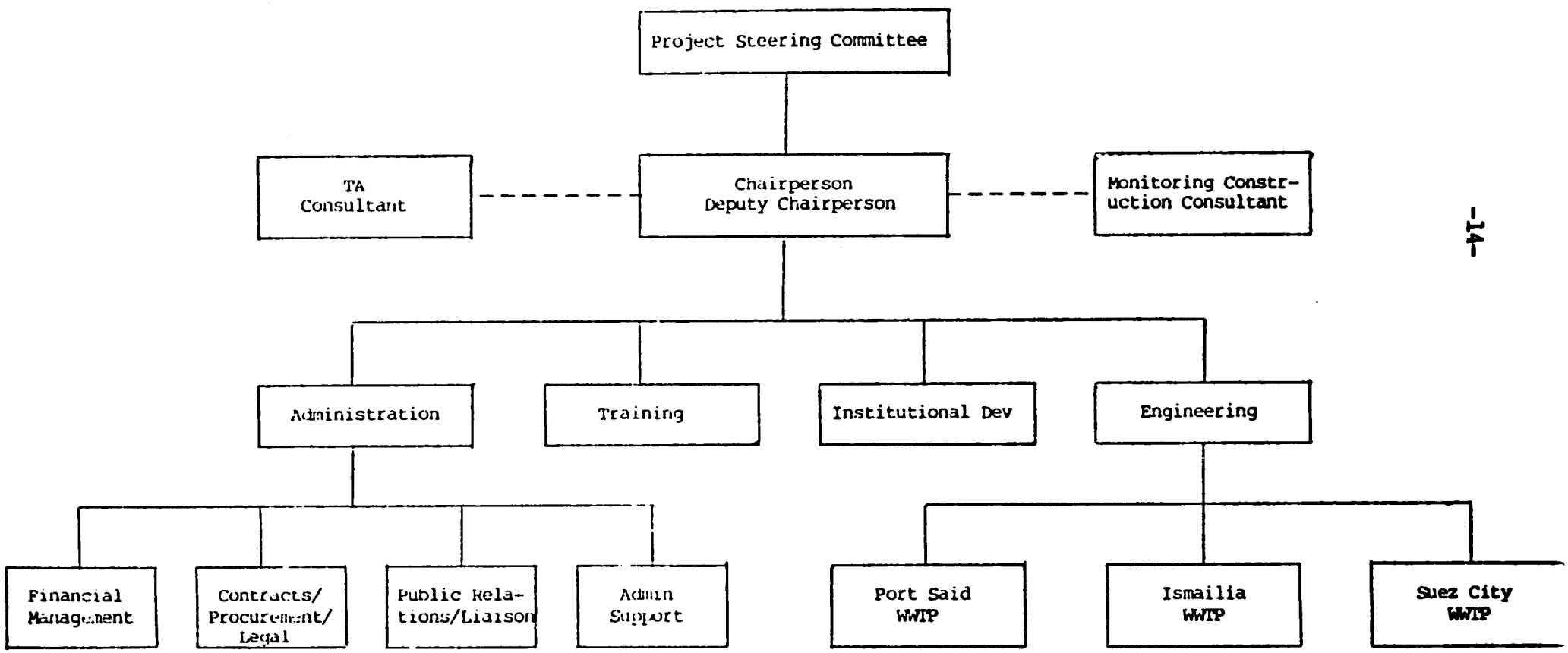
The CZWWO was created in December, 1986 by Minister Kafrawi, under a ministerial decree, specifically to replace NOPWASD as implementing agency for the wastewater component of the Phase II Project. This was done in response to three years of repeated complaints by USAID and the Canal Zone Governorates about delays and indecisions by NOPWASD as implementing agency on the Phase I Project. Within the framework of the decree, the project design team developed the specifics pertaining to CZWWO for purposes of implementing the Project.

USAID envisions this as an ad hoc mechanism put in place specifically to implement the wastewater component of the Phase II Project, rather than a new permanent organization. It is understood that it will draw heavily on qualified MHPU and NOPWASD personnel who will be assigned for the duration of the Phase II Project. The existence of the CZWWO is not planned to continue beyond the end of the Project.

The CZWWO consists of a Project Steering Committee (PSC) and an implementation support unit (see Figure J-5). The role of the PSC is advisory, policy guidance, monitoring progress, problem solving and decision-making during the entire life of the proposed Project. The staff of the implementation unit will perform the technical and administrative functions. The implementation support staff will review and approve IFBs, solicit and evaluate bids, and award contracts. It will manage four design/build contracts, monitor construction progress, approve payment, and accept completed facilities. To carry out these functions, the staff of the implementation unit will draw on the support of the A&E and institutional development TA contractors.

The PSC membership, according to the aforementioned decree, includes representatives of NOPWASD/MHPU, the Governor or his delegate from each of the Canal Zone Governorates, and the Managers of each local government

Figure K-5: Canal Zone Water and Wastewater Organization



wastewater department. This will assure the articulation of the technical design and other concerns of the three Governorates, the future owners of the wastewater facilities. The PSC is also expected to include representatives from the SCA Works Department, MPIC, MOF, and perhaps an observer from USAID. The PSC will meet as many times per year or as conditions require. Day-to-day operations and coordination of implementation activities will be provided by NOPWASD/MHPU appointed Project Manager and a full time Deputy Manager.

The structure of the implementation unit was developed by the Project Committee with the specific objective of managing the four Host Country Contracts for the Phase II Project. It thus has the advantage of absolute focus on project implementation without the distraction of any competing activities, and it can be staffed with precisely the human and technical resources it requires to manage these activities. Provision of adequate full time staff and institutional resources by NOPWASD/MHPU could be included as a Condition Precedent to the Project.

As indicated in Figure J-5, the core office of the implementation unit is the Engineering Department, which will have branches in Port Said, Ismailia, and Suez. Its functions will include technical review and approval of design work, construction monitoring, technical verification of invoice items, performance testing, and certification for acceptance. It will have a full complement of engineering services in the central office, as well as field engineers on site at each construction activity.

The Training Department and the Institutional Development Department are depicted in Figure J-5 at the same level as the Engineering Division, indicating their equal importance to the Phase II Project. The Training Department will coordinate all wastewater training activities, excluding the development of the SCA Training Center. The Institutional Development Department will coordinate and monitor all activities designed to strengthen the institutional capabilities of the local government wastewater departments. Both of these Departments will have the technical and managerial counterpart personnel required to carry out their tasks, and will draw heavily on the staff of the TA contractor.

Administrative and technical services other than engineering will be located in the central office, but personnel may be assigned when required to the city branch offices. The Financial Management Office will review and approve invoices and monitor and control local currency resources. It will have responsibility for making payments to expatriate contractors for local currency costs under the Egyptian Pounds letters of credits.

The Contracts/Procurement/Legal Office will be responsible for all CZWWO contracting and procurement. Its function will be to facilitate the procurement of all services and commodities required for the implementation of the wastewater component, in cooperation with the Design/Build contractors and the Project Consultants. It will have qualified personnel familiar with AID contracting procedures, and a legal staff for claims and other legal problems.

The Public Relations/Liaison Office will interact with relevant organizations within and outside the project to exchange information, facilitate approvals, resolve problems involving third parties, and anticipate potential difficulties before they reach a critical stage. This Office will be staffed with knowledgeable and resourceful personnel who have experience and contacts throughout the GOE and the water/wastewater sector. The Administrative Support Office will be responsible for CZWWO's internal services, supplies, and administrative coordination.

2. Management Capabilities

The CZWWO has been designed explicity to manage the wastewater component of the Phase II Project, and it will benefit from the experiences and lessons learned from the Phase I Project. Its mission is concentrated on the sole objective of implementing wastewater facilities in the Canal Zone, and thus there will be no complications or diversion of effort. Reflecting this focus, its organization is straightforward and the responsibilities of its departments are well defined.

The provision of qualified contract management personnel will be a critical pre-implementation exercise. The MHPU/NOPWASD has an adequate pool of experienced contract managers and technicians available for assignment. Full staffing with qualified personnel and the provision of other resources should be considered as a Condition Precedent of the Phase II Project.

3. Contracting

The Contracting/Procurement/Legal Office will cooperate with the Engineering Department in the development of IFBs, the provision of technical approvals, the evaluation and award of bids, and the procurement of all materials and services required for implementation of the wastewater component. Its efforts will be restricted to contracting and procurement for this Project, and it will be provided with precisely the resources necessary to accomplish this work. An A&E firm will assist the contracting staff of CZWWO in procuring the services of the design/build contractors.

4. Financial Management

Financial Management will be the responsibility of the Financial Management Office. Drawing on the experience of the Phase I Project, disbursement for Dollar payments will be made under AID Direct L/Comms. Thus financial management will be restricted to the issuance of certificates of performance and the verification of vouchers. It will also be responsible for management and disbursement of GOE counterpart funds. The CZWWO financial staff will work in close cooperation with the Project Consultants, who will provide technical and staff support as required.

In summary, CZWWO could seriously be considered as a viable option for the implementation of the wastewater component of the Phase II Project. This mechanism has the direct support of the local governorates and the implicit support of SCA, MPIC and some officials within NOPWASD as well. Given the GOE commitment and support of NOPWASD/MHPU and with the provision of

adequate resources, CZWWO can be organized as an effective entity for the implementation of the Phase II Project. It relies heavily on the technical and other resources, strengths and legal mandate of NOPWASD and also provides a mechanism for local participation. Admittedly, NOPWASD does not view CZWWO's establishment favorably and is most likely to resist any interference of outsiders. Recently, Minister Kafrawi has issued another decree on July 6, 1987 rescinding the establishment of CZWWO.

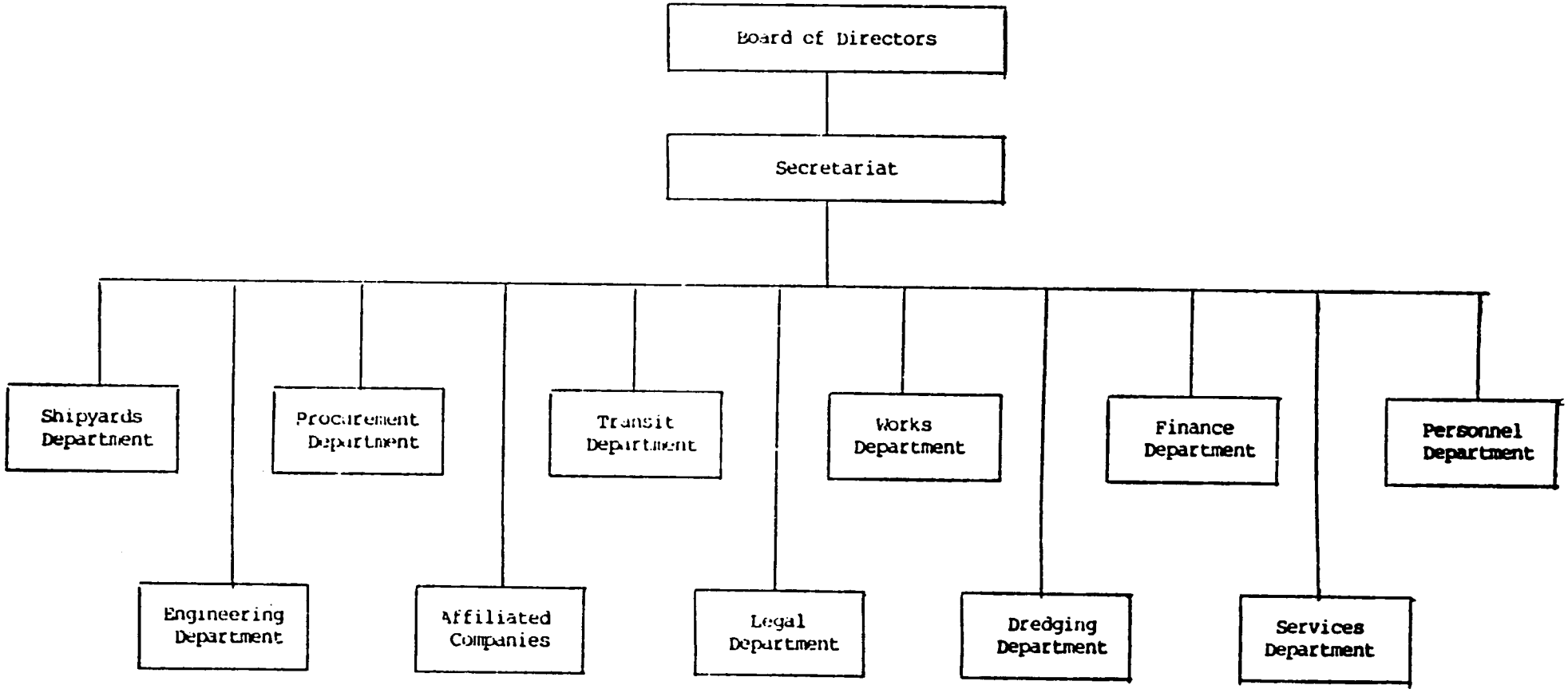
D. Suez Canal Authority (SCA)

1. Organization Structure and Authority

The SCA is a semi-autonomous government authority. Its prime responsibility is the operation, maintenance, and development of the Suez Canal. This involves the monitoring and control of maritime traffic, operation of Canal facilities and equipment, dredging and other canal maintenance, engineering for rehabilitation and expansion projects, and financial operations. It also includes the development of community infrastructure, the maintenance of roads, the provision of housing, and the operation and maintenance of water and electric utilities for all the Canal Cities.

The SCA organization consists of 12 Departments and a Board of Directors (See Figure J-6). The Board of Directors includes the Directors of each Department, who have equal votes and generally strive to make decisions by consensus. The Board deals with all high policy considerations, and also must approve all major contracts or purchases involving expenditures of LE 100,000 or more. Other issues are referred by the Directors seeking approval on any decision where consensus is desired. This "management by consensus" approach is typical in Egyptian public sector organizations, and often proves to be slow and indecisive at contract administration. However, it does not appear to be a problem in this case, as the SCA is known as one of the best-organized and most effective public sector organization in Egypt.

Figure K-6: Suez Canal Authority



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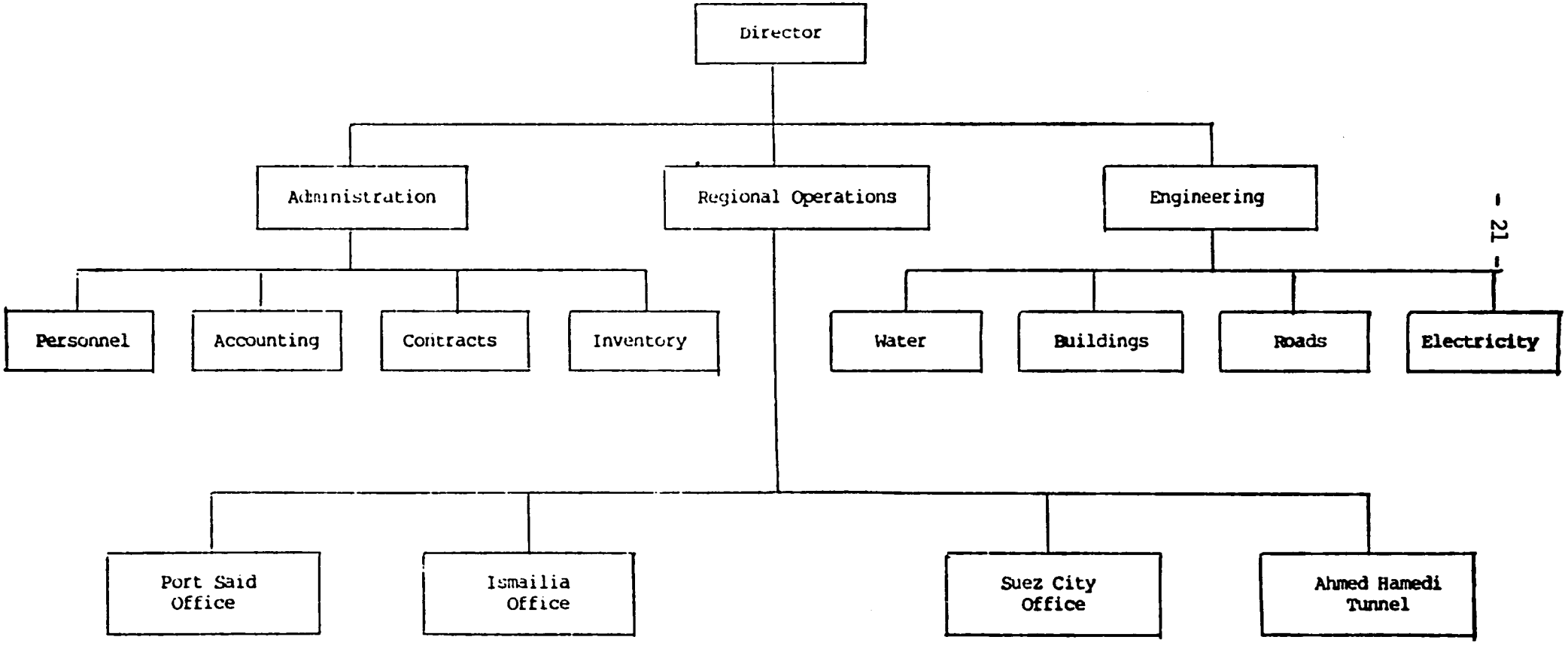
The Works Department is responsible for infrastructure and public utilities in the Canal Cities and throughout the Canal Zone. This includes water, electricity, roads, SCA building, and staff housing. The Department develops specifications for complex infrastructure projects, supervises and sometimes undertakes design activities, solicits bids and awards contracts, supervises construction, and manages, operates, and maintain facilities. It has branch offices in each of the Canal Cities to conduct these activities.

The Works Department organization is decipted in Figure J-7. It consists of branches for Water, Housing, Roads, Building, Electricity, and Finance. It maintains offices in the SCA Section located in each of the Canal Cities. Engineering and other technical resources are concentrated in the Main Office, with applications-oriented activities located in the branch offices. The Water Branch is the Works Department unit principally involved in the Phase I Project. It is divided into two sections, one for New Works and one for Operations and Maintenance. Both have offices in each of the Canal Cities.

Routine operations are conducted according to the functional responsibilities indicated by the organization structure. Policy and important decisions are made by the Works Department Executive Committee. The Committee alway includes the Director and his four Deputies, one of which is his assistant and the other three are the Works Department office managers in the Canal Cities. The Committee can be expanded to address specific tasks, and in the case of the Canal Cities Phase I Project it included the counterpart Project Manager in the Works Department. The Executive Committee approves IFBs, develops evaluation criteria and assesses bids, and awards contracts.

The Works Department has complete authority to implement water projects, but it can draw on other SCA departments when appropriate. it utilizes the Procurement Department for major purchases of materials and services. Its personnel are recruited by the Personnel Department. It has its own engineering and financial staff, but can draw on the more extensive department-level resources for large tasks. Particularly on the Canal Cities Projects, with their extensive requirement for skilled O&M workers, it

Figure K-7: SCA Works Department



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coordinates with the SCA Administration and Training Department in the development of O&M training programs.

The SCA Works Department did an excellent job of implementing the Phase I water treatment and distribution activities. All design and construction activities were accomplished on schedule, without any cost overruns. Therefore, it is proposed that the Phase II water component by implemented by the SCA Works Department without any major modifications to present implementation arrangements.

2. Management Capabilities

The SCA is one of the best public sector management organizations in Egypt. It generates more than $1 billion per year in foreign exchange for the GOE, and thus is given favored treatment in the allocation of resources required to accomplish its mission. The SCA manages the Suez Canal and most of the infrastructure in the Canal Zone. It performs or supervises all of the operation and maintenance of the Canal, and most O&M for Canal Zone facilities. It performs these extremely varied and complicated functions with expertise and dispatch.

The SCA Works Department is responsible for the management of most public utilities in the Canal Cities. This includes both the development of new facilities and the operation and maintenance of existing ones. Engineering and financial operations are centralized in the Main Office, but adequate technical resources are maintained in each of the three Canal Cities to operate local facilities and provide maintenance.

The SCA Works Department emphasizes a team approach to the design and implementation of new projects. The Project Manager on the Phase I Project considered his local SCA engineers, the local government wastewater manager, and the U.S. consultant engineers to be a team. He made little distinction between them, drawing on the advice of all and expecting them to coordinate their activities to implement the Project.

The Works Department maintains a detailed reporting system. Reports are filed for any significant event on construction sites, and the engineers in each city report weekly to their Section Chief. The Section Chief reports monthly on construction activities to the Manager of the Works Department in Ismailia. There is a wide array of technical and financial reports on operation of water treatment facilities and collection of revenues.

3. Contracting

USAID/FM recently conducted a detailed assessment of Works Department contracting procedures. Considerable evidence of their capability was available from their performance as implementing agency for the water component of the Phase I Project. They were found to maintain adequate files and conform with AID regulations in every respect.

The SCA has throughout its existence contracted for large scale construction services and for the procurement of commodities on both the international and domestic level. Formal authority for contracting is delegated by Decree No. 250, which contains contract regulations and standard provisions. This degrees of competition (purchase order, short list of pre-qualified contractors, advertised bids) are required,

Procurement of commodities is handled by the SCA Procurement Department. In cases involving technical design, installation, or construction, the Works Department serves as contract manager, This includes development of technical specifications, advertising, negotiation, and contract award, construction monitoring, and formal acceptance. Ongoing management is handled by a designated project manager, while basic decisions are often referred to the Works Department Executive Committee, previously described in Section 1. The Works Department is experienced in contracting with foreign firms, including CTE (French), PAMAG (German), and Permutil-Boby (Bristish).

The Works Department served as contract manager for the water treatment and distribution component of the Phase I Project. They used the Canal Cities Consultants to develop specifications and prepare IFBs, quickly responding with their comments or approval as appropriate. For each IFB they created an Evaluation Committee and developed evaluation criteria, assessed and scored the bids, and selected one. In all cases they followed AID regulations and guidelines as presented in Handbook 11 and other relevant documents.

The Works Department's performance as host country implementing agency on the Phase I Project was very satisfactory. They demonstrated both technical and managerial capacity in their administration of the Host Country Contract. They worked in concert with local and U.S. construction contractors, the consulting engineer, and USAID to solve problems, exert pressure for timely implementation, and assess the quality of construction.

4. Financial Management

A systematic assessment of voucher processing and payment procedures was conducted by USAID/FM. It was found that they are familiar with AID financial management guidelines, and process vouchers accurately and on time. Voucher processing involves both the Works Department and the Financial Department. Vouchers are first reviewed by Works Department engineers at the project site for technical compliance. Then it is sent to the Main Office where the Works Department accounting unit reviews it for compliance with contract terms. The results of the review are then forwarded to the SCA Financial Department for further review and approval. Each of these reviews takes 4 to 5 days. After approval the Financial Department issues a check to the contractor. Both the Works Department accounting unit and the Financial Department maintain records of all invoices.

SCA provided financial management for the water component of the Canal Cities Phase I Project. Early in the PRoject there were some delays in disbursement which were caused by procedural differences between the SCA Works

and Finance Departments. These delays were remedied, but disbursement is still a complicated procedure for the SCA. The Phase II project, being in the position to profit from this experience, has designated USAID to make all Dollar disbursements and completely avoid these difficulties.

E. Selection of GOE Implementing Agencies

GOE agencies included in the analysis are SCA, NOPWASD, Canal Zone for Water and Wastewater Organization (CZWWO), and the three local wastewater departments. SCA was the implementing agency for all water activities while NOPWASD was responsible for the implementation of all wastewater components under the Phase I Project. The three local wastewater departments, which are responsible for the operation and maintenance of wastewater facilities, played virtually no role in the design and construction of Phase I physical facilities. CZWWO was established by the Ministry of Housing and Public Utilities (MHPU) to facilitate and expedite the implementation of residual Phase I activities and the planning and management of Phase II Project components.

Each organization was analyzed with regard to its legal authority, its management capabilities including delegation of authority and the adequacy of managerial/supervisory staff, its contracting capacity including award and management of contracts with international firms, its financial management including ability to resolve payment disputes and process payments on timely basis, and its capacity to monitor, evaluate and satisfy typical USAID reporting requirements. USAID/FM also conducted an independent study to assess the adequacy of contracting and voucher examination procedures of the implementing agencies (see Appendix 1 and 2 to Annex J). The results indicate that there is limited or no capacity within the three Governorates to manage large projects. The three Governorates virtually played no role in the design and construction of the Phase I facilities. The local authorities have expressed a strong desire to actively participate in the implementation of Phase II Project without assuming the responsibility of its management.

1. Suez Canal Authority

SCA is the best run organization and has the required capacity and experience in managing many types/sizes of projects. SCA was able to complete all of its Phase I design and construction activities as planned and as scheduled, and, therefore, is proposed as the GOE agency for implementing the water component of the Phase II Project.

2. National Organization for Potable Water and Sanitary Drainage

a. Strengths

NOPWASD is proposed to be the implementing agency for the wastewater component of the Phase II Project. Several factors support this determination. NOPWASD is the only GOE agency with the legal mandate for the design and construction of water and wastewater facilities, with some exceptions, throughout Egypt. NOPWASD has greater technical capacity and more qualified personnel than the governorates to undertake large projects. In spite of numerous difficulties, NOPWASD was able to complete the Phase I Project. NOPWASD is the GOE designated agency for other AID financed project activities. NOPWASD's continuing involvement in AID financed activities over a long period of time provides NOPWASD the additional experience to improve its implementation of future donor financed activities. Positive steps have been taken recently by the GOE to strengthen NOPWASD operations. For instance, Minister Kafrawi has appointed a new Chairman and two key assistants to provide strong leadership to NOPWASD's staff. The AID financed Institutional Support Project is about to start and will provide NOPWASD the required resources to strengthen its capacity to discharge its functional responsibility.

b. Weaknesses

As the detailed Administrative Analysis (Annex J) points out, NOPWASD, as it exists today, is burdened with a bureaucratic system in which

an action on even the smallest of the task gets bogged down in a complex review and approval process. All of the decision making authority is centered in the position of its Chairman. There is no delegation of authority whatsoever. USAID experienced numerous difficulties during the implementation of the existing project. NOPWASD designated Project Manager did not have the authority to make even minor decisions. The amendment to provide for O&M services, Work Order No.3, experienced delays of about three years. The contract amendment for engineering studies, in support of the proposed Project, Work Order No.4, remains waiting to be signed after more than 18 months. NOPWASD frequently ministerpreted or misunderstood contract provisions resulting in scores of disputes. Virtually every contract experienced payment disputes and/or delays. The execution of even simple change orders was a lengthy and difficult process. The negotiation and settlement of claims and other disputes was an excruciating experience. The source of most of these difficulties could be attributed to the fact that the implementation responsibility was spread all over NOPWASD without any delegation of authority.

The local authorities in the Governorates and USAID complained for almost three years about implementation delays and other problems to Minister Kafrawi. In response to these complaints and apparently to appease USAID and the local authorities, the Minister established CZWWO in December, 1986. The ministerial decree provided for an executive board comprised of the representatives of the three Governorates, MHPU and other concerned agencies. It was anticipated that the MHPU will provide the new entity with the required human, financial and physical resources to support its mission. To this date, CZWWO essentially remained a "paper" organization. For a while, CZWWO appeared as a viable alternative (see the detailed annex) to NOPWASD. After six months of existence and building high hopes for local participation/control and effective implementation of the Phase II Project, Minister Kafrawi dismantled CZWWO in early July, 1987 (along with another organization established for Provincial Cities Development Project), and decided to focus on strengthening NOPWASD operations instead.

c. Proposed Remedies

As mentioned above, NOPWASD is proposed as the GOE agency responsible for the wastewater component of the Project. However, without addressing the problem of its complex internal review/approval process which involves a large number of committees and relies on the central authority of its Chairman, the Phase II implementation will most certainly experience expensive delays of several years and face other problems. It appears, at a minimum, NOPWASD should be required to establish within NOPWASD a small implementation unit staffed with qualified personnel and with reasonable delegation of authority from its Chairman. It is proposed that all of NOPWASD's concerns such as engineering, contracting legal, financial and others be represented in the implementation unit. The implementation unit should report directly to NOPWASD Chairman. The actions/decisions of the implementation unit should not be subjected to the review/approval of any other official/committee of NOPWASD. The establishment of the unit will bring focus to the implementation process, and make an identifiable group accountable for delays and other unresolved difficulties.

The establishment of a unit is, however, no guarantee that the implementation will proceed smoothly and not experience any difficulty. To make sure that NOPWASD is doing all it can, it is proposed that a project steering committee (PSC) comprising of the three Governors, or their designees, SCA representative (for coordination of proposed activities), NOPWASD Chairman and the representatives of MHPU, MPIC and MOF be established. The role of PSC will be advisory, policy guidance, monitoring progress, problem solving, and decision making during implementation. The PSC will meet periodically to review progress and resolve problems as reported by the head of the implementation unit and the contracting personnel. The PSC mechanism assures local participation/ control. The institutional development aspects of the project will get proper attention they deserve which otherwise would probably be ignored. In the process, the local authorities will gain a useful experience in the implementation of large projects. These outcomes in

turn contribute, no matter how limited, towards the attainment of another key objective of the Project, i.e., the eventual autonomy and self-sufficiency of the local utilities.

d. Recommendation

Given the strengths of NOPWASD, as discussed above, the creation of an implementation unit and PSC as proposed, and modifications to implementation arrangements based on lessons learned from our Phase I experience, as discussed in the following paragraphs, the implementation of wastewater component of the Phase II Project is most likely to proceed as planned.

3. Lessons Learned and Proposed Implementation Arrangements

Based on lessons learned from others and specifically from USAID's Phase I experience, several improvements to implementation arrangements enhance the administrative feasibility of the Project. A major source of problems on NOPWASD implemented Phase I Project activities was the decision to do separate procurements for engineering services (design and construction supervision), equipment and construction services. One design/build contract, including design/equipment/construction, for each individual physical facility is proposed as an implementation approach in the Phase II Project. Secondly, during Phase I, the construction work was awarded to one U.S. and eight Egyptian firms under nine separate contracts. While the AID financed U.S. contractor completed construction activities on time, construction work by Egyptian Contractors experienced significantly delays. While the selection criteria for design/build contracts under Phase II will encourage the participation of qualified Egyptian firms as subcontractors, the contracts will be awarded only to U.S. design/construction firms. Thirdly, the design and construction supervision services under Phase I were rendered to SCA and NOPWASD by a joint venture of U.S. consulting firms under two separate host country contracts. Despite clear contract provisions, the Consultant's

authority was questioned, which hampered the former's ability to exercise his professional judgment on a timely basis. USAID's involvement in the resolution of these disputes was time consuming. To avoid similar problems and to ease the implementation burden in the Phase II Project, a single overall construction monitoring firm for all water and wastewater activities under AID Direct Contracting procedures is proposed. Fourthly, under Phase I, SCA and NOPWASD negotiated overall contract agreements with the consultants to be performed during the life of the Phase I Project. The specific scope of work, corresponding level of effort and associated costs were left to be negotiated in the form of subsequent work orders within the scope of the overall agreements. This contracting option posed considerable difficulties when NOPWASD, for instance, chose to ignore and delay negotiation with the Consultant for O&M services to the Governorates. To avoid this problem in the Phase II Project, the entire scope of work, corresponding level of effort and associated costs will be negotiated upfront and included in the contracts. Lastly, recommendations made by the American Contractors in Egypt to avoid problems will be incorporated in the tender/contract documents.

The implementation of the Phase I Project also suffered for lack of meaningful participation of the Governorates, the ultimate owners/managers of wastewater facilities, in the design and implementation of Phase I activities. One important reason for this exclusion was their extremely limited managerial and technical capacity in these areas. An important program of institutional development is being proposed to address these constraints for the future in the new Project. Additionally, the Phase II Project was designed in collaboration with the Governorates. The final Project Paper incorporates ideas generated in a series of GOE/USAID Project Design Committee and other meetings with the local authorities. Being knowledgable of what is included herein and their representation on the proposed PSC enhances the chances of successful implementation of the Project. Finally, a series of workshops aimed at expediting implementation have been planned over the life of the Project.

4. Conclusion

In summary, it can be concluded that the organizational and implementation arrangements proposed for the Phase II Project are reasonable, and that the Project is administratively feasible.

F. Proposed Implementation Arrangements

The Phase I project was a success, providing the planned water and wastewater facilities and finishing major construction activities on schedule. Various implementation difficulties were encountered and solutions devised. As noted above, one of the two implementing agencies was found to be very capable, and another unsatisfactory. In addition, some important lessons were learned regarding implementation arrangements, and the Phase II Project is in a position to benefit from this experience.

Contracting and procurement arrangements on the Phase I Project were very complicated and time consuming. There were separate Host Country Contracts for engineering design services, one for the SCA and one for NOPWASD. There were 9 separate contracts for the construction of the various Project elements, including one U.S. and 8 Egyptian construction firms. For the procurement of materials and equipment there were 83 separate supply contracts.

The Phase II Project will avoid this fragmentation of contracting activities by using design/build or "turn key" contracts for major construction activities. For each water or wastewater facility a single firm or consortium will provide design, procurement, and construction services. Since the same contractor is responsible for design and procurement, materials and equipment can be ordered during the design stage. Since he is also responsible for construction, the contractor can initiate mobilization before the end of the design process, and will have no disagreement with the construction specifications and detailed plans. Thus the design/build approach provides greater efficiency, consistency, and faster completion than the traditional design-tender-build approach.

The design/build approach is common throughout Europe and the Middle East, and Egyptian authorities are very familiar with it. Meticulous control will be achieved by having the Monitoring of Construction Contractor on site to monitor the entire design/build process. Frequent review and approval of plans will be scheduled at various stages of the design process to assure that the facilities taking shape and their cost implications are acceptable to CZWWO and USAID.

The Phase I Project had separate procurements for engineering services for the water and wastewater components. The Project Engineering Consultant provided design services, construction supervision, and technical assistance to SCA and to NOPWASD under separate Host Country Contracts. In both cases the engineering services to be provided were described in general terms, and each major task was specified by negotiating work orders with the consultant as the need arose. This process was very complicated and time-consuming, in a number of instances resulting in impass and long delay.

The Phase II Project will utilize AID Direct contracts for the procurement of engineering services. One contract will cover technical assistance and support for institutional development and training for both the SCA and NOPWASD. The other will provide for a Monitoring of Construction Contractor to monitor all activities of the design/build contractors. Both contracts will include detailed scopes of work specifying all tasks and how they are to be accomplished. This contracting arrangement should eliminate the complications and misunderstandings which impeded the important training and institutional support component of the Phase I Project.

Another source of implementation problems on the Phase I Project revolved around misunderstanding by host country implementing agencies of AID payment procedures, resulting in denial of legitimate invoice items and withholding of payment. The Phase II Project will benefit from this lesson by assigning to USAID all responsibility for Dollar disbursements through AID Direct disbursement mechanisms.

Finally, the Phase I Project had very limited local government participation. Since these authorities are the eventual owners of the infrastructure, their involvement probably would have improved all aspects of design, implementation, and eventual operation and maintenance of the facilities provided. The Phase II Project has involved the participation of SCA and local government authorities in the project design effort from the beginning, and will continue to involve them in detailed design and implementation of facilities through their membership on the Project Steering Committee.

In conclusion, the proposed host country implementing agencies, SCA and NOPWASD have the capability of implementing the Phase II Project. Areas for institutional strengthening and technical support have been identified, and appropriate technical assistance programmed. Based on lessons learned in the Phase I Project, contracting and other implementation mechanisms have been simplified and improved. These are the best available implementation arrangements, and are recommended for the Canal Cities Water and Wastewater Phase II Project.

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SUEZ CANAL AUTHORITY
IMPLEMENTING AGENCY ASSESSMENT REPORT
EXECUTIVE SUMMARY
OFFICE OF FINANCIAL MANAGEMENT - FINANCIAL ANALYSIS

REPORT NO: 87-J-3 DATE OF REPORT: May 18, 1987
Prepared by: T.Johnstone and Mokhtar El Shaarani
Implementing Agency: Suez Canal Authority (SCA)
Project: Canal Cities Water and Sewerage Phase II
Project No: 263-0174

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Purpose of the Assessment:

AID plans to authorize 360 million dollars for the Canal Cities Water and Sewerage Phase II Project during the fourth quarter of fiscal year 1987. SCA has been proposed as the host country implementing organization for the water portion of the Canal Cities Phase II Project. As required by the Administrator's Sixteen Payment Verification Policy Statements (effective January 1, 1984) an assessment of SCA's contracting capabilities and voucher examination process is necessary. This assessment will form the basis for implementation planning decisions such as the choice of contracting mode. Because SCA will not receive AID funded advances or any other direct payments from AID this assessment did not include an evaluation of their accounting systems ability to account for such advances. The complete file of workpapers for this assessment is on file in the Controller's Office.

Assessment of SCA's Contracting and Contract Implementation Capabilities

General

The principal activity of the Suez Canal Authority is the operation and maintenance of the Suez Canal. The SCA has a number of subsidiary functions one of which is the planning, design, construction, operation and maintenance of all potable water facilities in the three Suez Canal Cities of Ismailia, Port Said and Suez. Under this project the SCA would continue to carry out these responsibilities for the Port Said water supply improvements in collaboration with project consultants.

SCA has a history of a well established organization structure and qualified personnel. The Suez Canal Authority operates as a semi-autonomous entity. The Canal fees that the Authority generates contribute to a significant portion of the GOE's annual revenue totaling almost 1 billion dollars a year. In general, the Authority enjoys a reputation as one of the best run governmental entities in Egypt.

In discussions with the project officer and the consulting engineers (Canal Cities Consultants) it was clear that they were satisfied with SCA's contract administration performance to date. In fact, they recommended using SCA as the lead implementing agency for Phase II of the Canal Cities Water and Wastewater Project. They emphasized that SCA's project implementation work for Phase I was completed on time and with a minimum of contract overruns.

Contracting Procedures

The design, procurement and installation of the water contracts under Phase II will be administered by the Works Department of SCA. Interviews with Works Dept officials disclosed that SCA issued decree number 250 in 1974 which set up the administrative procedures for contracting. This decree sets the limits for authorization of contracts and establishes guidelines for competitive bidding. Documentation was obtained showing delegation of authority from the Chairman of SCA to the Director of the Works Dept to approve and issue IFBS, request AID financing and sign contracts.

Works Dept engineers described SCA's contracting procedures as follows:

- request received for certain activity
- Works Dept performs feasibility study
- technical specifications prepared
- invitation for bids (IFB) prepared. IFBS include SCA's standard general contract provisions
- IFB advertised
- administrative order issued to set up committee for receiving

- administrative order issued to set up committee for evaluating and recommending selection of the successful contractor
- approval of recommended contract award obtained by SCA official in accordance with above mentioned administrative decree number 250
- contract negotiated, prepared and signed

Contract Monitoring

SCA has a thorough system of project monitoring and reporting. Site engineers report weekly to the Deputy Director of their section. Internal meetings between Works Dept engineers and other representatives such as the contractor's engineers are held regularly. Directors report monthly to the Head Office. The reports contain technical and financial information covering both new construction and operations and maintenance. Monthly reports go to the Director of the Works Department and sometimes the Chairman.

On the AID funded Phase I Project SCA in coordination with the consulting engineer prepared monthly progress reports and held monthly project meetings which were attended by officials of USAID and representatives of CCC. In addition, SCA's Works Department has current and past experience contracting with foreign firms such as the French company CTE, the German company BAMAG and the British company Permutit-Boby.

Equipment Procurement and Inventory

Per brief discussions with SCA officials it was found that SCA has an adequate procurement and inventory system. Although RIG/A/CAIRO, Audit Report No. 6-263-85-5 dated July 25, 1985 cited some weaknesses in accounting for AID financed equipment and materials, the overall opinion was that SCA has an adequate inventory control system. SCA's procurement and inventoring capabilities should not be a factor in the Phase II Project since the implementation plan for Phase II is to have the construction contractors be responsible for all procurement, receiving and storage of equipment and materials.

Contracting - Conclusion

Throughout the implementation of the existing Phase I Project the SCA has performed well in the review of project designs, contract documents and IFBS, the approval and award of contracts and the overall management of contractor performance.

In our opinion the SCA system of contracting and contract implementation is decentralized and relatively efficient. The system includes complete segregation of duties, thorough documentation supporting contract decisions and steadily escalating approvals.

Assessment of SCA's Voucher Examination Process

Voucher Examination Procedures

Both SCA's Works Department and Financial Department examine vouchers. Each department has two authorized representatives to approve the voucher. In the Works Department project engineers at the local city level certify that technical implementation is in accordance with contract specifications. The Financial Department then reviews the voucher for compliance with the contract's payment provisions and payment schedule. All supporting documentation is examined. Costs claimed are thoroughly reviewed for allocability, allowability and reasonableness. For services performed the review includes salaries, allowances, travel expenses and indirect cost rates. Equipment procurements are reviewed in accordance with delivery conditions. Costs claimed are compared to the contract budget. Costs questioned by SCA are discussed with the contractor and disallowed until full justification is submitted by the contractor. Unjustified delay of contractor's payments by SCA was not an issue in Phase I of the project. We found, the overall time required for voucher examination was reasonable.

For the Phase I Project CCC submitted monthly vouchers for actual costs incurred against their cost-plus fixed fee contract. At SCA's Financial Dept, we reviewed samples of these vouchers in the payment file. A Financial Summary of the contract is being maintained to control the contractor's vouchers against the contract's payment schedule. The summary also showed a history of payments posted against the budgeted amount. Transmittal letters were used to document approval of payment. In 1983 for the purposes of efficiency and simplicity SCA and CCC changed this contract from a cost plus to a lump-sum with fixed monthly payments contract.

Host Country Financial Audits

According to GOE laws and regulations, SCA is subject to audits by the Central Accounting Agency. An annual review of SCA's financial accounts and reports, in addition to surprise audits, is being performed. Also, SCA expenditures are closely monitored by a semi-independent resident representative of the Ministry of Finance. In addition, SCA as the implementing agency for water improvements under the Phase I Project has been audited by the AID Regional Inspector General in Cairo.

Voucher Examination - Conclusion

Based on our review and USAID's extensive prior experience with SCA's voucher examination process it is our opinion that the voucher examination procedures of SCA are satisfactory. In our opinion SCA is well-equipped to undertake new activities proposed by this project.

II Assessment of the GOE Implementing Agencies Contracting and Voucher Examination Capabilities:

The GOE agencies involved in the implementation of the Canal Cities Water and Sewerage Phase II Project are:

1) The Suez Canal Authority (SCA)

The following is a summary of the complete assessment report which is included as Annex APPENDIX J-1 to this project paper.

Throughout the implementation of the existing Phase I Project the SCA has performed well in the review of project designs, contract documents and IFBs, the approval and award of contracts and the overall management of contractor performance.

In our opinion the SCA system of contracting and contract implementation is decentralized and relatively efficient. The system includes complete segregation of duties, thorough documentation supporting contract decisions and steadily escalating approvals.

Based on our review and USAID's extensive prior experience with SCA's voucher examination process it is our opinion that the voucher examination procedures of SCA are satisfactory. In our opinion SCA is well-equipped to undertake new activities proposed by this project.

2) National Organization for Potable Water and Sanitary Drainage

NOPWASD was the GOE agency for implementing the Phase I wastewater component of the Project. Numerous difficulties were encountered during the implementation of payments to its suppliers of services and equipment. With an simplified review and approval process, in the form of a small responsive implementation unit, and the creation of a project steering committee, to review NOPWASD's performance on project implementation, should considerable improve NOPWASD's performance during the Phase II Project.

3) The Governorates of Ismailia, Port Said and Suez

These three Governorates' Wastewater Departments are responsible for the operation and maintenance of all of the project area's wastewater facilities. Under the Phase II Project these Governorates are not planned to have any AID funded contracting or voucher examination responsibilities and therefore have not been assessed.

III Audit Coverage

Funds provided by this project will be used to finance 4 lump sum, fixed price host country contracts with U.S. construction companies. Since these are lump sum, competitively bid, fixed price contracts they are not subject to audit of costs except for any cost-reimbursable items. They are, however, subject to audit for compliance with other AID regulations and therefore a small amount of audit funds are allocated for this purpose. This phase will have no host country contracts for engineering services. Funds will be used to finance 1 AID direct contract with a U.S. A&E firm, 1 AID direct contract with a U.S. management consulting firm, and the 4 host country construction contracts mentioned above. The PP's budget includes approximately $200,000 to cover the estimated auditing costs of these contracts. Audit funds budgeted by activity are as follows:

Activity	No. of Contracts	Type of Contract	Estimated Contract Amount ($000)	Audit Funds Budgeted
Construction Monitoring and Engineering Services	1	AID Fixed Rate	$ 15,500	$ 20,000
Design/Build-Water	1	HC-Fixed Price	$ 61,400	$ 40,000
Design/Build-Sewer	3	HC-Fixed Price	$319,000	$120,000
Institutional Development and TA Contract	1	AID Fixed Price	$ 17,200	$ 20,000

I Assessment of Canal Cities Water and Sewerage

Phase II - Methods of Implementation and Financing

In accordance with the requirements of the Sixteen Payment Verification Policy Statements the following table illustrates the methods of implementation and financing for AID funds as planned in the Canal Cities Water and Sewerage Phase II Project Paper.

ACTIVITY	METHOD OF IMPLEMENTATION	Type of Contract	METHOD OF FINANCING	APPROXIMATE COST ($000)	HC OR AID CONTRACT	HOST COUNTRY IMPLEMENTING AGENCY
1. Construction Monitoring and Engineering Services	AID Direct Contract	Fixed Rate	Direct Reimbursement	$ 15,500	AID	
2. Design/Build - Water	Host Country Contract	Lump Sum	Direct L/Comm	$ 61,400	HC	SCA-Works Department
Design/Build - Wastewater	Host Country Contract	Lump Sum	Direct L/Comm	$319,000	HC	NOPWASD
3. Institutional Development TA Contract	AID Direct Contract	Lump Sum Fixed Price	Direct Reimbursement	$ 17,200	AID	
4. Monitoring, Audit and Evaluation	AID Direct PSC or IQC	Fixed Price	Direct Reimbursement	$ 1,400	AID	

In item 2 the justification for using Direct L/Comms is that the host country does not have the financial resources to make payment and seek daily reimbursement from AID.

* The National Organization for Potable Water and Sanitary Drainage (NOPWASD)

a) Mission and Objective

In April 1981 Presidential decree # 197 was issued creating NOPWASD, as a general organization to prepare national policies and plans for potable water and sanitary drainage. It also performs the necessary studies and program design, and supervises the construction of national projects which exceed the capacity of the local authorities or serve more than one governorate. The decree specified NOPWASD's responsibilities as follows:

(1) Prepare national general plans for water supply and sanitary drainage works including the preparation of implementation schedules to be included in the general plan of the nation and monitoring of the execution of these works.

(2) Coordinate the plans for water supply with those for sanitary drainage.

(3) Conduct required studies and applied research in the field of potable water for home and general use and sanitary drainage. Participate in establishing quality standards for drinking water and wastewater disposal.

(4) Establish conditions and standards, and technical specifications for sewerage, sanitary drainage and water supply projects.

(5) Provide technical advice in the field of sanitary drainage and potable water.

(6) Establish training centers to improve the productive efficiency and quality of design, construction, and operation and maintenance of water and sanitary drainage utilities.

(7) Help governorates perform the necessary research and prepare designs for large or specialized projects and supervise their construction when this is required. NOPWASD will be reimbursed for these services, with fees determined by the Board of Directors in a special ordinance.

(8) Help governorates prepare contracts for large projects (Item 7), tender them locally or internationally, and evaluate bids. The organization has the right to utilize the services of local and international consultants for these activities.

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* This section has been reproduced in its entity from Water and Wastewater Sector Institutional Support Project, Project No. 263-0176 USAID/Cairo, July , 1985.

b) **Existing Organization**

NOPWASD's official organizational structure is depicted in Figure 11. The following description will concentrate on several central departments that have major impact on the organization's operation, namely:

- Central Department for Training
- Central Department for Research
- Planning and Follow Up
- Design
- Execution
- Administration and Finance
- Some staff departments serving the chairman

This brief description concentrates on the respective roles and staffing of key central departments, and highlights differences between the official organization chart and the actual conduct of day to day operations at NOPWASD. In our description of staffing we relied entirely on information gathered from the general department of Organization and Administration which does not include top management positions, i.e. General Directors, Undersecretaries, and Vice Chairmen for the organization.

Before discussing the roles of each department and its staffing a few general notes are in order:

1. NOPWASD was created in 1981 by amalgamating two independent general organizations, namely the General Organization for Potable Water (GOPW), and the General Organization for Sanitary Drainage (GOSD). Each of these organizations was responsible for planning and operating facilities all over Egypt in its respective field. After amalgamation the operation component was relegated to the local governments and the new organization tried to keep its most experienced operation and maintenance specialists, while leaving the less experienced to the governorates.

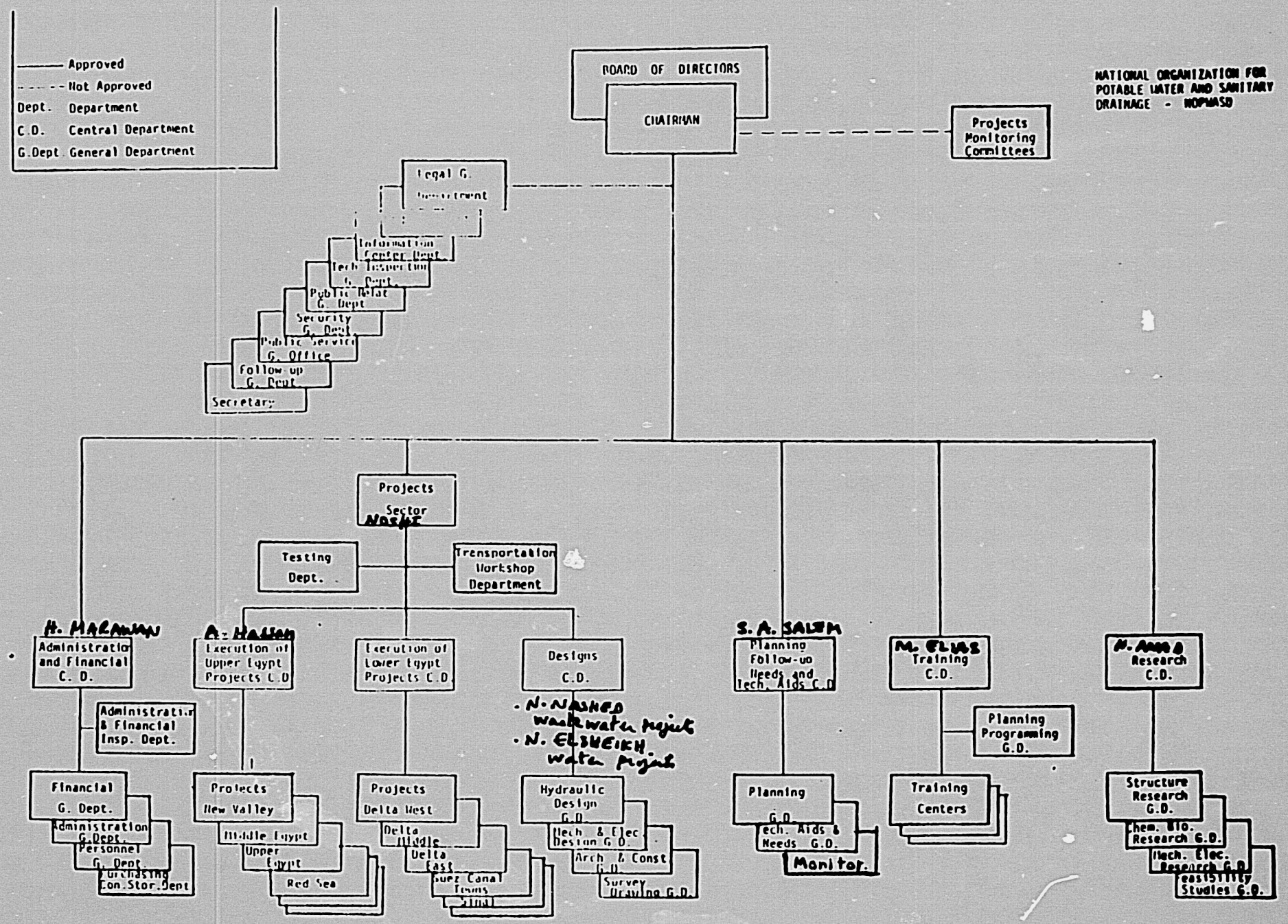
2. Despite the formal amalgamation of the two organization into NOPWASD in 1981, informally they continue to exist, with considerable autonomy prevailing especially within the projects sector between the water staff and the wastewater staff.

3. The main form of conduct of business in NOPWASD is through interdepartmental committees. This includes such functions as:

- Setting the yearly investment budget
- The five year investment plan
- Individual project planning and design
- Setting up new water companies
- Implementing the provincial water master plan
- Purchases for NOPWASD's projects both internal and external
- Hiring of new personal, and promotions, or penalties for existing personnel
- Any other administrative or financial change in the organization.

Many of the good engineers and accountants from NOPWASD's various departments work, at least part time after 3 pm, in the permanent committee for the water master plans and in the water companies assistance schemes. This is in addition to top management involvement in those committees.

Figure 11



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4. NOPWASD's headquarters, including the technical and financial departments, are in the Mogamma Building at Tahrir Square occupying 3/4 of the sixth floor in addition to 1/4 of the fifth floor. The Organization and Management Department as well as part of the Warehousing Department are in temporary locations in Manial, at Cairo GOSD's syphon by the University Bridge. The rest of the Warehousing Department is located in Mattaria and Abbassia neighborhoods of Cairo, where NOPWASD maintains central warehouses. In addition, the Department of Internal Audit and part of the archives are located on Mazloum Street, in downtown Cairo. Finally, the central garage and workshop are at the Abbassia warehouse site.

   Last year the organization intended to purchase a new building by the Pyramid Road in Giza where they could consolidate most of their offices. However, these plans were abandoned due to the GOE's plans for reducing expenditures. It is not very clear how long it will take to obtain suitable working space. NOPWASD has written to the Ministry of Housing asking help in solving the problem. This means that during the first phase of the proposed institutional support it is highly unlikely that NOPWASD will move into new quarters.

5. The presidential decree creating NOPWASD has given it the right to determine a fee to charge the governorates when providing technical assistance in planning, designing or supervising construction of the large projects in their jurisdiction. To date, NOPWASD's board has not adopted a fee structure for such services. Furthermore, it is not quite clear to NOPWASD how to account for such income and whether it can be retained or should be forwarded to the Ministry of Finance, since the agency is now a services organization rather than a financially productive one.

   As in many other institutions in Egypt, the talented people tend to be overloaded, especially those that have any foreign language capability. This is especially true of the engineers, who are one of the scarce resources in NOPWASD.

(1) Central Department for Research

The Central Department of Research is responsible for setting general policies for research and studies and setting the acceptable levels of services and priority standards for the general master plans for the water and wastewater sector. Generally, its objectives are:

a. Carry out technical and scientific research concerning the production and distribution of potable water and disposal of liquid waste.

b. Carry out technical and economic feasibility studies for projects.

c. Set and develop standards for potable water and its sources and for liquid wastes before their disposal to the waterways.

d. Make technical recommendations relating to potable water and sanitary drainage laws.

e. Benefit from international studies and research in NOPWASD's areas of responsibility.

f. Prepare studies for local and international conferences as well as organize such meetings in the areas of NOPWASD's responsibilities.

The Central Department for Research is not in actuality broken down in to the general directorates as shown on the chart. Furthermore, the general directors filling those positions are working in NOPWASD's other departments, mostly Execution. Three of the Department engineers work full time on setting up water companies in Beheira, Kafr El Sheikh, Sharkia, and possibly more to follow. This leaves five or six engineers to work on the other functions of the Department. The Central Department for Research also has the lead role in monitoring the water master plan prepared in 1980 by Binnie & Taylor, Abdel El Warith consortium, and informaly adopted informally by the General Organization for Potable Water. However, the Department does not take the leading role in setting the acceptable levels of service and priorities, with the Design Department doing this on a project by project basis. The department does participate in the planning committee.

(2) Central Department for Training

With responsibility for all training in the organization, its objectives are:

a. Delineate general policies for guidance and training of all kinds and at all levels.
b. Prepare detailed plans for all types of training.
c. Prepare plans for developing training technology in NOPWASD.
d. Monitor current developments in training.
e. Evaluate training related technical assistance received by NOPWASD, or given to other countries, in the water and wastewater sector.

f. Select and send trainees abroad and monitor their progress.
g. Prepare plans for developing and equipping training centers.
h. Prepare plans and facilities for the training of trainers.
i. Publicize training in the sector.
j. Prepare plans and compile sources for the financing of training.
k. Participate in studying performance indicators with other departments and agencies.

l. Provide technical assistance in training matters.
m. Prepare and maintain training records for the employees.

The department now has only two rooms for training purposes seating some 30-40 people. It conducts periodic training for engineers and operators in the sector but relies on other department heads and visiting lecturers to deliver the training. Due to the lack of a functioning training center, all Central Training Department engineers are assigned to project activities. It is not clear whether the department has the technical personnel indicated in the organization chart. Even the position of the General Manager for the Training center has been filled by an engineer from Execution who still heads a department in that section. The department relies on whatever material has been developed during the water master plan, as well as that prepared by the lecturers to train the trainees. The central department therefore does not have any functioning general directorates reporting to it, neither for planning nor for delivering training.

(3) Central Department for Planning

Carries out the activity of developing general and detailed national plans for water and wastewater within the framework of the general plan set for the nation. It also monitors those plans, and participates in acquiring materials and provides technical assistance to the governorates. It is responsible for the following:

a. Setting policies, as well as general and detailed plans and priorities nationwide.
b. Studying and preparing basic development plans for water and wastewater works that fall within the framework of the national general plans.
c. Preparing the execution plans and programs for the water and wastewater works being implemented.
d. Setting the plan for the utilities requirements from materials and equipment.
e. Preparing technical assistance to water and wastewater utilities.
f. Monitoring execution of the plans to evaluate them and to improve the planning capability of NOPWASD.

The Central Department of Planning is divided into three general directorates: one for planning, one for monitoring and one for requirements. According to the Department head, only two or three professionals in those departments have any experience with planning, as conducted by NOPWASD and the Ministry of Planning.

The Department coordinates closely with the Ministry of Planning. It is involved in the preparation of the yearly budgets submitted to the National Bank for Investments and the Ministry of Finance, but does not take the lead role. Rather the departments of Finance and Projects set the detailed budget requirements. With respect to monitoring plans, NOPWASD monitors only its own projects and relies on the Execution Department to monitor progress. For any other projects in the governorates NOPWASD relies on what the governorate reports as progress. Program planning in NOPWASD still suffers from many problems:

- The current five year plan gives priority to water and wastewater activities, but still makes no explicit statements commitment on levels service in terms of basic targets to be achieved or the time frame for their achievement.

- Although coordination between water and wastewater programs has improved since the amalgamation of GOPW and GOSSD, coordination with the planning of housing and the provision of potable water for non-domestic purposes still needs to be improved.

- Current planning procedures do not make long-term forecasts reflecting population and income growth, target service levels for domestic consumers, or estimated industrial and commercial demands. They are also not coupled with basic information on existing supply systems, in order to determine accurately how to best serve the population on a long-term basis.

The GOE has devoted major efforts to improve planning capabilities in the past five years. The Provincial Water Supplies Project, which provided a starting point and a framework on which to build, developed a long-term program of water supply investment and identified the regions of highest priority. The National Urban Policy Study has also provided basic information for population and income growth in the various regions of Egypt. NOPWASD has been created to improve coordination and planning in the sector. However, within NOPWASD today there still are not enough qualified multi-discplinary teams with engineering, financial and economic skills that can effectively carry out the planning functions as described above.

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The water master plan needs to be periodically updated. A similar effort is required for the wastewater sector and they both need to be integrated into a more comprehensive urban plan. Assistance in the form of some expatriate personnel and a structured training program for NOPWASD staff would enable the organization to complete better plans and programs for the sector.

As far as commodities procurement is concerned the department tries to act as a central purchasing agency on behalf of the local utilities for some strategic materials (i.e. alum). However, it is not quite clear how successful this activity is. In some cases the cost of allum through NOPWASD is higher than if imported by Cairo Water (GOGCWS). This prevents some local utilities from purchasing through NOPWASD. Furthermore, it is not clear how the department estimates local utilities' requirements or even checks the numbers submitted by these agencies. This is especially the case since NOPWASD has no control over Operation and Maintenance activities in the governorates.

As for technical assistance to local utilities, although this is an important function due to the limited experience of the localities it is not really concentrated in any one NOPWASD department, even though theoretically it is the responsibility of the planning department. As it stands now, assistance is performed on a case by case basis by pulling together two or three of the top managers and dispatching them to the local utility in cases of emergency. Furthermore, the activity has not been formalized by the board of directors since it has not agreed on a fee schedule to be charged for such services. It is not quite clear at this point if any records are being kept on the numbers or type of assistance requested by the local utilities, in order to judge the extent of that service.

(4) <u>The Projects Sector</u>

The Project's Sector supervises all water and wastewater projects from design, through construction, to delivery. This is carried out for projects built for NOPWASD or for the governorates. It also undertakes all activities for the transportation workshops and the Testing Departments. This sector has most of the engineers in NOPWASD and is composed of:

- Central Department for Design
- Central Department for Lower Egypt and Canal Execution
- Central Department for Lower Egypt and Red Sea Execution
- General Directorate for Mechanical Fleet and Workshops
- Directorates for Testing

a. **Central Department for Design**

This department is responsible for preparing the necessary designs for water and wastewater projects nationwide except Cairo and Alexandria. These designs are for projects undertaken by NOPWASD for its own account or for others. Included are site and paths selection, design calculations, general and detailed drawings, specification, bills of quantities as well as all documents necessary for bidding. It is also responsible for land acquisition, surveying, and drawing works. Furthermore, it reviews and approves calculations, drawings and reports prepared by engineering consulting offices.

The department is composed of four general directorates responsible for hydraulic design, mechanical and electrical designs, structural designs and survey land acquisition and drawings. Its staff is grouped by product (that is, those working on water projects as opposed to those working on wastewater projects) rather than technical specialization.

The chairman of NOPWASD is under the impression that the department relies too much on Egyptian consulting organizations for design works, and is thus underutilizing its internal capacity. It is not clear at this point how true that is for both water and wastewater projects. It can be expected however, that the reason for his attitude may be financial. The same engineers working in NOPWASD "moonlight" in consulting offices where they are better paid.

It is not possible at this time to determine how much of departmental resources are directed to land acquisition problems. Also, it was not also possible to judge first hand the quality of the designs prepared by the department, or the filing and handling of project documents. All that is known now is the distribution of the engineers in design among the various grades. This is not necessarily a good indicator of quality but reflects years of experience. Of the 41 engineers in the Design Central Department 12 are in grade I implying experience of at least 14 years, while 23 are in grade III implying experience of not more than six to eight years. USAID's general impression is that most of the designs prepared by NOPWASD are technically sound but that they usually lack the level of detail necessary for their proper implementation. In many instances however, those designs do not reflect adequate consideration for appropriate technologies especially with respect to economic operation and maintenance.

b. **Departments for Execution**

Both departments have similar responsibilities in their respective geographical areas:

- Supervise the construction of all projects undertaken by NOPWASD.
- Participate in preparation and approval of construction schedules and periodic inspection of all projects.
- Measure quantities and prepare payment documents for contractors.
- Prepare and update estimates of project requirements, approve them from Design Department and dispatch them to procurement departments.
- Participate in price setting committee for direct order work.
- Participate in committees for preliminary and final hand-over of projects.

NOPWASD has no regional offices, so all construction supervision is carried out from Cairo. The quality of the projects supervised by NOPWASD provides the final judgement on the performance of this department. To date it is USAID's impression that supervision of construction is very weak, virtually non-existent. This is attributed to two main causes: (1) lack of incentive to supervise closely public sector firms that have prepared the working drawings themselves, and (2) the limited experience of the engineers themselves.

It was not possible to assess the quality of 60 engineers assigned to Execution. Some inference can be made from their distribution by rank mainly based on years of experience. Only four of the engineers are grade I implying experience of more than 12 to 15 years, while 32 are in grade III implying experience of not more than six to eight years. Taking into consideration the fact that promotion in the lower grades are easier than the higher ones, this tends to confirm the lack of experience of the engineers in supervision.

In terms of lack of incentives and inadequacy of control mechanisms to supervise public sector firms, this is a national phenomenon and not unique to NOPWASD. Some exposure to better contract management and reporting can definitely help, but is no substitute for an environment that clarifies the relationship between client and contractor.

c. **Testing Department**

This department does not operate a laboratory. Its functions, as stated by NOPWASD, revolve around the testing and verification of pipe qualities and their fittings:

- Studying international pipe specifications
- Reviewing Egyptian recommendations for local pipes
- Monitoring pipe production and their bottlenecks and constraints
- Conducting technical, mechanical, and hydraulic tests on project requirements from pipes and fittings
- Issuing testing certificates for the pipes and fittings
- Testing pipes that would be required for use by Egyptian contractors abroad

It was not possible at this time to acertain what other tests this department performed. NOPWASD has three chemists on its staff, but they are located at the technical assistance/technical inspection department reporting to the chairman. The laboratory belongs to that department.

d. Mechanical fleet and workshop

This department is responsible for the operation and maintenance of NOPWASD's mechanical fleet and operates from the garages in Abbassia, with a dispatch office in Tahrir square.

(5) Central Department for Finance and Administration

This department is responsible for:

- Setting general policy for financial and administrative affairs and planning work programs and their schedules.
- Economic feasibility of projects.
- Setting the rules of work for the general directorates reporting to it and monitoring the preparation and execution of budgets, final accounts, tenders, and financial and administrative inspection.
- Monitoring the execution of civil service systems, and the written administrative and financial material that are presented to the board.

The department is composed of the following organizational sections:

- Financial Affairs
- Administrative Affairs
- Personnel
- Contracts, Purchasing and Inventory
- Financial and Administrative Inspection.

Following is a brief highlight of the roles of each section and its operation.

a. **Financial Affairs Directorate**

Theoretically this directorate plays three roles in NOPWASD:

- **Budgeting and funding**
- **Expense auditing**
- **Cost control**

In actuality there is at present no cost control section or function in NOPWASD at all.

As for as budgeting is concerned the directorate participates in preparing yearly budgets, together with the Planning & Control Department, and prepares cash flow requirements. In the yearly budget process NOPWASD directly interacts with the Ministry of Finance and the Ministry of Planning for allocations. The Ministry of Housing role involves only the foreign exchange budget that is controlled and allocated by the Ministry of Economy.

As far as expense tracking is concerned, NOPWASD now follows the government services organization system; that is the Governmental Cash Accounting System. This system is based on cash accounting receipts and payment principles and does not include a balance sheet. This is different from the better known Standard Accounting System (SAS). SAS is based on the principle of accrual accounting, which distinguishes between assets and liabilities and recognizes that assets have limited life. It allows the units to produce income and expenditure accounts and a balance sheet. It also features an account coding system, which uses up to seven digits to identify the type of income and expenditure. It is however biased towards economic principles, and geared toward national economic planning requirements rather than the specific needs of the user organization.

The accounting systems were studied in great detail by the "Provincial Water Supplies Project", before the formation of NOPWASD. They identified the weaknesses of the systems and suggested improvements. The study reviewed the procedures and systems used by both the General Organization for Potable Water (GOPW), the Standard Accounting System (SAS), and the Municipalities and Governorates, Governments Accounting for the following activities:

- fixed assets
- customer billing and collection
- inventories
- payment of suppliers
- cashiering
- payrolls
- accounts and reports
- budgetary control
- financial planning

They identified the following limitations:

* The present accounting and related functions with the exception of revenue billing and collection, are all based on the concept of central control with a minimum of delegated authority.

* The principal weaknesses common to both systems are:

  - insufficient delegation of expenditure authorization and control to the regional level and consequently excessive reliance on detailed checking and re-checking of individual expenditure documents;

  - a lack of pre-listing and summarizing of financial data. Prime documents generally pass from plant to national level;

  - the lack of efficient control systems;

  - the inability of the system to produce integrated management information suitable for use by line managers to monitor performance.

* Some of the present problems could be alleviated if basic accounting concepts were properly understood and applied to the existing systems. Others arise from the very nature of the present centralized system which restricts access to data for management control purposes and inhibits effective delegation of decision-making. For example:

  - because the accounting principles of the SAS system differ from those of the budgeting system and Governmental Cash Accounting System, the figures produced cannot be used on a comparative basis to monitor performance.

- the SAS accounting codes and ledger systems do not have adequate provision for analyzing expenditure to individual areas where costs have been incurred;

- many of the present accounting policies, particularly those relating to fixed assets, depreciation, accruals, bad debts and inventory issues have limitations which undermine the meaningfulness of the accounting information produced.

Little attempt is made to consolidate existing information and it was apparent throughout our review that the separate sections of the accounting department do not have a clear understanding of each other's functions and activities. In many instances useful information could be produced if management co-ordinated and integrated the accounting activities more effectively.

It is very important to investigate the issue in terms of what has been adopted from the study's recommendations and what should be done further. This is especially important since NOPWASD is now heavily involved in creating new water companies in several governorates in Egypt. Several of the employees in the department have participated in the study as GOPW employees, but it is expected that many of them need to be trained in basic accounting principles, as they have not worked with accrual accounting systems before either in the private or public sector of the economy.

b. Administrative Affairs Directorate

This directorate performs two main functions:

- Archiving and Central Secretariat
- Internal Services.

In addition this department should work to develop administrative procedures for NOPWASD. At present it does not do that, rather the organization and administration department is expected to carry out that function. This point will be investigated further when looking at the role and function of that department.

As far as archiving and information dissemination within NOPWASD, the system is primitive at best. Knowledge is disseminated through the informal "grape vine". Most departments do not rely on the general secretariat, either for filling or for circulating information within the organization.

Internal Services is responsible for:

- Maintenance and cleaning of headquarters, and buildings
- Health care for employees

- Employees' social services in terms of trips, housing, and financial assistance
- Cultural affairs and communication among employees
- Telecommunications affairs for NOPWASD
- Printing of documents, administrative orders and the like, necessary for conduct of business

It is not quite clear how this department will carry out both functions, with the quality of the present staff. The only person with a bachelor in administration is grade III i.e. with probably 10 years experience, while of the 27 clerks, one is grade I, seven are grade II and eight are grade III. This makes the staff more biased towards following traditional practices. It is also not quite clear how effective any administrative training would be in achieving breakthroughs in their performance.

c. Personnel Affairs Directorate

This directorate is responsible for implementing the civil service law with respect to salary, incentives, pension and social security; salary raises and promotion; recruitment, transfers and loans; and finally record keeping and leaves.

At present NOPWASD has some 1337 authorized and funded positions excluding 30 top management ones. At the latest count 890 of these are occupied as shown in Table 3. The relatively low manning level in the lower grades is a reflection of the low pay. This is especially apparent at the technical positions, either engineers, technicans or technical workers. But if the pay is low why do staff remain in the higher positions? The answer may be complex:

First, for the high positions the pay may not be as low compared to that in the private sector. Second, government provides security of employment. Third, some employees have a second source of income. Fourth, some staff are loyal and dedicated.

This loyalty however, is being streched by the continued situation of low pay and inequity of the payment structures.

Figure 12 shows the distribution of the filled positions by department. It is not very clear at this point how many of these 890 position filled are actually working and how many are or long leaves.

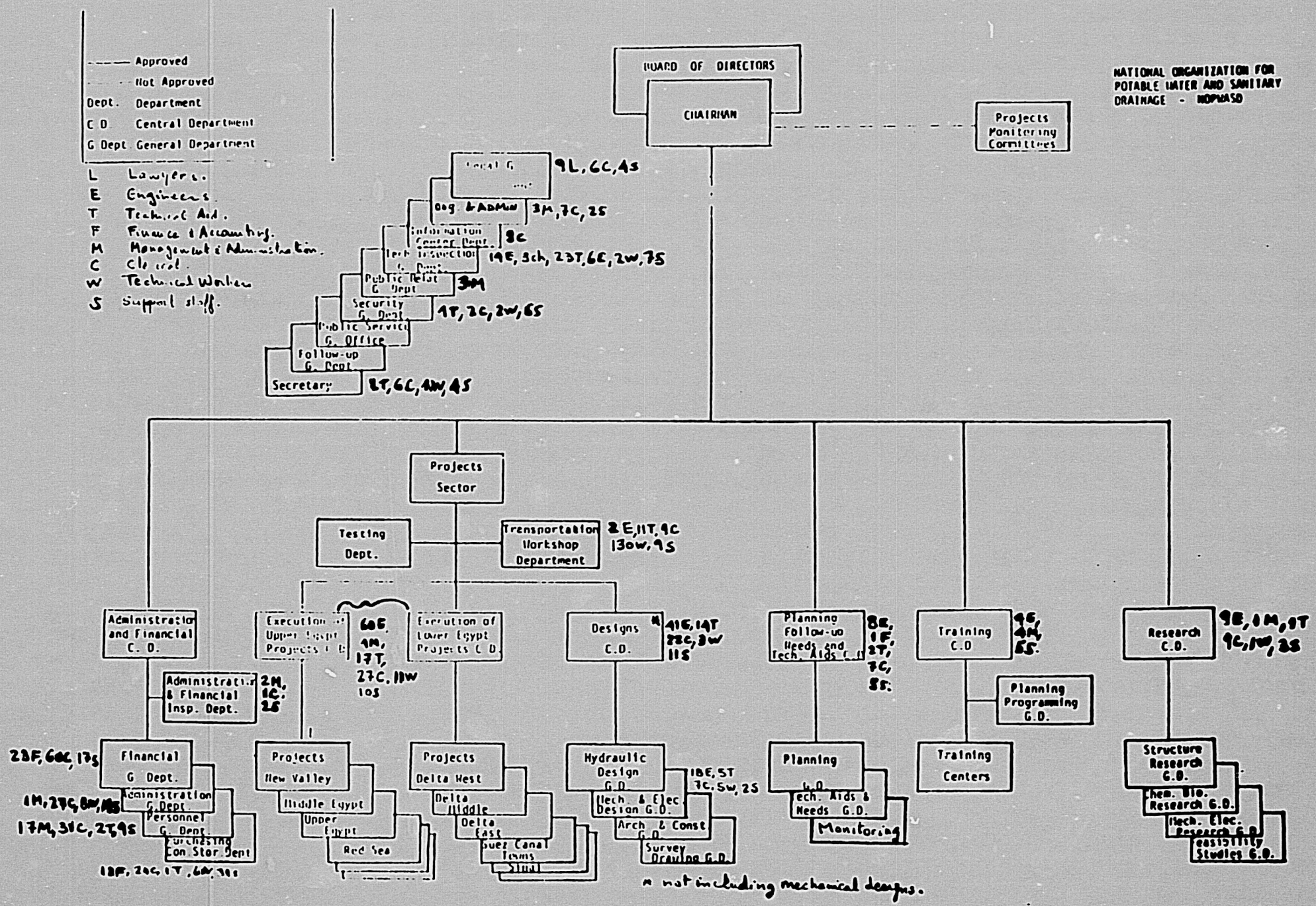
The personnel and pay policies in NOPWASD and in other government institutions are certainly one of the major constraints on performance. These were studied in the "Provincial Water Supplies Project" in 1980. Although a lot of changes occured, both to the civil service law and the organization working in the water and wastewater field, the major constraints identified seem to be still in existence, with respect to all aspects of personnel policies, These were:

TABLE 3
NUMBER OF AUTHORIZED AND FILLED POSITION IN NOPWASD BY GRADE AS OF 6/30/84

Grade		I		II		III		IV		V		VI		TOTAL	
Job Category		A	F	A	F	A	F	A	F	A	F	A	F	A	F
Legal		2	-	4	4	9	5							15	9
	%	0		100		55.6								60.0	
Engineering		33	26	57	60	155	70							245	156
	%	78.3		105.3		45.2								63.7	
Science				2	2	2	1							4	3
	%			100		50.0								75.0	
Finance& Accounting		7	7	13	13	28	17							48	37
	%	100		100		60.7								77.1	
Administrative		7	7	15	8	29	17							51	32
	%	100		53.3		58.6								62.7	
Technician		13	13	44	39	44	19	56	11					157	82
	%	100		88.6		43.2		19.6						52.2	
Clerical		12	12	52	51	90	92	163	99	16	4			333	258
	%	100		98.1		102.2		60.7		25.0				77.5	
Tech. Workers				39	38	76	64	56	25	71	29	33	11	275	167
	%			97.4		84.2		44.6		40.8		33.3		60.7	
Support Services					20	15	48	46	60	57	81	28	209	146	
	%					75.0		95.8		95.0		34.6		69.9	
TOTAL 890		74	65	226	215	453	300	323	181	147	90	114	39	1337	
	%	87.8		95.1		66.2		56.0		61.2		34.2		66.7	

Notes: A = Authorized, F = Filled
% filled to authorized

Figure 12



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- Recruitment
  - shortage of adequately trained skilled manpower
  - high proportion of skilled staff due to retire
  - little recruitment of young skilled personnel.

Difficulty in filling posts stems from:
- competition from private sector
- low pay
- poor promotion prospects
- lack of career development
- unattractive location of work

Selection procedures are cumbersome and waste managerial time:

- the first objective is to fill vacancies from within the organization, by promotion or reassignment
- vacancies must be advertised in two newspapers
- tests are often used in the selection
- all applicants satisfying the basic requirements are interviewed by a selection committee appointed by decree from the Chairman

- Pay
  Still after passing of law 26 for 1984 increasing wastewater workers salaries, pay in the sector is:

  - drastically uncompetitive;
  - bound by law
  - unfair to good workers
  - providing no incentive for improved performance

  - Promotion
    The system although not entirely linked to seniority and education level is restrictive.

    The major weaknesses are:

  - employees have to wait a long time for promotion. The worst case is in grade three in which graduate engineers are recruited. They must wait eight years and even then only 25 percent of the group will receive promotions.

  - less importance is attached to skills and knowledge than to seniority;

  - employees are sometimes given greater responsibility but no extra reward;

- the quality of supervision and management tend to decrease if the best staff are not promoted.

- Career development

  There is little evidence that NOPWASD actively promotes the careers of individuals. This is partly caused by the use of seniority as basis for advancement and partly due to the lack of any system to identify staff with potential.

- Performance review

  Many regard this as a paper exercise and waste of time, because the results do not accurately reflect performance and are not used to determine bonuses.

- Discipline and dismissal

  The law assigns to the "concerned authority", the task of listing contravention, disciplinary measures and inquiry formalities.

  NOPWASD has developed its own discipline procedures and has prepared a list of sanctions that can be applied, but cases of dismissal or forced retirement must be referred to a disciplinary court. This involves lengthy legal proceedings and may explain why the sanctions applied are lenient and fall short of recommendations for dismissal.

- Personnel administration and records.

  A personnel affairs committee consisting of the chairman and selected senior managers reviews all personnel affairs. The final authority for any action whether it be appointments, transfers, or secondments rests with the chairman. The personnel affairs section therefore carries out instructions and does not make decisions.

  Furthermore, the department is not effectively involved with human resource development, or welfare functions. Both are carried out by other departments.

- Environment

  The working conditions for many staff at NOPWASD are inadequate, being characterized by:

  . overcrowding and congestion
  . shortage of filing space
  . buildings in need of repair
  . safety and fire hazards

It is vital that the recommendations and conclusions of the 1980 study be reviewed in light of the more recent changes both in NOPWASD and the water company concept. If movement toward aleviating the constraints on personnel is not achieved, no institutional or training effort will achieve its target. Steps at various levels of government should be followed to bring about change in that situation.

d. Contracting, Purchasing and Inventory Directorate

This directorate performs three main functions:

. local and foreign purchasing
. contracting
. inventory

In purchasing and contracting the department applies the regulations for purchasing and bidding to insure fairness and correctness of procedures for both local and foreign purchase. It contacts the shipping, insurance and transport companies to ensure the delivery of the goods to NOPWASD's warehouses. It contacts banks for letters of credit and other financial matters related to contract administration, and participates in receipt of goods. It also maintains suppliers and agents records and data and maintains contact with the state council, tax authorities and other regulatory and central agencies.

In actuality contracting and purchasing are all done by special committees appointed by the chairman and all authority is usually vested in him. The Directorate involvement in those committees is complementary to that of design, execution, finance and planning. All procedures are supervised by the special committee which tenders, reviews, selects and prepares contracts for NOPWASD's purchases.

NOPWASD's warehouses are dispersed. The main warehouse is in Cairo-in Mattaria-with smaller ones all over Egypt. The warehousing department is responsible for maintaining and applying inventory and financial regulations. The department applies standard government procedures for record keeping and inspection. It is believed that such rules are so rigid that they penalize storekeepers for trivial errors, and do not allow for disposing of unused items.

(6) Departments in Staff to Chairman

Reporting directly to the chairman are some support departments. Figure 11 shows nine departments in total, in actuality three of these departments do not exist at all; these are:

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The Information Center
Public Service Office
The Follow-up Department

The remaining six departments are small and perform staff support functions. The chairman's secretariat handles appointments and board correspondence. Security is responsible for just that including safety and fire protection. Public relations is responsible for NOPWASD's image in the public eye, preparing brochures and monitoring the press. Presently this department does paper clippings for the chairman and arranges for VIP travel and meetings.

The Legal Department has three roles. It handles complaints and investigations of contraventions. It handles cases on behalf of NOPWASD. These first two roles usually overtake the more important last role of the department. The department's intervention in day to day activity of NOPWASD is by no means a routine procedure; it is the exception rather than the rule.

The Organization and Management Department is headed by NOPWASD's "institutional memory". It is to assist in the areas of work organization and manpower planning. The department is not located in Tahrir square but in Manial. It keeps records on manpower and on organizational responsibilities and has been instrumental in this analysis. However, it is not quite clear how effective it is in bringing about change in NOPWASD's activities.

Finally, the Technical Inspection Department - better known in NOPWASD as the Technical Assistance Department - has the role of periodic inspection of NOPWASD's site activities to ensure that the execution is performed according to the standards of quality and time. From the staffing pattern it is quite clear that it is the department that does the testing for water samples, since it is the only department in NOPWASD that employs chemists. It is not clear at this time whether this Department's staff is composed mainly from previous GOPW and GOSD operators that have remained with NOPWASD after operation and maintenance has become a governorates activity.

Lastly, a short note an information. The present information system in NOPWASD is by no means integrated. Very little summary information is collected and presented to management at any level for control purposes. Attention is focused, as was shown from the analysis of accounting systems, on observing regulations and presenting annual budgeting information to the central government. Even on projects supervised by NOPWASD, little is done to present information on performance monitoring.

The existing system cannot on a regular basis supply the various levels of the industry with the relevant information required. With the exception of one individual presently attending a course in information handling at the American University in Cairo, no one in NOPWASD has any experience in information management. A statistics department does exist in NOPWASD"s structure presently but it is manned by three clerks and the organization has no trained statistician on board.

b) Role of NOPWASD in the future

NOPWASD presently does not perform all its prescribed functions as specified in Presidential Decree 197 for 1981. In setting the general plans for water and wastewater it lacks the expertise for preparing comprehensive financial and physical plans that integrate water, wastewater and other urban activities. In conducting applied research and studies it has concentrated on participating in feasibility studies for setting up provincial water companies and has spent little time on modifications of water and wastewater quality standards, or on policy studies. Regarding technical specifications and standards for projects, these are presently being set, as on most Egyptian projects, by the project designers usually following tradition. Up to the present time NOPWASD has not embarked on developing new standards and procedures. NOPWASD's involvement in training is embryonic, and with no training centers it concentrates on municipal engineers. It does not cover the various aspects of design, construction, and operation and maintenance of water and wastewater facilities. The agency does assist the municipalities at present in designing, contracting and supervising construction of large projects according to the specifications set by NOPWASD. The agency does not yet charge for its services.

In the medium term, both the Ministry of Housing and NOPWASD do not envision any legislative changes to the role of NOPWASD in the sector. Rather it is intended that any assistance be used to help the agency extend its present role and ensure that it can properly fulfill the responsibilities defined in the presidential decree. The agency is presently intended to perform planning and technical assistance roles for both the central and local governments in the sector. In the long term some changes in this role may be necessary, especially as governorates requirements for technical assistance diminish. At that point in time, some legislative changes in the NOPWASD mandate may be required. Table 4 depicts the various functions and responsibilities of NOPWASD now and in the medium and long term future.

Development of NORWASU Functions

F. 3	AT Present	Medium Term	Long Term Future
Policy&Planning	- Preparing sector investment Program based on existing sector master plans and governorates requests. - Liaison with governorates or capital budgeting. - Design major capital works on behalf of governorates. - Participate in assigning foreign assistance to sector priorities.	- Preparing and updating sector master plans based on guidelines discussed and approved with MHPU. their own work. - Liaison with governorates on planning and budgeting issues. - Advising on physical&financial objectives and policies for water and wastewater supply. - Developing relevant design and operational standards&criteria. - Providing technical advice and specialist services on agency basis for design of major capital works. - Coordinate financial planning and funding of sector projects including foreign assistance.	- Setting targets and guidelines for levels of service and tariff policies for governorates to pla - Setting relevant design and operational criteria for capital projects in the sector. - governorates capital programs agent standards. - Negotiating central government capital funds to the governorate For both local and foreign funds - Reviewing governorates manpow plans and monitoring quality personnels.
Supervisory and regulatory	- Advising on regulatory workings of the sector.	- Advising on appropriate re-regulations governing financial, Administrative and technical pro-cedures of governorate utilities. - Advising on planning&operating standards of governorate utilities.	- Physical and financial super-vision of planning and operating standards of governorate utiliti (including quality of water produced and discharged).
Operational	- Construction supervision of major capital works on behalf of governorates. - Bulk procurement on behalf of gover-governorates of some items as required.	- Technical assistance&advice to governorates on some of the following: . construction supervision manuals and procedures. . operational systems of: . billing and collection . financial operation . personal . support service . Design manuals and standards	- Emergency assistance&trouble shooting capability only. - Maintaining the operational standards in terms of approval and dessimination of systems on billing and collection financial operations personnel procedures. personnel procedures. support services
Non-Operational Services	- Attempts at developing manpower deve-lopment and training programmers to meet meet sector needs. - Preparing feasibility studies as part of implementation of existing master plan.	- Development of comprehensive manpower development and training programs for sector. - Conduct some training programs for management,&middle grade staff. - Arranging external management training and advanced training of specialists. -identify areas for applied research.	- Dessiminate training material for use in industry. - Funding of research activitie

E. MHPU and NOPWASD Support Needs

To help both the MHPU and NOPWASD achieve their respective roles and functions in the water and wastewater sector a combination of possible assistance is recommended by USAID. It includes, long-term,(i.e. 30 months) and short-term technical assistance, pilot plant start-up and O&M services; training support through participant training, publications and equipment; and general support in terms of logistics information management and the funding of applied research. Based on the analysis of administrative capacity of the two organizations, this section attempts to answer the following questions: (a) What kind of assistance is required by the agencies; (b) How much can they absorb; and (c) How well can the agencies manage the assistance?

1. Ministry Capability

Three priority areas can be identified for support to enable MHPU to set policies and regulations, and to monitor and supervise the sector. These include: policy guidance, plan review and finance, management and coordination. The bulk of the expected assistance will be in the form of technical assistance. It would be supplemented by some minor logistics and data management, as well as participant training support.

Technical assistance absorptive capacity could be identified in terms of the ability to provide adequate counterparts, the ability to pay for local experts, and the ability to implement and use the assistance provided.

At present, the MHPU can easily provide approximately four or five, full-time staff professionals to work on the three areas identified above. This is not counting the time devoted by the Undersecretaries and top-level officials. This would provide for some 150 man months of effort. Although the MHPU has the intention to expand, (as discussed in the administrative capability analysis section) it can not be expected that the MHPU would be able to provide 20 or 25 staff professionals to work on the project in the near future. It is reasonable to assume though that MHPU can identify and add two or three more staff members to work on the project, making the total manmonths of staff time between 210 and 240 over the 30 month technical assistance period. The problem with language must be addressed rapidly however, as most of MHPU staff neither speak nor read English. Testing and training for English communication should start immediately, if not for everybody, at least for the key staff targeted to work on the project.

As far as paying for Egyptian experts in this fiscal year, MHPU has a total of LE 500,000 budgeted for studies and research. This money can be used to finance expert advisors for water and wastewater. Currently, the funding is being used to fund the Ministry's reorganization studies, as no other technical studies are underway. At a cost of $2,500 per manmonth for Egyptian experts, the MHPU can easily fund up to 200

man-months per year with LE 500,000. It should be possible under the present conditions for the MHPU to allocate 30 to 40 percent of such a sum per year during the 30 months of technical assistance, amounting to approximately LE 400,000 to LE 500,000. This should fund 160 to 200 man months of Egyptian expert efforts.

In terms of the potential use and implementation of the results of the assistance provided to the MHPU, it is difficult to assess. As far as the technical assistance is concerned, MHPU shall implement the management and policy advice if it is presented in a "camouflaged manner", that is if the advice is cast as "technical" versus "managerial" advice. Planning and policy guidance should be used as vehicles for management and organizational changes advice through the clarification of relationships and roles of the various sector organizations, and their potential impact on sectorwide goals and strategies.

Neither the long-range planning capacity or capability presently exists in the Ministry, nor the attitude for setting standards and systematic impact analyses. The capability may be developed through training both by interacting with advisors on-the-job, and by attending technical training in U.S. Ten to fifteen individual trips over the 30 months of technical assistance can easily be maintained for visitational travel and training in the U.S. from the MHPU in both the policy and planning areas.

Information handling at both the CDPU and MHPU in general is a major problem. At the present time MHPU does not have staff specializing in information handling or management. Training of such individuals is imperative if the design of a sector integrated management information system is to be implemented. In the mean time the introduction of small personal computers in the CDPU, at least for the advisory team use, can and will enhance the process. It could be possible to justify three personal computers -- one for the advisory team, one for the planning office and one for the office of the Undersecretary for Public Utilities.

The MHPU's ability to manage and administer the assistance contracts is not so obvious. Training in this area prior to final selection of technical assistance advisors may be justified. The Ministry of Development's handling of TAMS for ten years indicates that GOE officials can handle technical assistance contracts both administratively and financially. In terms of the procurement of goods or training under USAID regulations, it is expected that MHPU will need some assistance. Such assistance can either be provided through short term AID-direct contracts, or through training. The problem could easily be overcome the in MHPU since the level of effort in this component is probably limited. It is not expected that the MHPU will have problems with the provision of office space for the advisors. Some logistical support with the equipping of adequate office equipment will be necessary.

2. NOPWASD Capability

To enable NOPWASD to develop national plans to coordinate implementation and assist in the operational and other service provisions in the sector five priority areas have been identified. These include: Management and Finance, Planning and Economic Analysis, Manpower Development, Engineering and Environment, and Pilot Start Up and Operations and Maintenance. The support for NOPWASD would include both technical assistance and training support in publications and training aids, in addition to logistics, data management, and participant training support.

Unlike the MHPU, NOPWASD does have more staff professionals, it is thus expected that the agency can easily provide 12 to 15 competent staff professionals including engineers and accountants to support the first four tasks providing for 360 to 450 man months of effort. In addition approximately six engineers are needed for the start-up and O&M program. While the total number may not seem very high, in some cases however filling these posts will be more difficult then others. For the start up program and the engineering area the staff is currently available. This is also true for the management, finance, and planning areas. In the training area however, the availability of personnel is nonexistent. There is a need for specialized training in manpower development and training for at least three staff members, in addition to language training that a large number of the staff requires. So far efforts to identify the potential staff to work on the project have been limited, but all of those people proposed are presently working in NOPWASD on the implementation of the potable water master plan.

As far as paying for Egyptian experts, NOPWASD uses Egyptian engineering consultants on a regular basis. It is not clear at this point how much they actually pay them per year. The problem may surface if the expenditure on Egyptian experts for the ISP project substitutes for a major portion of the engineering assistance. NOPWASD's chairman does not seem concerned, and thinks that approximately LE 250,000 to LE 300,000 per year can be used for this purpose.

In terms of potential use and implementation of the results of the technical assistance, the technical issues such as economic analysis, engineering and effluent standards will get top management support. The external management problems such as the relationship between NOPWASD and the municipalities, will get the similar support. NOPWASD's internal management problems will not. These must be be addressed through the context of the technical and cost impacts on the performance of the agency. Proposed adjustments to the organizational structure should be approached very carefully with extensive inputs from the Central Agency for Organization and Administration, if any implementation is to take place.

The emphasis on training will allow the needs assessment and the training coordination to proceed satisfactorily. NOPWASD wants to see more staff from the sector receive training. If NOPWASD is able to provide new space for training and meeting rooms, the space can be equipped with training aids and equipment. Support for the Training Library will also proceed if the agency provides space for the development of the facility.

NOPWASD is already training two staff in information management at AUC to become the nucleous of the information center. When larger numbers of NOPWASD staff get training in this area the study of information needs and plans, and system design to integrate NOPWASD with both the Municipalities and the MHPU can occur. Actual purchases of hardware will be contingent upon this study and the availability of personnel for training. It is anticipated that additional staff training will be required. Before the end of the technical assistance contract NOPWASD will be ready to procure a microcomputer to cover a part of its information needs. The introduction of a few personal computers will improve NOPWASD's information needs. Personal computers could be utilized in the Construction, Planning, Finance, Training, and Research Departments, as wellas the Chairman's office.

Studies and conference support will promote NOPWASD's participation in the promotion of Sanitary Engineering issues. Presently, NOPWASD is not involved in this field, nor has it dealt with such issues before. The implementation of an extensive study and conference support program during the first phase of the project is highly unlikely. A small pilot program with one or more universities, and the sponsorship of one or two national water/wastewater conferences could be realized during the first phase of the program.

To improve NOPWASD's relations with the municipalities, a pilot start-up O&M program will be initiated. This program is contingent on two issues: (1) the availability of six to eight staff professionals to assist the advisors, and (2) that NOPWASD complete the modifications suggested by the advisors to ensure the operability of the plants. NOPWASD is anxious to see this component begin. It could be accelerated if USAID and NOPWASD agree on utilizing PVO assistance for this part. This technical assistance would be absorbed by NOPWASD through hands-on training activities, including the development of standard operating procedures, and operations and maintenance manuals. For NOPWASD the result would be the development of a start-up O&M training team to provide start-up and O&M services to municipal plants throughout the nation. This would enhance NOPWASD's current technical assistance role which primarily focuses on design and construction supervision. The four or five municipal plants receiving start-up and O&M assistance through the project would receive on-site, hands-on training for their O&M personnel.

It is expected that NOPWASD will not have a large problem with the repairs and renovations for the pilot plants. A cost estimate for repairs for three wastewater and two water treatment plants (based on budgeting 10% of capital cost as an allowance for wastewater and 2% for water plants) is somewhere between LE 1-4 million.

NOPWASD's ability to manage a technical assistance contract surpasses the MHPU's ability. NOPWASD has managed several foreign technical assistance contracts, and currently is managing one for USAID on the Canal Cities project. Some training in this area may be required, but it is less of a need then for the MHPU.

If NOPWASD follows through with its plan to acquire new office space, there will be adequate space provided for the advisors. Even in its current office quarters there exists sufficient space for advisor offices.

3. Scale of Assistance:

After reviewing both the MHPU and NOPWASD's requirements and capabilities it is not unreasonable to expect a smaller effort at the MHPU with three long-term advisors complemented with some 45 man months of short-term advisors, and approximately 180 manmonths for local advisors. This is in contrast to the longer effort at NOPWASD with five long-term advisors, and 140 man months of short-term, supplemented with 300 man months of local advisors. In addition, the start-up assistance effort requires approximately four long-term advisors, and nine manmonths of short-term, and 80 man months of local advisors.

The local advisors for both agencies will be handled through the MHPU and NOPWASD respectively, and should not present any major management or administrative problems. To ensure flexibility in the program, and to allow for a quicker response time than that of host country contracting, approximately 100 man months of short-term AID-direct contracts is factored in the technical assistance. The AID direct contracts will be used to start the project during the premobilization phase, for AID evaluations and to respond to an emergency request for assistance from another agency or municipality other than from the MHPU, NOPWASD, or a municipality where the ISR is actively involved. These contracts will be administered by USAID/Cairo and will not impose additional burdens on the MHPU or NOPWASD, except in providing counterparts when necessary.

USAID/Cairo prefers that the TA contract involve one firm serving both the MHPU and NOPWASD. The GOE agencies each would prefer separate contracts. This point remains under discussion with the two agencies.

CANAL CITIES WATER AND WASTEWATER PHASE II
(PROJECT 263-0174)

SOCIAL SOUNDNESS ANALYSIS

I. Sociocultural Feasibility

A. Introduction

Although USAID financing of wastewater systems for the three Canal Cities is programmed as two discrete activities, this analysis looks at the wastewater systems activities as a whole. The principal reason is to maintain a coherence of discussion regarding beneficiaries for what is essentially an interdependent wastewater network. Another important reason is that this Project will provide an opportunity to address key beneficiary issues that were not addressed under the collection phase.

The main thrust of the project is to provide assistance to relieve serious pollution of raw sewage into the receiving waters of Lake Timsah in Ismailia, Lake Manzala in Port Said, and the Gulf of Suez in Suez by providing adequately functioning wastewater treatment plants in the three Cities. The Project also addressed the problem of inadequate raw water supply to the City of Port Said. Lastly, a series of activities are proposed to strengthen the capacity of institutions involved in the delivery of water and wastewater services.

B. The Problem

Existing wastewater systems in the three Canal Cities were damaged during the 1967 and 1973 wars. These systems subsequently deteriorated because of inadequate budgetary support for repair, maintenance and expansion of these systems. Many of the existing facilities are poorly constructed and do not operate at even minimum levels of acceptability. This means that existing wastewater treatment facilities in the three cities provided

D. Beneficiaries of Improved Collection Systems

From Phase I we know that beneficiaries of improved collection systems are people living in the densely settled urban neighborhoods in each city. The technical analysis estimates that in 1987 calculations, approximately 60% of the total population of 396,100 in Port Said, (this excludes Port Fouad) resides in the urban services areas; approximately 65% of the total population of 265,899 in Ismailia resides in the urban service areas; and approximately 70% of the total population of 344,310 in Suez lives in the urban service areas. It is anticipated that the combined populations of the three cities will increase to over 2 million people by the year 2000.

Under Phase I the impact of USAID's assistance was indirect because the USAID financed components of the project did not provide for laterals and household hook-ups. A general assumption was that sector components that would touch beneficiaries directly would be financed by the GOE or by the beneficiaries themselves. The question is who pays the initial connection fee to cover the cost of installing pipes and internal household plumbing. The issue would be the ability to afford the initial capital investment rather than the regular monthly bill. Consequently, beneficiary impact in an improved collection system would be determined by ability and willingness of households to pay the initial connection fee, usually a one-time fee, for connection to the main collection network. Has the initial capital investment cost for connection been a constraint to achievement of beneficiary impact? Or has the GOE or beneficiaries paid for initial connection costs on a large enough scale to indicate significant impact of USAID's investment? What is the level of this impact?

If we do not have answers to the above questions, this project can be the vehicle for obtaining this information. The information can be obtained by carrying out a rapid appraisal study of the extent to which the USAID financed collection system.

virtually no treatment of raw sewerage. Consequently, large quantities of raw wastewater is discharged to surface waters used for fishing and recreational boating and swimming.

The sweetwater canal, the only source of raw potable water for Port Said, can presently deliver up to 125,000 m^3/day while the current average daily demand is in excess of 150,000 m^3/day, projected to increase to 219,000 m^3/day. The limited water supply seriously inhibits further development of the City. Lastly, the utilities involved in the delivery of wastewater services experience a series institutional shortcoming in the management, operation and maintenance of the physical facilities.

C. Beneficiaries of Improved Treatment Systems

Beneficiaries of improved treatment systems are not necessarily the same as the beneficiaries of improved collection systems. Any citizen who uses the lakes or the Bay where sewerage is now being discharged, whether or not they currently benefit from improved collection networks, will benefit from improved treatment systems. Consequently, this project is compatible with the sociocultural environment into which it will be introduced.

Treatment systems improved to reduce pollution will make the three cities a more favorable place for residence, business, tourism, and recreational activities. What needs to be determined is which groups in each city are the primary beneficiaries. It appears that the unsewered population in each of the three cities is, in all probability, the lowest 25th income precentile. Reduced pollution could have a tremendous positive impact on their living conditions, if communities in unsewered areas rely heavily on the lake water and the Bay for all their water needs. The primary task would be to design an impact study of the current uses of the polluted water sources. This study should be undertaken at the beginning of the project. A follow-up study should be undertaken at the PACD to determine how this project has affected pollution levels and water uses.

E. Beneficiaries of Improved Raw Water Supply

The beneficiaries will include the entire year 2000 population of Port Said. It is anticipated that 80% of the people will have full water services while the remaining 20% will be served through public fountains. This increased population coverage to twice as many people will be dependent upon the expansion of distribution network and the ability of the consumers to pay for hook-up and O&M services in the form of increased tariffs.

F. Beneficiaries of Institutional Improvements

The primary beneficiaries of these improvements will be the present consumer population in the Cities. The improved O&M and management of wastewater/water facilities will ensure consumers higher quality of services. The secondary beneficiaries will be that portion of the population who are not now served but would be served by the utilities due to improved organizational effectiveness procedures proposed under the Project.

II. Spread Effects: The Diffusion of Innovation

Diffusion and Willingness to Pay for Services

A key factor in the spread of services under this project will be the willingness of the GOE and beneficiaries themselves to pay for the delivery of collection and treatment services. There is some question of ability of beneficiaries to pay the capital costs associated with connecting to the water and sewer network, as well as doubt of their willingness to pay the costs associated with on-going operation and maintenance of service. The principal reason is the experience that people have had with poor quality service. One of the findings in the 1985 sector have not endorsed the argument that payment should be made by users an on-going basis to ensure that service will be upgraded. It was not clear that his same question was put to a cross-section of potential users.

Recommendation

- That the project include a component that will help the GOE outlined a plan to assess the ability of households in service areas to pay for delivery of both collection and treatment services. A beginning step would be a rapid appraisal of a sample of targeted households in service areas to determine willingness to pay for services. Such a survey may provide some indication of whether increased tariffs would constitute a political risk to the GOE. The simplest way to get an initial idea of what people are willing to pay for and how much they are willing to pay for specific services would be to ask them. A type of random user survey could be carried out during a winter season and a summer season since demand will differ in both seasons.

Household and commercial tariffs should be in amounts sufficient to cover the cost of operation and maintenance, as well as a certain percentage of the capital costs. This would hold for both water and wastewater networks. There is currently a charge for wastewater collection in the service areas of the three cities. Households in unsewered areas pay a relatively large amount for this service. For example, evacuating a typical cessipt of 2-3 cubic meters costs 7 LE on average. The frequency of evacuation depends on the concentration of cessipts ground water infiltration and whether the house is connected to the water distribution network.

Since the collection systems financed by USAID will serve those populations in the centers of the three cities, a beneficiary analysis would probable show that each system is serving populations with a greater ability to pay for services than the residents of the unsewered (and/or unserved) areas who are not connected to the public water and wastewater systems but pay a high percentage of household income for these services. Treatment systems financed by USAID will serve basically everybody who uses the polluted water sources. Obtaining a general profile of this beneficiary universe would be possible through a sample survey of users of the polluted water sources.

A major obstacle to actual follow-through on tariff collection is that people are much more willing to pay for amelioration of what they actually see to be a problem that impedes or seriously inconveniences them. Hence, selling them on the idea of paying for improved wastewater treatment will probably be met with less than overwhelming enthusiasm. One way of addressing the social awareness problem would be for the GOE to work up some public awareness campaigns to educate the public about the health costs and benefits of maintaining reduced pollution into the two lakes and the Suez Bay. Since it will be several years into the future before the treatment plants come on line, social awareness campaigns should be phased at a point close to start-up dates of plant operation.

III. Social Consequences and Benefits Incidence

A. General Social Impact

At the purpose level, the most significant indicator of general social impact of the treatment systems will be the capability of the systems to reduce to an acceptable level discharge of raw sewage into surface drains and the two lakes as well as into Suez Bay. The extent to which the systems are actually meeting this objectives can be determined by institutionalized wastewater quality testing. Currently, wastewater quality testing is done spordically, if at all.

At the goal level, the most significant indicator of general social impact would be improvement in the living conditions of the residents of the three cities. Eliminating incidents of wastewater flooding is certainly one positive step toward improving overall health status. However, this step alone is not likely to lead to significant changes in mortality and morbidity when other environmental health hazards exist.

Trying to relate improvements in water and wastewater systems measured as an increased and improved quality of water or the reduction of wastewater flooding -- and health status, is generally a very time consuming

and expensive undertaking. Past studies carried out by the World Bank reveal the difficulty of making a clear and direct correlation between improved public health and improved water/wastewater systems because of what is referred to in the literature as "confounding variables". At best, a strong association can be made. The epidemiologic linkage is very difficult to establish.

Nonetheless, a review of the epidemiology of water-borne diseases by a John Hopkins University professor for Frankfurt, Germany and Baltimore, Maryland indicated that in the upgrading of water and wastewater treatment plants, significant improvements in public health were realized only when more than 70% of household in the population are targeted for inclusion in the improved system. A working assumption of this analysis is that significant impact on public health is not discernible until a threshold coverage of 70% is reached. Health benefits should be a criterion of success for this project. A determination of the actual number of household hook-ups would provide the data required to document threshold coverage.

B. Social Impact and Differential Access

Some measurement of social impact and differential access is an issue of great concern in documenting extent of project success. However, a major information gap in the Mission's data bank is lack of solid evidence and concrete examples on how its investments in infrastructure projects have impacted Egyptian society. While determination of exact numbers of beneficiaries may not be feasible or even necessary, this project can obtain indicative evidence through a set of rapid, low-cost impact studies to be conducted during the start-up phase of the project. The purpose of these impact studies would be to determine differential social impact of USAID's assistance in upgrading water and wastewater networks in the three cities.

For example, there are different categories of users of the water sources, ranging from housewives to industrial managers and, of course, farmers. The project will general data through a series of small impact studies on how the various categories of users will benefit from reduced pollution in their water sources. Included in these studies will be a particular focus on how the upgraded systems impact the lives of women. To extract this data from the project it will be necessary to build into the design the necessary tasks (including scopes of work) and required funding.

Equally important for project implementation will be the development of a monitoring and evaluation system. In light of the need to conduct a series of small impact studies, a life of project monitoring and evaluation system should be considered as an alternative to the usual midterm and end-of-term evaluation. A life of project evaluation plan should be designed so that information needs of the project will envolve as project implementation experience changes over time. The cost of such an evaluation should be less than 5% of the total project budget.

IV. Summary

To address key beneficiary impact questions and issues under this project, the following rapid, low-cost studies are proposed for funding:

(1) Before and after survey of polluted water source users;

(2) Before and after water quality testing;

(3) User survey of willingness to pay for water/wastewater services; and

(4) Study of the actual number of household hook-ups to determine approximation to threshold number of 70%.

ID#SOCIAL

ANNEX M

INSTITUTIONAL DEVELOPMENT

CANAL CITIES WATER AND WASTEWATER PHASE II

PROJECT 263-0174

CANAL CITIES WATER AND WASTEWATER PROJECT

INSTITUTIONAL DEVELOPMENT PROGRAM

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CANAL CITIES WATER AND WASTEWATER PROJECT
INSTITUTIONAL DEVELOPMENT PROGRAM*

I. POLICY CONTEXT

A. USAID Policy and Program Objectives

Institutional development is one of the "Four Pillars" underpinning the agency wide development philosophy, as well as the mission's policy and program. It is reflected in USAID's project portfolio, and specifically in the projects of the water and wastewater sector. A sector Memorandum of Understanding (MOU) outlines the major policy parameters. The MOU, which was signed by the GOE Ministers for Housing and Public Utilities and Planning and International Cooperation, and cosigned by the USAID Mission Director, on January 22, 1984, conditioned any further funding of projects in the sector on the achievement of certain specific policy objectives. These objectives which are expected to be achieved by 1991, could be summarized as follow:

- attainment of financial viability,
- achievement of organizational effectiveness (autonomy),
- improvement in service delivery capability, and
- availability of competent manpower.

In addition to this broad range of concerns, USAID, and, by implication, the recipients of funds, must adhere to general policy stipulations that guide the AID assistance program generally, namely

- protection of environmental quality and public health,
- maintenance of a comprehensive financial accounting system,
- application of lessons learned elsewhere, such as those expressed in USAID internal policy papers and sector assessments.

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* In case of inconsistencies, the language in main body of the Project Paper represents the latest of the Project Committee's thinking on this component and, therefore, supersedes the subject matter in question.

USAID has already provided a significant amount of technical assistance in support of institutional development, through the Suez Canal Authority on behalf of and for the benefit of the three Canal Cities. These include the following activities:

- Long range master plans for Water and Wastewater Systems (1977)
- Analysis of Revenue Requirements and Cost-of-Service Rates (1979)
- Institutional Assessment of Wastewater Departments (1982)
- On-the-Job Training for System O&M (1983-ongoing)
- Manpower Needs Assessment for Municipal Wastewater Departments (1986)

A list of the various studies is appended and copies of the reports are on file. The organizational support element outlined in this project paper builds on the results of the earlier program of activities and expands the previous commitments, with a particular focus in two key issues, namely, the attainment of financial viability of the systems, and the achievement of organizational effectiveness, including a degree of autonomy of local government agencies from central government control.

The current dependency of the governorates in the Canal Zone on the fiscal resources from and the allocation by the central governmental agencies, renders the attainment of the mutually shared policy objectives a difficult proposition. The fiscal resources under the control of central ministries are not only the capital funds required for a sustained investment program in municipal infrastructure, but also the operating funds necessary to maintain the systems at high standards of performance. While the capital funds for wastewater system expansion are appropriated through the Five Year Plan preparation process managed by the Ministry of Planning, and allocated through the budgetary and administrative processes of the NOPWASD, a subordinated unit of the MHPU, the operating funds are obtained through the annual budget of the governorate on behalf of the municipality, managed through the central Ministry of Finance and its local governorate Finance Directorate.

The direct linkage between capital and operating cost requirements and the actual resource allocations for the wastewater systems has not yet been clearly established. Similarly, the fiscal relationship between the water supply system, which is under the policy and operating control of the Suez Canal Authority, and the municipal Wastewater system, remains uncoordinated. Water tariffs collected from consumers cover only a part of the recurrent cost of operating the water supply system, but do not contribute to a capital fund for the expansion of either the water or wastewater system. A 10 percent surcharge on the water bill of those consumers with central sewer system hook-ups, (which has been collected since 1986 by SCA and transfered to the account of the governorates' finance department), has served to meet certain emergency needs, but was clearly insufficient to meet even the requirements for overtime payments of wastewater personnel.

A comprehensive policy decision concerning the governorates' self-financing of its infrastructure investment program and the complete coverage of its recurrent operating cost, cannot be made unilaterally by the local governmental entities, but only with the concurrance of key national decision makers. Ongoing discussions between USAID and GOE ministries and between central and local government agencies may lead to such a self-financing agreement, to be implemented gradually over time. For the purpose of this project authorization, it will be assumed that such an "agreement in principle" will be reached prior to project authorization (but not stated as a condition precedent to disbursement of funds), and that the GOE will accept appropriate technical assistance to help implement the self-financing objective. The USAID funded technical assistance would be aimed at attaining the financial viability of the systems as a whole, and not only those system components built exclusively with USAID resources.

B. Organizational Interrelationships

Implicit in the achievement of the financial viability objective is the clarification of the responsibilities and pattern of interaction among the various governmental jurisdictions, agencies, departments and offices, which play a role in the financial management and administrative support effort. The organizations and the financial functions they perform for and on behalf of the Canal Cities are listed below:

1) Central Government Entities:

- MPIC (allocates capital resources within limits set for the sector as a whole, and monitors disbursements),

- MOF (allocates and accounts for capital and operating funds in annual budget and quarterly disbursements),

- MHPU (reviews and approves capital requests in the context of its long range and yearly urban housing development and desert settlement program),

- NOPWASD (coordinates and supports governorate requests for capital investments, designs & manages construction projects)

- MCA/MSAD (coordinates interministerial policy formulation on economic reform issues, approves reorganization proposals, job classification and compensation schedules),

- MOLG (coordinates and supports local government requests at interministerial policy deliberations as a friend-in-court. It also manages the interministerial coordination process for local development through the Technical AMANA.)

2) Regional Organizations:

- Suez Canal Authority (manages all investment programs and services associated with the efficient operations of the Canal, including on an interim basis, the water supply systems for the three cities. Maintains its own capital program and operating budgets, subject to approval from MPIC and MOF. Bills and collects user charges for water consumed by residents, industries, ships and its own activity centers.)

- Canal Zone Water and Wastewater Organization (established by the MHPU as a regional branch of NOPWASD, to serve primarily as the construction manager for donor funded facilities, in coordination and cooperation with the respective governors, serving in an advisory capacity)

3) Local Government Agencies (Governorate, municipal and markaz affairs)

- Office of the Governor (reviews, approves and submits departmental funding requests to central government agencies; provides policy guidance to all local executive agencies.)

- Governorate Department of Planning and Follow-Up (prepares long range capital program and negotiates with MPIC, MHPU, NOPWASD, MOF, etc.) and monitors disbursements.

- Governorate Department of Finance (prepares annual budget requests for submission to MOF, maintains all expenditure and revenue accounts).

- Municipal Department of Public Works/Engineering (supervises all divisions responsible for wastewater systems, electric distribution, vehicles and garages, public lands and parks, etc. Also prepares operating fund requests for submission to Governorate's Directorate of Finance.

- Other governorate functions, eg. Administrative Affairs, Personnel, Procurements, Legal Affairs, etc. (review governorate, markaz and municipal departmental funding requests for compliance with other priorities, policies, programs, projects.)

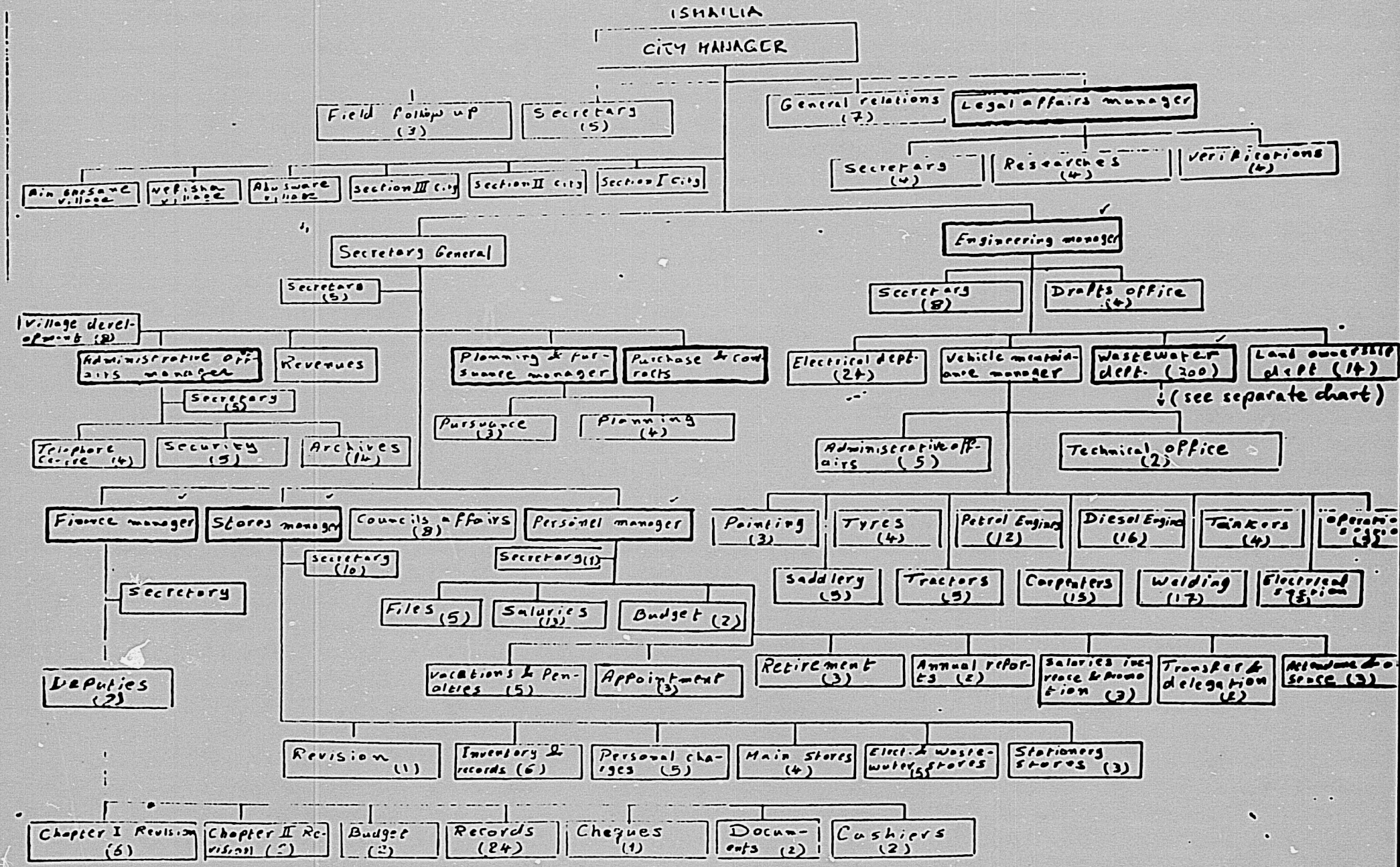
4) Private Sector Interests

- Service Contractors (render services at negotiated fees, eg. emptying of septic tanks, delivery of potable water to those households not connected to public service networks.)

- Private Voluntary Organizations (monitor quality and cost of service delivery system and press for performance improvements, including the organization of self-help measures.)

- Academic and Vocational Training and Research Centers (monitor intergovernmental decision process, provide assistance under short-term contracts, including advisory services and surveys.

The organizations listed above all have a keen interest in the financial situation of the water and wastewater systems affecting the Canal Cities. While the formulation and approval of the Capital Investment Program (at least at the Five Year Plan preparation stage) involves most of the organizations in direct and indirect confrontation and negotiation, the formulation and approval of the Annual Operating Budget involves only a few of


ISMAILIA
CITY MANAGER
Field follow up (3)
Secretary (5)
General relations (7)
Legal affairs manager
Secretary (4)
Researches (4)
verifications (4)
Ain Ghosane village
Nefisha village
Abu Sware village
Section III City
Section II City
Section I City
Secretary General
Secretary (5)
Village development (8)
Administrative affairs manager
Revenues
Secretary (5)
Telephone Centre (4)
Security (5)
Archives (14)
Planning & pursuance manager
Purchase & contracts
Pursuance (3)
Planning (4)
Engineering manager
Secretary (8)
Drafts office (4)
Electrical dept. (24)
Vehicle maintenance manager
Wastewater dept. (200)
Land ownership dept (14)
(see separate chart)
Administrative affairs (5)
Technical office (2)
Finance manager
Stores manager
Councils affairs (8)
Personnel manager
Secretary
Deputies (2)
Secretary (10)
Secretary (1)
Files (5)
Salaries (13)
Budget (2)
Vacations & Penalties (5)
Appointment (3)
Retirement (3)
Annual reports (2)
Salaries increase & promotion (3)
Transfer & delegation (2)
Attendance & absence (3)
Painting (3)
Tyres (4)
Petrol Engines (12)
Diesel Engines (16)
Tankers (4)
Operation section (3)
Saddlery (5)
Tractors (5)
Carpenters (15)
Welding (17)
Electrical section (3)
Revision (1)
Inventory & records (6)
Personal charges (5)
Main stores (4)
Elect. & wastewater stores (5)
Stationery stores (3)
Chapter I Revision (6)
Chapter II Revision (2)
Budget (2)
Records (24)
Cheques (1)
Documents (2)
Cashiers (2)

the affected parties and tends to reflect historical resource allocation patterns, as documented by the MOF/GDOF, rather than the realistic requirements, as defined by the operating agencies.

Consequently, the current structure and process of decision making could not accommodate the desire for significant change, either in terms of increased capital and operating fund allocations from central government resources, or in terms of strengthening the governorates' self-financing and management capabilities. Assuming that the governorates are prepared to opt for the latter approach, the establishment of a new organizational framework, with revised policy parameters and legal mandates would be an essential pre-condition for change.

C. Assessment of Institutional Constraints

The nature of the institutional constrains have been identified and discussed among GOE and USAID funded consultants as early as 1978 and periodically throughout the past 10 years. The 1978 study, conducted by BVI-ATK with Sabbour Associates, analyzed the revenue requirements and utility management capabilities from a comprehensive perspective and with the view toward introducing the concept of an automonous self-financing utility organization, based on the US and European models. The lack of GOE response to the "radical" concept of change, led USAID in 1982 to fund yet another assessment, but focussed not on broad based organizational change, but only on administrative improvements of the one governorate department, which bears the principal responibility for the O&M of the muncipal wastewater system components. The 1982 report contained a large number of relatively minor specific policy and administrative changes, as well as a reiteration of the earlier broad fiscal policy recommendations. None of these proposals were implemented by the time USAID commissioned another assessment of the manpower training needs of the wastewater departments. The 1986 study again

restated earlier proposals and added more specific recommendations concerning the strenghtening of O&M specific manpower capabilities. The lack of accomplishements to date can be attributed to a number of reasons, all of which may serve as a lesson for this fourth USAID funded attempt to overcome the inertia for change. The major reasons are, but may not be limited to the following:

- a general lack of understanding on the part of expatriate engineering consultant companies of the inherent complexity of the Egyptian governmental structure and interaction process. The institutional assessments were undertaken as part of a large scale capital assistance program and the small amounts budgeted for the technical assistance component was viewed as a sufficient effort to protect the investment from premature deterioration.

- the absence of an official commitment or personal motivation by local government personnel to implement what some GOE officials privately have characterized as naive and shortsighted reform proposals, presented to agencies which have no jurisdiction over the process of resolving critical policy issues.

- the reluctance on the part of MPIC to approve expensive multiyear technical assistance efforts in support of politically sensitive reform agendas, forcing donors to present such assistance as an integral part of on as an adjunct to a capital assistance project, irrespective of the strength of the relationship between the type and size of physical infrastructure improvement and the nature and complexity of the institutional reform requirements.

It has become evident from the experience of institutional reform effort in Cairo, Alexandria, the provincial cities of Fayoum, Minia, Beni Suef and Beheira, that an infrastructure construction project does not lend itself as a vehicle to introduce the desired changes in municpal or organizational management and administrative practices. Experience elsewhere suggests

that the two disparate elements can and should be authorized as complementary efforts under one program umbrella, but that they must be implemented separately, albeit on a parallel track. The general manager of a major construction project could not be expected to serve also as facilitator and supervisor of institutional change at the host government agencies. It is unrealistic to expect expatriate engineering consultants and their Egyptian support personnel, drawn mostly from private sector firms, to identify and introduce changes in the structure and process of central and local governmental decision-making except for minor construction and O&M specific functions, which did not exist previously. It is also unrealistic to assume that a municipal department supervisor and his engineers who are responsible for designing projects, supervising their construction, operation and maintenance, could or would attempt to influence the management and administration of other municipal departments, even though their lack of performance effects the performance of his department. The latter point can be illustrated by means of the organization chart for the city and governorate of Ismalia, (Diagram 1), which shows the structure and interaction patterns of all departments and offices responsible for various aspects of municipal functions, such as water distribution, wastewater collection and associated treatment activities. For instance:

- The Wastewater Division is only one, albeit the largest concern of the Public Works and Engineering Department. It manages all facilities in place and controls manpower resources, but has no responsibility for legal affairs, financial and personnel management, inventory control and other administrative and planning functions.

- The Legal Department is responsible for the contractural relationship with SCA regarding the supply of potable water, as well for the maintenance and enforcement of the regulatory framework, e.g. codes and ordinances, which govern the activities of all other departments, the private sector and the behavior of consumer groups.

- The Finance Department handles all fiscal transactions under the guidelines and as the local agent for the central Ministry of Finance, accounting for all approved expenditures and resources collected. The water and wastewater relected financial transactions are not treated as a separate cost center, which would facilitate the balancing of cost with the income derived from user charges, but as an intergral part of the national system of accounts.

- The Personnel Department implements the job placement policies of the central government and adheres to organization structures, position classifications and compensation structures approved by the Ministry of State for Administrative Development. Any changes aimed at upgrading the personnel in the sanitary sector must be approved by central authorities and would have a precedent setting effect on other local governments.

- The activities of other departments such as planning, housing, health are similarey structured to respond both vertically and horizontally to emerging needs, but with very little flexibility and autonomy to introduce substantial changes of benefit to only one municipal function and objective, i.e., the improvement in the delivery of water and wastewater services.

Consequently, any attempt at organizational change must be cognicent of the broader implications and address the issues from both the national and local perspective. The dual and comprehensive perspective removes the organizational support effort beyond the immediate concerns of those responsible for facility construction. It requires the establishment of a separate management umbrella, as is discussed in the implementation plan of this project paper. Another justification for a different implementation mechanism can be inferred from the role which expatriates would play in the goal setting, design and implementation process. While expatriate design engineers and construction managers have an accepted supervisory responsibility, this role does not extend to interventions in or changes

to the governmental decesion processes. Expatriates may assist in formulating certain performance targets and intermediate benchmarks and provide a supportive environment, but the changes must be mobilized from within the governmental agencies and cannot be superimposed from the outside. Performance targets can be quantified and agreed upon informally by both the GOE and USAID officials. However, USAID and its contractors can only act in a capacity of facilitators, rather than as agents of change. The key to success lies in the mix of assistance that raises aspirations, induces motivations, and stimulates a broad range of self-help activities.

D. Options for Institutional Change

Prior to the initiation of any local discussion over institutional changes, there will be an agreement in principle at the national, i.e., interministerial level of government, concerning the degree of local self-financing authority and organizational autonomy to be exercised by the governorates. In addition, clarification will be sought concerning the temporary or permanent nature of the legal mandate of the SCA, particularly the geographic and functional scope of responsibilities for the provision of water and wastewater services, as well as the rights and roles of local government in the formulation of an equitable tariff structure, including the retention and use of revenues collected. Furthermore, it would seem appropriate to obtain an amplification of the central government's tacit policy support for the establishment of self-financing Regional Water and Wastewater Organizations at the governorate level, such as those in Beheira, Kafr El-Sheikh, Daqahliya, and in other places, where semi-autonomous organizations are in various stages of formation or under discussion.

Assuming that the national interest groups will support the principle of decentralization of decision making and consequently the strengthening of local organizational entities, several options deserve serious consideration:

1. Establishment of a separate Department of Water and Wastewater within the SCA, to plan, construct, operate, maintain all water and wastewater systems within the entire Canal Zone. A separate Financial Division would be responsible for tariff formulation, accounting, billing and collection of funds sufficient to cover all recurrent cost, depreciation and contributions to capital reserve. An Advisory Board, composed of political representatives would assist in devising the most equitable formula for the assessment of tariffs, but without the power of shifting the fiscal burden from the consumers to the public at large.

2. Establishment of a Regional Water and Wastewater Organization in each of the three governorates, which would require the transfer of SCA responsibilities for water supply to the new entities, the transfer of responsibilities of the municipal departments' wastewater service functions, and the governorates' responsibilities for water supply to rural markazes and villages. Each organization would carry out the entire range of utility functions, with an Advisory Board of political representatives determining equity considerations and ratifying the tariff structure.

3. Maintenance of the present organizational and functional arrangement with SCA and the governorates retaining separately their respective rural water supply functions, and the municipal public works departments retaining the wastewater collection and treatment responsibilities. The financial aspects, i.e. cost estimating and accounting, billing and collection, planning and budgeting, cost/benefit analyses and social cost allocations, etc. could be consolidated and placed under the auspices of an expanded SCA Utility Finance Division, or placed with a new Public Utility Commission, with supervisory authority over all operating agencies.

4. Expansion of the scope of the newly created Canal Zone Water and Wastewater Organization, to assume the operation, maintenance and finance functions in addition to the construction management functions. However, this option would be inconsistent with the decentralization objective, as long as the organization remains a subordinated unit of the Ministry of Housing and Public Utilities and NOPWASD. If the organizational linkage with MHPU/NOPWASD were to be served, this option would become a variant of option (1).

Each of the four alternatives has significant implications for the various affected parties to the decision process, and a choice from among the four approaches could not and should not be made prior to project authorization. However, it could be expected that an appropriate reorganization plan be implemented by 1991, the target date stipulated in the MOU for achieving the "financial viability" and "organizational effectiveness" objectives. In the meantime, the USAID funded technical assistance effort would provide the necessary inputs to help national and local government decision makers to achieve a mutually agreed upon and politically acceptable output.

II. TECHNICAL ASSISTANCE PROGRAM

The focus of the technical assistance effort is centered on the substantive and functional problems encountered by those responsible for the provision of water and wastewater services in the Canal Cities. The locus of activities is the existing jurisdictional framework of agencies, departments and offices which are currently carrying out these functions. If any one of the organizational options, identified in the previous section were to be adopted, the locus and the focus of activities may have to be adjusted. Although such a jurisdictional realignment of functions is not expected until initiation of the implementation phase of the program assistance, it must remain a critical element in all technical deliberations and an firm objective to be pursued throughout the analytical phase.

The legal, organizational, managerial and administrative reforms suggested in this Project Paper are expected to occur gradually over a time period of three years, and at a pace dictated by circumstances which cannot be foreseen or predetermined. The process of introducing changes into the existing structure and functional arrangements is outlined in the implementation plan. The program of technical assistance is defined below in terms of the Expected Accomplishments, hopefully to be met by the MOU target date of 1991, and in terms of the Tasks to be addressed by the respective participants. The participants in the respective "Task Forces" include GOE officials from the municipal, governorate and central ministerial (functional) agencies serving in an advisory capacity.

The responsibiility for ensuring overall policy coordination and interministerial cooperation lies with the existing Interministerial Local Development Council and its Technical Amana, which was established by agreement between the GOE and USAID to assist with the objective of decentralizing and strengthening Local Government throughout Egypt. The USAID funded Local Government program (283-0182) is pursuing a broad program of institutional reform, similar in scope and substance to the one identified below, and close coordination among the various parties and expatriate technical assistance providers is therefore required.

A. Expected Accomplishments

The objectives to be achieved are not listed in any agreed upon order of priority or in the sequence of activities to be undertaken, but reflect a sense of the relative importance of the issues and the difficulties of resolving same, based on the USAID experience with other institutional support programs. They are listed here only to provide a overview of various program elements which are further detailed in the Task Descriptions and the consultant Terms of References. The expected accomplishments are stated in general terms without any quantitative measurements. However, it is anticipated that specific measurements of achievements will be stated as targets and benchmarks in the agreed upon Work Plan which is to be

prepared by consultants and to be revised and approved by the respective committees. Following are the major categories of expected accomplishments:

1) Clarification of the legal mandates and jurisdictional responsibilities for the provision of water and wastewater services in the three governorates of the Canal Zone, including any amendment to or revision of the current regulatory framework governing management and administrative practices, as well as environmental standards, purity of potable water, quality of wastewater effluent, disposal of hazardous (toxic) waste, excludable solids, effective enforcement program, etc.

2) Adoption of a tariff structure, covering 100 percent of O&M and capital depreciation for all water and wastewater facilities in place and those under construction.

3) Improvement to the existing (or i.e. if a new organization is to be established, the installation of a new) financial management and administrative support systems, including efficient procedures, as well as appropriate equipment, e.g. furniture, computer hardware and software systems, procurement stores management and inventory control system, etc.

4) Introduction of a permanent personnel training and career development program for managerial and administrative employees, concurrently with (but most likely separate from-) the on-the-job training of O&M personnel for the wastewater treatment plants.

(The latter program is presented separately, and will be part of the Design-Built-Operate-Train and Transfer Contract (DBOT) for the respective facilities. Any subsequent O&M related training may also be obtained under contract with the Vocational Training Center, managed by SCA's Ship Building and Repair Division.)

5) Establishment of a municipal network expansion program to extend water and wastewater lateral pipes and house connections to unserved communities, including the provision of a line of (unsubsidized) credit to facilitate and expedite a community upgrading program. Establishment of an effective performance monitoring system for municipal public works in general and for individual water and wastewater system components and equipment in particular, incl. manuals of standard operating procedures, laboratory and other testing requirements, safety programs, etc.

6) Establishment of a public education/public relations program, focussing on public health issues, water conservation, enforcement of pretreatment and disposal of hazardous waste, and the cost/benefits of public services provided, public hearings on new projects, responsiveness to consumer complaints, increased private sector role, availability of information, etc.

B. Task Descriptions

The task descriptions below attempt to identify the range of activities necessary to bring about the desired results. They are lisited in the same general order as the expected accomplishments, or "outputs". Whether the proposed "inputs" are sufficient to generate the "outputs" must be subject to further analysis and may require adjustment in the scope of the effort. The vagueness in the program formulation is deliberate in order to permit flexibility throughout the implementation phase. The specific tasks to be addressed by the local government staff and consultants, include, but are not limited to the following:

1) Jurisdictional Responsibilities and Legal Mandates

a. Establish (and staff on a temporary basis) an Office of Strategic Planning and Management as adjunct to the Office of the Governor of Ismailia, to coordinate the institutional reform activities authorized under this project, to assist the Governor in evaluating long-range development plans and programs, and to coordinate and support local resource mobilization efforts, including those efforts funded under the USAID Local Development II program. The proposed functions are similar in scope to the Office of Management and Economic Development (OMED) which will be established under the Local Development Program II in Cairo, Giza, Alexandria, Suez and Port Said. The Urban LD II program does not include Ismailia.

b. Establish (and support on a temporary basis) an Intergovernmental Advisory Council on Institutional Reform, composed of all effected public and private sector interest groups, to assess the impact of proposed organizational and administrative changes and to evaluate the equity of proposed tariff structures. Assess the feasibility of transforming the temporary Advisory Council into a permanent Public Utility Commission to supervise the performance of all public utility services provided by public organizations and private enterprises, in the Canal Zone.

c. Analyze the applicable regulations, environmental standards, criteria, and administrative procedures concerning the purity of potable water and quality of wastewater effluents, pretreatment and disposal of hazardous and toxic water, control of (excludable) solids, etc. Review the effectiveness of the enforcement program and introduce appropriate revisions to the regulatory framework and improvements to the administrative system.

d. Review the applicable laws and decrees to clarify the permanent or interim responsibilities for the provision of water and wastewater services in the respective Canal zone, governorates' markazes and municipalities. Analyze organizational options as outlined above and propose appropriate enabling legislation or clarifying amendments to existing decrees.

e. Analyze the long range staffing implications of the various organizational options, and identify possible cooperative relationships with water and wastewater organizations in other metropolitan areas in Egypt, and the US, regarding the sharing of information and cost of manpower development and the coordination of fiscal and organizational policy matters.

2) Tariff Structure, Formulation and Approval Process

a. Establish and maintain a data base and cost estimating capability in each of the current water and wastewater operating divisions; quantify the O&M cost in the context of acceptable Standard Operating and Maintenance Procedures for the systems as a whole, its various system components and geographical divisions, as well as by expenditure categories, such as manpower salaries and benefits, replacement parts, equipment, machinery, tools, meters, fuel, electricity, materials, chemicals, etc.

b. Establish and maintain a data base and economic analysis capability to assess periodically the cost effectiveness of O&M practices and use of appropriate technology; evaluate the pattern and variables of water consumption and wastewater disposal practices by user groups and quantify the price sensitivity, i.e. ability and willingness to pay of the various consumer groups.

c. Develop or adapt an existing and appropriate computer software system, capable of analyzing the complex financial data series, and of balancing 100% of all O&M cost factors with potential revenue streams from water sales and wastewater services, including certain predetermined equity considerations. The system should be sufficiently comprehensive, yet simple to operate and maintain so as to permit frequent (quarterly) updates, and designed for centralized (SCA) and/or decentralized (Governorate Office of Finance) use.

d. Establish a Tariff Review and Ratification process, involving representatives of all public and private sector interest groups, possible under the auspices of the aforementioned (Public Utility Commission). Prepare appropriate data for presentation at public hearing(s) and for periodic publication in a local newspaper or special issue.

e. Establish a consolidated billing, revenue collection and accounting process for water and wastewater services, including an administrative enforcement process to settle all accounts receivable within a given time frame. Establish a system of fines and incentives, including a technical assistance program to help certain customers meet their financial obligations on a timely manner.

3) Financial Management

a. Review the financial management practices of governmental entities responsible for the provision of water and wastewater services; assess the degree of integration and the efficiency in carrying out financial functions such as cost factor analysis, longrange capital programming, annual budgeting, revenue collection and cash management, accounting and record keeping, evaluation and auditing, setting of standards and reporting on financial performance.

b. Analyze the desirability and feasibility of strengthening the governorate and/or municipal finance departments to accommodate consolidated water and wastewater utility operations, or alternatively, to transfer the respective financial management functions to another regional entity. Clarify steps leading to implementation of an improved financial management system at selected location(s).

c. Assist in establishing an integrated system of accounts, including the introduction of new and revision of existing data formats, data gathering and processing methods and procedures, the procurement and use of appropriate computer hardware and software systems, record maintenance and reporting; as well as suitable office furniture. Provide hands on training for existing personnel or assist in hiring additional personnel from within or outside of the government agencies.

4) Personnel Management

a. Review the personnel management practices of the three Canal Zone governorates, Suez Canal Authority and other organizations involved in the provision of water and wastewater services, assess the adequacy of the career development and personnel management system for all functions and employee categories associated with the utility sectors, including but not limited to position classifications, career path opportunities, job descriptions and technical qualifications, performance standards, compensation levels and benefits, skills assessment and certification requirements, international external training opportunities, promotional opportunities, procedures for intergovernmental transfers and exchange of personnel.

b. Analyze the fiscal, local and administrative implications of the introduction of proposed changes to the personnel systems at the governorate and municipal level, at the SCA or at a new organization. Discuss possible impliciations and implementation issues with the Central Organization for Administration and Management of the Ministry of State for Administrative Development, including the potential impact on other jurisdictions.

c. Based on the outcome of negotiations and agreements between central and local government agencies, assist with the implementation of changes to the personnel management system(s), including the provision of adequate level of funding through budgetary allocations and arrangements for training of personnel, e.g. contractual arrangements for on-the-job training for plant operators or at vocational training centers (Training of plant and network O&M personnel is discussed elsewhere in this project paper).

5) Inventory Control and Stores Management

a. Review the current practices of procurement, inventory control and stores management of the three governorates and SCA, as it affects the planning, design, construction, operation and maintenance of water and wastewater systems, as well as other municipal utility operations. These includes the valuation of all mobil and fixed assets, replacement parts, equipment, materials, tools, warehouses, storage facilities and open spaces, garages and workshops. Analyze the procurement process (acquisition and requisition), logistics and transport/distribution system etc.

b. Analyze options for centralization and decentralization of facilities and procedures and recommend an appropriate implementation program, which integrates all disparate elements into one comprehensive control system.

c. Assist with the implementation of an effective and efficient system, including the installation of computerized inventory control systems, the acquisition of shelving and storage bins, including an adequate inventory of spare parts, tools, materials and other replenishable supplies, the construction or rehabilitation of workshops, garages, warehouse, the protection of unsecured open storage space. Introduce improved procedures for handling of material to assure ease of retrieval, protection of material, safety and minimum risk to materials and employees.

d. Ensure compatibility of inventory control system and asset master catalogues with those prepared by other water and wastewater utility organizations in the metropolitan areas of Cairo, Alexandria and provincial cities, to permit an exchange of surplus materials or the bulk procurement of parts under fiscal ??? conditions. Dispose of assets or materials for which there is little potential use; review foreign source procurement and FX requirements and investigate opportunities for import substitution in conjunction with the needs of other organizations.

6) Municipal Service and Network Expansion

a. Assist with municipal efforts aimed at improving the long range analytical and planning capability for utility system expansion, project design and feasibility studies; assist with the preparation of an accelerated network expansion program, including leak detection and repair, a general rehabilitation of facilities and preventive maintenance; establish map files with accurate data of system characteristics, which permit easy retrieval, periodic update and public dissemination to potential users; establish a mechanism to coordinate the design and construction of all public utility services and road surfacing activities.

b. Develop an "Interim Service Improvement Program" in each of the currently unsewered communities, assess the characteristics and adequacy of septic holding tanks, identify requirements for repair, rehabilitation, replacement and cleaning of tanks through self-help or contractor efforts, establish a public assistance program for sanitary home improvements and urban neighborhood upgrading, including the provision of credit and program management assistance through public agencies or private voluntary organizations.

c. Identify and resolve constraints experienced in the selection process and use of private and public sector companies/contractors involved in the entire range of sanitary utility services i.e. plumbers, local manufacturers of pipes and fixtures, construction contractors for collection pipelines, holding tanks, cleaning, transporting and disposal of waste, composting of waste, plant O&M, etc. Provide assistance through the local Chamber of Commerce or other PVO channels to strengthen small scale enterprises in their service delivery capability.

7) Community Health and Education

a. Develop a system of monitoring and evaluating relevant health statistics through the correlation and analysis of appropriate data series by the Governorate Departments of Public Health. Propose a cooperative research program in conjunction with the USAID funded (NOPWASD controlled) research program. Suggest and initiate a comprehensive water and wastewater related community survey and laboratory testing program to be conducted under the auspices of the SCA water laboratory or a university faculty.

b. Develop a community education program focussing on public concerns such as water conservation, bulky solids to be excluded from wastewater collection system and canals, solid waste collection and disposal practices, pretreatment and disposal of hazardous or toxic waste;

prepare material for use in schools about the bacterial, viral and parasitic deseases associated with the unsanitary consumption of water and disposal of wastewater, use of canal water for washing, etc.

c. Develop a public information program (e.g. multimedia releases), to communicate to governorate residents the nature and public response to consumer complaints, the justification for tariff increases, the results of public health related research, the scope, substance and timing of public hearings to be held to discuss proposed capital improvement programs or the dedication of new facilities, etc. Establish an office at the municipal council with an adequate number of telephone lines and personnel, to respond to consumer complaints and emergency situations.

8) Miscellaneous Support Activities

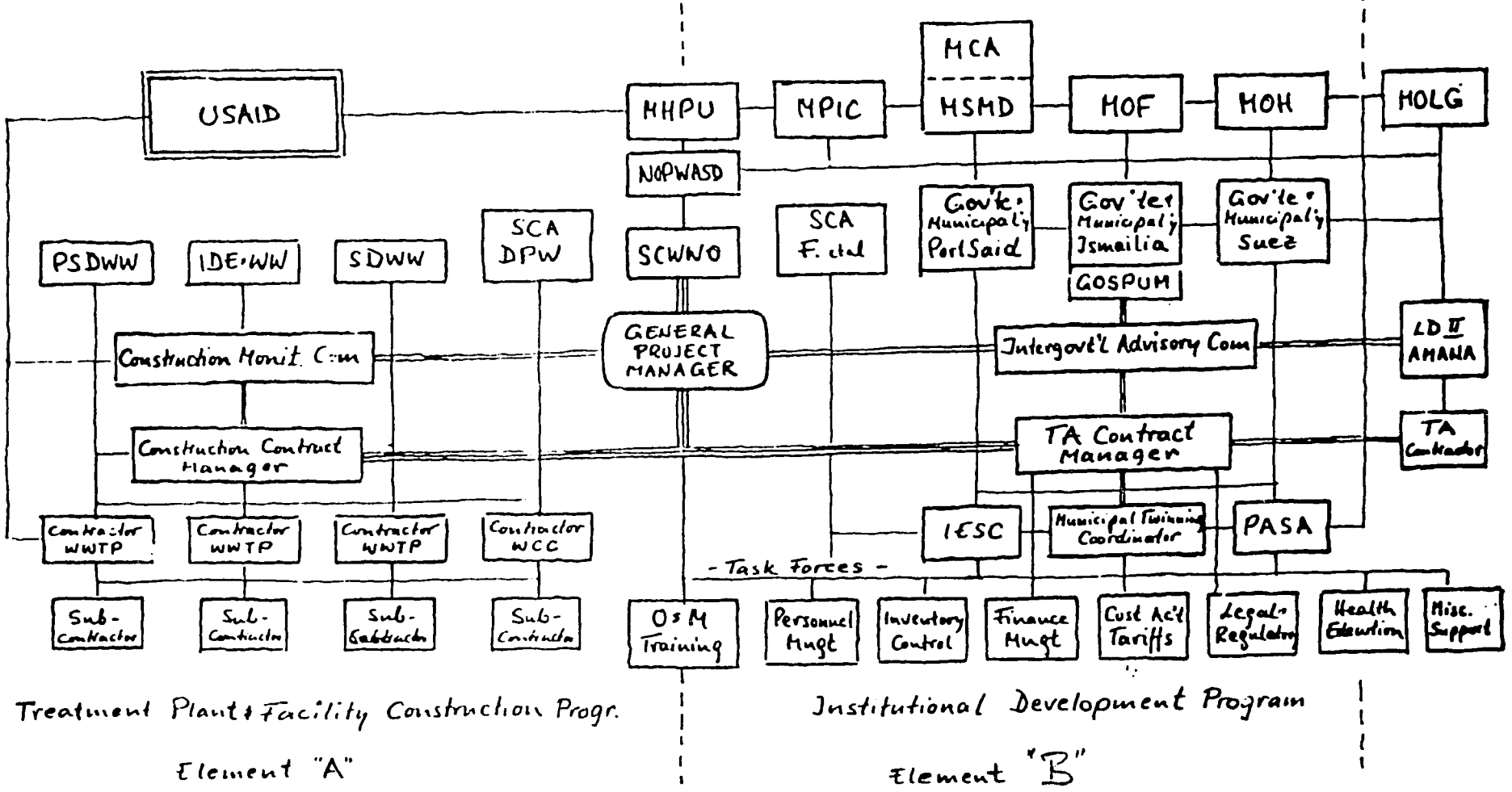
Provide assistance to other governmental agencies on other utility related matters, strengthen the comprehensive planning process, intergovernmental coordination and cooperation through the introduction of new techniques and methods, the timely dissemination of information at meetings, seminars, conferences and the informal exchange of reports, studies, general professional literature.

V. PROJECT IMPLEMENTATION

A. Management and Organizational Interaction

Institutional development efforts are complex undertakings involving numerous interest groups and individuals. The management of such a complex set of activities is by necessity a multi-lateral rather than a unilateral effort, which reponds to and induces change at multiple pressure points. Diagram 1 identifies the organizational relationships and shows the interaction pattern among the various affected parties. It distinguishes

Diagram 1
Project Implementation
ORGANIZATIONAL RELATIONSHIPS



the parties by the nature and degree of responsibilities, varying from the policy review and approval authority excercised by central line ministries to the implementation of functional activities at the level of departmental task forces. It assumes that change is not only directed from above i.e. from the officials at the Ministries but will also emerge from the bottom i.e. from the officials at the governorate departments, and that the momentum for change will be sustained by intermediaries i.e. the contractors and coordinating committees. The roles of the respective parties are outlined below:

- Interdepartmental Task Forces: The burden of implementing system improvements rests on the shoulders of officials currently responsible for the various basic functions. The tasks outlined in the previous chapter would be addressed by members of the various Task Forces, composed of the respective governorate and municpal department heads and his/her deputies, expatriate and local contractor personnel, and advisors from U.S. counterpart organization. Task Forces would be established to address and resolve problems in (1) financial management, (2) tariff formulation and cost accounting, (3) stores and inventory management, (4) municipal service and network expansion, (5) community health and education, (6) legal mandates and regulatory reform, (7) personnel management, (8) on-the-job training for operation and maintenance, (9) miscellaneous support functions, including comprehensive planning and program coordination.

- Contractor Support: It is expected that one US Contractor be retained to manage the technical inputs provided by expatriate and local Egyptian experts on a full-time basis, as well as by subcontractors who would provide service under a limited time arrangements i.e. U.S. personnel retained under a PASA, IESC, or PSC. The TA contractor would also manage the Task Force personnel exchange between the Canal Cities and a U.S. municipality and counterpart departments, under a "Twinning" arrangement, as described in subsequent sections of this chapter. In addition, the TA contractor would be obligated to coordinate with the Institutional Development Contractor, who

serves as the staff to the Secretariat of the Local Development Program (Technical Amana), which has the general oversight and policies support responsibilities under the auspices of the Interministerial Coordinating Council.

- Intergovernmental Coordination: Obtaining policy support and concurrance on technical system improvements must be sought laterally among the three cities and other provincial cities affected by any potentially precedent setting changes, as well as horizontally among the three levels of government, i.e. ministerial, governorate and municipal/market level. The proposed intergovernmental advisory committee for the Canal Cities institutional development program will be constituted as a regional subcommittee to the LDII Technical Amana, in parallel with the two existing subcommittees for urban and provincial development. The integrated Committee structure will ensure a maximum flow of information, as well as measure of cooperation and coordination.

- Political Support: A number of proposed system improvements cannot be implemented unless they have been properly reviewed and endorsed by the political and legislative entities at the governorate and central government levels. For instance, the elimination of subsidies and the imposition of new or higher user charges effects the constituents of elected and appointed representatives in the political parties and the legislative assemblies. The Interministerial Local Development Committee, the Minister for Cabinet Affairs and the Chairman of the Governors Council are expected to provide appropriate policy guidance on matters related to tariff increases, regulatory reforms, jurisdictional realignments i.e. the granting of autonomy for the efficient provision of water and wastewater services, and changes in compensation scales for utility personnel.

The three governorates and the SCA are expected to contribute to the overall effort in a significant manner, the most critical element of which is the agreement in principle to seek implementation of the institutional reform agenda. Such an agreement would be expressed in the form of a Memorandum of Understanding, (MOU) signed by the principal partners, i.e. the three Governors and the Chairman of the SCA, and which would be appended to the official Grant Agreement between USAID and the MPIC, subject to ratification by the Peoples' Assembly. The Regional MOU would expand on the original national version signed by the MPIC, MHPU and USAID and would outline the policy framework, the expected outputs and inputs and certain intermediate benchmarks to monitor the rate of progress made toward achievement of the objectives. It would also confirm the availability of GOE contributions in the form of the

- Provision of appropriate office space in various locations, to accommodate the work of consultants, and to house the additional and/or new managerial and administrative functions to be established under the program;

- designation and/or employment of local counterpart staff, with payment of comparable salaries, bonuses and incentives, including promotion to existing or new positions, based on revised job classifications, to be established under the program;

- establishment of an Intergovernmental Advisory Committee to oversee the consultants' activities, coordinate and expedite the implementation of policy decisions;

A more detailed statements of goals, objectives, tasks and the respective contributions from the various participants will be presented with the "Terms of Reference" for consultant services, which to be prepared following project authorization.

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B. Contractual Support

The analysis and implementation of the institutional development activities would be managed under a contractual arrangement, concurrently with, but separate from the Design-Built-Operate-Train and Transfer (DBOT) contract for the three wastewater treatment plants and the sweetwater conveyance canal. Both the institutional development and the facility construction elements of the project would be implemented under AID-Direct contracting procedures. While the justifications for the AID-Direct DBOT contract are explained elsewhere, the justification for the use of an AID-Direct contract mode in assisting institutional development is based the following:

- the predominantly short-term nature of highly specialized expatriate consultants to be retained under subsidiary contractual arrangements with USAID, namely PASA (Participating Agency Service Agreements), MBE Sec. 8-A (Minority Business Enterprise Set-asides), IESC (International (Retired) Executive Service Corps), Cooperative Agreement (for the Twinning of Municipal Functions);

- the greater flexibility to retain and compensate Egyptian consultants and sub-consultants, who would be working along side the expatriate experts and the local governmental counterpart staff. Egyptian private sector consultants could not be retained under the existing host country procurements and compensation regulations;

- the source and origin of commodities to be procured, would be the US, and in the case of certain equipment, such as computers, special guidelines apply to the choice of hardware technology and use of software.

However, the main reason for selecting the AID-Direct contract mode is explained by the necessity to employ experts under a mix of contractual forms. These include the principal private sector

consultant firm, procured under competitive selection procedures, a series of short term assignments under an existing USAID contractual agreement, such as PASA, WASH/PSC, and IESC, and most importantly, a twinning arrangement with a US municipality, under the terms of a Cooperative Agreement. The importance of the twinning arrangement to this project is outlined below.

C. The Concept of "Twinning"

A twinning arrangements pairs similar organizations, or sets of organizations, for the purpose of transferring relevant knowledge. It involves a "mature" entity or institutional framework with solid and well established managerial and operational experience, and on the other side, a set of relatively young organizations, or one that is unprepared to handle complex technical systems and management issues. It fosters constructive internation among enlightened leaders, who are seeking to enhance their management capabilities, to train their staff and to improve their operational procedures, and, last but not least, theri professional and political standing.

The exchange of information through twinning can offer distinct advantages over the more common form of technical assistance, i.e. the assignment of consultants on a long term contract basis. It also offers certain psychological and distinct political advantages over consultantive relationships. Host country officials look upon twinning as a cooperative effort between colleagues and may feel more receptive to advice offered in the context of a demonstrated and observable activity. Both twinning partners gain potential prestige, public recognition, expressions of gratitude and other intangible rewards in addition to the financial compensation for their efforts. The absence of the profit motive has a significant social leveling effect and also removes the traditional constraints such as resentment, envy, mistrust and categorical rejection based on politically motivated principles of remaining "independent of foreign influence". The flexibility inherent

in a twinning relationship permits a fluidity of the knowledge transfer process, which can adapt to periodic changes in personnel, while maintaining a focussed attention on understanding and shaping the evolving structure and process of institutional/organizational interaction patterns.

Institutional twinning has been used in various countries in a broad range of sectors and activities, including ports, water supply, irrigation, power, agriculture, forestry, banking, research centers, universities, and municipal management. In recent years, twinning has frequently been used in the urban development sector, where municipal governments of developing countries have been paired with local governments in industrial countries, for the purpose or reorganizing administrative functions and addressing the problems of urban growth comprehensively.

The objectives of the twinning arrangement must be carefully defined for maximum effectiveness. It must be recognized from the outset, that the twinning of organizations alone cannot satisfy the rquirements of the USAID funded project and that it can only be viewed as a complementary method of dealing with issues that could not or should not be addressed in the context of a narrowly drawn and performance based consultant contract. It must also be recognized that organizations or personnel within the agencies are not necessarily compatible simply because they are in the same business. Both parties to a twinning arrangment will require guidance and a supervisory management framework within which to set up the interaction process and to maintain the learning activities over a period of time.

USAID involvement in the development phase of the twinning relationship is crucial as is the role of the third party facilitator during the implementation and evaluation phase. Objective evaluations of the success of the effort are also critical in order to ensure cost effectiveness in the achievement of objectives. The evaluation requirement alone would

mandate the involvement of local universities or research centers as the contract administrator of the twinning relationship.

D. Twinning Criteria

The choice of contract mode is determined by the necessity to place full implementation responsibility with the principal partner of the twinning arrangement, who would be held accountable for the development of both the substantive, as well as the administrative aspects of the program. An AID funded Cooperative Agreement the principal U.S. partner is preferred to a Host Country contract with any of the Egyptian partner agencies, if for no other reason than to avoid potential inter-agency rivalries and conflicts over the setting of priorities or the selection of participants.

The principal U.S. partner would be selected on a limited competitive basis. The selection process would be informal rather than through formal advertisement, and would be based on a set of objective and weighted criteria, which reflect the requirements of the participating GOE agencies. Potential candidate cities and their environmental agencies would be contacted through th office of the PVO "Gister Cities International" which in turn would solicit "Expressions of Interest" that may lead to direct negotiations of a Cooperative Agreement. The selection of the cities and the preliminary discussions with at least 3 contenders would be carefully documented to avoid the appearance of favoritism.

Potential U.S. twinning partners with the Canal Cities should meet at a minimum the following general criteria:

- A metropolitan population in excess of 0.5 million, with an economic base and land use characteristics reflecting complex changes over time and disparities in the public resource allocation process;

- A governmental structure and coordinated decision process involving all levels of government (Federal, State, Metropolitan, Municipal, Special District), as well as private sector interest groups, such as organized community groups and industry lobbies;

- A complete and technologically advanced municipal system of sanitary infrastructure and a service delivery program, which meets, if not exceeds, the basic objectives as outlined in the Memorandum of Understanding concerning organizational effectiveness, financial viability, manpower competency and service reliability;

- Several active associations of professional managers, engineers, researchers, technicians, representing local government planning and operating agencies, consultant firms, construction contractors, research and training institutions, laboratories, state and federal regulatory agencies, legislative committees and environmental lobbying groups;

- An academic institution or consortium of universities which offers degree programs and certificated courses in the areas of environmental management, sanitary engineering, public health, urban and regional planning, public administration, and finance;

- A management entity such as a "Center for Metropolitan Policy Research and Coordination" or an "Institute for International Development" with a demonstrated administrative capability and motivation to foster the "Town and Gown" Relationship, not only among the interdisciplinary professional interest groups within the local metropolitan framework, but also at the international level;

- A critical number of individuals in each of the various public agencies, firms, institutions, who have experience in, or knowledge of the urban and specifically sanitary conditions of Middle Eastern cities, and/or who are interested in contributing to the resolution of problems through intensive interaction with their respective Egyptian counterparts.

Metropolitan areas and their organizations which could meet most of these requirements would include Boston, Philadelphia, Baltimore, Washington, Atlanta, Miami, Pittsburgh, Cincinnati, Los Angeles, etc. New York already has an ongoing "Sister City" relationship with Cairo, which could perhaps be expanded to cover the more complex set of activities outlined in this project paper. Similarly, the USAID funded "University Linkage Program" between Boston's MIT and Cairo University could perhaps be expanded and serve as the vehicle for the governmental twinning arrangement. Washington and its Sanitary Utility Organization already has a USAID funded technical assistance program with the City of Amman, Jordan. Each of the cities may be able to contribute to the project in a valuable and unique way. However, the ultimate choice must reflect both the desires of the Egyptian participants, as well as the program objectives of USAID. A selected number of cities will be contacted to submit a proposal describing their capabilities along the general criteria listed above, and also in response to the more specific questions and concerns raised by representatives of the canal cities.

E. Administrative Guidelines

Assuming that a general understanding can be reached between the Mayor and City Council of a city in the U.S. and the Cairo Governorate concerning the scope of the professional exchange and the assignment of the administrative responsibility, project implementation would include the following tasks:

- Ratification of a detailed Memorandum of Understanding between the governing bodies of the respective metropolitan areas and the various participating agencies and institutions;

- Execution of a sub-contract between the designated institutional participant/facilitator, including an Egyptian subcontractor and USAID Cairo;

- Designation of a Program Activity Council in the U.S., as a counterpart to the Intergovernmental Advisory Council in the Canal Cities, representing all interested parties, as well as a smaller Executive Committee, composed both of U.S. and Egyptian Council representative and staff;

- Formulation of a long term and annual agenda of observational travel and joint analyses, aimed at the resolution of specific problem areas and issues, the identification of travel dates and associated logistical arrangements;

- Selection of participants based on objective eligibility criteria and competitive review procedures, including participation in preparatory seminars, language training, if necessary, and self-directed research;

- Arrangement of travel and logistics at U.S. host city, including the issuance of detailed agenda of guided plant visit extensive participation in office activities, and conferences, seminars, professional and social interaction;

- Determination of follow-up consultancy services by U.S. government officials or academic personnel, to assist in the resolution of Canal Cities specific issues;

- Evaluation of program effectiveness, based on a comprehensive framework of analysis, including cost benefit assessments and attitude surveys to permit appropriate revisions for each annual cycle.

Reporting requirements would by necessity be extensive and would reflect the experimental nature of this unique knowledge transfer process. Aside from the regular financial and monitoring reports mandated by USAID and GOE project management regulations, the TA contractor will be expected to prepare a series of reports documenting the successes and/or failures of the twinning concept, including an assessment of the applicability of the concept in other sectors, cities and countries.

F. Budget and Cost Factor Analysis

Table 1 shows the estimated level of effort by task and contractural mode. Preliminary cost estimates for the various project elements are identified in Table 2. The allocation of funds over a five year period is shown in Table 3 below. The costs are based on conservative assumptions as to the number of eligible participants. Certain critical cost factors are discussed below:

1) Exchange Program Participants

The budget provides for participant travel and per diem expenses of 50 Egyptian and 15 U.S. officials over a period of three to five years. If spread over a 5 year period, the annual budget would allow for the month long travel of 10 Egytian officials and 3 Americans, which is a relatively small number, when compared with the potential demand from the various participating agencies in the canal cities. The conservative estimate of participants also reflects the limited English language capabilities of the pool of Egyptian municipal officials.

2) Fees, Charges and Tuition

As part of the program of total immersion into the U.S. municipal institutions, it will be necessary for Egyptian participants to attend professional conferences and seminars arranged by a multiplicity of service providers, including professional associations, universities and research institutions, consultancies, consumer and public interest groups. The budget provides for attendance fees, as well as for the payment of membership fees for Egyptian officials, to ensure continued receipt of newsletters and journals at least for the duration of the project. It also provides for use of computer time and other information access fees.

3) Procurement of Commodities

The success of any knowledge transfer process is based on the ease of access to information sources. The budget provides for the purchase of professional books, journal subscriptions, software, analytical tools and instruments, etc. Considering the expense of professional literature and instrumentation, the amount allocated may be insufficient and may require an upward adjustment, pending preliminary evaluation of initial project effectiveness.

The procurement of commodities for the broader institutional support program is not yet defined. It is expected that the procurement program will include the acquisition of a computer system to handle the expanded financial management and other municipal functions, facilities for the inventory control and management system equipment, instruments, tools; as well as office furniture. i.e. filing systems, supplies, etc., to establish a well functioning administrative environment. A detailed procurement plan will be prepared following completion of the first phase of the analysis of needs.

4) Reimbursement of Cost for U.S. Municipal Officials

It is expected that American counterpart officials be reimbursed for expenses incurred while hosting their Egyptian colleagues. In addition, U.S. municipal and state government officials would be compensated for time spent on assisting in the resolution of Egytian problems. It is assumed that the U.S. municipal officials will also be able to provide additional assistance under Personal Service Contracts (PSC), during officially approved leave of absence from their full-time job, or on their personal time.

5) Local Contributions

The Egyptian organizations' cash and in-kind outlays, which are aimed at implementing the recommendations developed by participants in the twinning arrangement, will be counted as a contribution to the project objectives. The budget assumes that the GOE agencies participating in the project will meet, if not exceed, the traditional USAID expectation of a 25% contribution to a Cooperative Agreement.

TABLE M-1

INSTITUTIONAL DEVELOPMENT TECHNICAL ASSISTANCE REQUIREMENTS

(1987 COSTS)

POSITION U.S. POSITIONS	ESTIMATED PERSON/MONTH	COST US $	COST L.E.
Project Director	66	990,000	719,400
Project Cooridnator	66	990,000	719,400
Financial Manager	25	375,000	272,500
Water Revenue Collection Specialist	25	375,000	272,500
Senior Sanitary Engineer	15	225,000	163,500
Administrative Manager	28	420,000	305,200
Storage Inventory Control Specialist	17	255,000	185,300
Administrative Manager for Career Development	12	180,000	130,800
Performance Monitoring Specialist	12	180,000	130,800
Subtotal	134	3,990,000	2,899,400
Local Position			
Public Relation Specialist	12		15,600
Legal Mandate Specialist	30		39,000
Administrative Manager	12		15,600
Storage Inventory Control Specialist	6		7,800
Performance Monitoring Specialist	4		5,200
Support Staff	300		270,000
Subtotal	364		353,200
TOTAL		3,990,000	3,252,600

TABLE M-2

INSTITUTIONAL DEVELOPMENT EQUIPMENT BUDGET

(1987 COSTS)

	COST	
	US $	L.E.
Computers - Hardware and Software	750,000	100,000
Office Equipment and Supplies	-	500,000
Tools and Equipment	500,000	200,000
Project Support Vehicles and Maintenance	150,000	200,000
TOTAL	1,400,000	1,000,000

TABLE M-3

INSTITUTIONAL DEVELOPMENT OBSERVATIONAL TOURS BUDGET

(1987 COSTS)

	Estimated Person/month	Cost US $ (Per Diem)	Cost L.E. (Travel)
Financial Manager	8	20,000	40,000
Water Specialist	8	20,000	40,000
Administrative Manager	8	20,000	40,000
Storage Specialist	4	10,000	20,000
Senior Local Off.	32	80,000	160,000
TOTAL	60	150,000	300,000

TABLE M-4

INSTITUTIONAL DEVELOPMENT FINANCIAL PLAN
(1987 Costs)

Element	Cost US $	Cost L.E.
Technical Assistance		
134 US person/month	3,990,000	
364 Local person/month		3,253,000
Equipment	1,400,000	1,000,000
Observ. Tours		
60 Local person/month	150,000	300,000
Subtotal	5,540,000	4,553,000
15% Contingency	831,000	683,000
TOTAL	6,371,000	5,236,000

TRAINING ANNEX

CANAL CITIES WATER AND WASTEWATER PHASE II PROJECT

PROJECT 263-0174

JUNE 22, 1987

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TRAINING ANNEX

I. CURRENT STATUS

A. Introduction

The water and wastewater sector in Egypt and in the Canal region, has given little attention to the development of managerial and technical human resource development skills. The impact of this on facility operations and maintenance is that the systems are not managed, operated nor maintained effectively or efficiently. The sector employs university-educated engineers for managerial and engineering staff needs, technical-school graduates for technical level postitions, and semi-skilled and unskilled workers for assistant and laborer-level positions. Employees enter service with the government and the Suez Canal Authority with general educational training, and with very little applied training to the the needs of the water/wastewater sector. In the case of wastewater, new recipients join the wastewater departments with extremely limited pre-service training and receive no formal post-service training during their careers. Employees develop their skills from on -the-job observations or from interested supervisors. In contrast, the SCA places a higher priority on employee development. The SCA hires higher caliber engineers, technicians and primary school graduates. Even though the SCA does not offer pre-service training for the water sector, the SCA does offer limited in-service training opportunities in management skills for engineers, managers and supervisors, and specialized technical off-shore training for engineers and managers. Although the SCA offers no formalized in-service training for its technical, skilled or unskilled water sector employees, the SCA encourages informal hands-on O&M training by trained supervisory and management personnel.

B. Project Training History

The Canal Cities I Project funded urgent improvements to the water and wastewater systems of the three cities of Port Said, Ismailia and Suez. The project included a small operations and maintenance training element ($5.5 million), representing approximately 3% of total project funds. Training activities were divided into two distinct phases -- pre-construction training to improve the operations and maintenance of the cities' existing water/wastewater systems, and start-up operations and maintenance training activities to train staff on proper operations and maintenance of the newly-constructed wastewater facilities.

1. 1981-82 Training

The initial phase of training in the Canal Cities had a primary objective -- to train water and wastewater department personnel in proper operations and maintenance skills to improve existing operations. The training was coordinated and delivered by Canal Cities Consultants (CCC) in English and Arabic in both formal classroom and informal field settings over a 12-month period.

In the wastewater sector, CCC trained approximately 200 trainees, primarily engineers and supervisors, from the three cities in classroom collection system and treatment plant operations and maintenance. An unidentified number of city wastewater supervisory, technical and laborer staff also participated in CCC's informal on-the-job training sessions including sewer maintenance, sewer inspection, electrical and mechanical maintenance, and pump station operations.

The wastewater departments also participated in observational training in the United States. Two wastewater managers representing each of the three cities travelled to the US to participate in hands-on training at a Florida wastewater utility, visit several US wastewater utilities in different regions, and attend a wastewater seminar and annual conference.

The 1981-82 water sector training for SCA by CCC involved limited classroom instruction for engineering and supervisory staffs in treatment plant operation, chlorination, and laboratory procedures. The majority of the training was on-site, hands-on training in treatment plant operations, chlorine safety, laboratory procedures, water distribution systems, and water leakage surveys.

At the conclusion of the 1981-82 training program, CCC conducted a Training Needs Assessment addressing the long-term needs of the wastewater sector. The assessment provided the basis for the development of a preliminary concept plan for wastewater training upon the completion of collection system and pump station construction. (CCC did not address the SCA's training needs as the Authority had not requested that start-up training was required at the completion of construction.) The concept plan was then developed into Work Order 3 for Operations and Maintenance Training. Because of numerous delays during the approval process, the training contract was finally signed on June 30, 1986, and implementation began with the final acceptance of the completed pump stations.

2. 1986-88 Training

(a) Wastewater Activities

Work Order 3 activities began August 1, 1986 and are scheduled to complete after 18 months, in January 1988. The program includes: (1) start-up and operations assistance for the pump stations and large diameter sewers, (2) an assessment of long-term human resource and institutional development needs of the three wastewater departments, (3) the development of standard operations, maintenance and safety systems for the pump stations and collection systems, and (4) the development and delivery of trainer training, technical collections system and pump stations O&M training, managerial wastewater O&M training, and laborer safety training.

Work Order 3 activities began with the acceptance of the completed facilities from the construction contractor. As a result, the first program activity included direct assistance-- on-the-job start-up training for pump station staff. In each of the three cities CCC assigned one expatriate operations specialist and two Egyptian O&M specialists. The three direct assistance teams assisted governorate staff with initial operations, equipment trouble-shooting, and the application of proper operation, maintenance and safety procedures. One expatriate sewer maintenance specialist was assigned on a rotational basis to assist the governorates get all the project-procured sewer maintenance equipment operational, as well as to train collection system personnel in proper equipment operations and maintenance techniques.

CCC also prepared dual language operations and maintenance management system documentation for the collections systems and pump stations. This includes the development of operation and maintenance manuals for each of the cities' completed pump stations, and the development of highly graphic, dual language standard operating procedures, standard maintenance procedures and standard safety procedures for the collection systems and pump stations.

The formal training element in Work Order 3 includes the development and delivery of (1) a training curriculum for trainers, (2) technical training for collections system and pump station personnel, (3) managerial training for collection system and pump station management staff, and (4) basic safety training for wastewater department laborers. Within Egypt CCC developed the dual language training course modules, training posters, visual aids, mock-ups and cutaways.

The trainer training course was the initial training course delivered by CCC. Following the trainer course, the participating engineers (from Ismailia and Port Said only), assisted the consultant in the delivery of the 15 collections system and 20 pump station technical modules, and the safety and managerial training module deliveries. The training curriculum introduced the developed standard procedures to the wastewater department staff, and the expatriate specialists will reinforce the procedures through on-the job direct assistance, job aids and video taped versions of the standard procedures.

In general, Work Order 3 O&M training activities have been a successful effort to instill proper operation and maintenance skills in governorate wastewater staff. Over 100 collections system staff have participated in formal and informal training activities, and approximately 200 pump station staff have participated in hands-on and classroom training. Early results of the formal training, and indications from the expatriate O&M specialists have revealed that staff perform their necessary job duties more effectively and efficiently, and that this is reflected in facility and equipment operations. The primary area in which the training may show the least success is the long-term effect of the trainer training. It was envisioned that the training of selected governorate staff in trainer methodology would give the governorates the skills to enable them to utilize the developed training curriculums for future in-house training efforts. Given that Suez Governorate was not convinced that the trainer training was an activity in which they wanted to participate, and the difficulties both Ismailia and Port Said Governorates have had in allocating sufficient space in which to conduct classroom training, Work Order 3 has revealed that it is necessary that the training recipients be involved in the design, development, and delivery of training from the initiation of activities.

(b) Water Activities

In 1985 the SCA first requested USAID assistance to develop the Authority's institutional capacity to properly train its water sector personnel to manage, operate and maintain its large water treatment and distribution systems. This request reflected a new SCA policy promoting the development of internal human resource development systems within the Authority. Because project resources for this purpose were not available, USAID approved the use of limited unobligated funds ($200,000) in support of short-term offshore training activities for water management and engineering staff, and agreed to fund the request in the Phase II project. Observational training was initiated in 1986 with eleven participants attending hands-on training sessions in US municipalwater utilities, attendance at specialized training seminars and attendance at specialized water conferences. This activity will complete during 1987 with five additional participants travelling to the US.

II. PROPOSED PHASE II TRAINING RATIONALE

As is clearly outlined in the Technical Annex, the Canal Cities Phase II project will finance the construction of three wastewater treatment facilities and the rehabilitation of a raw water line.

(1) In Port Said the project will fund the construction of a new 150,000 m 3/d primary treatment plant with a discharge to Lake Manzala. The new facility will require staff training and skills required to: effectively manage the facility; operate and maintain the screening facilities, grit chambers, primary settling tanks, chlorination units and sludge handling facilities; conduct the necessary laboratory procedures and analyses; manage the on-site warehousing and inventory control systems, and perform necessary first echelon maintenance in the on-site workshop.

(2) In Ismailia the project will fund the construction of a new 90,000 m3/d capacity wastewater treatment plant with a land disposal system. The new facility will require staff training and skills required to: effectively manage the system; operate and maintain the screening facilities, anaerobic lagoons and rapid infiltration beds; monitor the water quality of the wells in the "green" area and conduct the necessary laboratory procedures and analyses; manage the on-site warehousing and inventory control systems; and perform necessary first echelon maintenance in the on-site workshop.

(3) In Suez the project will fund the construction of a new 200,000 m3/d capacity wastewater treatment plant with a land application system. The new facility will require staff training and skills required to: effectively manage the system; operate and maintain the screening facilities, anaerobic lagoons and rapid infiltration beds; monitor the water quality of the wells in the "green" area and conduct the necessary laboratory procedures and analyses; manage the on-site warehousing and inventory control systems; and perform necessary first echelon maintenance in the on-site workshop.

(4) For the Port Said Water System the project will fund the rehabilitation and concrete lining of the existing Sweetwater Canal from Qantara to El Raswa. The upgrading of the Sweetwater Canal will require very minimal operations and maintenance skills.

In support of the primary construction and rehabilitation activities, the Phase II project will finance complementary institutional and human resource development activities for the wastewater and water organizations and their respective staff resources. The institutional development component is discussed in the Institutional Analysis (Annex L), and the discussion of the human resource development component follows in Sections III - VII.Based on USAID's knowledge and experience of wastewater operations in the Canal Cities, it was determined at an early stage that wastewater infrastructural development would also require complementary human resource development project inputs. To verify our assumptions, a needs assessment task was included in CCC's Work Order 3 scope of services. Section III. A. summarizes the Consultant's major findings and recommendations in support of our preliminary assumptions.

In contrast to wastewater, the SCA itself has been the driving force behind a human resource development project component. In addition to the SCA's request for a raw water system, the Authority has reiterated its 1985 request to USAID for assistance in the development of a training program specifically for its water sector. An analysis of SCA's training needs follows below in Section III B.

III. IDENTIFIED NEEDS

A. Wastewater Sector Training Needs

As part of the Work Order 3 Scope of Services, CCC was tasked to conduct a Training and Institutional Needs Assessment to assess the three governorates' abilities to manage, operate and maintain complete wastewater systems. Because the governorates' existing wastewater facilities do not function properly or function at all-- it was determined that an updated assessment be conducted to specifically evaluate the conditions in each of the three cities, and identify those areas in which improvement is needed as part of the Phase II project.

In October 1986 CCC's assessment team initiated its analysis of the wastewater departments with a series of structured interviews with wastewater managers and supervisors and governorate public officials. The results of the interviews were then applied to performance indicators developed from WASH's Technical Report No. 37, "Guidelines for Institutional Assessment- Water and Wastewater Institutions". The team interviewed governorate personnel on Management, Finance, Management Personnel, Technical Personnel, Inventory, Supply Procurement, Collection System Performance, Pump Station Performance, and Wastewater Treatment Plant Performance issues. The interviews were then applied to performance indicators including Organizational Autonomy, Leadership, Management and Administration, Commercial Orientation, Consumer Orientation, Technical Capability, Developing and Maintaining Staff, Organizational Culture, and Interactions with Key External Institutions. Based on the performance indicators the assessment team derived conclusions to which recommendations for organizational change and future project inputs were developed.

Assessment Conclusions and Recommendations

Operations and Maintenance Personnel/Human Resource Development Needs

-- CCC concluded that the three cities' current staffing for for the existing collections and pumping stations is adequate given the Work Order 3 plans for direct assistance, hands-on training and formal training for technical and managerial personnel.

-- CCC recommended that the wastewater departments create/designate management positions for collections system, pump station or wastewater engineers not currently provided in the cities' organizational structure.

-- One of the Consultant's primary conclusions was that the three governorates do not have adequate staff available or skilled to operate and maintain primary wastewater treatment facilities. Because the cities do not maintain operations wastewater treatment plants, they do not possess personnel skilled to properly manage, operate or maintain a wastewater treatment facility. The Consultant recommended that the cities be required to staff the newly-constructed plants with personnel possessing minimum qualifications (see Exhibit 1).

Based on preliminary plans for the Phase II project as presented in the Project Identification Document, CCC prepared the following staffing requirements for the primary plants planned for the three cities based on the below stated assumptions:

Port Said: Based on a 190,000 m3/d facility, a staff of 115 trained personnel is required.

Ismailia: Based on a 190,000 m3/d facility, a staff of 115 trained personnel is required.

Suez: Based on a 190,000 m3/d northerly facility, a staff of 115 trained personnel is required.
Based on the size and technology of the facilities proposed for the Phase II project, a recalulation of the staffing needs has been completed and is illustrated in Table I.

Table I
Revised Staffing Requirements

City	PID Proposed Facility m3/day	Revised PP Facility m3/day	PID Proposed Staffing	Revised PP Staffing
Port Said	190,000	150,000	115	95
Ismailia	190,000	90,000	115	89
Suez	190,000	200,000	115	100

Within each city the wastewater treatment facilities will require sufficient management, engineering, supervisory, operations, laboratory, mechanical, electrical, semi-skilled and unskilled laborer staff. A preliminary estimate of the staffing requirements for these job categories for the proposed treatment plants has been revised based on CCC's staffing plan, and is illustrated in Table II below.

Table II
Illustrative Staffing Requirements for the
Proposed Wastewater Treatment Plants

Position Title	Port Said	Ismailia	Suez
Wastewater Plant Manager	1	1	1
Assistant Plant Manager	1	1	1
Management Information Specialist	1	1	1
Electrical Engineer	1	1	1
Mechanical Engineer	1	1	1
General Supervisor, Plant Operations	1	1	1
General Supervisor, Plant Laboratory	1	1	1
General Supervisor, Central Maintenance	1	1	1
Pump Station Chief	1	1	1
Supervisor, Pump Station	1	1	1
Supervisor, Screening & Grit Removal	1	1	1
Supervisor, Primary Settling	1	1	1
Supervisor, Chlorination	1		
Supervisor, Drying Beds	1	1	1
Chemical Analysis	1	1	1
Chemical Technician	2	2	2
Clerk	2	2	2
Storekeeper	2	2	2
Groundwater Monitor		1	1
Groundskeeper	1	1	1
Electrician, Foreman	2	2	2
Electrician	5	5	5
Assistant Electrician	6	6	6
Mechanic, Foreman	2	2	2
Mechanic	5	5	5
Assistant Mechanic	6	6	6
Machinist	2	2	2
Welder	2	2	2
Loader Operator	3	3	3
Driver	6	6	6
Senior Laborer	10	10	10
Laborer	24	21	24
Totals	95	89	100

-- From the revised staffing estimates, it is then possible to directly apply these new estimates to CCC's additional assessment

conclusions and recommendations. Based on the personnel staffing requirements, CCC's next recommendation was that prior to the completion of construction, (1) identified plant and wastewater department staff receive adequate training in-country in appropriate wastewater treatment topics related to the position requirements, (2) pre-start-up training be should conducted to introduce staff to facility-specific needs, and (3) that adequate start-up and operations assistance be conducted to assist staff during start-up and the initial operations period.

Exhibit 2 presents a proposed schedule for initial training for wastewater treatment plant personnel with the suggested topics and number of training contact hours. Courses range from Wastewater Plant Operations and Theory for operators and supervisors, to safety training for mechanics, semiskilled and unskilled laborers. CCC also recommends that wastewater department managers participate in specialized utility management training either in-country or offshore.

To assist the three cities with start-up and the initial period of operations, CCC recommends that an expatriate team of wastewater operations and maintenance specialists be assigned to the plant for pre-start-up and start-up activities and for a period of at least 24 months thereafter to assist with facility operations.

B. Water Sector Training Needs

1. Identification of Water Sector Manpower Needs

To date no formal assessment on the Suez Canal Authority's training/human resource development needs has not been undertaken, because of the nonavailability of sufficient project funds for this purpose. To assist USAID in the development of the Phase II project paper, the SCA appointed a Training Committee to study the Authority's long-term water sector training needs, and to conduct a preliminary water sector manpower training assessment. Task One involved the classification of current water sector jobs and employees, and Task Two was the projection of umet and future staffing needs.

(1) As a first step, the SCA identified its current water sector job classifications into 42 categories. Currently SCA's water sector employs approximately 511 employees in its three water systems. The Port Said system employs a staff of 198, Ismailia employs 132, and Suez employs 181. Exhibit 3 illustrates this staffing pattern as of 1/87.

(2) Since the SCA's current water sector staffing does not satisfy the sector's manpower requirements, as a second step, the SCA identified those job classifications with present deficits Exhibit 4 depicts the current shortage of 313 employees, with a deficit of 72 in Port Said, 100 in Ismailia, and 141 in Suez.

(3) As a third step, SCA then projected its staffing needs for the system expansions planned for Ismailia and Suez over the next five year period. In view of the low maintenance requirements envisioned for the proposed concrete lining of the sweetwater canal between Quantara and El Raswa, it has been determined that the current staff serving the sweetwater canal will be sufficient to meet its staffing needs. Exhibit 5 illustrates SCA's need for 81 new staff to serve system expansion, with one additional staff for Port Said, 40 more for Ismailia, and 40 more for Suez.

(4) Finally as a fourth step, the SCA defined its annual water sector manpower needs with an eight percent retirement ratio and a ten percent attrition rate. Exhibit 6 illustrates SCA's average annual need of 57 staff for the entire water sector -- with a need for 21 staff for Port Said, 18 for Ismailia, and 18 for Suez.

While the SCA presents a convincing argument in suppport of staff requirements for the water sector, it will be necessary to verify SCA's internal assessment at a later stage of project development.

In support of its staffing requirements, the SCA next identified the general areas in which they believe training activities should be focused. Task 3 identified 13 training objectives for engineers, supervisors, technicians, operators, foremen, laboratory technicians, meter readers, and storekeepers. These training areas are illustrated in Exhibit 7.

2. Human Resource Development Activities at the Suez Canal Authority

For the past fifty years the Suez Canal Authority has been involved in personnel skill development activities. Since the reopening of the canal to international traffic 12 years ago, the Authority has placed an even greater importance on staff development because of the dispersion of skilled labor resulting from the closure of the canal, and lucrative employment opportunities in the Gulf.

Shipyard Training

With limited resources available for staff training, the SCA initially concentrated its efforts in those areas most directly related to the primary function of the Canal. Since 1975 one of the SCA's development priorities has been the modernization and training of its shipyard to serve SCA's internal ship building and maintenance needs, as well as to offer commercial maintenance and ship building services to the external market transiting the canal. Because of the unavailability and quality of applicable technical training programs in Egypt and the SCA's great demand for skilled personnel, in 1976 the Authority initiated the development of its own technical training program. With external assistance the SCA hired a UK consultant to develop a training plan targeting the technical trades.

The training plan was completed in 1976, and activities began with the appointment of a Shipyard Training Department with approximately 50 employees. Because these experienced technicians possessed only technical skills, the first phase of the program was the training of instructors in trainer methodology, as well as the development of training facilities. Over the next five year period newly-appointed instructors were sent to the UK to participate in formal courses in vocational training methodology and to practice those skills in actual training programs at British shipyards for periods of six months or more. SCA training staff participated in training methodology in 16 trades including milling/grinding, turning, benchfitting, refrigeration mechanic, foundry, forging, pipefitting, woodworking, mechanics, instrumentation and controls, electrical distribution, plating and welding. Training Department administrators and managers also participated in formal training in the UK in the areas of training administration and curriculum development.

Training delivery at the Shipyard Training center began in 1978 with the return of the first group of trained instructors. Because of construction and financing delays associated with the newly-planned training center in Port Fouad, it was necessary to renovate underutilized storage space and offices in the shipyard compound for temporary training workshops and classrooms. Since 1982 the training program has been fully operational with trained personnel, but the program remains well below its intended capacity and potential because of the Port Fouad construction delays.

Currently the Shipyard program graduates approximately 120 trainees annually from an entire student body of 480 enrolled in the four-year program. To train this large number in the temporary facility, it is necessary to train in three daily shifts, and in spite of an increased dmeand for skilled personnel in the subject trades throughout the Authority, the SCA is not in a position to expand enrollment to satisfy the demand.

SCA's new Port Fouad location is a well-designed, expansive training facility located approximately two kilometers from the main shipyard. Despite long-term delays, construction of the facility is moving well, and occupancy is planned for late 1988. The new facility's capacity is 1200 students, therefore each class will enroll approximately 300 students. As this exceeds the shipyard's current demand for technically skilled graduates in the above trades-- there exists room for expansion in the center's curriculum for either SCA internal purposes or for other external training purposes.

SCA's Shipyard Training program is based upon a British vocational education/apprentice training curriculum specifically adapted to the Egyptian context. The program accepts only well-qualified primary school graduates -- boys that are approximately 15 years of age, coming primarily from the canal region.

Students enter the program with minimal technical skills, and the first year is devoted to general technical training and academic skills with limited practical training. At the end of Year One students select a specialization from among nine trades (see Exhibit 8) for the final three years of training. During Year Two and Three students spend more than half their training in structured workshops, and during Year Four, 90% is practical training in structured workshops or in supervised on-the-job activities in the shipyard. Upon satisfactory completion of the four-year vocational program, graduates receive an SCA Diploma of Technician Training. Before becoming full-time employees of the SCA, graduates are required to satisfy their military obligations, and participate in short-term refresher training sessions at the shipyard. The SCA Technician graduate enters the SCA as a Grade 8 technician, and through on-the-job experience and participation in advanced in-service specialized technical training (to begin upon the completion of the new Port Fouad facility), a technician has promotion potential to a Grade 3 Senior Foreman Technician.

3. Other SCA Training Programs

As previously discussed, in addition to the Shipyard pre-service training program, SCA sponsors in-service management training opportunities for engineers, managers and supervisors (see Exhibit 9), and off-shore training in specialized technical areas for engineers and managers. Because of limited resources the Authority provides management and technical skills training to senior foreman, supervisors and managers only, to encourage informal, hands-on training at the worksites. Currently, these in-service training opportunities are the only training programs open to the water sector. Few if any shipyard graduates are assigned to the watersector, and as a result all the non-engineers in the water sector enter the SCA with limited skills acquired from the public education system, and leave with skills acquired on-the-job.

Because of the overwhelming benefits of pre-service and in-service training to the Authority, the SCA has expanded its efforts to develop supplementary technical training based on the shipyard model for other Authority functions. In 1984 SCA hired a UK consultant to conduct a feasibility study for the development of a vocational training program to serve the needs of the Transit and Dredging Departments. Upon completion of the study (funded by the European Economic Community) the decision was made to move ahead with a canal maintenance vocational training center in Ismailia provided that external funding sources would provide technical assistance and equipment. In 1985 this decision was reversed as a result of canal shipping, and the EEC's decision to withdraw funding of the program's foreign exchange components. Today this program remains on hold.

SCA's request to USAID for equipment and technical assistance to develop water sector training is part of SCA's new policy to develop formalized pre-service training for new hires and provide refresher technical training to mid-career staff throughout the organization. To date the SCA Chairman has appointed a Water Training Committee to study the issue, and has made staffing and financial commitments to allocate the necessary resources to develop formal training systems for the water sector.

IV. TRAINING ALTERNATIVES

Based on the training recommendations presented by Canal Cities Consultants for the wastewater sector, and SCA's request for training development assistance, it is necessary to present the options available for water and wastewater training. The primary options include:

(1) the development of a Canal zone water/wastewater training program;

(2) the development of organization-specific training systems;

(3) the utilization of local training institutions;

(4) training by local water or wastewater consultants;

(5) training by expatriate water or wastewater consultants; and

(6) off-shore training.

Alternative 1: The development of a Canal Zone water/wastewater training program.

This option was first proposed by the SCA. This option would involve the SCA's expansion of its Port Fouad Shipyard training program to include a training curriculum targeted to pre-service water and wastewater technical level training, and the development of satellite training centers in each of the three cities for in-service training for management, engineering, technical, laboratory, semi-skilled and unskilled personnel. The program would be a cost effective use of instructor, curriculum and facility resources because of the many technical similarities of the water and wastewater sectors.

The administration and implementation of this type of program would not be easy because of the four separate actors involved. In proposing this option, the SCA stated that they would administer the program, and the three governorates would be required to contribute resources in support of the program. The governorate reaction to this alternative has not been at all positive -- the governorates are not willing to participate in a SCA-administered water/wastewater program.

Alternative 2: The development of organization-specific training systems

This option has been requested by the governorates and SCA respectively. Based on CCC's training recommendations and USAID's observations and conclusions regarding the Work Order 3 activities -- for the wastewater sector -- this option would involve the three governorates' active participation in the design, development and delivery of in-service wastewater training systems. The option would build upon the training curricula developed for Phase I, and institutionalize training systems in to the wastewater department function.

Based on SCA's request for water training development assistance, and USAID's evaluation of training potential, this option would involve SCA's active participation in the design, development and delivery of appropriate technical pre-service training curricula and in-service training systems. This option sould expand upon the SCA's developing training department and institutionalize training systems into the Authority's water sector.

This model has been tested on the Cairo Sewerage I project (263-0091), with the Syphon Pump Station Operations and Maintenance demonstration training program. The program has had measurable success and will be expanded to train all functions within Cairo GOSD.

Alternative 3: The utilization of local training institutions

This option is not feasible at the present time, as no appropriate water/wastewater training programs exist in Egypt.
--The 1985 Water and Wastewater Sector Assessment studied the various local training alternatives, and concluded that sector training structures are virtually non-existent. Sector-specific training resources are uncoordinated, and training approaches are not well focused.

-- In its analysis of local training capabilities within the Canal Zone, the SCA-funded assessments in 1976 and 1984 also concluded that appropriate, quality technical training systems were unavailable.

Alternative 4: Training by local water and wastewater consultants

This option has been tried on selected USAID-funded sector projects. The results have been less than optimal due to a lack of experienced instructors and the non-availability of approriate training materials. The training has been short-term, with an emphasis on the development of focused technical skills relevant to the existing systems. To date this type of training has had minimal impact on improving operations and maintenance skills and performance.

Alternative 5: Training by expatriate water and wastewater consultants

This option has been tried on a number of water/wastewater projects in Egypt, and as part of the Canal Cities I project (refer to Sections I and III). The efforts have had varying degrees of success-- with the most successful being those that have focused on hands-on skill training at the worksite, utilized locally-hired staff in the actual training delivery, and developed system-specific Arabic language and/or highly graphic training materials and job aids. The training programs have been relatively short-term, and as a result, the long-term impact of training has been minimal because of the non-participation of beneficiaries in the training development process.

Alternative 6: Off-Shore Training

This option has been utilized as part of the early training components on most of the USAID-funded water/wastewater projects in Egypt. To date most participant training has focused on short-term nonacademic (two weeks to two months) technical or managerial training programs, observational hands-on training at US municipal utilities, or sector conference attendance. Those activities which have had the most impact have been highly structured observational, hands-on activities by GOE participants possessing strong English language skills. Given the training requirements of the water/wastewater sector, it would be most logical to include only a minor participant training component in the overall training plan.

The Selected Alternative

The preferred alternative is Alternative Two. Based on the needs assessments, the requests by the GOE agencies, and USAID's experience within the sector, we propose the development of organization-specific training systems. This alternative will provide the three wastewater departments and the Suez Canal Authority with appropriate technical and equipment assistance to gain the necessary skills to manage, operate and maintain the newly constructed systems, and to develop system-specific training departments.

V. HUMAN RESOURCES DEVELOPMENT DESCRIPTION

The Canal Cities Phase II project will finance two major training activities to upgrade the water and wastewater personnel skills to properly manage, operate and maintain the newly-constructed and proposed systems. The leading activity will be the development of organizational-specific operations and maintenance training systems, followed by facility-specific start-up training and operations assistance for the new wastewater treatment systems in the three cities.

A. Development of Operations and Maintenance Training Systems

1. Wastewater

Prior to the initiation of project training activities, each of the three governorates will be required to identify at least four permanent wastewater training counterparts to work full-time in counterpart relationships with the Technical Assistance Consultant's training staff in the development of comprehensive wastewater operations and maintenance training systems. Governorate counterparts will include a Wastewater training manager and technical O&M instructor trainees representing the treatment, pump station and collection divisions in each of the three cities. Training system development will be conducted within each city in hands-on, training team, apprentice relationships between the expatriate training specialists and the identified instructor trainees. Twinning and observational training opportunities will also be programmed as is deemed appropriate. The wastewater training systems development program will involve at least six

major activities, to include: Trainer Training, Program Planning and Identification, Program Development, Program Implementation, Monitoring and Evaluation, and Program Modification and Follow-up.

Trainer Training

The initial activity will involve trainer training for the identified training staff. This activity will introduce and acquaint training staff to operation and maintenance training methodology and skills. During subsequent project activities, governorate trainers will have sufficient opportunities in which to implement, test, and develop these skills.

Program Planning and Identification

As part of the second activity, program planning and identification, the training team will conduct personnel skill testing and evaluation to determine training needs for the new treatment facilities. The team will also test those functions not adequately addressed during the Phase I project, and subsequently, and develop a comprehensive training development plan and schedule.

Program Development

Based on the identified field training needs and priorities, the Technical Assistant Consultant/Wastewater Department training (TA/WWT) team will develop appropriate supervisory, operations, maintenance and safety training curricula. Since the primary training needs focus on wastewater treatment, it is envisioned that the majority of the training modules developed will also focus on wastewater treatment topics. The course curriculum developed will include an appropriate mix of pre-service training modules to introduce the assigned personnel to wastewater treatment skills as well as in-service training modules to develop and enhance these skills overtime. This phase of the program will train the wastewater trainers in the development of course modules, supporting manuals/handbooks, standard procedures, maintenance checklists, training aids, models and cutaways and audio-visual aids. The training materials will be developed in the colloquial Arabic dialect and will be supported with sufficient graphic illustrations to reflect the literacy skills of the wastewater department trainees. During the program development phase the TA consultant will coordinate with both the MCC and more closely with the design-build contractor to ensure that the training curriculum adequately reflects the operational needs of the treatment facilities, and carefully integrates the contractors' facility-specific standard operating/safety procedures, preventive maintenance programs and O&M manuals.

Program Implementation

During this phase, training delivery will begin. The TA/WWT team will initiate training delivery during the 12-month period prior to the completion of the wastewater facilities and prior to the pre-start-up and start-up hands-on training by the DBC for the treatment plants, and simultaneously for other facility/equipment training. Following start-up of the treatment facilities, the TA/WWT team will work closely with the DBC to

coordinate the formal training activities with the contractors' informal, on-the-job training activities. During this phase, trainer skills and the developed curriculums and supporting materials will be field tested. The consultant will assist the wastewater trainers in the revision/refinement of the curriculums and training materials.

Monitoring and Evaluation

With the completion of the initial training course deliveries, the TA/WWT team will develop performance evaluation systems based on performance indicators to test the skills of the newly-trained personnel, and the O&M performance of facilities/equipment with trained personnel. The performance evaluation systems will be implemented as required, and the results will be translated into appropriate follow-up training responses.

Program Modification and Follow-up

Training follow-up activities, course modifications and refresher training curriculums will be designed, developed and implemented as are required based on evaluation and system needs.

Anticipated Output

At the conclusion of this activity, the wastewater departments will have developed the institutional and human resource capacity to design, deliver, evaluate and modify in-service supervisory, operations, maintenance and safety training programs. Each city will have four trained trainers and developed wastewater training facilities housed at the new wastewater treatment plants. As wastewater department needs and priorities change, the departments will have the capability to expand their training systems to meet those needs.

2. Water

Prior to the initiation of project training activities in the Canal Cities, the Suez Canal Authority will be required to create a water training division within the Authority's Training Department, and appoint at least ten permanent instructors for water training activities. It is envisioned that the division will include a director, instructor trainees, and support personnel, and that the SCA will provide adequate building space in the completed Port Fouad training facility to house pre-service training activiies and adequate space at the primary water treatment facilities in the three cities for in-service training activities. Instructor trainees will be selected from amongst SCA's current water sector personnel resources, or will be new hires. The SCA instructor trainees will work full-time in counterpart training relationships with the TA consultants' training staff in the design and development of a pre-service training for skilled technicians, and a comprehensive in-service training for supervisors, operations, maintenance and support personnel assigned to the treatment and distribution divisions. Training system development will be conducted primarily in hands-on training team, apprentice relationships with the expatriate training specialists in Egypt. Selected, short-term nonacademic and observational training/twinning opportunities in the US or third countries will also be programmed to

complement the development program. The water systems development program will include at least five major activities to include: Trainer Training, Program Planning and Identification, Program Development, Program Implementation, Monitoring and Evaluation, and Program Modification and Follow-up.

Trainer Training

The initial activity will focus on trainer training for the identified training staff. This activity will introduce and acquaint training staff to management and technical training methodology and skills. During subsequent project activities, SCA instructors will have sufficient opportunities in which to implement, develop, test and refine these skills.

Program Planning and Identification

During the second major activity, program planning and identification, the Technical Assistance Consultant/Suez Canal Authority (TA/SCA) training team will conduct personnel skill testing and evaluation to determine training needs for three cities present and planned treatment and distribution systems. The team will develop a comprehensive training development plan and schedule -- including a curriculum development plan, equipment procurement plan, and facility renovation plan.

Program Development

Based on the identified training needs and priorities, the TA/SCA team will develop appropriate pre-service technical and in-service supervisory, operations, maintenance, and safety training curricula appropriate for water treatment and distribution training. This phase of the program will train the water instructors in the development of course modules, supporting manuals/handbooks, standard procedures, maintenance checklists, training aids, models and cutaways, and audio-visual aids. The training materials will be developed in the colloquial Arabic dialect and will be supported with sufficient graphic illustrations to reflect the literacy skills of the water sector staff. During this phase the TA/SCA team will coordinate closely with (1) the Port Fuoad training staff to ensure standardization of methodology and curriculum, and (2) with water system management to ensure that the training modules reflect the operational and preventive maintenance needs of the upgraded facilities.

Program Implementation

During program implementation, training delivery will begin in the developed and renovated training facilities. The SCA instructors will deliver pre-service technical training to the first group of selected water technicians, and will deliver the in-service technical and supervisory training modules to field personnel. During this phase, instructor skills and the developed curriculums and supporting materials will be field tested. The consultant will assist the water instructors in the revision/refinement of the curriculums and training materials.

Monitoring and Evaluation

Upon the completion of initial course deliveries (first with the in-service programs), the TA/SCA team will develop performance evaluation systems based on performance indicators to test the skills of the newly-trained water personnel, and the O&M performance of facilities/equipment with trained personnel. The performance evaluation systems will be implemented as required, and the results will be translated into appropriate follow-up training responses.

Program Modification and Follow-up

Training follow-up activities, course modifications, and refresher training curriculums will be designed, developed, tested and implemented as are required.

Anticipated Output

At the conclusion of this activity the water sector will have developed the institutional and human resource capacity to design, deliver, evaluate and modify pre-service technical training and in-service supervisory, operations, maintenance and safety training programs. The SCA will have at least ten trained instructors and developed water training facilities at the Port Fouad training center, and developed field training centers in the cities of Port Said, Ismailia and Suez. The developed systems will adhere to the SCA's organizational training objectives, and as sector needs change, will have the capacity to expand their training systems to meet those needs.

B. Facility-Specific Operations Training

The wastewater treatment plant design-build contractor(s) (DBC) will be responsible to provide on-site facility-specific training to the permanent staff assigned to the wastewater treatment facility in each city. Operations training will acquaint staff to the facility prior to completion of construction during the prestart-up period. Following facility commissioning and start-up training, direct operations assistance will continue for at least two years.

At least twelve months prior to start-up, each city will be required to designate/hire staff for the wastewater facility in accordance with DBC staffing recommendations. Likewise, the DBC will be required to closely coordinate with the TA/WWT team during the development of the operations training program to ensure standardization of methodology, and during implementation, to cooperate in joint training objectives and activities.

Phase I -- Prestart-up Training

During the 12-month period prior to the completion of the facility, the DBC will conduct prestart-up training. This training will acquaint staff to the equipment/processes in the facility primarily through formal hands-on and limited classroom training. Prestart-up training will include equipment testing with manufacturers' representatives, and during this phase, staff will be introduced to the DBC's developed standard procedures.

Phase II -- Start-up Training

During the start-up training phase, the DBC will work closely, on-site (on a 24-hour basis) with plant management, technical and monitoring staff to apply proper operations, maintenance and safety procedures.

Phase III -- Direct Operational Assistance

For a period of approximately 24 months, the DBC will maintain plant operations and maintenance specialists on-site to assist plant staff with operations. The DBC O&M specialists will assist staff in trouble-shooting, in the application of standard operation and safety procedures, in the application and use of preventive maintenance programs, and in the application of effluent monitoring systems.

Anticipated Output

At the conclusion of the three-year operations training program, the wastewater treatment facility staff in the cities of Port Said, Ismailia and Suez will have the training, hands-on experience, and management systems required to properly manage, operate and maintain the newly-constructed wastewater treatment plants.

VI. HUMAN RESOURCES DEVELOPMENT IMPLEMENTATION PLAN

The proposed implementation schedule for the two major operations and maintenance training activities follow in Table III. The implementation schedule depicts the major tasks to be conducted as part of the capacity-building program for the wastewater and water sectors by the TA consultant, and for the facility-specific wastewater operations training to be conducted by the DBC. The schedule is for illustrative purposes only, as the final implementation tasks and activities may vary form what is projected during project design.

CANAL CITIES WATER & WASTEWATER
HUMAN RESOURCES DEVELOPMENT IMPLEMENTATION PLAN

TRAINING CAPACITY DEVELOPMENT	
Start-Up Activities	
Mobilize TA Team	06/01/89 - 06/30/89
Update W/WW Needs Assessment	07/01/89 - 08/31/89
Develop TOT Courses & Workshop	08/01/89 - 11/30/89
Teambuilding Workship with SCA and Wastewater Trainers	12/01/89 - 12/31/89
TRAINER TRAINING	
TOT in Basic Training Methods	01/01/90 - 02/28/90
TOT in Intermediate Training Methods	03/01/90 - 04/30/90
TOT in Advanced Training Methods Based on Needs Assessment of Staff Skills	05/01/90 - 06/30/90
PROGRAM PLANNING AND IDENTIFICATION	
Complete Needs Assessment	07/01/90 - 07/31/90
Finalize Wastewater Training Curriculum Plan	08/01/90 - 09/30/90
Finalize SCA Preservice & In-Service Training Curriculum Plans	08/01/90 - 09/30/90
Develop Equipment Procurement Plans	08/01/90 - 09/30/90
Initiate Equipment Procurement	09/01/90 - 08/31/91
Finalize Program Development Schedules	08/01/90 - 09/30/90
Coordinate w/SCA on Development of Water Training Facilities	09/01/90 - 08/31/91
Coordinate w/DBC on Development of WW Facilities	09/01/90 - 03/31/93
PROGRAM DEVELOPMENT	
Conduct Skill Development Workshops	10/01/90 - 12/31/90
Observational Training	
Develop Water/Wastewater Curriculums	01/01/91 - 03/31/92
Training Module Development	01/01/91 - 03/31/92
Materials Development	01/01/91 - 03/31/92
Standard Procedures Development	01/01/91 - 03/31/92
Maintenance Aids Development	01/01/91 - 03/31/92
Models/Cutaways Development	01/01/91 - 03/31/92
Audiovisual Aids Development	01/01/91 - 03/31/92
PROGRAM IMPLEMENTATION	
Wastewater Treatment Introductory Training Delivery	04/01/92 - 03/31/93
In-Service Wastewater Training Delivery	07/01/91 - 12/31/93
Pre-Service Water Technical Training Delivery	09/01/91 - 12/31/93
In-Service Water Training Delivery	04/01/92 - 12/31/93
MONITORING AND EVALUATION	
Develop Performance Evaluation Systems	09/01/91 - 12/31/93
Implement Performance Evaluation Systems	11/01/91 - 12/31/93
PROGRAM MODIFICATION AND FOLLOW-UP	
Redesign/Modify Modules	04/01/92 - 12/31/93
Deliver Modified Modules	06/01/92 - 12/31/93
TREATMENT PLANT SPECIFIC O&M TRAINING	
Mobilize O&M Training Staff	10/01/92 - 10/31/92
Program Development	10/01/92 - 03/31/93
Prestart-up Training Delivery	04/01/93 - 10/31/93
Comissioning/Start-up Training	07/01/93 - 01/31/94
Direct O&M Assistance	10/01/93 - 01/31/96

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VII. HUMAN RESOURCES DEVELOPMENT FINANCIAL PLAN

The Human Resources Development project activities will require USAID contributions to include: technical assistance, equipment and funds for off-shore training/twinning activities. (The costs for facility-specific O&M training is included in the design-build contract and includes techncial assistance and training-facility construction costs.) GOE contributions to these activities include LE funds for the water sector training facility construction and renovation costs, local expenses, and in-kind salary contributions.

Table IV illustrates the technical assistance budget, reflecting an estimated cost of $5,946,650, and LE contributions of 4,187,840. Table V illustrates the estimated equipment financial plan of approximately $1,220,000 and LE 425,000 and Table VI illustrates the participant/twinning training budget of $270,000 and LE 120,000. The total estimated human resources development financial plan then follows in Table VII. GOE contributions to the human resource development element will include in-kind contributions of trainer/instructor resources, wastewater department staff resources, SCA personnel resources, and SCA facility, land and building renovation inputs.

Table IV
Illustrative Technical Assistance Budget

Position	Estimated Personmonths	Costs	
US POSITIONS		US$	LE
Senior Training Specialist	54	810,000	588,600
Wastewater Operations Training Specialist	54	810,000	588,600
Water Operations Training Specialist	54	810,000	588,600
Electrical Maintenance Training Specialist	36	540,000	392,400
Mechanical Maintenance Training Specialist	36	540,000	392,400
Water Quality/Laboratory Training Specialist	30	450,000	327,000
Mechanical Maintenance (Machinist) Training Specialist	30	450,000	327,000
SUBTOTAL	294	$ 3,681,000	LE 2,616,000
LOCAL POSITIONS			
Training Specialists	162		210,600
Support Personnel	300		270,000
SUBTOTAL	462		LE 480,600
TOTAL		$ 3,681,000	LE 3,096,600

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Table V
Illustrative Equipment Budget

	Cost US$	Cost LE
Training Equipment and Supplies Training center equipment, models, expendable materials, printing, processing	400,000	225,000
Audiovisual Equipment Video equipment, monitors, projectors, recorders, screens		200,000
Training Resources Books, manuals, prepared course material	50,000	
Production Equipment Photocopy equipment, stencil duplicator, word processing system	70,000	
Data Processing Equipment Personal computers, software	60,000	
Maintenance Equipment	90,000	
Laboratory Equipment Water quality control equipment	150,000	
Safety Equipment	150,000	
Vehicles Passenger vans, mobile training unit	250,000	
TOTAL	$ 1,220,000	LE 425,000

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Table VI
Illustrative Twinning/Participant Training Budget

	US$	LE
Wastewater Departments		
Travel: 12 trainees @ LE 5000		60,000
PerDiem/Expenses: 12 trainees @ $2500	30,000	
Wastewater Subtotal	30,000	60,000
Suez Canal Authority		
Travel: 12 trainees @ LE 5000		
PerDiem/Educational Expenses: 12 trainees @ $20,000	240,000	60,000
SCA Subtotal	240,000	60,000
TOTAL	$ 270,000	LE 120,000

Table VII
Illustrative Human Resources Development Financial Plan

Element	Cost	
	US$	LE
Technical Assistance		
294 US personmonths	3,681,000	2,616,000
462 Local personmonths		480,600
Equipment	1,220,000	425,000
Twinning/Participant Training	270,000	120,000
Contingency @ 15%	775,650	546,240
TOTAL	$ 5,946,650	LE 4,187,840

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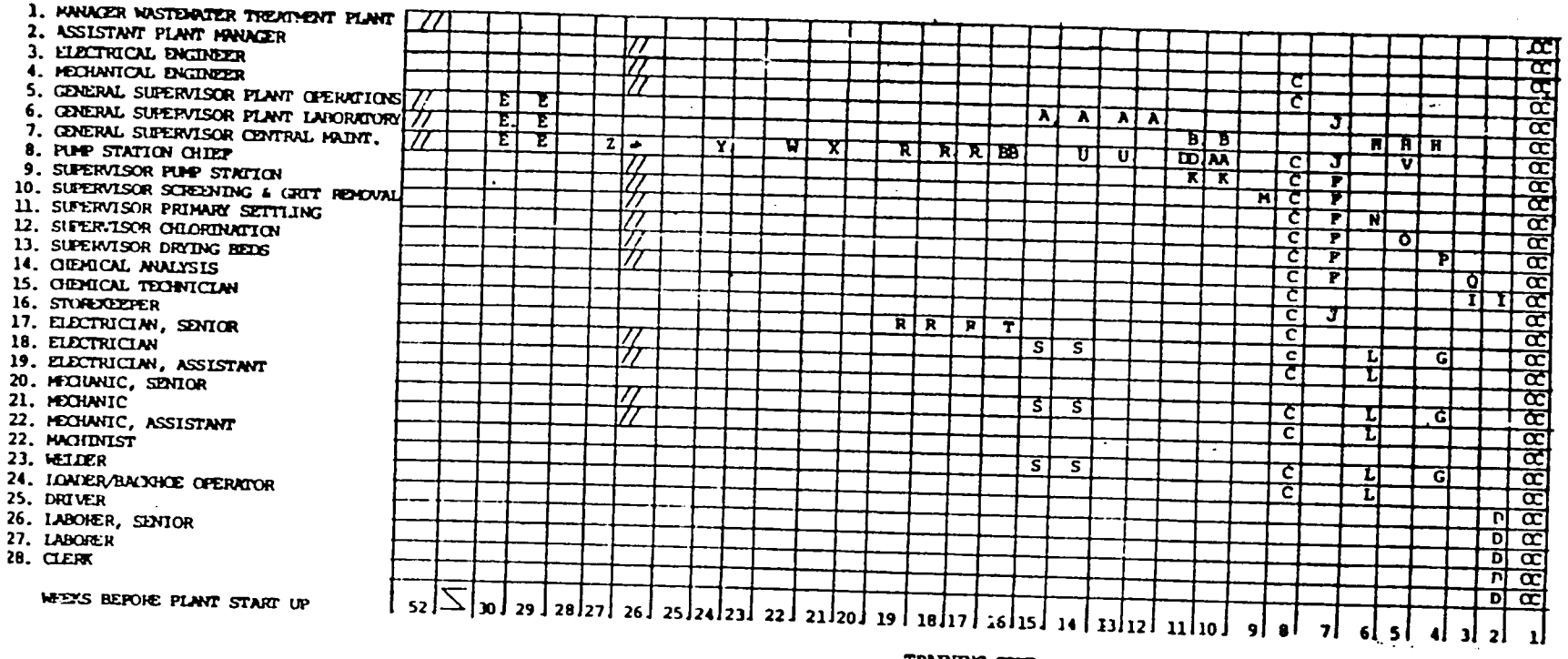
EXHIBIT 1

EDUCATION REQUIREMENTS BY JOB CLASSIFICATION FOR PHASE TWO WASTEWATER TREATMENT PLANTS

TITLE	EDUCATION REQUIRED
Wastewater Plant Manager	University
Assitant Plant Manager	University
Electrical Engineer	University
Clerk	Secondary
General Supervisor Plant Operations	University
General Supervisor Plant Laboratory	University
General Supervisor Central Maintenance	Secondary/Training
Pump Station Chief	Secondary
Supervisor Pump Station	Secondary
Supervisor Screening and Grit Removal	Secondary
Supervisor Primary Settling	Secondary
Supervisor Chlorination	Secondary
Supervisor Drying Beds	Secondary
Chemical Analysis	University
Chemical Technicians	Secondary
Storekeeper	Secondary
Electrician, Senior	Experience/Training
Electrician	Experience/Training
Electrician, Assistant	Experience/Training
Mechanic, Senior	Experience/Training
Mechanic	Experience/Training
Mechanic, Assistant	Experience/Training
Mechanist	Experience/Training
Welder	Experience/Training
Loader/Backhoe Operator	Experience/Training
Driver	Experience/Training
Laborer, Senior	On The Job Training
Laborer	On The Job Training



TRAINING CODE

SUBJECTS		KEY
WASTEWATER PLANT OPERATIONS & THEORY	160 HOURS	A
WASTEWATER PLANT OPERATIONS & THEORY	80 HOURS	B
WASTEWATER PLANT OPERATIONS & THEORY	40 HOURS	C
WASTEWATER PLANT OPERATIONS & THEORY	20 HOURS	D
SUPERVISORY TRAINING	80 HOURS	E
SUPERVISORY TRAINING	40 HOURS	F
SUPERVISORY TRAINING	20 HOURS	G
LABORATORY ANALYSIS 50% LAB & THEORY	120 HOURS	H
LABORATORY ANALYSIS 50% LAB & THEORY	80 HOURS	I
LABORATORY ANALYSIS 50% LAB & THEORY	40 HOURS	J
PUMP STATION OPERATIONS AND THEORY	80 HOURS	K
PUMP STATION OPERATIONS AND THEORY	20 HOURS	L
PUMP STATION OPERATION & MAINTENANCE	40 HOURS	M
SCREENING AND GRIT REMOVAL	40 HOURS	N
PRIMARY SETTLING	40 HOURS	O

SUBJECTS		KEY
CHLORINATION	40 HOURS	P
DRYING BEDS	40 HOURS	Q
FUNCTIONAL ENGLISH	120 HOURS	R
FUNCTIONAL ENGLISH	80 HOURS	S
RECORD KEEPING AND INVENTORY CONTROL	40 HOURS	T
M.C.C. & ELECTRICAL THEORY & REPAIR	80 HOURS	U
PUMP OPERATIONS AND THEORY	40 HOURS	V
GASOLINE ENGINE REPAIR	40 HOURS	W
DIESEL ENGINE REPAIR	40 HOURS	X
WELDING THEORY	40 HOURS	Y
HYDRAULIC THEORY AND REPAIR	40 HOURS	Z
METERING AND METER REPAIR	40 HOURS	AA
DRAFTING AND BLUEPRINT READING	40 HOURS	BB
SAFETY	40 HOURS	CC
MACHINIST THEORY	40 HOURS	DD
DATE OF HIRE OR DESIGNATION		//

PHASE II

WASTEWATER TREATMENT PLANTS

TRAINING SCHEDULE

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Exhibit 3

Suez Canal Authority
1987 Water Sector Manpower

Position	Suez	Ismailia	Port Said
Clerk	4	1	
Typist	1	1	
Electrical Power Technician	16	15	23
Diesel Mechanic	8	13	10
Steam Mechanic		1	
Plumber	26	15	43
Bench Fitter	7	6	5
Metal, Turner	3	6	4
Welder	4	3	2
Metal Forming Technician (Plater)		1	3
Draftsman		1	
Storekeeper	1	1	2
Crane Operator	4	1	11
Assistant Clerk	13	7	4
Filter Operator	8	3	7
Machinist	10	23	6
Car Mechanic		1	
Office Serviceman		1	1
Service worker	40	25	25
Bobbin Electrician			2
Tractor Mechanic			8
Instrumentation Mechanic			4
Furniture Carpenter	2		3
Tractor Driver	2		
Wiring Electrician	4	1	7
Construction Technician	6		1
Builder	2		3
Driver	4		
Laboratory Analyser	1		1
Painter	3		
Gardener	4		
Metal Cutting & Welding Technician			2
Blacksmith			4
Electrician for Nets & Equipment			10
Assistant storekeeper			1
Civil engineer	5	3	7
Mechanical engineer	2	1	1
Electrical engineer	1		1
Subtotal	181	132	198
Total	511		

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Exhibit 4

Suez Canal Authority
Current Water Sector Manpower Shortage

Position	Suez	Ismailia	Port Said
Builder		1	
Plumber		6	21
Storekeeper	6	3	2
Car Driver		3	
Blacksmith		1	
Assistant Clerk	36	6	15
Assistant Storekeeper		30	
Service worker	25	45	20
Instrumentation Mechanic		1	
Metal Former (Plater)		2	
Fireman	8	8	
Tractor Driver		1	
Crane Operator	2	2	
Filter Operator	13	10	
Gardener		6	5
Welder	4	2	
Office Service Man			2
Carpenter			2
Diesel Mechanic	4		5
Machine Operator	29		
Construction Technician	4		
Electrical Power Technician	10		
Subtotal	141	100	72
SCA Total	313		

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Exhibit 5

Suez Canal Authority
Water Sector Manpower Needs for the New Facilities

Position	Suez	Ismailia	Port Said
Civil Engineer	1	1	
Mechanical Engineer	1	1	
Electrical Engineer	1	1	
Construction Technician	2	2	
Mechanic	2	2	
Electrician	2	2	
Instrumentation Technician	2	2	
Electrical Engineer	1	1	1
Electrical	12	12	
Mechanic (pumps)	8	8	
Filter Operator	8	8	
Subtotal	40	40	1
SCA Total	81		

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Exhibit 6

Suez Canal Authority
Annual Water Sector Manpower Needs

Position	Suez	Ismailia	Port Said
Power Electrician	2	2	2
Diesel Mechanic	1	1	1
Plumber	3	3	6
Bench fitter	1	1	1
Metal turner	1	1	1
Welder	1	1	1
Metal former	1	1	1
Crane Operator	1	1	1
Filter operator	2	2	2
Machine operator	1	1	1
Wiring electrician	1	1	1
Construction technician	1	1	1
Laboratory analysis technician	1	1	1
Storekeeper	1	1	1
Subtotal	18	18	18
SCA Total	57		

Exhibit 7

SCA Phase II Water Sector Training Needs

1. Electrical Power Technician
   - High voltage, "11,000v - 3,000v"
   - Transformer, "11,000v - 380v"
   - High tension cable work
   - Distribution switches and low tension networks, "380v - 220v"
   - Electrical motors
   - Electrical instruments for measurements
   - Generators, batteries, etc.

2. Mechanical Technician (diesel)
   - Diesel engine works (Operation and Maintenance)
   - Mechanics of other instruments (fuel pumps, generators, etc.)
   - Work on all gages in the engine
   - Blower maintenance-different kinds of pumps

3. Instrumentation Technician
   - Repair and maintenance of water meters and other instruments for water facilities purposes (discharge, velocity, pressure, etc.)

4. Welding and Forming Technician
   - Welding for different kinds of metals
   - Forming, manufacturing of special units of pipe and their accessories

5. Machine Operator (equipment operator)
   - Have a good knowledge for operation of diesel engines, pumps, etc.
   - Daily maintenance of engine before and after operation
   - Daily reports for the engine or pump
   - Different kinds of engine measurements

6. Metal Foreman (machanist)
   - Forming of moving units (cylinders, gears, etc.) for pumps, blower, engines, motors, chlorine units, etc.

7. Filter, Clarifier, Chlorine, Dosing pump operator
   - Operation of clarifiers, filters, chlorine, dosing pumps
   - Maintenance and flushing of different units in the treatment plant (filters, clarifiers, reservoirs, etc.)
   - Control of different units of the treatment plant as one unit.

8. Plumber
   - Erection of different kinds of pipes
   - Maintenance and repair of pipes
   - Erection of new connections for consumers
   - General knowledge about water phenomenon in the pipes (water flow, velocity, water pressure) and its effects on pipes.

9. Meter Reader

Reading of different kinds of meters
Estimation of daily consumption of alum, polymers, chemicals, power, fuel, etc. in the treatment plant
Estimation of raw water, treated water, and losses in the treatment plant and distribution network.
Estimation of total cost of cubic meter of treated water

10. Laboratory Technician

Chemical and bacterial analyses of potable and raw water
Treatment of potable water

11. Storekeeper

General knowledge about the accessories of different units of the treatment plant and accessories of water pipes, valves and fittings
Official work of stores (receiving and dispensing, etc.)

12. Industrial Security and Fire

Studies for industrial security and fire protection
Precaution against fire, chlorine gas, and industrial problems

13. Training for Engineers and Supervisors

Treatment plants (design, construction, erection, operation, and maintenance)
Water networks (design, erection, operation and maintenance)
Economical operation and maintenance of water treatment plants and water networks
Control methods of water treatment plants and water networks and the relation between discharge and pressure
Management and cost estimation for operation of the treatment plants and water networks
Methods of computer uses in water utilities (design, management, operation, costs estimations, meter reading, billing, etc.)
Safety studies for water utilities and precautions

Exhibit 8

Suez Canal Authority
Port Said Shipyard Training Program

Skill Specializations

1. Electricity
2. Shipbuilding
3. Welding
4. Piping
5. Mechanical Installation
6. Machines (Fitting, Turning, Miller)
7. Foundry
8. Forging
9. Woodworking

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ELECTRICITY CURRICULUM

Subject	Year 1	Year 2	Year 3	Year 4
I Classroom/Theoretical Technical Training:				
1. Shipyard Technolgy	2			
2. Metallurgy	3			
3. Engineering Drawing	5	3		
4. Tools Technology	3			
5. Mathematics	2	2	2	
6. Physics	2			
7. Electrical Engineering		2	2	3
8. Electronics		2	2	
9. Mechanics		2		
10. Electrical Drawing			3	3
11. Testing Equipment			2	
12. English Language	2	2		
II Workshop/Practical Training:	12	18	24	30
III Other Training:				
1. Games	1	1		
2. Religion	1	1	1	
Total Training Hours Per Week	33		36	
Total Training Hours Per 40 Week Year	1320		1440	

SHIPBUILDING CURRICULUM

Subject	Year 1	Year 2	Year 3	Year 4
I Classroom/Theoretical Technical Training:				
1. Shipyard Technology	2			
2. Metallurgy	3			
3. Shipbuilding Technology		3	3	2
4. Engineering Drawing	5			
5. Shipbuilding Drawing		3	5	4
6. Mould Loft Drawing		3	3	
7. Tools Technology	3			
8. Mathematics	2	2	2	
9. Physics	2			
10. English Language	2	2		
II Workshop/Practical Training:	12	18	18	27
III Other Training:				
1. Games	1	1	1	
2. Religion	1	1	1	
Total Training Hours Per Week		33		
Total Training Hours Per 40 Week Year		1320		

WELDING CURRICULM

Subject	Year 1	2	3	4
I Classroom/Theoretical Technical Training:				
1. Shipyard Technology	2			
2. Metallurgy	3	2	2	
3. Welding Technology		4	6	4
4. Shipyard Terminology		3	3	2
5. Engineering Drawing	5			
6. Tools Technology	3			
7. Mathematics	2	2	2	
8. Physics	2			
9. English Language	2	2		
II Workshop/Practical Training:	12	18	18	27
III Other Training:				
1. Games	1	1	1	
2. Religion	1	1	1	
Total Training Hours Per Week		33		
Total Training Hours Per 40 Week Year		1320		

PIPEFITTER CURRICULUM

Subject	Year 1	2	3	4
I Classroom/Theoretical Technical Training:				
1. Shipyard Technology	2			
2. Metallurgy	3			
3. Engineering Drawing	5			
4. Tools Technology	3			
5. Mathematics	2	2	2	
6. Physics	2			
7. Piping Drawing		4	3	4
8. Piping Technology		3	3	3
9. Thermal Engine		2		
10. Job Estimation			2	2
11. English Language	2	2		
II Workshop/Practical Training:	12	18	18	24
III Other Training:				
1. Games	1	1	1	
2. Religion	1	1	1	
Total Training Hours Per Week		33		
Total Training Hours Per 40 Week Year		1320		

MECHANICAL INSTALLATION CURRICULUM

Subject	Year 1	2	3	4
I Classroom/Theoretical Technical Training:				
1. Shipyard Technology	2			
2. Metallurgy	3	2		
3. Engineering Drawing	5	4	3	3
4. Tools Technology	3			
5. Mathematics	2	2	2	
6. Physics	2			
7. Thermal Engine		2	2	2
8. Steam Engine		2	2	
9. Machine Technology		2	2	
10. Erection and Transmission Equipment			2	2
11. Job Estimation				2
12. English Language	2	2		
II Workshop/Practical Training:	12	15	18	24
III Other Training:				
1. Games	1	1	1	
2. Religion	1	1	1	
Total Training Hours Per Week		33		
Total Training Hours Per 40 Week Year		1320		

MACHINES (FITTER, TURNER, MILLER) CURRICULUM

Subject	Year 1	2	3	4
I Classroom/Theoretical Technical Training:				
1. Shipyard Technology	2			
2. Metallurgy	3	2	2	3
3. Engineering Drawing	5	4	3	
4. Tools Technology	3			
5. Mathematics	3	2	2	
6. Physics	2			
7. Machine Technology/Maintenance		3	3	3
8. Thermal/Steam Engine			3	
9. English Language	2	2		
II Workshop/Practical Training:	12	18	18	27
III Other Training:				
1. Games	1	1	1	
2. Religion	1	1	1	
Total Training Hours Per Week		33		
Total Training Hours Per 40 Week Year		1320		

FOUNDRY CURRICULUM

Subject	Year 1	2	3	4
I Classroom/Theoretical Technical Training:				
1. Shipyard Technology	2			
2. Metallurgy	3	2	2	3
3. Engineering Drawing	5	4	3	
4. Tools Technology	3			
5. Mathematics	2	2	2	
6. Physics	2			
7. Forming Technology		2	3	3
8. Job Estimation				3
9. English Language	2	2		
II Workshop/Practical Training:	12	18	21	24
III Other Training:				
1. Games	1	1	1	
2. Religion	1	1	1	
Total Training Hours Per Week		33		
Total Training Hours Per 40 Week Year		1320		

FORGING CURRICULUM

Subject	Year 1	2	3	4
I Classroom/Theoretical Technical Training:				
1. Shipyard Technology	2			
2. Metallurgy	3	2	2	
3. Engineering Drawing	5	4	3	3
4. Tools Technology	3			
5. Mathematics	2	2	2	
6. Physics	2			
7. Forging Technology	2	2		3
8. English Language		3	3	
II Workshop/Practical Training:	12	18	21	30
III Other Training:				
1. Games	1	1	1	
2. Religion	1	1	1	
Total Training Hours Per Week	33	33	33	36
Total Training Hours Per 40 Week Year	1320	1320	1320	1440

WOODWORKING CURRICULUM

Subject	Year 1	2	3	4
I Classroom/Theoretical Technical Training:				
1. Shipyard Technology	2			
2. Metallurgy	3			
3. Engineering Drawing	5			3
4. Tools Technology	3			
5. Mathematics	2	2	2	
6. Physics	2			
7. Carpentry Engineering Drawing		4	5	
8. Carpentry Technology		3	3	3
9. English Language	2	2		
II Workshop/Practical Training:	12	20	21	30
III Other Training:				
1. Games	1	1	1	
2. Religion	1	1	1	
Total Training Hours Per Week	33	33	33	36
Total Training Hours Per 40 Week Year	1320	1320	1320	1440

Exhibit 9

Suez Canal Authority's In-Service
Training for Engineers, Managers and Supervisors

Program Topics

- Administration
- Production Control
- Managerial Process
- Motivation and Education
- Management Information Systems and the Manager