

Report No. 1542-SY

Appraisal of an Aleppo Water Supply Project Syrian Arab Republic

FILE COPY

June 1, 1977

Projects Department
Europe, Middle East and North Africa Regional Office

FOR OFFICIAL USE ONLY



Document of the World Bank

This document has a restricted distribution and may be used by recipients only in the performance of their official duties. Its contents may not otherwise be disclosed without World Bank authorization.

APPRAISAL OF
AN ALEPPO WATER SUPPLY PROJECT

SYRIAN ARAB REPUBLIC

CURRENCY AND EQUIVALENTS

Currency Unit	=	Syrian Pound (LS)
LS 1	=	US\$0.25
US\$1	=	LS 3.95
LS 1,000,000	=	US\$253,000
US\$ 1,000,000	=	LS 3,950,000

WEIGHTS AND MEASURES

mm	=	millimeter (1 millimeter = 0.039 inches)
cm	=	centimeter (1 centimeter = 0.39 inches)
m	=	meter (1 meter = 3.28 feet)
km	=	kilometer (1 kilometer = 0.62 miles)
kv	=	kilovolt
ha	=	hectare (1 hectare = 2.471 acres)
km ²	=	square kilometer (1 km ² = 247.1 acres)
m ³	=	cubic meter (1 m ³ = 264.2 US gallons)
m ³ /sec	=	cubic meter per second (1 m ³ /second = 22.8 million US gallons per day)
lcd	=	liters per capita per day (1 lcd = 0.26 US gallons per capita per day)

ABBREVIATIONS AND ACRONYMS

Arab Fund	-	Arab Fund for Economic and Social Development
EPEA	-	Etablissement Public des Eaux d'Alep (Aleppo Water Supply Authority)
EPEF	-	Etablissement Public des Eaux de Fiegh (Damascus Water Supply Authority)
MHU	-	Ministry of Housing and Utilities
MLG	-	Ministry of Local Government
PDF	-	Public Debt Fund
SPC	-	State Planning Commission
USAID	-	United States Agency for International Development

Fiscal Year

January 1 - December 1

APPRAISAL OFAN ALEPPO WATER SUPPLY PROJECTSYRIAN ARAB REPUBLICTable of Contents

	<u>Page No.</u>
SUMMARY AND CONCLUSIONS	i-iii
I. INTRODUCTION	1
II. THE SECTOR	1
A. Background	1
B. Water Resources	2
C. Organization	2
D. Levels of Service	2
E. Sector Planning	3
F. Previous Water Supply Projects	4
III. THE PROJECT AREA	4
A. Background	4
B. Water Supply	5
C. Sewerage	6
IV. THE PROJECT	7
A. Objectives	7
B. Description	7
C. Cost Estimates	9
D. Implementation	10
E. Disbursements	12
F. Environmental Impacts	13
V. THE PROJECT ENTITY	14
A. Background	14
B. Organization and Management	14
C. Operations	15
D. Accounts	15
E. Billing and Collection	15
F. Training	16
G. Audit	16
H. Insurance	16

Table of Contents (Continued)

Page No.

VI.	FINANCE	16
	A. Past Performance and Present Financial Position	16
	B. Financing Plan	17
	C. Tariffs	18
	D. Future Operations and Financial Position	19
VII.	JUSTIFICATION	19
	A. Demand	19
	B. Least-Cost Solution	20
	C. Economic Analysis	20
VIII.	RECOMMENDATIONS	21

ANNEXES

1	Summary of Legislation
2	Forecasts of Population, Connections, Consumption and Production
3	Existing Water Supply Facilities in Aleppo
4	Description of the Water Supply Component of the Project
5	Cost Estimates
6	Draft Terms of Reference for Engineering Consultants for Aleppo Sewerage Study
7	Draft Terms of Reference for Technical Assistance to (a) the State Planning Commission and (b) Public Construction Enterprises
8	Construction Schedule
9	Key Indicators
10	Estimated IBRD Loan Disbursements
11	EPEA's Organization Chart
12	EPEA - Income Statements Actuals (1973-76) and Projected (1977-84)
13	EPEA - Cash Flow Statements Actuals (1973-76) and Projected (1977-84)
14	EPEA - Balance Sheets Actuals (1973-76) and Projected (1977-84)
15	Assumptions for the Financial Projections
16	Etablissement Public des Eaux d'Alep (EPEA) - 1977 Tariffs
17	Justification

MAPS

IBRD No. 12699	Source, Headworks and Transmission System
IBRD No. 12722	Distribution System

APPRAISAL OF
AN ALEPPO WATER SUPPLY PROJECT
SYRIAN ARAB REPUBLIC
SUMMARY AND CONCLUSIONS

- i. Past levels of access to potable water supply in Syria have been above average for the Middle East. However, as a result of rural-urban migration and inadequate investments in supply works during the past six years, available volumes are no longer sufficient to meet the population served and large investments in urban water supplies are required in order to ensure adequate access in the near future. Prior Bank lending in the sector has been for water supply in the capital city of Damascus where the situation was most critical. Out of a Credit of US\$15.0 million in 1973 (401-SYR), US\$13.0 million is being used to finance an emergency phase of distribution works which are presently more than 50% completed with construction proceeding according to contract schedule. Supply works partly financed by a 1976 Bank loan of US\$35.0 million (1241-SYR) are also well underway.
- ii. Aleppo is the principal manufacturing and trading city in northern Syria. With the expansion of the area served, migration and natural growth, the population served by Etablissement Public des Eaux d'Alep (EPEA) has increased by 8.2% per annum during 1970-76 to a total of 1.0 million. Because of the rapid growth in demand, there has been a severe shortage of water during the summer months since 1973. This shortage should end with the completion of ongoing works in 1977, but with expected growth of demand, supply will again become inadequate by 1981 unless a further expansion of the facilities is undertaken immediately.
- iii. The objectives of the water supply component of the project are: (a) to extend the water source and transmission facilities to meet increasing demands in Aleppo; (b) to reinforce the distribution and thereby improve minimum pressures and reduce risks of pollution within the system; (c) to extend the supply into fringe areas of the city occupied mainly by urban poor; and (d) to provide technical assistance to improve the project implementation and operational capacity of EPEA. The objectives of the other components of the project are to provide technical assistance for: (a) preparation of sewerage projects for Aleppo and Lattakia; (b) improving construction sector planning capabilities in the State Planning Commission; and (c) improving administration in the public construction enterprises.
- iv. The main elements of the water supply component of the project are a transmission line of 220,000 m³/d capacity and associated pumping facilities to convey water from Lake Assad to Aleppo, treatment plant expansions and extensions and improvements to the existing trunk distribution system. Construction is scheduled to begin at the end of 1978 and to be substantially finished by 1981.

v. The estimated project cost is US\$116.8 million with a foreign exchange component of US\$58.4 million. A Bank loan of US\$50.0 million is proposed, equivalent to about 43% of the project cost, for a period of 17 years including 3-1/2 years grace. The balance of the financing will be provided by internal cash generation and by the Government.

vi. The Government of the Syrian Arab Republic will be the Borrower of the Bank loan and will onlend US\$48.5 million to EPEA. The balance of the loan of US\$1.5 million will be made available to government agencies to finance the foreign exchange cost of the other components of the project. EPEA is a semi-autonomous authority responsible for water supply in the Aleppo area and has been well-managed by an experienced, qualified and efficient team. During the last few years the management has been overextended because of lack of staff to operate the facilities and supervise the ongoing construction of work.

vii. EPEA has an impressive financial record and has generated a substantial proportion of its investment requirements, but the financial performance has deteriorated in recent years due to rapid inflation. EPEA implemented new charges and tariff structure in February and May 1977 which provides an average revenue equivalent to LS 1.10/m³ (US\$0.28/m³) of water supplied. The new tariff represents an increase of about 100% on the former scale which was introduced in 1959. EPEA has agreed to implement whichever is the higher of (i) the present charges; or (ii) rates which will yield revenue sufficient to finance each year during the period 1978-82 not less than 15%, and beginning with the year 1983 to finance each year not less than 35%, of the average cost of investment during each consecutive three-year period. With the completion of the ongoing works and the proposed project, the net fixed assets are projected to increase to LS 598.7 million, a twelve-fold increase on 1976.

viii. Contracts for civil works and equipment estimated to cost more than US\$300,000, to be financed from the proposed Bank loan, will be awarded on the basis of international bidding in accordance with the Bank's guidelines. Other contracts, not to exceed in aggregate US\$5.0 million, will be awarded on the basis of local competitive procurement procedures acceptable to the Bank. Domestic preference of 15%, or the customs duty, whichever is lower, will be allowed to local manufacturers on contracts procured under ICB. The civil works contracts are expected to be awarded to local contractors.

ix. The major benefits associated with the provision of a reliable and safe water supply are health-related and would be partially revealed through medical cost saving, a general improvement in individual well-being and a cost saving to or increased productivity of business enterprises. Statistics to support calculations of such benefits are not available. The average revenue of LS 1.10/m³ resulting from the new charges introduced in 1977 is equal to the long term marginal cost of water calculated at a discount rate of 10% which is estimated to be the opportunity cost of capital in Syria. The rate of return for the project is 10%.

x. Agreement having been reached on the issues outlined in this report the project is suitable for a Bank loan of US\$50.0 million to the Government of the Syrian Arab Republic for a period of 17 years including 3-1/2-year grace at current Bank interest rates. US\$48.5 million of the loan is to be onlent to Etablissement Public des Eaux d'Alep (EPEA) on conditions acceptable to the Bank and the balance of US\$1.5 million to be retained by the Government to be used as follows: US\$1.25 million for sewerage studies of Aleppo and Lattakia; US\$0.05 million for technical assistance to the State Planning Commission and US\$0.20 million for technical assistance to public construction enterprises.

APPRAISAL OF
AN ALEPPO WATER SUPPLY PROJECT
SYRIAN ARAB REPUBLIC

I. INTRODUCTION

1.01 The Government of the Syrian Arab Republic has requested a Bank loan to help finance a project to (a) expand the water supply facilities in Aleppo, (b) undertake feasibility studies for improving the sewer systems and constructing sewage treatment plants in Aleppo and Lattakia, and (c) provide technical assistance to the State Planning Commission and to public construction enterprises in Syria. The total project is estimated to cost US\$116.8 million equivalent with a foreign exchange component of US\$58.4 million. A Bank loan of US\$50.0 million is proposed, equivalent to about 43% of the project cost, for a period of 17 years including 3-1/2 year grace. The balance of the financing will be provided by internal cash generation and by the Government. The Government of the Syrian Arab Republic will be the Borrower of the Bank loan and will onlend US\$48.5 million to Etablissement Public des Eaux d'Alep (EPEA-Aleppo Water Supply Authority). The balance of the loan of US\$1.5 million will be made available to government agencies to finance the foreign exchange cost of the other components of the project.

1.02 A Bank identification mission to Aleppo was undertaken in May 1976. An appraisal mission comprising Messrs. W. Cosgrove, W. Hayden, W. Keilani and P. Jeffcoate (Consultant) visited Aleppo in November/December 1976. The Aleppo and Lattakia sewerage feasibility studies and the technical assistance components of the project were identified by Bank's sector and economic missions which visited Syria in November/December 1976. This report, based on information provided by the Government, and EPEA and on the missions' findings, was written by Messrs. Hayden, Keilani and Jeffcoate.

II. THE SECTOR

A. Background

2.01 The Syrian Arab Republic, situated at the eastern extreme of the Mediterranean Sea (Map 12699), is about one third the size of France. The topography is generally mountainous in the western coastal area but, further east, the main feature is the Euphrates Valley which intersects a flat or slightly undulating landscape with more mountainous country in the extreme east. The climate is generally Mediterranean with hot, dry summers and moderately wet winters, but inland the rainfall is low producing semi-arid or desert conditions. Syria's population in mid-1975 was 7.4 million and grew at the rate of 3.3% during the 1960-70 census period. The urban population, estimated at 3.4 million, grew at 5% during the same census period and now comprises about 46% of total population.

B. Water Resources

2.02 Large surface and groundwater resources are available in Syria, but the distribution is unbalanced. Annual rainfall varies between 500 mm and 1,000 mm in the coastal and mountain areas, but in the eastern and southeastern areas, the range is between 50 mm and 500 mm. In spite of the substantial resources, scarcity of water is a present and growing problem in some regions, particularly the south-central. The two principal rivers in Syria, the Euphrates and the Orontes, are utilized for public water supplies. There are also a number of important aquifers, mainly in the limestone of the Lebanon and anti-Lebanon mountain ranges, one of which feeds the Figh Spring supplying Damascus.

C. Organization

2.03 The Ministry of the Euphrates is responsible for the development and use of the Euphrates River while the Ministry of Public Works and Hydraulic Resources is responsible for management and allocation of water resources elsewhere. Responsibility for water supply and sewerage in urban and rural areas is shared by the Ministries of Housing and Utilities (MHU) and that of Local Government (MLG). MHU is responsible for general guidance and assistance on technical matters and for project design and construction. MLG has overall responsibility for the services provided by the municipalities who operate and maintain the systems.

2.04 Eight major cities in Syria have semi-autonomous water authorities. Each of the authorities is managed by a board of directors comprising a general manager, five departmental heads and a representative of the workers. However, the Government, through MHU, exercises wide control over all important matters such as tariffs, budget, personnel, salary levels and capital investment. In February 1974, the Government issued Decree No. 18 (Annex 1) which now governs all public authorities. This Decree outlines the structure of public authorities and provides general rules for operation and management. The detailed regulations for each authority are provided in a separate decree. Outside the major cities, all but the smallest urban centers have water supply distribution systems managed by units within the municipal administrative structure.

D. Levels of Service

2.05 Treated water is provided by metered house-connection for about 70% of the population in the eight major cities. The balance of the population depends upon private wells, a limited number of public taps and water vendors. The percentage of the population served through house-connections will be substantially improved when service is extended to the illegal squatters residing outside the existing city boundaries. Service levels for the urban

poor residing within the city limits is generally satisfactory. The proportion of rural population with reasonable access to safe water is estimated by MHU to have risen from 50% in 1970 to 60% in 1975, a service level clearly above average in the Middle East.

2.06 Municipal officials estimated that 75% of the dwellings in the major cities had sewage disposal facilities. All municipal sewerage systems are combined systems designed as stormwater and wastewater collectors. There are no sewage treatment plants and most of the networks discharge raw sewage to rivers, irrigation fields or the sea. Widespread use of polluted streams for irrigation creates serious health hazards.

E. Sector Planning

2.07 Water demand in the principal cities is projected to outstrip supply by mid-1980 and projects are underway to expand supply. The Fourth Plan (1976-80) provides for an investment of about LS 2,476.0 million (US\$627.0 million) in the water supply sector; LS 1,552.0 million for the eight public authorities, LS 14.0 million for other municipalities and LS 910.0 million for rural areas. About 55% of the proposed investment program is allocated for the cities of Damascus and Aleppo. The Bank is already assisting the Damascus project (para 2.11). By its involvement in a project outside Damascus the Bank is increasing its impact on the development of financial and institutional policies of the sector. The Aleppo Project is the only other major water supply included in the Fourth Plan. The Government is placing more emphasis on improving the quality and safety of the water supplied by providing longer hours of service, reducing leakages and improving treatment, particularly disinfection.

2.08 Current Government plans give increasing priority to reduction of pollution of major water sources. Pollution control studies are currently being undertaken for the Barada and Orontes Rivers and for the construction of sewage treatment plants in Damascus, Homs and Hama. These studies are being partly financed by IDA under Credit 401-SYR. Similar studies are planned for Aleppo and Lattakia (para 4.09).

2.09 Prior to May 1977, the water authorities and municipalities were dependent on Government finance for most of their capital investment because most water supply tariffs had not been increased for about two decades and consequently, some authorities were not recovering their cash operating expenses. Substantial tariff increases were implemented in May 1977 which should improve the financial performance of the sector. No charges are made for sewerage services.

2.10 A serious constraint on implementing the planned sector program is the shortage of professional and skilled manpower. Two factors contribute to this problem; first, the low salary structure in the public sector compared with the very attractive rewards in the private sector and in neighbouring Arab countries and secondly, the lack of training programs for water supply

and sewerage personnel. Financing provided by the Arab Fund for Economic and Social Development for the Second Damascus Water Supply Project includes an amount for consulting services for the establishment of a water supply and sewerage manpower training center in Syria.

F. Previous Water Supply Projects

2.11 In 1973, IDA agreed to assist in financing a project designed to supply water to Damascus with a credit (401-SYR) in the amount of US\$15.0 million of which US\$13.0 million was to be onlent to Etablissement Public des Eaux de Figeih (EPEF-Damascus Water Supply Authority). In the aftermath of the 1973 events, it became evident that costs would considerably exceed estimates and IDA agreed to a revision of the project description to utilize the credit for urgently required distribution works. In June 1973, the United States Agency for International Development (USAID) agreed to lend US\$48.0 million for the remaining distribution works. In April 1976, the Bank agreed to finance the Damascus supply works needed in order to meet the increased demand. Bank financing for this project (Loan 1241-SYR) in the amount of US\$35.0 million was supplemented by loans from the Arab Fund (US\$41.3 million) and USAID (US\$14.5 million).

2.12 Construction of the distribution works under Credit 401-SYR is proceeding in accordance with the contract schedule with about 50% of the works completed to date. As a result of a leak detection and meter maintenance program being carried out by EPEF, losses and consumption have been reduced so that the increasing number of consumers can be served with the limited production available until completion of the new supply works being built under Loan 1241-SYR. Construction is well underway on the Bank-financed tunnel which is the major component of the supply works. Of considerable concern at the moment is a shortage of key personnel, required by EPEF for project implementation, which has resulted in delays and lack of coordination with other project components being parallel financed by the Arab Fund and USAID. This could seriously affect utilization of Bank-financed components which are proceeding on schedule. EPEF has now decided to advertise in neighboring Arab countries in order to attract the needed staff. There are no restrictions on the salary levels paid to expatriates.

III. THE PROJECT AREA

A. Background

3.01 Aleppo is the principal manufacturing and trading city in northern Syria. The city is strategically located between the Euphrates and the Mediterranean on the ancient trade route from the Far East. The city is built around the citadel, at an elevation of some 400 meters above sea level, and set in a hollow in the hills below the confluence of various small valleys forming the catchment of the Quwaik River. It enjoys a Mediterranean climate with an average annual rainfall of 460 mm.

3.02 In prehistoric times the citadel's defensive site and surrounding agricultural resources gave rise to an early settlement. The city is first mentioned in recorded history at the beginning of the third millenium B.C. for its defense against a group of Semitic conquerors. It played an important part in the many ancient empires that ruled the Middle East and, in 1516, Aleppo was incorporated in the Ottoman Empire and underwent a remarkable commercial expansion which continued until the end of the 18th century. Some of the most beautiful monumental covered bazaars in the East are to be found in Aleppo and date from this period. After the fall of the Ottoman Empire the city formed part of the French mandate and became an industrial center. This development continued after independence and the city today is the principal center for the cotton and other manufacturing industries in Syria.

3.03 The area supplied by EPEA extends beyond the city boundaries and the population, which was growing annually at 3.3% before 1970, increased after that year at 8.2% per annum due to boundary extensions, migration and extensions of the supply area to include neighboring villages. The estimated population in 1976 was 1,027,000 (Annex 2).

B. Water Supply

3.04 Aleppo's source of public water supply is an intake on Lake Assad, a reservoir on the Euphrates River some 80 km east of the city. When the dam was built at Tabqa, the original river intake was submerged and a new intake was built on Lake Assad. The Intake pumps are at some risk because the pump motors are installed at a level over 15 m below the lake top level and could be submerged due to some mishap (para 4.08). Since the construction of Lake Assad the raw water quality has been generally very good although EPEA states that high turbidities have occurred on rare occasions and there have also been seasonal algal infestations. The water is pumped to treatment plants near the source where it is dosed with chemicals, settled, filtered and chlorinated. After gravity-flow through an 82 km aqueduct to the city, the water is refiltered, ozonised and repumped to service reservoirs for supply. The first phase of this system was completed in 1967 and duplication of the initial scheme, undertaken during recent years, should be fully commissioned during 1977. A detailed description of the existing works is in Annex 3 and shown on Maps 12699 and 12722.

3.05 During and since the filling of the reservoir, silt has been deposited to a considerable depth around the Intake rendering the lowest two of the three Intake gates inoperable. It was foreseen in the original design that this silting would occur and that, with full utilization of the reservoir for irrigation, after 15 to 30 years the silt would block the Intake unless corrective measures were taken such as the construction of a barrage or a training wall. Recent measurements of the depths of silt show that the rate of silting has subsided in the last twelve months. EPEA has agreed to engage consultants to carry out detailed studies to determine the extent of the problem (para 4.08). The Government has agreed to take adequate measures to prolong the life of the Intake.

3.06 The bulk of the area is served from two groups of service reservoirs feeding a major ring main around the old city, pressures being maintained by balancing reservoirs. The extensive high level areas surrounding the old city are served by a number of separate zones each with its own repumping station and water tower. In 1975 there were some 650 km of distribution mains of diameters up to 400 mm and about 110,000 connections serving some 90% of the population in the area to be supplied, including some outlying villages. About 100,000 people without a piped supply live in illegal dwellings in the elevated areas on the outskirts of the city. In November 1976, the Governor of Aleppo authorized EPEA to provide piped supplies and house-connections to all these houses and the expansion has already commenced. The service levels for urban poor residing within the city of Aleppo is very satisfactory.

3.07 Consumption in 1975 was 83 lcd and is expected to increase immediately to 90 lcd when the present constraints are removed in 1977. Supplies to many parts of the city have been shut off in rotation for long periods each day thus producing serious health hazards from back-syphoning. This situation should improve with the completion of the second phase works in 1977, but with the expected growth of demand, the supply will again become inadequate by 1981.

C. Sewerage

3.08 The Public Works Department of the Municipality of Aleppo is responsible for the operation and administration of the combined sewerage system in addition to solid waste disposal and roads. No sewerage charges are levied and the system is financed from the municipal budget which is in turn subsidized by central Government. The system serves approximately 80% of the municipal population and, of the remainder, 10% rely on septic tanks. Most of the system was constructed in the last 60 years, but the main interceptors were built in the 1940's. Surcharging occurs frequently as a result of the rapid development of the city.

3.09 The municipality has no sewer maintenance program or mechanical equipment for sewer cleaning and maintenance and consequently the system is in poor condition. All flow is by gravity into three interceptors which discharge into the Quwaik River. The outfalls are surrounded by small agricultural plots which utilize the river flow for contact irrigation. During periods of very low flow, virtually undiluted raw sewage is used for irrigation creating serious health problems which periodically reach epidemic proportions. Accurate health statistics are difficult to obtain because cases are not always reported by private practitioners. However, the Aleppo Health Directorate estimates that in 1972 there were as many as 200 cases of cholera, 3,000 cases of typhoid and 100 cases of poliomyelitis. The number of cases of water-related diseases for 1975 was: dysentery 185, infectious hepatitis 186, typhoid 207. In Lattakia, there is a need to relocate the present sewage outfalls because of a proposed port expansion, and to extend the system to serve planned tourist and industrial development areas. MHU has begun selecting consultants for the feasibility studies and financial assistance for these studies is included in the project (para 4.09).

IV. THE PROJECT

A. Objectives

4.01 The objectives of the water supply component of the project are: (a) to extend the water source and transmission facilities to meet increasing demands in Aleppo; (b) to reinforce the distribution system and thereby improve minimum pressures and reduce risks of pollution within the system; (c) to extend the supply into fringe areas of the city occupied mainly by the urban poor; and (d) to provide technical assistance to improve the project implementation and operational capacity of EPEA. The objectives of the other components of the project are to provide technical assistance for: (a) preparation of sewerage and sewage treatment projects for Aleppo and Lattakia; (b) improving construction sector planning capabilities in the State Planning Commission; and (c) improving administration in the public construction enterprises.

B. Description

4.02 Project details are given in Annex 4 and the layout of the proposed works is shown on Maps 12699 and 12722. The project consists of:

(a) Water Supply Component

- (i) an aqueduct about 75 km long to deliver 220,000 m³/d; and pumping mains about 12.5 km from the source to deliver 110,000 m³/d;
- (ii) pumping facilities at Lake Assad to produce 220,000 m³/d and extensions to other pumping and treatment facilities at existing stations to produce an additional 110,000 m³/d with provision for increase to 220,000 m³/d in a subsequent stage;
- (iii) service reservoirs of total capacity of about 100,000 m³;
- (iv) distribution mains to serve the high level area at present occupied by urban poor and where future growth is planned;
- (v) renewals, ancillary buildings and equipment comprising additional and replacement vehicles, auxiliary store buildings, attendants' houses, administration offices and accounting equipment; and
- (vi) consultants' services and training.

(b) Aleppo and Lattakia Sewerage Studies

Engineering services for studies of improvements to the sewer systems and the provision of sewage treatment and disposal for Aleppo and Lattakia.

(c) Technical Assistance to the State Planning Commission and to Public Construction Enterprises

- (i) Consulting services to assist the Directorate of Planning for Building and Construction within the State Planning Commission (SPC) to establish a system to collect, monitor and analyze data relating to the country's total construction and building resources.
- (ii) Provision of technical assistance in cost accounting, equipment repair and warehousing for the large Syrian public construction enterprises.

C. Cost Estimates

4.03 Cost estimates for the project are provided in detail in Annex 5 and summarized below.

(a) <u>Water Supply</u> <u>Component</u>	LS (Million)			US\$ (Million)			<u>% of Proj-</u> <u>ect Cost</u>
	<u>Local</u>	<u>Foreign</u>	<u>Total</u>	<u>Local</u>	<u>Foreign</u>	<u>Total</u>	
Aqueduct and Pumping Mains	109.4	62.8	172.2	27.7	15.9	43.6	37.3
Pumping Stations and Telemetry	3.9	37.5	41.4	1.0	9.5	10.5	9.2
Treatment Plant	10.6	10.3	20.9	2.7	2.6	5.3	4.4
Distribution Facilities	17.1	32.5	49.6	4.3	8.2	12.5	10.7
Ancillary Buildings and Equipments	4.8	2.6	7.4	1.2	0.7	1.9	1.7
Consultants	5.2	15.2	20.4	1.3	3.8	5.1	4.3
Training	<u>0.8</u>	<u>0.8</u>	<u>1.6</u>	<u>0.3</u>	<u>0.2</u>	<u>0.5</u>	<u>0.4</u>
<u>Sub-total</u> (Base Cost)	151.8	161.7	313.5	38.5	40.9	79.4	68.0
Physical Contingencies 15%	<u>21.8</u>	<u>25.2</u>	<u>47.0</u>	<u>5.5</u>	<u>6.4</u>	<u>11.9</u>	<u>10.2</u>
<u>Sub-total</u>	173.6	186.9	360.5	44.0	47.3	91.3	78.2
Price Contingencies	<u>55.7</u>	<u>38.0</u>	<u>93.7</u>	<u>14.1</u>	<u>9.6</u>	<u>23.7</u>	<u>20.2</u>
<u>Sub-total Water Supply Component</u>	229.3	224.9	454.2	58.1	56.9	115.0	98.4
(b) <u>Aleppo and Lattakia Sewerage Studies</u>	1.0	4.9	5.9	0.2	1.3	1.5	1.3
(c) <u>Technical Assistance</u>	<u>0.2</u>	<u>1.0</u>	<u>1.2</u>	<u>0.1</u>	<u>0.2</u>	<u>0.3</u>	<u>0.3</u>
<u>PROJECT TOTAL</u>	<u>230.5</u>	<u>230.8</u>	<u>461.3</u>	<u>58.4</u>	<u>58.4</u>	<u>116.8</u>	<u>100.0</u>

4.04 The cost estimates reflect conditions expected to prevail at June 1977 and are reasonable. The major element of cost is the aqueduct, the estimated cost of which is based on design and construction methods similar to those for the previous aqueducts. The project estimates have been based on current unit costs and the works being constructed by local contractors. A physical contingency allowance of 15% has been added to cover unforeseen conditions which may arise during the detailed design and construction period.

4.05 Allowances have been made for future price escalation as follows:

	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
Imported Equipment	8	8	8	7	7
Local Civil Construction	15	12	12	10	10

The price increases for equipment are adequate and in line with the Bank's recommendations. With the rapid economic developments in Syria and the political conditions in recent years, there have been exceptionally high annual increases in local unit prices (20% average for three years 1973-75). The rate of increase is expected to moderate in view of the Government's revisions to the Fourth Plan and the price increases that have been allowed are reasonable.

4.06 During the project construction period, EPEA would also undertake expansion of the secondary distribution facilities at an estimated cost of LS 26.0 million.

D. Implementation

Administration

4.07 Project implementation will be carried out by EPEA with the assistance of consultants. To expedite the implementation of the current works, a project committee, under the Governor of Aleppo, has been established by a Presidential Decree for a period ending January 1978. The decisions of this committee on procurement, execution and commissioning are exempted from compliance with all Government regulations, except those relating to salaries of employees. The Government has agreed to extend the mandate of the committee to cover the project.

Status of Engineering

4.08 The project has been defined in sufficient detail to enable reasonable cost estimates to be formulated, but additional studies are required to ensure that the most appropriate construction techniques are selected for constructing the individual elements. It is expected that refinements, if any, would result in lower costs than estimated. EPEA has invited proposals from engineering consultants to undertake the following works: (a) a review of the various techniques of constructing the transmission system; (b) a review of water treatment requirements in the light of changes in water quality since the construction of Lake Assad; (c) a study of the silt deposition around the Intake (para 3.05); (d) a study of protection requirements for the intake pump motors (para 3.04); (e) optimization of proposed distribution system, and extension into fringe areas; (f) the preparation of detailed design, specifications and bid documents and bid evaluation and

supervision of construction. A total of 800 man/months of consulting services is included in this project component reflecting EPEA's difficulty in recruiting staff (para 5.04). EPEA has agreed to select consultants prior to July 31, 1977. A condition of effectiveness is that the consultants have commenced work on studies (a) to (d) inclusive.

4.09 The Government has requested Bank assistance to undertake feasibility studies for the improvement of sewerage facilities in Aleppo and Lattakia and US\$1.25 million has been included in the loan for this purpose. Engineering consultants will be appointed by the Government to advise the MHU and the municipalities on sewage collection, treatment and disposal. Draft terms of reference are in Annex 6 and involve about 200 man/months of consulting services.

4.10 The Government has recently established a Directorate of Planning for Building and Construction within SPC to collect data on the construction resources in the country. The Directorate will also collect data on construction costs to enable it to provide a satisfactory basis for price escalation formula on construction contracts. Lack of appropriate price escalation clauses is one of the causes of unsatisfactory tenders for Government and Bank's contract in Syria in recent years. The Government will retain experts to assist SPC to collect and analyze data on construction and building material resources. The Government has also established a number of semi-autonomous public construction and building companies to carry out a portion of the country's public development program. The Government will retain experts to advise the public construction enterprises on cost accounting, heavy equipment repair and servicing, inventory control and warehousing. Draft terms of reference are in Annex 7 and involved about 40 man/months of consulting services. Financial assistance of US\$0.25 million, to cover the foreign exchange cost of the above studies, is included in the proposed loan.

Procurement

4.11 Contracts for civil works and equipment estimated to cost more than US\$300,000, to be financed from the proposed Bank loan, will be awarded on the basis of international bidding in accordance with the Bank's guidelines. Other contracts, not to exceed in aggregate US\$5.0 million will be awarded on the basis of local competitive procurement procedures acceptable to the Bank. All major items of equipment and pipes are expected to be imported. Domestic preference of 15%, or the customs duty, whichever is lower, will be allowed to local manufacturers on contracts procured under ICB.

4.12 Bidders for civil works contracts are expected to include national construction enterprises which under their charter, are exempt from normal supervision by the employer. The Government has agreed that, for a national construction enterprise to be qualified for the bidding, this provision in its charter would be waived. In addition under Syrian legislation public construction enterprises are exempt from posting bid bonds and performance bonds. Agreement has been reached with the Government that tender calls

will require bidders to state the cost of bid bonds and performance bonds as separate items and the cost of these will be deducted from the amount of the tenders when comparing tenders which include those from public enterprises.

Construction Schedule

4.13 The proposed program of planning, design, procurement and construction is shown in Annex 8. Apart from the supply and installation of additional Intake pumps and controls towards the end of 1977, the delivery of materials would begin in the latter part of 1978 and most of the construction would occur during 1979 and 1980, the project would be substantially completed in 1981. During negotiations the program was reviewed and an understanding was reached with EPEA on critical dates.

Land Acquisition

4.14 The land and wayleaves for the aqueduct and other works are already owned by EPEA and where the mains are to be laid within highway limits, no wayleaves are required.

Monitoring Criteria

4.15 The project will be monitored by performance and progress indicators which will also be used in EPEA's control operations. A list of key indicators, shown in Annex 9, was reviewed during negotiations. The Bank received assurances that EPEA will establish and maintain such statistical and other systems as may be necessary to produce the agreed indicators and will report the relevant information to the Bank within three months of the end of each quarter. Reporting would continue for about five years after project completion.

E. Disbursements

4.16 The proposed Bank loan of US\$50.0 million will be disbursed towards the cost of the project elements as follows:

(a) Water Supply Component

- | | |
|--|--|
| (i) <u>Equipment and materials</u>
(US\$25.00 million) | 100% of the C.I.F. cost of directly imported equipment, pipes and materials, 100% of the ex-factory cost of locally manufactured equipment, pipes and materials and 70% of the cost of locally procured imported equipment, pipes and materials. |
| (ii) <u>Civil Works</u>
(US\$14.10 million) | 25% of the cost of civil works. |
| (iii) <u>Consultants Services</u>
(US\$3.75 million) | 100% of the foreign exchange cost of consultant's services. |
| (iv) <u>Specialized Training</u>
(US\$0.25 million) | 100% of the foreign exchange costs of training for EPEA personnel. |
| (v) <u>Unallocated</u>
(US\$5.40 million) | For physical contingencies. |
| (b) <u>Aleppo and Lattakia Sewerage Studies</u>
(US\$1.25 million) | 100% of the foreign exchange cost of consultants' services. |
| (c) <u>Technical Assistance to Ministry of Planning and to Public Construction Enterprises</u>
(US\$0.25 million) | 100% of the foreign exchange cost of consultants' services. |

The estimated schedule of disbursements is in Annex 10. On completion of the project, any unused balance of the loan would be cancelled if there were no similar works to which they could be applied.

G. Environmental Impacts

4.17 The volume of water to be withdrawn from the Euphrates is not significant relative to total flows. The volume of sewage discharged to the Quwaik River under the project will be increased but the Government is taking measures to provide for treatment of this sewage, beginning with studies financed under the project.

V. THE PROJECT ENTITY

A. Background

5.01 Regulations governing the establishment of public authorities and corporations in Syria were enacted under Government Decree No. 18 of February 1974 (Annex 1). This Decree formalizes the proceedings for establishing public institutions and lays down general rules regarding the appointment of directors, the authority and responsibility of the Government and the Board of Directors and general administrative procedures. Decree No. 18 also specifies that each authority should be established under a separate decree that contains specific regulations pertaining to that authority. Accordingly, Etablissement Public des Eaux d'Alep (EPEA) was established in 1975 by Decree No. 2410 as a semi-autonomous authority responsible for the water supply of the city of Aleppo and villages near the transmission pipeline from the Euphrates River (Annex 1). This Decree supersedes Decree No. 237 of 1947 which established the original Service des Eaux d'Alep.

B. Organization and Management

5.02 EPEA's organization chart is in Annex 11. As provided by Decree No. 18, control of EPEA is vested in a six-member Board of Directors composed of the President/Director General, four department managers and one representative of the workers. The Minister of Housing and Utilities acts as chairman of the Board when the annual reports are reviewed, and when important issues are under consideration. In practice, all important decisions must, before being implemented, be confirmed by a ministerial order issued by the Prime Minister's office. In addition the Minister of Housing and Utilities must approve various Board decisions relating to organization of the authority, procurement and personnel matters. Despite this ministerial control system, EPEA has a substantial amount of independence in its day-to-day operations.

5.03 The Director General is responsible for the execution of the Board's decisions and reporting directly to him are five experienced department managers. The total staff employed is 756 including 16 engineers, 15 other professional staff, 725 skilled and unskilled workers. EPEA has been well managed and has competent and experienced operating staff, but specialized training is required particularly in system design and treatment plant operation (para 5.09).

5.04 EPEA's annual budget including manpower levels must be approved by the Government, but the Director General can hire temporary workers, for a period of less than six months. During the last five years, EPEA was unable to fill many vacancies due to the low public sector salary levels which are substantially less than those in the private sector and neighboring Arab countries. Resignations and transfers of all staff in the public sector must be approved by the Government and this approval is difficult to obtain. As a

result, EPEA's annual staff turnover is only 1.5%, but morale of the staff is bound to be affected by this restriction. Assurances were obtained that the Government will permit EPEA to be adequately staffed at all times with experienced and qualified personnel.

5.05 The administrative, clerical and design staff are housed in numerous inadequate office buildings throughout the city with resulting lack of communications and inefficiency. The project provides for the construction of a new office building for EPEA.

C. Operations

5.06 During recent years EPEA staff has been heavily engaged in the construction of the second phase supply works. Working under heavy pressure because of lack of staff, they have managed to install temporary pumps and treatment facilities and minimize the supply interruptions. Because the staff has been over-stretched in meeting their primary objective of providing water, it is understandable that there has been some deficiency in updating records and forward planning of the new works but, in the circumstances, their performance has been very good.

D. Accounts

5.07 EPEA's accounts are maintained on a commercial basis. The classification and grouping of the accounts are tailored to meet the requirements of the Syrian Unified Accounting System. An outline of this system was issued in 1974, and details of the accounts for the water supply authorities were established by a committee of representatives of the Ministry of Finance and the Water authorities. This system, which is very detailed, has been satisfactorily applied to EPEA's historical accounts. EPEA's accounting staff is competent and the accounts and supplementary statistics, which are kept manually, are up-to-date. EPEA is in a position to develop a modern management accounting and budgetary control system and provision for staff training in this field is included in the project (para 5.09).

E. Billing and Collection

5.08 The billing and collection of customers' accounts is satisfactory. All connections are metered and bills are prepared on a two-month cycle. An effective disconnection system for non-payment is in operation. Domestic accounts receivable at December 31, 1976 represent 2-1/2 months of water sales, but official department accounts are outstanding for four months. In 1977 the Government introduced new regulations requiring Government departments to pay their accounts promptly and EPEA's receivables for official departments have already been reduced. EPEA billing machines are in need of replacement and funds are provided in the Bank's loan for machines for billing and accounting work.

F. Training

5.09 In order to upgrade EPEA's professional staff, training is required in distribution system analysis, treatment and water quality control, management accounting and budgetary control, electronic accounting and management. At present, there are no suitable facilities for this training in Syria and provision is made in the Bank loan for external training. EPEA has agreed to submit a training program to the Bank for comment prior to June 30, 1978.

G. Audit

5.10 EPEA accounts are audited by the Ministry of Finance auditors to ensure compliance with Government regulations. The audit for 1975 had not been started in November 1976, and the final audit certificates for the previous five years have not yet been issued. In 1977 the Ministry of Finance assigned an auditor full time to audit the accounts of EPEA. The internal audit unit is very weak and needs upgrading. EPEA agreed to have its accounts audited annually by independent auditors acceptable to the Bank and to furnish the auditor's report not later than four months after the end of each year.

H. Insurance

5.11 EPEA has insurance coverage for vehicles. Private insurance for third party claims does not exist in the Syrian Arab Republic. EPEA has agreed to make provisions satisfactory to the Bank for insurance against such risk and in such amounts as shall be consistent with appropriate practice.

VI. FINANCE

A. Past Performance and Present Financial Position

6.01 EPEA has an impressive financial record and has generated a substantial proportion of its investment requirements. The total cost of the first phase project completed in 1967 was LS 67.0 million of which LS 42.0 million or 63% was provided from internal cash. The cost of the second phase project to December 1976 was LS 124.0 million; LS 45.0 million or 36% was provided by EPEA. The deterioration in the financial performance is due to rapid inflation.

6.02 EPEA's income statements, cash flow statements and balance sheets for the period 1973-76, together with projections of these annual statements for the period 1977-84, are shown in Annexes 12, 13 and 14. The income statements show an adverse trend in the operating ratio from 49% in 1973 to about 66% in

1976. This is due to the substantial increase in cash operating costs, mainly as a result of inflation. In 1976 cash operating costs increased by 53% over the previous year, while the increase in revenue due to growth in water sales was only 10%. As a result, the rate of return on average net fixed assets decreased from 12.7% in 1975 to 7.7% in 1976.

6.03 EPEA's debt/equity ratio increased from 30:70 in 1973 to 49:51 in 1976. This was caused by the increase in borrowing from the Public Debt Fund (PDF) to finance the second phase supply from the Euphrates, due to be completed in 1977. At the end of 1976 total PDF loans, EPEA's only long-term borrowings, amounted to LS 80.0 million. According to the Syrian law, EPEA should, after meeting operating costs and investment requirements transfer its cash surplus to the PDF. In practice, EPEA has had no cash surplus in the past years as all cash generated has been utilized for internal financing.

B. Financing Plan

6.04 The following table shows EPEA's estimated financing requirement and the sources of funds for the construction period 1978-82.

	FY 1978-82		%
	<u>LS Million</u>	<u>US\$ Million</u>	
<u>Requirements</u>			
Water Supply Component (the project) /1	454.2	115.0	95
Secondary Distribution System	<u>26.0</u>	<u>6.6</u>	<u>5</u>
Total	<u>480.2</u>	<u>121.6</u>	<u>100</u>
<u>Sources</u>			
Proposed IBRD Loan	191.6	48.5	40
Gross Cash Generation	167.5		
Less Debt Service and Increase in Working Capital	<u>85.5</u>		
Net Cash Generation	82.0	20.8	17
Government Contribution	<u>206.6</u>	<u>52.3</u>	<u>43</u>
Total	<u>480.2</u>	<u>121.6</u>	<u>100</u>

/1 Includes LS 5.9 million expenditure in 1977.

6.05 EPEA's program of work during the period 1978-82 is estimated to cost LS 480.2 million (US\$121.6 million) of which LS 454.2 million (US\$115.0 million) is for the proposed water supply component and LS 26.0 million

(US\$6.6 million) for EPEA's expansion of the secondary distribution system during the project construction period. The proposed Bank loan of US\$48.5 million (LS 191.6 million) for the water supply component will provide 85% of the foreign exchange cost of US\$56.9 million or 42% of the project component costs.

6.06 The balance of the financial requirement of LS 288.6 million (US\$73.1 million) will be provided by internal cash generation of LS 82.0 million and a Government equity contribution of LS 206.6 million. The Government agreed to provide EPEA with the balance of its financing requirement including cost overruns.

C. Tariffs

6.07 Details of the new tariff structure introduced in May 1977 are shown in Annex 16. Applicants for a new supply are required to purchase in advance the right to a fixed allowance in perpetuity. Total water allowances for water right holders represented less than 5% of the total water sales during the past years. Consumption in excess of the free allowance is charged at LS 0.60/m³ (US\$0.15/m³) for household and LS 0.75/m³ (US\$0.19/m³) for non-household consumption. The new tariffs represents an increase of about 100% on the former scale which was introduced in 1959. Even though there is no progression in the new tariff, this should not affect the access of poorer members of the community to the service as the price of water is still low.

6.08 In February 1977, a new scale of fixed charges was introduced which was estimated to yield about 42% of EPEA's future revenue. The cost of a connection for a small household ranges from LS 590.0 to LS 790.0 (US\$150-200). However, poorer consumers can arrange with EPEA to pay the major part of these charges by installments over a four-year period. During negotiations, EPEA's representative stated that these charges are not a deterrent to lower income consumers as they have achieved a 100% connection during a recent expansion of the system into a low income area of illegal dwellings. The Bank stressed the importance of introducing a progressive tariff structure when future tariff changes are required.

6.09 To secure a reasonable contribution to capital expansion from internal cash generation during the project construction period, agreement was reached that EPEA will set rates at whichever is the higher of the following two levels:

- (i) rates at a level not below LS 0.60/m³ for metered water sold for household consumption and LS 0.75/m³ for meter water sold for non-household consumption; or
- (ii) rates which, together with revenue from other charges, are adequate to cover operating expenses (excluding depreciation), debt service and increased working capital, will provide revenue sufficient to finance each year during the period 1978-82 not less than 15%, and beginning with the year 1983

to finance each year not less than 35%, of the average cost of investment during each consecutive three-year period comprising an actual and two forecast years.

According to the financial projections a further rate increase will not be required until 1982.

D. Future Operations and Financial Position

6.10 The assumptions used in preparation of the financial projections are in Annex 15. The projected operating expenses, which were LS 14.4 million in 1976, are expected to double by 1978 and quadruple by 1984. With the completion of the ongoing works and the proposed project, the net fixed assets are projected to increase to LS 598.7 million in 1982, a twelve-fold increase on 1976 level.

6.11 EPEA's rate of return on average net fixed assets is projected to increase from 7.7% in 1976 to 12.2% in 1977 due to increased tariffs. The rate of return will be maintained at about 12% during the project construction period and will decline to 2.9% in 1984 as a result of transferring the project work to fixed assets. Utilization of the transmission system, the major element of the project, is projected to increase from 33% in 1983 to full utilization in 1991. During this eight-year period relatively small investment in pumps and treatment will be required for full utilization, and therefore the rate of return should steadily increase.

6.12 The debt equity ratio at the end of 1982 is projected at 41:59. The debt service coverage is projected at 1.1 in 1983 rising to 1.2 in 1984. EPEA agreed not to incur any further loans, without Bank's consent, unless its net cash generation, before depreciation and interest, exceeds 1.5 times its debt service in any future year, including debt service on the amount to be borrowed.

VII. JUSTIFICATION

A. Demand

7.01 Aleppo has experienced severe restrictions in supply for the past three years because of rapidly rising demands and delay in commissioning of current construction works. Projected future demands require the commissioning of additional works by 1981 as proposed in the project to avoid reimposition of supply restrictions. Failure to proceed with the project will restrict economic development of the Aleppo region. The annual growth in population of the area served is projected at 3.3%. This rate is conservative when compared with the abnormal 8.2% annual growth during 1970-76 (Annex 2). Because of the recent supply constraints, per capita consumption is low at about 84

lcd for 1976. Per capita consumption is conservatively projected to increase at 3% a year to reach about 113 lcd in 1984. The project will extend the water supply system into the fringe areas of the city presently occupied by an estimated 100,000 urban poor.

B. Least-Cost Solution

7.02 The only proven major source of water available for Aleppo is from Lake Assad on the Euphrates River. The project cost estimates are based on the duplication of existing supply works with staged construction where appropriate and extensions to the main distribution system. EPEA is engaging engineering consultants to review the various techniques for constructing the transmission aqueduct so that bid documents will be based on the least-cost construction method (para 4.08). Consultants will also assist EPEA in the analysis of the existing distribution system to optimize the design of the reinforcement and extensions to outlying areas.

C. Economic Analysis

7.03 There are a variety of benefits associated with the provision of a reliable and safe water supply the most important of which are health related. The health benefits would be partially revealed through medical cost saving, a general improvement in individual well being and a cost saving to, or increased productivity of, business enterprises. Unfortunately, statistics to support calculations of such benefits are not available. If incremental water supply revenues from the project at present tariffs are used as a minimal measure of economic benefits, the project would have an internal economic rate of return of 10% (Annex 17).

7.04 The problems of measurement of water supply benefits highlight the need to formulate a tariff policy which reflects the true cost of the service. If the price of water is fixed at a level which approximates the long-term marginal cost of supplying the service, economic efficiency will be attained from a resource allocation point of view.

7.05 The long-term marginal cost of water supply in Aleppo is estimated to be approximately LS 1.14/m³ at a discount rate of 10% (Annex 17) which is estimated to be the opportunity cost of capital in Syria. The average revenue of LS 1.1/m³, resulting from the new charges introduced in 1977, is thus equal to the long-term marginal cost.

VIII. AGREEMENTS REACHED AND RECOMMENDATIONS

8.01 During negotiations, agreement was reached on various issues referred to in Chapters III to VI of this report, including the following matters of particular significance:

- (a) The Government has agreed to take adequate measures to prolong the life of the Intake (para 3.05).
- (b) EPEA will set:
 - (i) rates at a level not below LS0.60/m³ for metered water sold for household consumption and LS 0.75/m³ for metered water sold for non-household consumption; or
 - (ii) rates which, together with revenue from other charges, are adequate to cover operating expenses (excluding depreciation), debt service and increased working capital, will provide revenue sufficient to finance each year during the period 1978-82 not less than 15%, and beginning with the year 1983 to finance each year not less than 35%, of the average cost of investment during each consecutive three-year period comprising an actual and two forecast years.

8.02 Before the loan is declared effective, consultants shall have commenced work on a number of studies (para 4.08).

8.03 Agreement having been reached on the issues set forth in this report, the project is suitable for a Bank loan to the Government of the Syrian Arab Republic of US\$50.0 million for a period of 17 years including three and a half years of grace at current Bank interest rates. US\$48.5 million of the loan to be onlent to Etablissement Public des Eaux d'Alep (EPEA) and the balance of US\$1.5 million to be retained by the Government for the sewerage studies and technical assistance.

June 1, 1977

APPRAISAL OF
AN ALEPPO WATER SUPPLY PROJECT
SYRIAN ARAB REPUBLIC

Summary of Legislation

There are two Government decrees which control EPEA's general activities, Decree No. 18 of February 15, 1974, complemented by Decree No. 2410 of July 12, 1975. The following are summaries of the principal elements of each of these decrees.

A. Decree No. 18, February 15, 1974

Law Governing Establishments, Public Societies and Companies

1. The following articles of the Decree affect EPEA which is considered to be an "Etablissement Public".
2. In order to achieve its objectives the establishment shall apply the various appropriate methods while acting within the limits of the laws and regulations currently in effect. It may:
 - (i) execute the conditions of the above Decree which created the establishment;
 - (ii) create, join, divide or eliminate economic units;
 - (iii) create branches or interior centers or eliminate same;
 - (iv) grant loans to public societies or enterprises governed by this Decree and guarantee loans which are granted to them; and
 - (v) enter into loan agreement with the State or financial and banking establishments local or foreign, without prejudice to the rights of the State planning authority by virtue of the regulations presently in force.
3. It is administered by a director general (named by a decree which establishes his salary and indemnities) and an administrative council whose members, chosen in accordance with the laws and regulations in force, shall include:

- (i) the director general (as president);
- (ii) five directors from within the establishment; and
- (iii) a workers' representative who is an executive member of the trade union concerned and who shall be designated by the executive of the General Federation.

The president and directors shall be confirmed in their positions by ministerial order.

4. By-laws related to the following matters shall be promulgated by Decree: finances, accounting, procurement, financial incentives, and fundamental principles to be followed in arbitration and transactions.
5. The following matters shall be administered by ministerial order:
 - (i) the administrative organization and responsibilities;
 - (ii) regulations related to supplies, distribution, storage and public relations;
 - (iii) transfer of personnel between establishments under the authority of the same ministry and contracts with experts and technicians; and
 - (iv) nomination of one of the directors as deputy director general.
6. The administrative council is the authority responsible for the adoption of the policy to be followed by the establishment in order to achieve the objectives for which it was created. It shall
 - (i) establish a draft of the essential principles and by-laws to be promulgated by the appropriate authority;
 - (ii) establish standards;
 - (iii) decide policies and production, export, sales, operations, commissions and income objectives in order to meet the goals decided by the State;
 - (iv) establish detailed plans and work programs to guarantee production, ensure quality control and the economic use of resources and to ensure increased productivity in order to meet the needs of the establishment;

- (v) establish the annual plan for the establishment for which it is responsible, including:
 - (a) operations
 - (b) production
 - (c) sales
 - (d) labor
 - (e) costs and revenues
 - (f) budget estimates;
 - (vi) assure coordination between the public societies and the establishment for which it is responsible and act in a manner to reduce differences between them;
 - (vii) study the regular reports presented to it on the operations of the establishment and its financial situation and take any appropriate necessary measures; and
 - (viii) study all matters which the Minister or director general deems useful to submit for its consideration which is relevant to the operations of the Authority.
7. The administrative council presided over by the Minister shall:
- (i) approve the annual plan of the establishment within the framework of the five-year plan and without prejudice to the powers of the Ministry of Plan;
 - (ii) approve the annual financial reports;
 - (iii) propose an increase or decrease of the authorized capital of the establishment. (A final decision on this shall be taken by the superior planning council); and
 - (iv) create, join, divide or suppress economic units.
8. The administrative council may constitute its members into one or more commissions to which it may provisionally delegate its powers; it may retain the services of such experts as it may deem necessary.
9. The director general has the following functions:
- (i) to execute the decision of the administrative council;
 - (ii) to manage the "Etablissement Public" and evolve work methods, to reinforce management and to delegate, name, advance or transfer staff in accordance with the approved annual plan for labor after considering the available credits in the budget;

- (iii) supervise the works of the Establishment;
 - (iv) award bonuses within the limits of the approved budget and impose fines on the personnel; and
 - (v) delegate certain of his functions to the directors.
10. Its capital shall be composed of:
- (i) shares owned by the State;
 - (ii) state equity investments;
 - (iii) holdings and related investments; and
 - (iv) other sources fixed by the establishing Decree.
11. Financial resources shall be composed of:
- (i) its net profits;
 - (ii) reserve funds and depreciation;
 - (iii) borrowings and credit facilities;
 - (iv) State credits; and
 - (v) special revenues from its activities or services provided to third parties.
12. It shall invest its (financial) resources in:
- (i) financing of its plans and covering its expenses and payments required by the nature of the tasks assigned to it; and
 - (ii) deposit of the excess of its revenues to the treasury of the Public Debt Fund.
13. (a) The accounting system shall conform to the principles of commercial and industrial accounting and its budget shall be established on the same principles.
- (b) The assets shall be considered as the property of the State with the exception of assets which are designated by law to the public use.
 - (c) It shall have the right of expropriation to house its employees and economic units in conformity with the law governing expropriation.

B. Decree No. 2410, July 12, 1975

Applying Decree No. 18 of 1974 to "Etablissement des Public des Eaux d'Alep" (EPEA)

1. The name of Aleppo Water Authority shall be changed from "Service des Eaux D'Alep" (SEA) to "Etablissement Public des Eaux D'Alep" (EPEA). EPEA shall enjoy all the authorities and be charged with all the responsibilities of SEA.
2. The dispositions of Decree No. 18 apply to EPEA which shall be attached to the Ministry of Housing and Utilities.
3. As stated in Article No. 1 of Decree 2780 of December 15, 1954 and in accordance with SEA's charter which was issued by Decree No. 327 of May 29, 1947, EPEA is charged with the supply of water from the Euphrates source or any other and the distribution of this water within the administrative limits of the city of Aleppo and the villages along the water transmission line between the Euphrates and Aleppo.
4. EPEA's capital is fixed at LS 75.0 million covered by
 - (i) funds contributed by the State, and
 - (ii) its holdings.
5. All laws and regulations presently in force related to EPEA staff shall continue to apply to them.
6. All laws, by-laws and regulations related to EPEA not in conflict with Decree No. 18 of February 15, 1974 shall continue to apply to it.

June 1977

APPRAISAL OF
AN ALEPPO WATER SUPPLY PROJECT
SYRIAN ARAB REPUBLIC

Forecasts of Population, Connections, Consumption and Production

A. Population

1. Before 1970 the population served by EPEA was increasing at an average annual rate of 3.3%, but during the period 1970 to 1976 at the very high average rate of 8.2% a year (i.e. from 640,000 in 1970 to 1,027,000) in 1976. This growth in population served is attributed to the following:

- (i) an increase in the population of the city of Aleppo at a high rate of about 6.2% annually from 640,000 in 1970 (census figure) to 867,000 in 1976 (sample estimate by the Bureau of Statistics), the increase being due partly to migration from outlying villages and partly to expansion of city boundaries;
- (ii) an expansion in the population served to include residents of illegal settlements that took place outside the city limits during the period 1970-76; and
- (iii) the supply to certain villages along the transmission line between the water intake and the city of Aleppo, the total population of which was estimated in 1976 at 60,000.

2. A particular example of the migration is shown by the fall in total population of the villages of Bab and Sephire from 90,000 in 1970 to 30,000 in 1976.

3. The future rate of growth will depend on population movements which are influenced by job opportunities. The Government's new agricultural schemes and the improvements in social services in the rural areas outside Aleppo could reduce substantially the future migration to the city. Accordingly, an annual growth of 3.3% for the population served by EPEA, reflecting only the previous natural growth of population, has been assumed for projections in the years 1977-2000 (see Attachments 1 and 2).

B. Connections

4. The policy of EPEA has been to provide direct service to as many consumers as possible and also to provide for a separate metered connection for each dwelling unit (see Attachment 3). Almost all the properties in the old city of Aleppo have direct connections, but there are some properties taking supplies by extensions from neighbors' connections which avoids the

official connection charges. To discourage further migration from villages to the city the population of the illegal settlements, which is at present served by water vendors, was not connected.

5. Recently (1976) the Government decided that these settlements should be provided with all services and EPEA is expected to provide between 1977 and 1981 direct connections wherever feasible or otherwise with public taps within reasonable distance. The municipality of Aleppo will meet the cost of water provided from the public taps.

C. Past Trends of Production and Consumption

6. During the period 1972-75 domestic consumption averaged 78% of total water consumed (Attachments 1 and 4). Average per capita water consumption of 83 lcd was low bearing in mind that 90% of the consumers were connected. This was mainly due to constraints in the supply resulting from inadequate production facilities.

7. During the period 1972-75, peak monthly (and weekly) consumptions were about 20% higher than the average (Attachment 5). An increased production of 25,000 m³/d has been achieved by overloading treatment plant, installing temporary pumps to enable more water to be taken from Lake Assad and, additionally, by taking groundwater supplies from private sources which have now as a result been overpumped.

8. Water losses during 1972-75 were about 30% of water produced from Stations II and about 24% of water pumped into the city.

D. Future Consumption

9. A permanent additional supply of 90,000 m³/d of water is expected to be made available in 1977. As a result, the average per capita consumption is expected to increase gradually from 83 lcd in 1975 to 102 lcd in 1981.

10. The number per household served by a direct connection is assumed to decline from 8 persons in 1976 to 6.4 in 1984 and the population directly connected is projected to increase from 90% of total population in area served to about 97% during the same period. Average per capita consumption is projected to reach 113 lcd in 1984 and to continue on an increasing trend to reach 200 lcd in the year 2000. This figure corresponds closely to that derived from the assumed trends for average consumption (excluding new industry) and population based on historic rate.

11. Industry at present utilizes groundwater from their own wells for processing purposes and water taken from EPEA is used for domestic purposes only. A large industrial estate is now nearing completion which will depend upon EPEA for all water requirements. Industrial consumption, which is now insignificant, is projected to rise to about 18% of EPEA's water sales in 1984 (Attachment 1).

12. The trend of peak production required to meet summer demands based on data for the period before 1972 when constraints were imposed, has been used to determine project design criteria (see Attachments 2 and 5). On these assumptions the supplies from the second stage works now being commissioned appear unlikely to prove adequate after 1980. It is assumed that constraints will not be necessary in 1981 on the basis that small deficits can be met either by overloading the works slightly or by introducing groundwater from private sources which should have recovered yield after resting during the period 1977 to 1980.

June 1977

APPRAISAL OF
AN ALEPPO WATER SUPPLY PROJECT
SYRIAN ARAB REPUBLIC

Mission Estimates of Consumption Data: Years - 1967-1984

Year	Population in Area Served Thousand	Population With Direct Connections Thousand ^{1/}	No. Connections Thousand	Production Million m ³	Per Capita Consumption lcd ^{2/}	Total Sales Million m ³	Sales Excluding Industry Million m ³	Industry Supplied By EPEA Million m ³ ^{3/}	Unaccounted For Water %
1967	528		74.0	23.1	83	16.4	16.1	0.3	29
1968	573		77.7	25.7	85	18.2	17.8	0.4	29
1969	589		81.9	27.9	90	19.9	19.5	0.4	29
1970	640		86.9	30.0	92	22.1	21.6	0.5	26
1971	692		92.1	32.3	91	23.4	22.9	0.5	28
1972	749		96.2	33.2	87	24.3	23.7	0.6	27
1973	810		100.3	38.5	82	24.9	24.3	0.6	35
1974	877		104.4	39.8	80	26.3	25.6	0.7	34
1975	949		109.9	41.7	83	29.4	28.6	0.8	29
1976	1027	925	116.3	45.3	84	32.2	31.4	0.8	29
1977	1061	967	124.0	51.5	90	36.5	34.7	1.8	29
1978	1096	1006	136.0	55.0	92	40.9	36.9	4.0	26
1979	1132	1050	150.0	62.4	97	46.0	40.1	5.9	26
1980	1169	1100	162.0	67.9	98	50.4	42.0	8.4	26
1981	1208	1152	172.0	75.2	102	55.8	44.8	11.0	26
1982	1248	1200	182.0	79.5	106	59.2	48.2	11.0	26
1983	1289	1228	192.0	84.7	109	62.8	51.5	11.3	26
1984	1332	1293	202.0	89.8	113	66.8	54.8	12.0	26
2000	2239			255.0	200	182.5	164.2	18.3	28

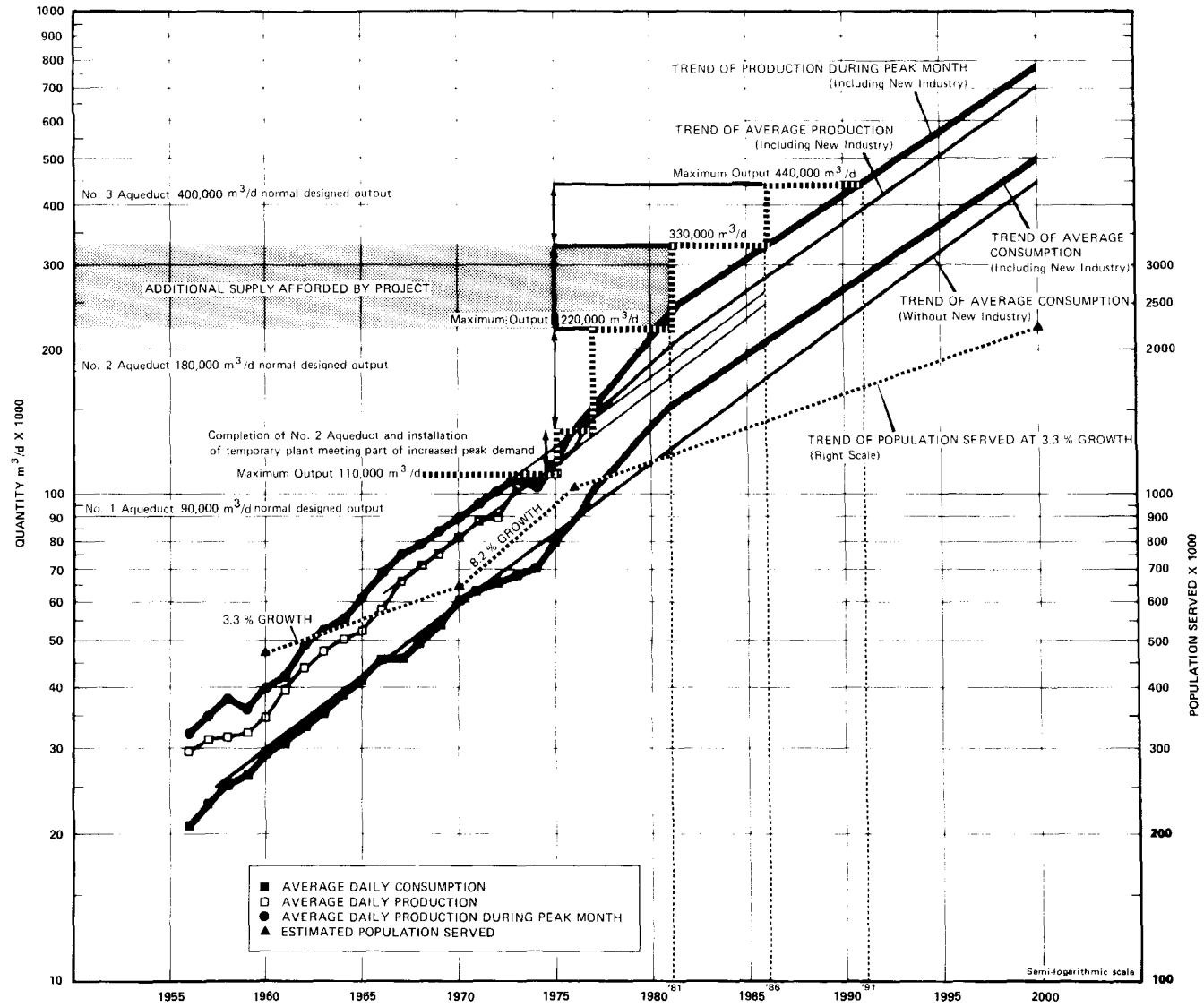
^{1/} The number per household served by a direct connection is assumed to decline from 8 persons in 1976 to 6.4 in 1984 and the population directly connected is projected to increase from 90% of total population in area served to about 97% during same period.

^{2/} Based on population of supply area.

^{3/} Existing industry utilizes private wells for process purposes and the small supply from EPEA is used for domestic purposes. All future water demand for the new industrial estate will be supplied by EPEA.

June 1977

APPRAISAL OF
AN ALEPPO WATER SUPPLY PROJECT
SYRIAN ARAB REPUBLIC
FORECASTS OF POPULATION, CONSUMPTION AND PRODUCTION FROM LAKE ASSAD



June 1977

World Bank - 17006

ANNEX 2
Attachment 2

APPRAISAL OF
AN ALEPPO WATER SUPPLY PROJECT
SYRIAN ARAB REPUBLIC

Number of Connections

Consumption Per Capita per Day	1970	1971	1972	1973	1974	1975
Less than 100	64,734	68,976	72,147	75,456	78,510	82,807
100 lcd and less than 200	19,098	19,821	20,624	21,283	22,035	23,037
200 lcd and less than 1m ³	1,390	1,588	1,711	1,899	2,115	2,363
1 m ³ and less than 2m ³	17	17	17	17	14	12
2 m ³ and less than 5m ³	17	19	19	19	19	17
5 m ³ and less than 10m ³	17	17	18	16	15	14
Official Departments	597	596	605	600	582	597
Army	38	48	48	54	59	65
Mosques and Turkish Baths	375	376	376	376	376	377
Other Religious Places	45	45	45	45	49	49
Municipality	456	460	460	452	470	465
Others	106	104	103	104	112	114
Total	86,888	92,067	96,173	100,321	104,356	109,917

June 1977

APPRAISAL OF
AN ALEPPO WATER SUPPLY PROJECT
SYRIAN ARAB REPUBLIC

Analysis of Water Consumptions
By Range and Group

	<u>Quantity Consumed During the Year</u>			
	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>
	-----M ³ '000-----			
Bi-Monthly Consumption Range				
Consumption less than 10 m ³	3,016	2,905	3,190	3,099
Analysis of Consumption over 10 m³				
1-10 m ³	6,784	7,085	7,709	8,539
11-100 m ³	8,446	8,648	9,133	10,639
101 m ³ and more	<u>3,006</u>	<u>3,161</u>	<u>3,334</u>	<u>3,761</u>
Sub-Total	21,252	21,799	23,366	26,038
Flat Rate Consumption	<u>3,049</u>	<u>3,138</u>	<u>2,945</u>	<u>3,368</u>
Total	<u>24,301</u>	<u>24,937</u>	<u>26,311</u>	<u>29,406</u>
Consumer Groups				
- Domestic	18,189	18,535	19,412	21,974
- Official	4,247	4,528	4,964	5,304
- Free Municipality and Religious Places	936	908	870	956
- Allowance for Water Right Holders	<u>929</u>	<u>966</u>	<u>1,065</u>	<u>1,172</u>
Total	<u>24,301</u>	<u>24,937</u>	<u>26,311</u>	<u>29,406</u>

June 1977

APPRAISAL OF
AN ALEPPO WATER SUPPLY PROJECT
SYRIAN ARAB REPUBLIC

Bi-Monthly Consumption Data

<u>Period</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>
	-----M ³ '000-----			
January and February	3,046	3,312	3,714	3,930
March and April	3,312	3,675	3,718	4,212
May and June	4,133	3,762	4,329	4,724
July and August	5,042	4,863	4,967	5,729
September and October	4,868	5,012	5,306	5,876
November and December	<u>3,900</u>	<u>4,313</u>	<u>4,277</u>	<u>4,935</u>
Total	<u>24,301</u>	<u>24,937</u>	<u>26,311</u>	<u>29,406</u>

June 1977

APPRAISAL OF
AN ALEPPO WATER SUPPLY PROJECT
SYRIAN ARAB REPUBLIC

Existing Water Supply Facilities in Aleppo

Background

1. In ancient times the city of Aleppo depended on local wells and on the Quwaik River for supplies of water. The first public supply system dates back to 1914 when, under the Turkish rule, a project was constructed to bring water to the city, a distance of 10 km from the Hilian Spring. In 1932, to meet increasing demands additional supplies of water were taken from the Quwaik River using an intake 3 km outside the city.

General

2. These sources were abandoned for public supplies when, in 1951, the Government of Syria began a major project based on abstraction from the Euphrates River near Aarouda Serhire. The works included a pumped intake (Station I) delivering to a treatment work at Station II where, after chemical dosing, sedimentation, filtration and chlorination, the water was pumped to the head of an aqueduct affording gravity flow some 82 km to Aleppo. There it discharged to Station III to be refiltered, ozonized and repumped to the Karm-el-Djabal service reservoir for distribution.

3. The design output from the scheme is 90,000 m³/d; the treatment and pumping facilities at each station were provided in three stages each of 30,000 m³/d capacity. The aqueduct is constructed generally of in-situ concrete pipe cast in open cut following the contours, but includes sections in tunnel and also a number of inverted siphons.

Recent Works

4. During the period 1965 to 1975 a dam was constructed on the Euphrates at Tabqa forming a reservoir called Lake Assad. The dam controls the river flow for irrigation and power supplies. The lake, which has a maximum top water level of 305 m, submerged the water supply Intake and necessitated the construction of a new Intake.

5. At the same time, because of increasing demands for water Etablissement Public des Eaux d'Alep decided to duplicate the original scheme based on abstraction from the new Intake in Lake Assad. The present intention is to raise the top water level of Lake Assad sometime at the beginning of the

next century from 305 m to 325 m and, when this is done, the Station II "Old" works will be submerged. For the duplicate water supply, Station II "New" has been constructed above the future level of Lake Assad at an elevation of 336 m.

6. This duplicate Phase 2 Scheme which was begun in 1971, is still only partially operative, but should be completed and fully commissioned in 1977. The design output of these Phase 2 works is again 90,000 m³/d. The second aqueduct delivers to a Station III "New" where the water is refiltered and ozonized before being repumped to a new service reservoir at Haidarie for distribution into the low level zone which serves the old central part of the city. Although the design output of the Phase 2 works is 90,000 m³/d the capacity of the terminal tunnel leading to Station III "New" is 220,000 m³/d. Map IBRD 12699 shows the layout of the existing works including the positions of the new Intake, the Stations II and III and the line of the aqueducts. The water quality in Lake Assad is normally good except during infrequent algal infestations or following flood flows.

Intake

7. The Intake is constructed of a reinforced concrete tower in the form of two concentric vertical, cylindrical walls, the annular space housing the pumps all mounted in the base of the tower at an elevation of 285.0 m. The water passes from the Lake through a rectangular duct into the inner cylindrical chamber, flow being controlled by means of three vertical penstocks each 3 m high to permit choice of level for abstraction varying from the base level of 282 m to 292 m. The intake duct occupies one segment of the annulus, the other three segments being reserved for three groups of electrically driven pumps. Two groups installed are as follows:

- (a) 4 No. Electric Pumps Rated Capacity each 48,000 m³/d
Static Head 27 m (3 in operation and 1 standby)
delivering at a maximum rate of 143,000 m³/d to
Station II "Old".
- (b) 3 No. Electric Pumps Rated Capacity each 54,000 m³/d
Static Head 51 m (2 in operation and 1 standby)
delivering 108,000 m³/d to Station II "New".

8. The pumping installation includes also the following auxiliary equipment:

- (a) Duplicate Silt Pumps for pumping to waste from the
central intake chamber. Rated Capacity 3,600 m³/d.
- (b) Duplicate Drainage Pumps for pumping station drainage.
Rated Capacity 700 m³/d.
- (c) Duplicate Fire Pumps. Rated Capacity 1,500 m³/d.

9. The silt pumps may be converted to additional drainage pumps by valve manipulation. The fire pumps are brought into operation automatically by a smoke sensitive device in the cable room at an upper floor of the station. The drainage pumps are operated automatically by electric probes.
10. The main pump-sets are horizontal spindle direct coupled. Each draws from the inner intake chamber by independent suction and delivers vertically to a steel delivery bus main buried in the outer wall of the station.
11. The third segment of the annular space is at present empty, but the suction and delivery pipework already in place is suitable for installing 3 large vertical spindle electric pump-sets, but with motors only 3 m above pumps.
12. The control room is at ground floor level at 307 m; the main distribution panel and cable rooms are immediately beneath the control room.
13. The Intake pumps are at some risk because the pump motors are installed at a level over 15 m below the lake top level and could become submerged due to some mishap. The capacity of the drainage pumps is less than that of the fire pumps and the conversion of the silt pumps for use as additional drainage pumps would require valve operation by hand at depth and is therefore of doubtful value.
14. Another potentially troublesome feature is that silt has already been deposited in the bed of the Lake around the intake. In 1964 the Syrian Government had retained consulting engineers to advise on problems associated with the proposed reservoir construction including the deposition of silt and its effect on the pumping of water whether for Aleppo public supply or for the proposed irrigation works. The consultants considered probable silt deposition assuming lake levels varying, from top water level of 305 m to 285 m due to seasonal use of the water, and there appeared to be adequate evidence of silt loadings in the river at that time. Various sites were considered for the abstraction works for public water supply and the recommendation was that there should be a new intake downstream of the existing intake.
15. The project report for the construction of the reservoir, submitted in 1972 did not appear to pay any regard to the changes in silt deposition with the variation in lake level. It predicted that silt deposition would not significantly affect the abstraction of water from the new intake, sited upstream of the old intake where it has now been constructed, for some 15 years; that the intake could still be used for 30 years by which time it was proposed that the dam and the lake level would be raised and a new intake would in any case be required.
16. The silt is now reported to be some 3 m thick at the intake with the result that only the upper one of the three intake gates 3 m deep, can be used. There is no factual information about the incidence of deposition, when it occurred and whether it is still taking place. It is reported that the top 1 m is not consolidated and the thickness of deposit cannot be measured precisely. It is also reported that, when the reservoir was being

filled, the water level was in range 282 m to 285 m during the April/May period of maximum silt loading, and that much of the silt was deposited at that time. The reservoir is not yet used significantly because most of the major irrigation works have yet to be constructed. At the current rate of construction of these works, wide variations in level of the reservoir are unlikely for at least five years and drawdown to 290 m should not occur before 1990.

17. It has also been reported that, although lake level have not varied, high turbidities have been experienced during two periods in the raw water delivered to the treatment plant. It is possible that these incidents resulted before abstraction was confined to the upper intake; otherwise, the high turbidities might be attributable to disturbance of partially settled silt with unusual currents during high river flows or high winds. Since Lake Assad was constructed the Keban Dam has been constructed upstream in Turkey and a further dam at Karakaya is also proposed. Once these new dams are completed, the turbidity of the water arriving at Lake Assad is expected to decrease.

Station II "Old"

18. This station, at an elevation of 309 m, provides for chemical dosing with aluminum sulphate and lime, clarification, filtration and chlorination. There are 4 clarifiers and three groups of rapid gravity filters, each of the latter being designed to act at the rate of 30,000 m³/d. There is an estimated station loss of 3%, but during the 1976 peak demand periods and with good quality raw water, the station has been delivering at a maximum rate of 137,000 m³/d (i.e. over 50% higher than the design output). With the low turbidities experienced since the construction of Lake Assad, there has been little chemical dosing even during periods of high algal infestation. It is probable that, during such periods, the settling tanks are not effecting any quality improvement; also that the algae content could be reduced by chemical coagulation and settlement.

19. The pumping station contains:

5 No. diesel pump-sets Rated Capacity (each) 24,000 to 29,000 m³/d. Static Head 106 m (4 in operation and 1 standby).

4 No. diesel alternators Rated Output 1,050 Kw providing water (now standby) for the electric pumps in the Intake Station and for chemical and other plant operation in Station II "Old".

Two of the pumps and two of the generators were installed in 1953 and are due for renewal.

STATION II "New"

20. This station has been recently established as part of the Phase 2 works at an elevation of 336 m.

The treatment plant comprises:

- 3 Settling Tanks each designed for a flow of 35,000 m³/d, at 1.75 m/h.
- 2 Groups of rapid gravity filters each designed for a flow of 48,000 m³/d at 5 m/h.

21. The pumping station, when completed, will contain:

- 3 No. Electric pump-sets of Rated Capacity (each) 0.53 m³/s (45,000 m³/d) Static Head 81 m (2 operating and 1 standby).
- 4 No. Diesel Alternators of Rated Capacity (each) 1100 Kw to provide part standby power for the Intake Pumps, the Station II "New" pumps and auxiliary equipment in case of failure of the public supply.

22. The station contains buildings and equipment for dosing the water with aluminum sulphate, lime and chlorine; also the buildings for storage of chemicals. In addition there will be administration and control buildings and houses for operations.

23. All these works are still under construction, but it is expected that they will be substantially completed and commissioned during 1977.

STATION III "Old"

24. At this station the water receives final treatment and is pumped to the Karm-el-Djabal service reservoir.

The treatment facilities comprise:

- 2 Groups of rapid gravity filters Total Rated Capacity 1.06 m³/s (90,000 m³/d).
- 3 Groups of ozonizers Total Rated Capacity 1.06 m³/s (90,000 m³/d).

25. There are covered storage tanks for filtered and for ozonized water. The filters are operated for periods of four or five days between backwashing; there are no major problems with this final treatment and a high quality is obtained in the treated water.

26. The pumping station contains:

5 No. Diesel pump-sets Rated Capacities (each) 25,000 to 28,000 m³/d.

1 No. Diesel pump-set Rated Capacity 17,000 m³/d.
all to Static Head of 43 m (5 in operation and 1 standby).

3 Diesel Alternators Rated Power (each) 550 Kw which provide power for ozone and for filter operation.

27. Initially there were only 4 diesel pump-sets, but there have been subsequent additions, one in the main Pump House and the second more recently installed temporarily in an adjacent store building, in order to deal with increasing demands before Station II "New" is commissioned. Two of the diesel pump-sets and one of the diesel alternators were installed in 1953 and are due for replacement.

STATION III "New"

28. This station when completed will contain the following:

2 Groups of rapid gravity sand filters having a combined rated output of 1.06 m³/s (90,000 m³/d) at 6.25 m/h.

Building and equipment for ozonation up to a rated output 1.06 m³/s (90,000 m³/d).

The Pump House will contain:

3 No. Electric pump-sets each of Rated Capacity 45,000 m³/d.
Static Head about 43 m (2 operating and 1 standby).

2 No. Diesel alternator-sets Rated Capacity (each) 800 Kw
to provide standby power in the event of failure of the public supply system.

29. In addition there is one diesel pump-set installed temporarily in a garage building of capacity about 0.25 m³/s (20,000 m³/d) together with a temporary chlorination plant which has helped to meet increasing demands in advance of the commissioning of the main pumping station and treatment plant.

Pressure Conduits

30. There are pressure conduits conveying water from the Intake to Stations II, from Stations II to the Head of the Aqueducts and from Stations III to the service reservoirs.

31. There are of ductile iron except where indicated and are detailed below:

	<u>Number</u>	<u>Diameter (mm)</u>	<u>Length (km)</u>
Intake to Station II "Old"	1	1,000	4.50
Intake to Station II "New"	2) 1,000) 900	1.35 5.20
Station II "Old" to Head of Canal (Grey Iron)	3	750	7.0 (about)
Station II "New" to Head of Canal	2	900	5.5
Station III "Old" to Karm-el-Djabal Res (Grey Iron)	3	700	5.25
Station III "New" to Haidarie Res	2	1,000	1.50

32. Most of these are of recent construction and all are reported in good condition, not subject to leakages or failures.

Aqueducts

33. The two existing aqueducts are generally similar in design and alignment. In most places the route follows the contours, but gradually falling from an elevation of 411 m to 382 m over a length of about 82 km.

34. The aqueduct cross-section is egg-shaped, but with a flat invert, the maximum width being about 1.35 m. The full height is 1.63 m, but the normal operating depth of water is 1.35 m. The construction is of mass concrete with nominal reinforcement only.

35. Most of the length has been constructed in open excavation, but where the depth of cover exceeded 7 m, construction has normally been in tunnel the cross-section being very similar. Five valleys have been crossed with inverted siphons constructed of pre-cast concrete pipes 1.45 m diameter bedded on weak mass concrete.

36. There is a washout at the bottom of each siphon which discharges to the stream. The final length of No. 2 aqueduct in tunnel, delivers to Station III "New", which adds some 2 km to its length.

37. Although each aqueduct has a design flow of 90,000 m³/d they may each, with some difficulty, be operated surcharged when the maximum flow is increased to 110,000 m³/d. The last 7 km of No. 2 aqueduct (in tunnel) leading to Station III "New" is of larger cross-section with a design flow of 220,000 m³/d. There is an estimated leakage loss of 3% in the aqueducts.

Distribution System

38. Water from the Station III "Old" is pumped to service reservoirs at Karm-el-Djabal and that from Station III "New" to the Haidarie service reservoir all situated on the eastern side of the city and having a floor level of 425.5 m and a Top Water Level of 430.5 m. Details of the reservoirs are as follows:

<u>Service Reservoirs and Water Towers (WT)</u>	Number	Total Capacity (m3)	TWL (m)
Karm-el-Djabal	3	75,000	430.5
Haidarie	1	50,000	430.5
Ansari (balancing)	2)	32,000	418.5
Achrafie (balancing)	2)		418.5
Dar-el-Awad (W.T.)	1		
Achrafie (W.T.)	1		461.0
Ansari (W.T.)	1		460.0
University (W.T.)	1		478.0

39. The water is distributed from these reservoirs to the low-lying older part of the city, on the east to all areas below 405 m elevation and on the west to all areas below about 390 m elevation. In order to maintain pressures on the western side during periods of peak demand, balancing reservoirs have been constructed at Achrafie and Ansari both of which have a floor level of 413.5 m.

40. The distribution network for this central zone is based on a ring main which has been constructed over a period of years and has a diameter generally of 900 mm, 800 mm and 750 mm, but there are a few sections of different diameters with a minimum of 650 mm.

41. In addition there are leading mains of diameters varying from 500 mm to 250 mm running through the center of the old city and similar spur mains serving some outlying areas of low elevation.

42. Most of the new developments on the outskirts of the city are on land at too high an elevation to receive supplies of water from the central zone. These individual areas are served from a number of water towers each supplied from pumping stations sited near the reservoirs. There is also a central area around the Karm-el-Djabal which is supplied in this manner.

43. Although some of the mains in the center of the city are old, most of the system has been constructed during the past 25 years, the total length of distribution mains of all diameters having increased fairly uniformly from 120 km in 1951 to over 650 km in 1975. The mains are generally in good condition; leakages and losses are relatively small. Pressures are acceptable throughout the area, except during recent months when problems have arisen due to inadequate water from source to meet the growing demands. In all other

respects, a good continuous supply has been maintained to all properties served. The original supply served only the old city, but as the city boundaries have been extended the distribution system has been expanded to serve the areas within the enlarged boundaries.

44. Although the intention is to provide an individual service connection to each property there have been many illicit extensions from connections to adjoining properties. There are also many new developing areas within the area supplied where the houses have been built illegally and where there are no piped supplies. Water is carted to those areas and stored in individual cisterns. EPEA have estimated that 100,000 people within the present area served do not have a piped supply of water.

June 1977

APPRAISAL OF
AN ALEPPO WATER SUPPLY PROJECT
SYRIAN ARAB REPUBLIC

Description of the Water Supply Component of the Project

Background

1. This project forms the third phase of a scheme for abstracting water from the Euphrates River, now Lake Assad, treating and pumping it to Aleppo. The first phase works provided a supply of 90,000 m³/d and the treatment facilities were broken down into three stages each of 30,000 m³/d. The second phase begun in 1971 was initially designed to duplicate these works and again the treatment facilities were to be broken down into two stages each of 45,000 m³/d. But there were delays in construction and, furthermore, the demands for water have increased so rapidly that, before the works were completed the two treatment stages were merged. Also, the decision was taken to increase the design capacity of the terminal length of tunnel aqueduct into Aleppo from 90,000 m³/d to 220,000 m³/d in anticipation of further increased needs.

2. Already, before the second phase works are completed, it is foreseen that they will be fully utilized by about 1981 and there is urgent need to proceed with further works to increase the available supply.

3. Because of the increased rate of growth of demand, and also to meet new industrial demands, the project comprises works of a capacity designed to be equal to twice the maximum that could be supplied in each of the first two phases (i.e. equal to the combined capacity of first two phases working at their maximum rate).

4. Furthermore, although the civil works for pumping and treatment will be designed for full duplication only half the pumps, pumping mains and treatment equipment will be installed and are included in the estimated cost. The remainder will be installed as the demand increases.

Aqueduct and Pumping Mains

5. A new aqueduct will be constructed paralleling the two existing aqueducts. Its design flow capacity will be 220,000 m³/d. There will be inverted siphons where the valleys are crossed as previously and other sections which could be in tunnel where the depths of excavation are excessive. The gravity section could be of concrete with only minimal surface reinforcement as previously or it could be of pre-cast or prestressed concrete construction, the method to be adopted being decided after investigations by

consulting engineers. If constructed as previously of mass concrete, the cross-section will be egg-shaped 1.92 m maximum width, 2.30 m high and the normal water depth about 1.90 m. The inverted siphon sections will be 2.15 m diameter.

6. The aqueduct will be 75 km long, terminating at the inter-connection chamber. The supply for industry and adjoining villages, estimated at 30,000 m³/d initially and rising to 50,000 m³/d, will be taken off near this junction and the total remaining flow will then pass through the two existing sections of tunnel to Station III "Old" and Station III "New".

7. Duplicate ductile iron pumping mains Ø 1,000 mm from the Intake to Station II "New" already exist along the Intake approach embankment a distance of 1.35 km terminating at an interconnecting header pipe which has 6 No. 900 mm flanged outlets. Two of these are occupied by existing 900 mm ductile iron mains to Station II "New". The project proposal is to lay one additional 1,200 mm ductile iron main 5.2 km long to supply at the rate of 110,000 m³/d to Station II "New". A further similar main being added in the second stage works to provide for pumping a total of 220,000 m³/d. Surge pressures are controlled by existing dual inlet and outlet valves at the Intake and no major surge problem is foreseen.

8. The project provides for a similar ductile iron pumping main 1,200 mm diameter 5.5 km long to convey the water from Station II "New" to the head of the Aqueduct. A second similar main will be laid in the second stage works.

Pumping Stations

9. The Intake and Intake Pumping Station have been constructed in Lake Assad with a space left in the structure for the installation of additional pumps required for the project. Suction and delivering pipeworks have been installed and tenders had already been called for the pumps before the visit by the appraisal mission. The proposal is to install 3 No. vertical spindle direct-coupled electric pump-sets each of capacity 110,000 m³/d delivering from a minimum level of 282 m to Station II "New" at 336 m; at full load, two will be operating and one standby. The lake level will normally be at about 300 m and thus the static head will be reduced from 54 m to 36 m and the estimated total head from 61 m to 43 m.

10. There may be some difficulty in obtaining pumps which, not only comply with the very precise layout for the suction and delivering pipework but also have suitable characteristics for efficient operation over widely varying pressures. The discharge in normal conditions of lake level is likely to be much more than 110,000 m³/d.

11. The motors of the new pumps will be some 3 to 4 m above the pumps, which will greatly improve the present installation where there is some risk of flooding of the electric pump motors (Annex 3). The installation risks

will be investigated by consulting engineers and in the detailed design; additional separately controlled, independently powered high capacity drainage pumps will be installed and any other measures recommended by the consulting engineers will be taken for normalizing the protection against flooding.

12. Since the construction of the dam at Tabqa and the filling of the reservoir to form Lake Assad, silt has been deposited in the Intake forebay to a depth of 3 m. In the project report for the dam and reservoir works, silting was foreseen, but it was not expected to begin to interfere with abstraction from the Intake for 15 years and the life of the Intake was estimated to be 30 years by which time it is intended to raise the dam and to construct a new intake. Various proposals for extending its life were considered including a barrier or training wall, but no detailed investigation was carried out. The early deposition has exceeded estimates, but this may have been due to the initial filling. The project provides for consulting engineers to undertake detailed investigations to determine whether the situation has now stabilized and what additional works, if any, may have to be undertaken to extend the life of the Intake and ensure continuous trouble-free operation.

13. Station II "New" will be expanded by the construction of an additional pumping station to deliver to the head of the canal. The station will be of adequate size for plant of rated output 220,000 m³/d. The initial installation included in the project is for electric pump-sets having an output of 220,000 m³/d and for standby diesel generators sufficient to permit discharge at half rate during any period of failure of the public power supply.

14. Station III "New" will be expanded by the construction of an additional pumping station to deliver to new Service Reservoirs. The station will be adequate for the installation of pumping plant of rated capacity at least 130,000 m³/d increasing the total output from the station to 220,000 m³/d, but only half the plant will be installed in the project. Standby diesel generator sufficient capacity to provide for pumping at 65,000 m³/d will be installed in the project.

15. Some of the diesel pump-sets and diesel generators in Station II "Old" and Station III "Old" date back to the original installation in 1953. Most of these still function well, but the machines are no longer in production and spare parts are very expensive and difficult to obtain. In the Station II "Old" the plant operates at only 5 Kv whereas the more recent plant is all 6 Kv. The machines are due for replacement and the project includes for doing this as soon as possible after the installation of the new machinery scheduled for 1977. The opportunity will be taken to replace with 3 Kv plant in Station II "Old." The proposed new plant is as follows:

Station II Old

- 2 No. Electric pump-sets (operating at 6 Kv)
- 2 No. Diesel generators each 2000 KVA capacity

Station III Old

- 2 No. Electric pump-sets
- 1 No. Diesel generator of 1400 KVA capacity

16. The control of flow from the Intake through the pumping stations to the service reservoirs in Aleppo, particularly the aqueduct flow, is not a simple matter and demands careful judgement and foresight combined with long operational experience of the station attendants. The capacity of the aqueduct is some 300,000 m³, equal to over a day's supply from Station II. Thus the discharge reacts only very slowly to changes in the rate of pumping at Station II. Although there is very limited storage in the clear water tanks at Station III "Old", the pumping from Station III must ideally match the incoming flow and yet it must also be dictated by the demand except insofar as changes in demand can be met from the storage in the service reservoirs. Aqueduct flows in excess of demands must be avoided to prevent overflow and loss of treated water.

17. The project provides for the transmission of water levels and flows at the various stations and reservoirs to a central control room by means of radio and telephone signals. This will be of considerable benefit in the operations of the supply system and should result in reduction of water losses and also possibly in labor costs.

Treatment Plant

18. Additional rapid gravity filters of rated capacity 110,000 m³/d will be provided for the treatment of the increased flow of water. Plant will be installed to permit prechlorination of the raw water and this will also afford final chlorination if required. Provision will be made in the layout for such further treatment facilities including primary settlement, chemical dosing, flocculation and settlement, micro-straining or any other treatment which may be recommended by consulting engineers based on the operating experience of the existing treatment plants and the plants which have yet to be commissioned.

Distribution Facilities and Service Reservoirs

19. An allowance has been made for additional large diameter trunk-mains to distribute the increased supply from Station III "New" but the least-cost scheme for these new mains has not been finalized. The existing ring main is inadequate to transfer the water from the east to the west of the city. Most of the additional water will be required in the high level zones at present served by a number of water towers; investigations will show whether the new trunk mains should be laid which will perpetuate such a system or whether it would not be better to lay a new high level trunk ring main around the north of the city to serve the high level areas from a new suitably sited service reservoir. The project has been appraised on the basis that a high level trunk main 1,200 mm diameter will be laid from Station III to a new service reservoir to be constructed on high ground at a level of about 450 m near to the University. Additional spurs 1,000 mm to the north and 900 mm to the

south will serve developing high level areas. An additional 1,000 mm trunk main from the existing ring main, to serve developing areas in the low level zone south-west of the city has also been included. Secondary distribution facilities not included in the project will be financed from internal cash generation.

20. The total capacity of the existing service reservoirs and water towers is about 160,000 m³. Reservoirs with a total capacity of 100,000 m³ will be added under the project to raise total storage to maximum day demand (a precaution against the need to shut down the intake during dredging) and to provide storage in the high pressure zone.

Ancillary Buildings and Equipment

21. The project provides for replacement of vehicles and for additions in keeping with the expansion of the supply area and organization.

22. The various works of this expanding undertaking, many of which are sited remote from Aleppo, require improved accommodation for the station attendants. There is provision in the project for the construction of a number of houses to suit these needs.

23. The administrative, clerical and design staff are housed in numerous inadequate buildings throughout the city with resulting lack of communications and inefficiency. The project provides for the construction of a new office building to be erected at Station III "New."

24. Accounts are at present kept manually; the project provides for the purchase and installation of mechanical accounting, and for staff training in operation and a budgetary control.

June 1977

APPRAISAL OF
AN ALEPPO WATER SUPPLY PROJECT
SYRIAN ARAB REPUBLIC

Cost Estimates

LS Million

	Total Costs ^{1/}			Expenditures 1977			Expenditures 1978			Expenditures 1979			Expenditures 1980			Expenditures 1981		
	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total
A. WATER SUPPLY SYSTEM																		
Aqueduct & Pumping Mains ^{2/}	109.4	62.8	172.2	-	-	-	17.7	19.5	37.2	31.8	16.3	48.1	34.5	17.4	51.9	25.4	9.6	35.0
Pumping Stations & Telemetry	3.9	37.5	41.4	0.2	3.7	3.9	1.0	11.4	12.4	1.4	13.9	15.3	1.3	7.5	8.8	-	1.0	1.0
Treatment Plant ^{3/}	10.6	10.3	20.9	-	-	-	1.8	1.9	3.7	4.7	4.0	8.7	2.4	2.7	5.1	1.7	1.7	3.4
Distribution Facilities	17.1	32.5	49.6	-	-	-	-	-	-	3.2	10.0	13.2	6.4	12.6	19.0	7.5	9.9	17.4
Ancillary Buildings & Equipment	4.8	2.6	7.4	-	-	-	-	-	-	1.9	1.7	3.6	1.8	0.6	2.4	1.1	0.3	1.4
Consultants	5.2	15.2	20.4	0.4	0.9	1.3	2.0	4.4	6.4	1.1	2.6	3.7	0.8	3.1	3.9	0.9	4.2	5.1
Training	0.8	0.8	1.6	-	-	-	0.2	0.2	0.4	0.3	0.3	0.6	0.2	0.2	0.4	0.1	0.1	0.2
Sub-total	151.8	161.7	313.5	0.6	4.6	5.2	22.7	37.4	60.1	44.4	48.8	93.2	47.4	44.1	91.5	36.7	26.8	63.5
Physical Contingencies (15%)	21.8	25.2	47.0	-	0.7	0.7	3.1	6.0	9.1	6.4	7.5	13.9	6.9	6.8	13.7	5.4	4.2	9.6
Sub-total	173.6	186.9	360.5	0.6	5.3	5.9	25.8	43.4	69.2	50.8	56.3	107.1	54.3	50.9	105.2	42.1	31.0	73.1
Price Increases ^{4/} (26% on Total)	55.7	38.0	93.7	-	-	-	3.1	3.6	6.7	13.2	9.5	22.7	19.0	13.2	32.2	20.4	11.7	32.1
Sub-total	229.3	224.9	454.2	0.6	5.3	5.9	28.9	47.0	75.9	64.0	65.8	129.8	73.3	64.1	137.4	62.5	42.7	105.2
B. ALEPPO SEWAGE - STUDY	1.0	4.9	5.9	-	-	-	0.6	2.9	3.5	0.4	2.0	2.4	-	-	-	-	-	-
C. TECHNICAL ASSISTANCE TO MINISTRY OF PLANNING AND TO PUBLIC CONSTRUCTION ENTERPRISES	0.2	1.0	1.2	-	-	-	0.1	0.5	0.6	0.1	0.5	0.6	-	-	-	-	-	-
Total	230.5	230.8	461.3	0.6	5.3	5.9	29.6	50.4	80.0	64.5	68.3	132.7	73.3	64.1	137.4	62.5	42.7	105.2

^{1/} Costs expressed as June 30, 1977.

^{2/} Assumes "in-situ" concrete construction generally.

^{3/} Based on new high level system.

^{4/} Price increases calculated by compounding following inflation ratio:

Year (Calendar and Fiscal)	1977	1978	1979	1980	1981
Local Costs	15%	12%	12%	10%	10%
Foreign Costs (Equipment)	8%	8%	8%	7%	7%

Note: All costs in Syrian Pounds (LS)

June 1977

APPRAISAL OF
AN ALEPPO WATER SUPPLY PROJECT
SYRIAN ARAB REPUBLIC

Draft Terms of Reference for Engineering Consultants
for Aleppo Sewerage Study

Introduction

1. The World Bank water supply and sewerage sector study mission during November-December 1976 reviewed the critical health aspects of Aleppo Sewage collection and disposal. The mission agreed with the conclusions of the Aleppo Health Directorate that the use of untreated sewage for contact irrigation of vegetable crops contributes to the high incidence of waterborne and water-related diseases in Aleppo. Cholera epidemics occur on almost an annual basis. In 1974 the Aleppo Muhafaza reported the highest morbidity rates for typhoid fever, dysentery, infectious hepatitis and scabies in Syria.
2. Additionally, large financial losses are incurred by the farmers, since the crops are destroyed during epidemics. The economic consequences are further aggravated by the burdens of medical treatment costs and lost productivity.
3. Engineering studies are required of possible methods to reduce the high morbidity rates and to reduce the concomittant financial losses to the community. Preliminary engineering studies will be developed for sewage treatment and disposal. Feasibility studies covering the improvement of the existing sewage collection system will also be prepared with particular emphasis on combining interception and outfall in addition to the rehabilitation of the system.

Draft Terms of References

4. The World Bank has been requested to finance the third phase of the Aleppo water supply which will meet the water demands to about the year 1990 when further source developments are likely to be required. Provision of additional water to meet the increasing municipal needs will intensify the problem of wastewater disposal. Therefore, the Ministry of Housing and Utilities has proposed the appointment of consulting engineers to undertake the sanitation studies which would be partly financed from the proceeds of the Bank loan.

Preliminary Engineering and Feasibility Studies

Part I - Collection System Improvement

5. The consulting engineers shall prepare the following studies:

Preliminary engineering and feasibility studies for a staged program of development and construction for the collection and transport including pumping of municipal and industrial liquid waste and of storm water in the Aleppo urban area.

The studies shall include:

- I. Collection, collation and analysis of data related to environmental characteristics such as hydrology, hydrogeology, topography, geology, climate, water supply, agriculture, industry, population, and land use trends. The data shall also include any other information required for preliminary engineering studies.
- II. Development of a comprehensive program of identification of existing municipal and industrial wastewater loadings and characteristics and the projection of future wastewater loadings.
- III. Preparation of storm water drainage studies, including:
 - (a) Definition of drainage areas in terms of size and other component characteristics.
 - (b) Analysis of rainfall intensity, duration and frequency in the overall area contributing to the storm water loading for the Aleppo system.
 - (c) Determination of runoff for which a drainage system is required, including justification of choices on factors used.
- IV. Evaluation of the existing facilities for the collection, transport, and disposal of all wastewater with respect to cost, capacity, efficiency, and deficiencies.
- V. Investigation, justification and selection by areas of either:
 - (a) separate sewers;
 - (b) partially separate sewers; or
 - (c) combined sewers;

with attendant design standards, criteria and unit costs utilized in decision-making.

- VI. Determination of the sewer laterals, trunk mains, force mains, pumping stations, and interceptors urgently required to serve the areas selected and which can be constructed during a 3-year period. This will include remedial measures where specified.
 - VII. Preparation of maps showing (1) the areas to be covered by the 3-year program, and (2) the required construction to serve these areas.
 - VIII. Development of preliminary designs for the required structures in the 3-year program including diameters, lengths, capacities of laterals, mains and interceptors, location, capacities, and types of pumping stations.
 - IX. Preparation of a construction program for the 3-year period.
 - X. Preparation of a total cost estimate and yearly investment program including cost of final designs, construction supervision, contingencies, and expected price increases.
6. Reports of the Consulting Engineers

The Consulting Engineers shall submit the following reports:

<u>Report</u>	<u>Submission</u>
Work Plan and Staff Scheduling Program	30 days after commencement
Preliminary Definition of Alternatives	60 days after commencement
Interim Report including bases for decision and recommendations	6 months after commencement
Draft Final Report	10 months after commencement
Final Report	12 months after commencement

Part II - Sewage Treatment Plant

7. The Consulting Engineer shall prepare the following studies:
- I. Review of wastewater characteristics and loadings including industrial wastes, in order to determine the optimum method and degree of treatment consistent with Government's health and environmental objectives and the consumers ability to pay.
 - (a) Final effluent characteristics should be such that the effluent can safely be used for contact irrigation in agricultural production.

- (b) Dry season versus rainy season variations in wastewater should be given careful consideration.
- II. Investigation, justification and selection of the optimum method and degree of treatment.
- (a) Special reference should be given to aerated and non-aerated wastewater stabilization ponds, oxidation ditches, and extended aeration processes.
- (b) Alternative sewage handling and treatment procedures should compare various sludge handling and disposal facilities particularly with regard to sludge utilization within the existing compost production program.
- III. Development of preliminary designs for the selected plant to serve the first stage sewerage program including location, sizes and dimensions of all plant elements.
- IV. Preparation of a 3-year program of treatment plant construction.
- V. Preparation of a total cost estimate and yearly investment program including cost of final designs, construction supervision, contingencies and expected price increases.
8. Reports of the Consulting Engineers

The Consulting Engineers shall submit the following reports:

<u>Report</u>	<u>Submission</u>
Work Plan and Staff Scheduling Program	30 days after commencement
Preliminary definition of alternatives	60 days after commencement
Interim Report including bases for decision and recommendations	6 months after commencement
Draft Final Report	10 months after commencement
Final Report	12 months after commencement

June 1977

APPRAISAL OF
AN ALEPPO WATER SUPPLY PROJECT
SYRIAN ARAB REPUBLIC

Draft Terms of Reference for Technical Assistance to:

- (a) State Planning Commission, and
- (b) Public Construction Enterprises

- (a) Draft Terms of Reference for a Technical Consultant (Individual) to assist State Planning Commission (SPC)

Introduction

1. The State Planning Commission (SPC) of the Government of the Syrian Arab Republic is seeking the assistance of an appropriately qualified expert to assist the Directorate of Planning for Building and Construction within the SPC to establish a system to collect and analyze data on the construction and building material resources in the country. The individual would be under contract to the Government; the duration of the contract, in the first instance, would be 6 months with the possibility of extension up to a further 2 months.

Qualifications

2. The individual should be a mature, qualified civil engineer with general experience in the planning, design and construction of civil works and buildings. More specifically, he should be conversant with modern contracting procedures, contract documentation (including provisions for price adjustment), cost estimating and the breakdown of project costs. He should preferably have had experience of working with local counterparts, suitably qualified, and training them in the various aspects of his scope of work. A comprehensive knowledge of English is essential; some knowledge of French and Arabic would be desirable.

Scope of Work

3. The general objective is to assist the new Directorate, within a period of about 6 months, to establish a system to collect, monitor and analyze data relating to the country's total construction and building resources. More specifically, the consultant shall:

- (a) Make recommendations as to the organization and staffing of the new Directorate, with an indication of the level and qualifications for each post;

- (b) Compile a list of building and construction contractors presently operating in Syria (public and private, domestic and foreign), classified by capacity and indicating the type and annual value of work executed, equipment holdings (replacement value and annual depreciation), workers employed (skilled and unskilled), etc.;
- (c) Review the cost estimates of projects included in the 5-year public sector development program, and develop coefficients of the breakdown of typical project costs indicating the proportions of labor, equipment depreciation, and principal materials consumed, as a basis for estimating the demands of construction resources for general planning purposes;
- (d) Assess the private sector demands in the construction and building sector and develop similar coefficients as in (c) above;
- (e) Assess the total demand for construction resources and principal building materials in the public and private sectors over the next 5 years;
- (f) Reconcile demands with the supply of construction resources and building materials, indicating the desirability for the expansion of existing or the creation of new public construction enterprises, or for any changes in the sources, volumes and nature of domestically produced building materials;
- (g) Develop and monitor, in collaboration with the Central Bureau of Statistics, a procedure for using price adjustment formula in public construction and building contracts, and therefrom derive appropriate price contingency allowances for future projections and cost estimating purposes.
- (h) Investigate potential savings of building materials which might be effected by:
 - (i) adopting higher structural design and standards and increased supervision, especially in the private construction sector, and
 - (ii) substituting gypsum based products for cement based products in building construction.

4. The Directorate of Planning for Building and Construction will make the following staff available to participate in the study (Government to provide details of available staff).

Reporting

5. The consultant shall prepare and submit to SPC end-of-month reports on the progress in establishing the basic system. The progress report at the

end of the 5th month shall contain comprehensive recommendations for future action.

(b) Draft Terms of Reference for a Consulting Firm to Assist Public Construction Enterprises

Introduction

1. Over the past few years, the Government of the Syrian Arab Republic has established a number of semi-autonomous public construction and building companies to carry out a portion of the country's public sector development program. The Directors of a number of these government enterprises have requested technical assistance to improve procedures and practices relating to cost accounting, heavy equipment repairs and servicing, and inventory control and warehousing.

2. The service of a consulting engineering firm are required to furnish a team of three appropriately qualified experts in the above fields. The members of the team should spend one year each in total, providing assistance on a roving commission basis to, in the first instance, five of the largest construction enterprises in Syria, namely:

- the "General Company for Irrigation" (SARICO);
- the "General Company for Roads" (RODCO);
- the "General Company for Buildings";
- the "General Organization for the Implementation of the Industrial Projects";
- the "General Company for Water Projects".

3. The contract would be with the Government of Syria for an initial duration of one year. A second phase of the contract may be negotiated on similar terms to extend coverage of the technical assistance to the remaining construction organizations, namely:

- the "Construction Company for Works";
- the "Syrian Arab Company for Reconstruction";
- the "Concrete Company".

Qualifications

4. The consulting firm should have had general background experience in providing similar technical assistance to public civil works construction or maintenance authorities. The team of three experts should each be appropriately qualified in their particular fields, and they should have had at least 10 years experience with a public or private construction agency. They should preferably have experience of working with and training suitably qualified local counterparts. All team members should have a comprehensive knowledge of the English language and at least one member should be fluent in Arabic; some knowledge of French and Arabic by all team members would be desirable.

Scope of Work

5. The general objective is to improve the present procedures and practices of the major public construction enterprises in the fields of cost accounting, equipment repair, and warehousing. General recommendations shall be made in common for all public enterprises, with particular recommendations for individual enterprises. The location and organization of a suitable central coordinating and monitoring agency for all public enterprises shall be included in the recommendations. For each enterprise an appropriate management information system shall be developed.

6. The particular activities of each team member shall include (inter alia) the following:

Cost Accounting

- (a) Develop for each enterprise, appropriate cost accounting procedures in relation to the Government's annual reporting and auditing requirements;
- (b) Establish appropriate individual project site accounting procedures, and, for each enterprise, a central (headquarter) data processing system, computerized if appropriate;
- (c) Establish appropriate equipment "rental" charges for different classes of construction equipment including estimated residual values on completion of individual works;
- (d) Introduce a system for assigning the central (headquarter) and site overhead costs for each enterprise to project estimates;
- (e) Investigate the advantages of introducing current (replacement) cost accounting into present procedures;
- (f) Produce a manual of recommended procedures and forms to be used in cost accounting.

Heavy Equipment Repair

- (a) Review the existing practices and make recommendations for improving the workshop facilities and workshop equipment for carrying out repairs and servicing to heavy construction equipment at central and site locations;
- (b) Institute a training program for drivers, mechanics and operators;
- (c) Introduce appropriate procedures for keeping account of time and materials spent in the repair and servicing of equipment;

- (d) Investigate the possible advantages (administratively and financially) of a central equipment pool of specialized heavy construction equipment (e.g. pile drivers, asphalt mixing plants, heavy bulldozers with rock rippers, etc.) for use periodically by different public enterprises in project construction.

Inventory Control and Warehousing

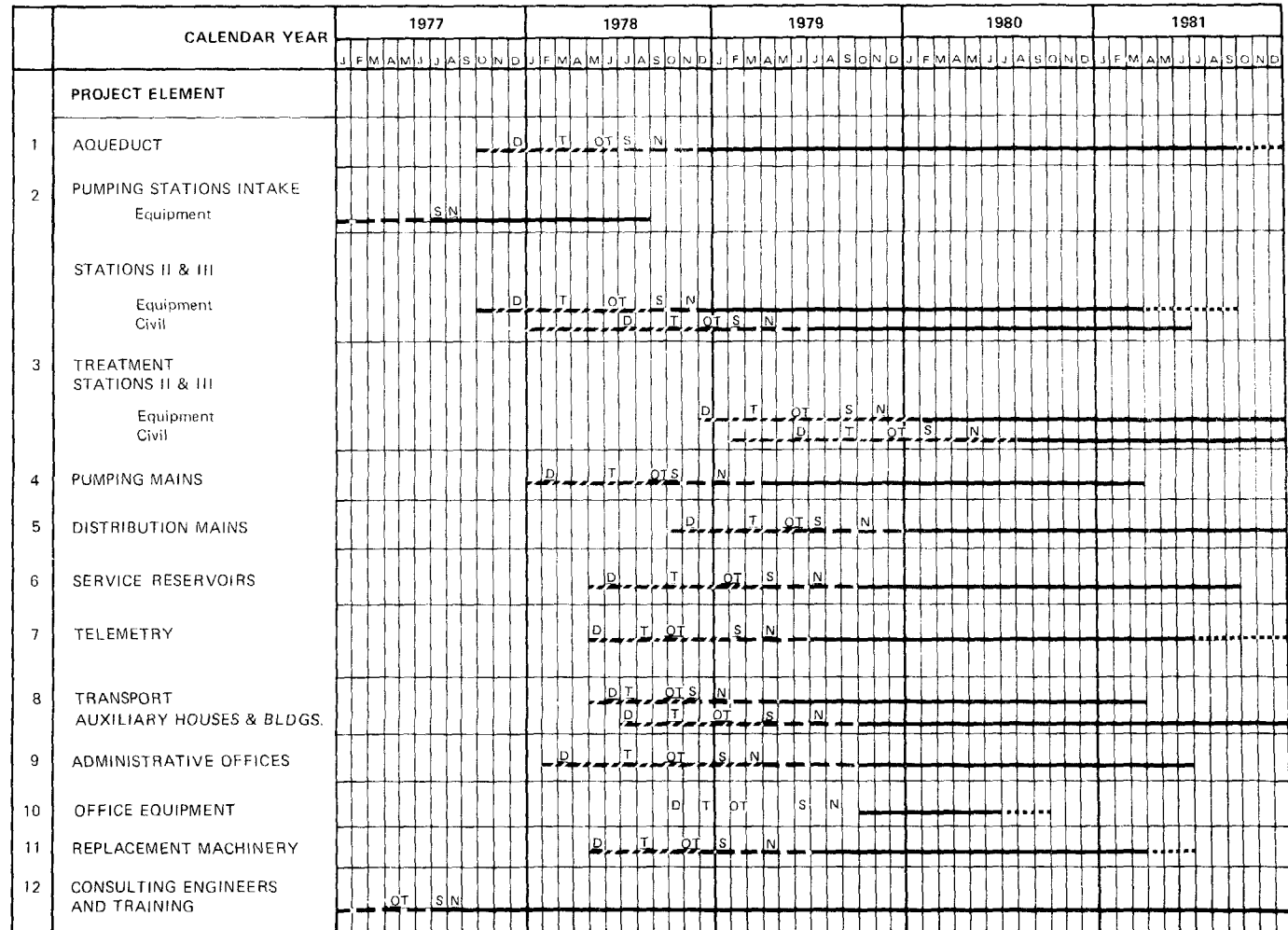
- (a) Review and comment on the present purchasing, accounting, storage and distribution system for mechanical equipment, spare parts, and construction materials used by public enterprises;
- (b) Develop appropriate central and site warehousing systems and inventory controls for each enterprise;
- (c) Train staff in inventory management and control procedures;
- (d) Produce a manual on recommended practices.

Reporting

7. The consulting firm shall submit to Government comprehensive quarterly reports on progress in the three specialized fields, with brief monthly reports in the interim. A comprehensive report on future recommendations for technical assistance and training shall be submitted one month before the end of the contract period.

June 1977

APPRAISAL OF
AN ALEPPO WATER SUPPLY PROJECT
SYRIAN ARAB REPUBLIC
Construction Schedule



LEGEND

- Planning, preparation of tender documents, bid analysis
- Mobilisation and field installation
- Contract Work
- Testing and finishing

- D Completion of design brief
- T Tender documents issued
- OT Opening tenders
- S Signature of contract
- N Notification to start work

June 1977

World Bank-17030(R)

APPRAISAL OF
AN ALEPPO WATER SUPPLY PROJECT
SYRIAN ARAB REPUBLIC

Key Indicators

The following key indicators will be monitored during the execution of the project to measure the progress made in achieving the technical, financial, administration and training objectives. In each case, the figures (budget and actual) will be shown for the latest two-monthly period and for the same for the previous year. Cumulative totals for the current year and previous year to date will be provided where appropriate.

I. Operational

- water produced 10^6 m^3
- a) Intake
- b) Stations II 10^6 m^3
- c) Stations III 10^6 m^3
- total water sold 10^6 m^3
- water sold to industrial consumers 10^6 m^3
- water sold to other consumers 10^6 m^3
- unaccounted-for water as a percentage of water pumped at Station II
- lengths of new mains laid in separate sizes
- number of new connections
- total connections
- estimated population served by house connections
- % of population served in the area to be supplied
- number of meters replaced
- number of meters repaired
- number of leaks discovered
 - a) mains
 - b) services
- number of leaks repaired
 - a) mains
 - b) services
- maximum and minimum pressures at selected points on the distribution system

- analyses of water (chemical, biological and bacteriological) at
 - a) raw water intake
 - b) settled water Station II
 - c) filtered water Station II
 - d) untreated water Station III
 - e) treated water Section III
 - f) water from selected points in distribution system
- number of permanent employees
- number of temporary employees
- number of employees per 1,000 connection
- man/months of professional training
- man/months of training for tradesmen and operators
- number of employees that received training
- man/months of engineering consultants services

II. Financial

- revenue collection % $\left(\frac{\text{Cash collected for two months}}{\text{Billing for two months} \times 100} \right)$
- average revenue per m3 sold - Industrial
 - Other
- operating expenses/m3 produced at Station II
- average number of days between meter reading and delivery of bill
- average number of days bill outstanding (by customer category)

III. Public Health Statistics

Public health statistics will be reported in the two-monthly report which follows publication of the statistics by the Ministry of Health (or the Central Bureau of Statistics). Incidence of the following diseases in Aleppo will be reported:

- Cholera
- Typhoid
- Malaria
- Intestinal parasites
- Diarrhea
- Eye diseases
- Skin diseases

June 1977

APPRAISAL OF
AN ALEPPO WATER SUPPLY PROJECT
SYRIAN ARAB REPUBLIC
Estimated IBRD Loan Disbursements

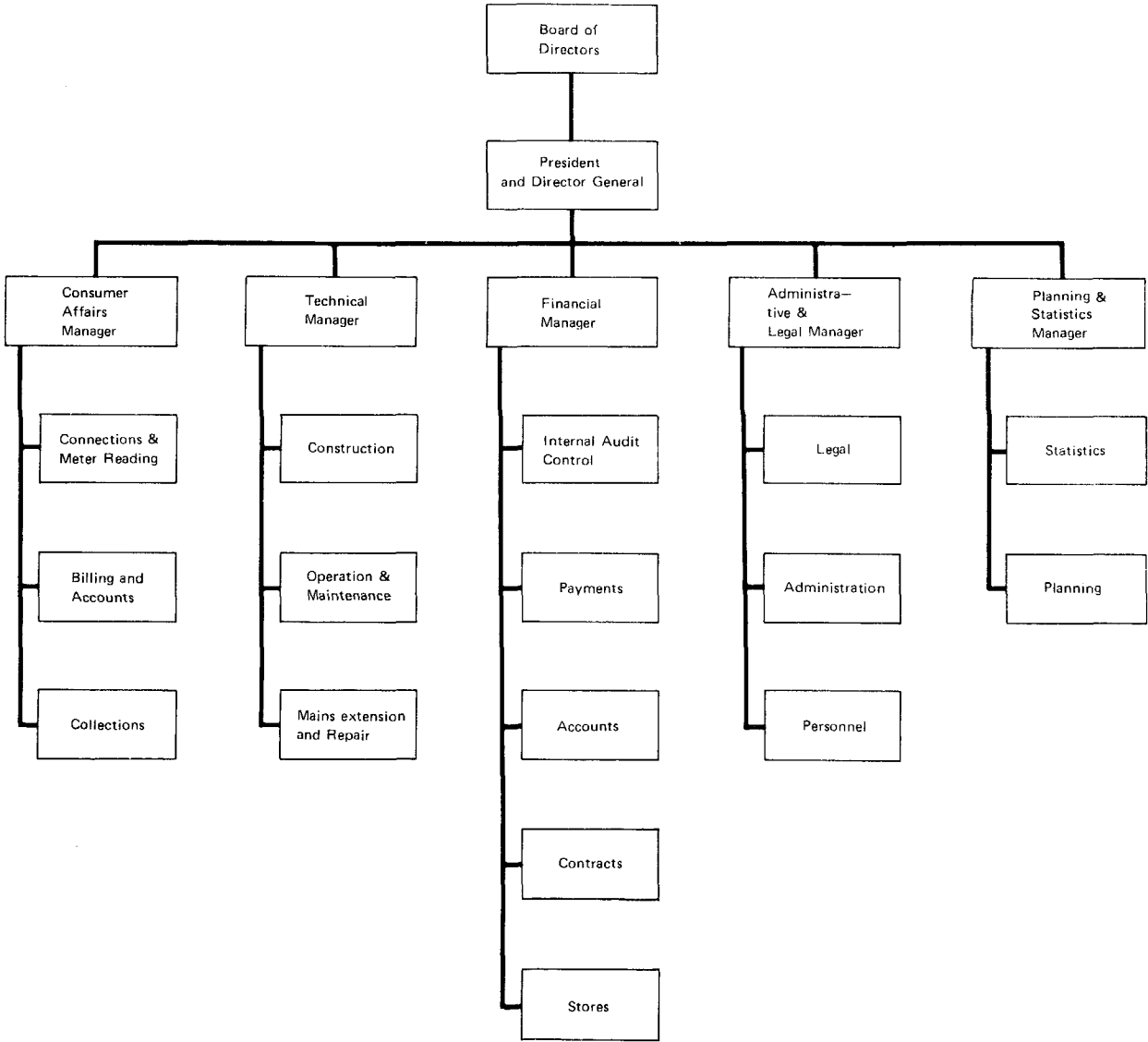
(Assumed Date of Effectiveness January 1, 1978)

<u>Bank Fiscal Year and Quarter</u>	<u>US\$ million Cumulative Disbursement</u>
<u>1977/1978</u>	
December 31, 1977	
March 31, 1978	
June 30, 1978	2.0
<u>1978/1979</u>	
September 30, 1978	5.0
December 31, 1978	8.5
March 31, 1979	12.0
June 30, 1979	15.5
<u>1979/1980</u>	
September 30, 1979	19.0
December 31, 1979	24.0
March 31, 1980	28.0
June 30, 1980	32.0
<u>1980/1981</u>	
September 30, 1980	36.0
December 31, 1980	41.0
March 31, 1981	43.0
June 30, 1981	45.0
<u>1981/1982</u>	
September 30, 1981	47.0
December 31, 1981	48.0
March 31, 1982	49.0
June 30, 1982	50.0

Source: Mission's estimates

June 1977

APPRAISAL OF
 AN ALEPPO WATER PROJECT
 SYRIAN ARAB REPUBLIC
 ETABLISSEMENT PUBLIC DES EAUX D'ALEP (EPEA)
 ORGANIZATION CHART



APPRAISAL OF
AN ALEPPO WATER SUPPLY PROJECT

SYRIAN ARAB REPUBLIC

EPEA'S INCOME STATEMENTS

ACTUALS (1973-1976) AND PROJECTED (1977-1984)

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Year Ending December 31												
Total Population in area Served(Thousand)	810.0	877.0	949.0	1027.0	1061.0	1096.0	1132.0	1169.0	1208.0	1248.0	1289.0	1332.0
No. of connection (Thousand)	100.3	104.4	109.9	116.3	124.0	136.0	150.0	162.0	172.0	182.0	192.0	202.0
Water produced (Million m ³)	38.5	39.8	41.3	45.3	51.5	55.0	62.4	67.9	75.2	79.5	84.7	89.8
Water consumption (Million m ³)	24.9	26.3	29.3	32.2	36.5	40.9	46.0	50.4	55.8	59.2	62.8	66.8
- Domestic, Commercial & Government	24.9	26.3	29.4	32.2	34.7	36.9	40.1	42.0	44.8	48.2	51.5	54.8
- Industry	-	-	-	-	1.8	4.0	5.9	8.4	11.0	11.0	11.3	12.0
Unaccounted-for Water	35.0	34.0	29.0	29.0	29.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
Average Rate (LS/m ³) Metered	.30	.30	.30	.30	.50	.65	.65	.65	.65	.80	.80	.80
Average Rate (LS/m ³) Industry	-	-	-	-	.60	.60	.60	.60	.60	.75	.75	.75
LS MILLION												
<u>Operating Revenues</u>												
Domestic, Commercial & Government	7.5	7.8	8.9	9.2	15.6	24.0	26.1	27.3	29.1	38.6	41.2	43.8
Industry	-	-	-	-	1.1	2.4	3.5	5.0	6.6	8.3	8.5	9.0
Sales of Water Rights	2.7	2.8	3.8	4.8	6.0	9.0	10.5	9.0	7.5	7.5	7.5	7.5
Meter Maintenance	.3	1.3	1.6	1.7	3.9	4.5	5.2	5.6	5.7	6.3	6.7	7.0
Other Income	1.6	1.5	1.9	2.2	5.2	5.7	6.3	6.8	7.2	7.6	8.0	8.4
Total	12.1	13.4	16.2	17.9	31.8	45.6	51.6	53.7	56.1	68.3	71.9	75.7
<u>Operating Expenses</u>												
Personnel	3.2	3.9	4.5	6.4	7.3	9.1	10.9	13.2	15.3	18.5	19.8	22.4
Material and Maintenance	.7	.8	.9	1.5	1.6	2.1	2.2	2.3	2.4	2.5	3.4	3.5
Administration and General	.2	.4	.2	1.0	1.2	1.5	1.9	2.1	2.6	3.1	3.4	3.8
Electricity and Fuel	1.8	2.0	2.1	2.9	3.8	4.0	4.4	4.8	5.3	5.5	5.9	6.3
Depreciation	1.9	2.5	2.6	2.6	4.7	7.1	7.6	7.9	8.1	15.4	22.7	23.0
Total	7.8	9.6	10.3	14.4	18.6	23.8	27.0	30.3	33.7	45.0	55.2	59.0
Net Income Before Interest	4.3	3.8	5.9	3.5	13.2	21.8	24.6	23.4	22.4	23.3	16.7	16.7
Interest Charges	-	-	-	-	-	2.6	5.6	9.8	13.5	15.3	14.5	13.2
Net Income	4.3	3.8	5.9	3.5	13.2	19.2	19.0	13.6	8.9	8.0	2.2	3.5
Rate of Return %	9.0	8.9	12.7	7.7	12.2	12.6	13.7	12.8	12.5	6.0	2.8	2.9
Operating Ratio	49.0	53.0	48.0	66.0	43.0	37.0	38.0	42.0	46.0	43.0	45.0	48.0

June 1977

APPRAISAL OF
AN ALEPPO WATER SUPPLY PROJECT
SYRIAN ARAB REPUBLIC
EPEA'S CASH FLOW STATEMENTS
ACTUALS (1973-1976) AND PROJECTED (1977-1984)

LS Million

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	Total 1978-1982	1983	1984
Year Ending December 31													
<u>Internal Cash Generation</u>													
Net Income Before Interest	4.3	3.8	5.9	3.5	13.2	21.8	24.6	23.4	22.4	23.3	115.5	16.7	16.7
Depreciation	1.9	2.5	2.6	2.6	4.7	7.1	7.6	7.9	8.1	15.4	46.1	22.7	23.0
Total	6.2	6.3	8.5	6.1	17.9	28.9	32.2	31.3	30.5	38.7	161.6	39.4	39.7
<u>Operational Requirements</u>													
Working Capital	10.6	7.5	17.1	-7.2	-26.4	11.1	1.8	-1.5	1.9	9.2	22.5	0.0	1.1
Debt Service													
Interest IBRD	-	-	-	-	-	2.6	5.6	9.8	13.5	15.3	46.8	14.5	13.2
Repayments IBRD	-	-	-	-	-	-	-	-	-	7.1	7.1	14.2	14.2
Total Debt Service	0	0	0	0	0	2.6	5.6	9.8	13.5	22.4	53.9	28.7	27.4
<u>Total Operational Requirements</u>	10.6	7.5	17.1	-7.2	-26.4	13.7	7.4	8.3	15.4	31.6	76.4	28.7	28.5
<u>Total Available from Operation</u>	-4.4	-1.2	-8.6	13.3	44.3	15.2	24.8	23.0	15.1	7.1	85.2	10.7	11.2
<u>Construction Requirements</u>													
Project	-	-	-	-	5.9	75.9	129.8	137.4	105.2	-	448.3	-	-
Other Works	5.2	12.6	26.7	18.8	57.8	4.0	4.0	5.0	6.0	7.0	26.0	6.0	7.0
Total	5.2	12.6	26.7	18.8	63.7	79.9	133.8	142.4	111.2	7.0	474.3	6.0	7.0
Balance to be Financed	9.6	13.8	35.3	5.5	19.4	64.7	109.0	119.4	96.1	-1.1	389.1	-4.7	-4.2
Financed by:													
Existing Public Fund Loan	3.5	10.0	35.3	7.4	0								
IBRD						33.2	53.9	53.9	41.6	9.0	191.6	-	-
Equity Contribution	7.2	4.1	6.1	0	12.9	32.5	56.0	66.5	51.6	0	206.6	0	0
Surplus or Deficit of Funds	1.1	0.3	6.1	1.9	-6.5	1.0	0.9	1.0	-2.9	9.1	9.1	4.7	4.2
Balance Beginning of the Year	1.7	2.8	3.1	9.2	11.1	4.6	5.6	6.5	7.5	4.6		13.7	18.4
Balance End of the Year	2.8	3.1	9.2	11.1	4.6	5.6	6.5	7.5	4.6	13.7		18.4	22.6
Debt Service Coverage (excluding Sales of Water Right)						7.7	3.9	2.3	1.7	1.4		1.1	1.2

June 1977

APPRAISAL OF
AN ALEPPO WATER SUPPLY PROJECT

SYRIAN ARAB REPUBLIC

EPEA'S BALANCE SHEETS

ACTUALS (1973-1976) AND PROJECTED (1977-1984)

	LS Million											
	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
As of December 31												
Assets												
Fixed Assets												
Plant in operation	73.1	74.4	77.2	77.8	208.7	222.7	237.0	242.0	248.0	683.0	694.0	700.0
Less: Depreciation	25.8	28.3	30.9	33.5	38.2	45.3	52.9	60.8	68.9	84.3	107.0	130.0
Net plant	47.3	46.1	46.3	44.3	170.5	177.4	184.1	181.2	179.1	598.7	587.0	570.0
Work in progress	23.8	35.1	59.0	77.2	10.0	75.9	195.4	332.8	438.0	10.0	5.0	6.0
Current Assets												
Cash and bank	2.8	3.1	9.2	11.1	4.6	5.6	6.5	7.5	4.6	13.7	18.4	22.6
Accounts receivable - water	4.0	3.5	3.6	3.6	4.8	6.6	7.7	8.9	9.5	18.8	11.9	13.1
Accounts receivable - other	5.5	4.8	5.3	8.6	8.0	9.0	10.5	9.0	9.0	10.0	10.0	10.0
Inventories	5.8	5.7	6.8	20.0	7.0	7.0	8.0	8.0	6.0	6.0	6.0	6.0
Advance payments	11.8	26.3	45.0	27.9	6.0	9.0	8.5	8.5	6.0	6.0	5.0	5.0
Total	29.9	43.4	69.9	71.2	30.4	37.2	41.2	41.9	35.1	46.5	51.3	56.7
Total Assets	101.0	124.6	175.2	192.7	210.9	290.5	420.7	555.9	652.2	655.2	643.3	632.7
Liabilities												
Equity												
Capital	50.9	54.4	59.7	63.2	76.4	95.6	114.6	128.2	137.1	145.1	147.3	150.8
Equity contribution	7.2	11.3	17.4	17.4	30.3	62.8	118.8	185.3	236.9	236.9	236.9	236.9
Other reserves	2.4	2.7	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Equity	60.5	68.4	80.4	83.9	110.0	161.7	236.7	316.8	377.3	385.3	387.5	391.0
Long Term Debt												
Existing Public Fund loan	26.6	36.6	71.9	79.3	79.3	79.3	79.3	79.3	79.3	79.3	79.3	79.3
Proposed IBRD	-	-	-	-	-	33.2	87.1	141.0	182.6	184.5	170.3	156.1
Total	26.6	36.6	71.9	79.3	79.3	112.5	166.4	220.3	261.9	263.8	249.6	235.4
Current Liabilities												
Euphrates Authority	5.7	5.7	6.4	6.4	8.6	-	-	-	-	-	-	-
Accounts payable	5.0	10.8	13.9	20.2	10.0	13.0	14.0	15.0	9.0	2.0	2.0	2.0
Retirement provision	.6	.6	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
Deposits	2.6	2.5	2.1	2.4	2.5	2.8	3.1	3.3	3.5	3.6	3.7	3.8
Total	13.9	19.6	22.9	29.5	21.6	16.3	17.6	18.8	13.0	6.1	6.2	6.3
Total Liabilities	101.0	124.6	175.2	192.7	210.9	290.5	420.7	555.9	652.2	655.2	643.3	632.7
Debt/Debt Equity Ratio	30:70	35:65	47:53	49:51	42:58	41:59	41:59	42:58	41:59	41:59	39:61	38:62

June 1977

APPRAISAL OF
AN ALEPPO WATER SUPPLY PROJECT
SYRIAN ARAB REPUBLIC

Assumptions for the Financial Projections

Income Statement

1. The local inflation rates, used in the projection are as follows:

<u>Year</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980 onwards</u>
Local inflation %	15	12	12	10

2. Population served, number of connections, water produced and volume consumed reflect projections in Annex 2.
3. The new tariff implemented in 1977 is LS 0.60 for household consumption and LS 0.75 for non-household consumption; the average tariff is LS 0.65.
4. Revenues from metered sales have been calculated by applying average tariffs to metered volumes. Industry tariffs are based on average tariff for non-household consumption less an allowance for depreciation in accordance with the agreement between EPEA and the industrial estate. Industry has already contributed LS 17.6 million towards the capital cost of present works.
5. No increase in the LS 750 average purchase price of a water right was assumed. All new connections are assumed to purchase water rights.
6. EPEA, which owns all water meters, increased its annual meter rent and maintenance charge from LS 3.0 to LS 36.0. The charge for this item is assumed to be maintained at same level during the projection period.
7. Other income is projected to increase in proportion to number of connections plus local inflation.

Personnel

8. It is assumed that the staff would increase in line with the increase in number of meters, except for the staff in Stations I and II where staff is assumed to grow at a lower rate because of elimination of the generation station and the use of electricity provided by the Syrian Electric Authority. Also personnel expenditure is assumed to increase by local inflation factors.

9. Material and maintenance is projected at 1% of gross fixed assets at the beginning of the year up to the year 1981 and to decrease to 0.5% after the project goes into operation.
10. Administration and general expenses are projected to increase in proportion to the number of consumers plus local inflation.
11. Present electricity charges are about LS 0.10 kwh in accordance with an agreement between EPEA and the National Electric and Power Authority. Future electricity cost is projected to increase in proportion to water production plus inflation.

Depreciation

12. As of 1956 and up to the end of 1975 EPEA was using a schedule of depreciation rates that was yielding an average depreciation rate of about 3.3% on average gross fixed assets. In June 1976 EPEA's Board of Directors decided to reduce the depreciation rates, as of the year 1976, so they would reflect more accurately the actual lives of the assets. The application of the EPEA's new depreciation rates to different asset components would produce an average depreciation rate of 2.2%. The mission judges that these rates are inadequate and do not reflect the obsolescence of assets. Accordingly, specific rates were assigned, in the appraisal, for the different types of assets of the project components. These assigned rates produced a weighted average depreciation rate of about 3.3%. The following table compares the specific depreciation rates used for the appraisal for major asset components with those which EPEA is currently using.

<u>Item</u>	<u>Appraisal Rates %</u>	<u>EPEA's Rates %</u>
Aqueduct	2.0	1.25
Pumps	7.0	5.0
Treatment plants	5.0	2.5
Distribution	2.5	2.5

Cash Flow

13. The Bank loan of US\$48.5 million is assumed to be onlent for a period of 18 years including a grace period of 4 1/2 years, at an interest rate of 8.2%.
14. The 1977 investment figure of LS 57.8 million under other works reflects cost required for ongoing works. Of this figure an amount of LS 20 million is already covered by advance payments.

Balance Sheet

15. Cash requirements are forecast at about four months of cash operating expenses.

16. Water accounts receivable are projected at three months of water sales.
17. "Accounts receivable others" mainly include installments of water right sales which are payable within a maximum of four years are projected to grow in proportion to the annual sales of water right sales.
18. Following the completion of the present works inventories, which amounted to LS 20 million in 1976, are assumed to decrease to LS 7 million in 1977.
19. The high figure of LS 27.9 million for advance payment in 1976 is due to two factors; EPEA has paid a 100% advance against letters of credit to avoid Bank charges and a substantial amount of equipment already on site for ongoing project had not been transferred to work in progress. EPEA is assumed to change this payment practice during the project construction period and accordingly the advance payments figure is projected to decline substantially in 1977 and stay at about same level thereafter.
20. Accounts payables are assumed to range at about 15% of construction requirements during the period 1978-81, then to be at a level of LS 2.0 million thereafter.
21. Deposits are assumed to grow in proportion with number of connections.

June 1977

APPRAISAL OF
AN ALEPPO WATER SUPPLY PROJECT
SYRIAN ARAB REPUBLIC

Etablissement Public des Eaux d'Alep (EPEA)

May 1977 Tariffs

<u>Non-Recurring Charges</u>	<u>Payable by</u>	<u>Amount</u>
(i) Water Right Purchase	All applicants as of February 1977	Based on a rate of LS 1,500 for a supply of 1.0/m ³ a day with a minimum purchase of 0.25/m ³ a day. EPEA decides on the amount of water to be purchased based on the size of the premises. The subscriber is entitled to a free water allowance of one-third of the quantity of water right purchased.
(ii) Distribution System Fee	Domestic and small business	LS 150.0
	Large business	Minimum LS 200.0
(iii) Connection Fee	All applicants	Cost + 25%
(iv) Application Fee	do	LS 20.0
(v) Meter Installation	do	LS 20.0
(vi) Deposits	do	Based on three months estimated consumption plus value of meter.

<u>Recurring Charges</u>	<u>Payable by</u>	<u>Amount</u>
(i) Metered Consumption (for consumption in excess of water right holders free allowance)		
	Household	LS 0.60
	Non-household	LS 0.75
	Villages of Bab and Safira	LS 0.30
	Religious Institutions	FREE
(ii) Meter rent and Maintenance		LS 3.0/month
(iii) Temporary Supplies		LS 150.0/year
<u>Other Charges</u>		
(i) Reconnection charge		LS 7.0
(ii) Meter Destruction		LS Cost + 30%
(iii) Meter Relocating		LS 30.0
(iv) Illegal Connection		LS 200.0

June 1977

APPRAISAL OF
AN ALEPPO WATER SUPPLY PROJECT
SYRIAN ARAB REPUBLIC

Justification

A. Least-Cost Solution

1. The only proven major source of water available for Aleppo is from Lake Assad on the Euphrates River. The project cost estimates are based on the extension of existing works for the conveyance and treatment of water from Lake Assad to Aleppo.

2. The project estimates are based on the assumption that the aqueduct would be of concrete in situ construction. The project has been defined in sufficient detail so that reasonable cost estimates could be prepared. A staged construction of the aqueduct was found not to be economical but staging of equipment and pumping mains was provided for where feasible. Since expansions of the Aleppo supply works after 1990 will supply an area at a higher elevation requiring a pumped main and/or possibly a different source, a larger transmission main than the one proposed is not justified. Engineering consultants will be engaged by EPEA to devise alternative distribution schemes for meeting the future demand and to use a computer model of the system to select the least-cost solution.

B. Internal Economic Return

3. The project is expected to be completed by the year 1981 and be fully utilized by the end of the year 1991. The benefit period covers 30 years after commissioning, a period related to the composite depreciation rate of 3.3%. Assets added after 1981, mainly pumps, a treatment plant and distribution lines, are assumed to have a residual value after the end of the benefit period.

4. Costs necessary to obtain the full benefits of the project include the following:

- (i) Capital expenditure for the project
- (ii) Expansion of the distribution system during the years 1981-91

- (iii) Additional pumps and treatment plant to be installed during 1986-89.
- (iv) Increase in operating costs above the 1980 base year. The increase in operating cost is assumed constant after 1991.

Costs are at 1976 prices and an allowance of 10% was made for taxes included in contractors prices. No shadow pricing is employed in the calculation as the reported unemployment is low, and the exchange rate used for the Syrian pound is a free market rate which has shown remarkable stability.

5. There are many benefits associated with the provision of a reliable and safe water supply, the most important being health related. The proposed project will ensure that future demands for water can be met thus avoiding loss of pressure in parts of the distribution system that could result in back-syphoning. This is the most important in Aleppo in view of the present inadequate sewage collection and disposal system. The health benefits will be partially revealed through medical cost savings, a general improvement in individual well being and a cost saving to, or an increase productivity of, business enterprises. It is not possible to quantify these benefits, however, because the recent health statistics showing a prevalence of water-borne diseases cannot be attributed to the intermittent water supply alone, but are a combination of inadequate water supply and sewage disposal systems.

6. Using the new tariff introduced in 1977 as a minimal measure of the project benefits, the internal economic rate of return on the Project is 9.8%. The actual rate of return is substantially higher as the additional health and environmental benefits were not included as they are difficult to quantify.

C. Average Incremental Costs and Proposed Water Supply Tariffs

7. The problem of water supply benefit highlights the need to formulate a water supply tariff policy which reflects the true cost of supplying water in Aleppo. The object of this would be to ensure that future investment decisions can be made with greater confidence in their economic merit. If the price of water supply is fixed at a level which approximates to long term marginal cost of supplying this service, then it will be demonstrable that increments in consumption of water are valued by consumers at least as much as the resources consumed in providing this increment i.e. approximate economic efficiency will be attained from a resource allocation point of view.

8. In estimating the long-term marginal costs of supplying water in Aleppo, an average incremental cost calculation was carried out on incremental volume of water to be sold and incremental capital and operating costs associated with the proposed project for the years 1977 to 2110. The capital costs which were used in the calculation were those required to utilize the full potential of the proposed aqueduct and distribute this water. Provision was

made for the construction of additional filters and for the installation of additional pumps, ozonation and treatment plant equipment in 1986. No capital costs associated with the second phase development presently underway were included in the calculation.

9. An average incremental cost exercise was carried out using discount rates of 6, 8 and 10 percent for water sold. The results are summarized as follows:

<u>Discount Rate</u>	<u>Water Supply</u> LS/m ³
6	0.73
8	0.92
10	1.14

10. The current average revenue of LS 1.10/m³ is equal to the long-term marginal cost of water discounted at a rate of 10% which approximates the opportunity cost of capital in Syria.

June 1977

APPRAISAL OF
AN ALEPPO WATER SUPPLY PROJECT
SYRIAN ARAB REPUBLIC
INTERNAL RATE OF RETURN OF WATER SUPPLY INVESTMENT
LONG TERM MARGINAL COST OF WATER 1976 PRICES

<u>Year</u>	<u>Incremental Water Sales Million m³</u>	<u>Investment in Project</u>	<u>Other Investment</u>	<u>Incremental Operating Cost</u>	<u>Total Cost</u>	<u>Residual Investment</u>	<u>Incremental^{1/} Revenue</u>
-----LS Million-----							
1976	0			0	0		
1977	0			0	0		
1978	0	49.0		0	49.0		
1979	0	80.0		0	80.0		
1980	0	82.3		0	82.3		
1981	5.4	57.0	3.6	0.5	61.1	1.3	5.9
1982	8.8		2.8	1.0	3.8	1.0	9.7
1983	12.4		3.0	1.1	4.1	1.2	13.6
1984	16.4		2.7	1.3	4.0	1.2	18.0
1985	20.6		2.7	1.6	4.3	1.2	22.7
1986	25.6		30.0	2.1	32.1	12.0	28.2
1987	30.6		30.0	2.5	32.5	12.0	33.7
1988	35.6		30.0	3.0	33.0	12.0	39.2
1989	41.6		2.7	3.2	5.9	1.3	45.8
1990	46.6		2.7	4.1	6.8	1.3	51.3
1991	53.6		2.7	4.6	7.3	1.4	59.0
1992	60.6		2.7	5.2	7.9	1.4	66.0
1993	60.6			5.2	5.2		66.0
1994	60.6			5.2	5.2		66.0
1995	60.6			5.2	5.2		66.0
1996	60.6			5.2	5.2		66.0
1997	60.6			5.2	5.2		66.0
1998	60.6			5.2	5.2		66.0
1999	60.6			5.2	5.2		66.0
2000	60.6			5.2	5.2		66.0
2001	60.6			5.2	5.2		66.0
2002	60.6			5.2	5.2		66.0
2003	60.6			5.2	5.2		66.0
2004	60.6			5.2	5.2		66.0
2005	60.6			5.2	5.2		66.0
2006	60.6			5.2	5.2		66.0
2007	60.6			5.2	5.2		66.0
2008	60.6			5.2	5.2		66.0
2009	60.6			5.2	5.2		66.0
2010	60.6			5.2	5.2		66.0

Total residual investment

47.3

The long-term marginal costs of water are as follows:

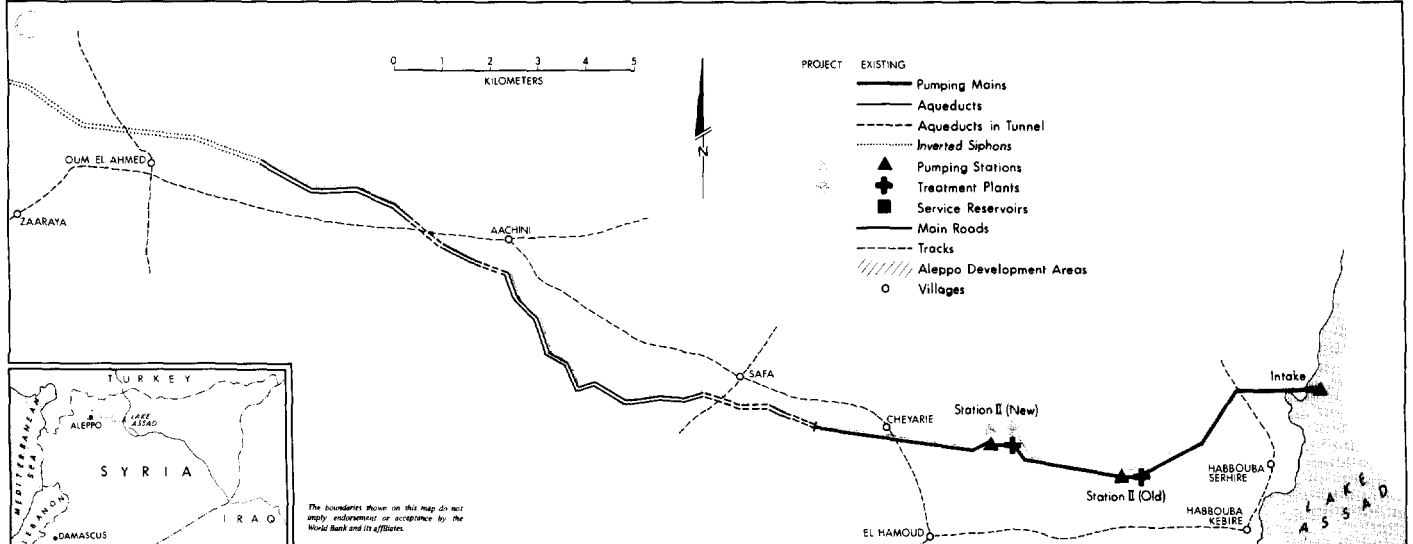
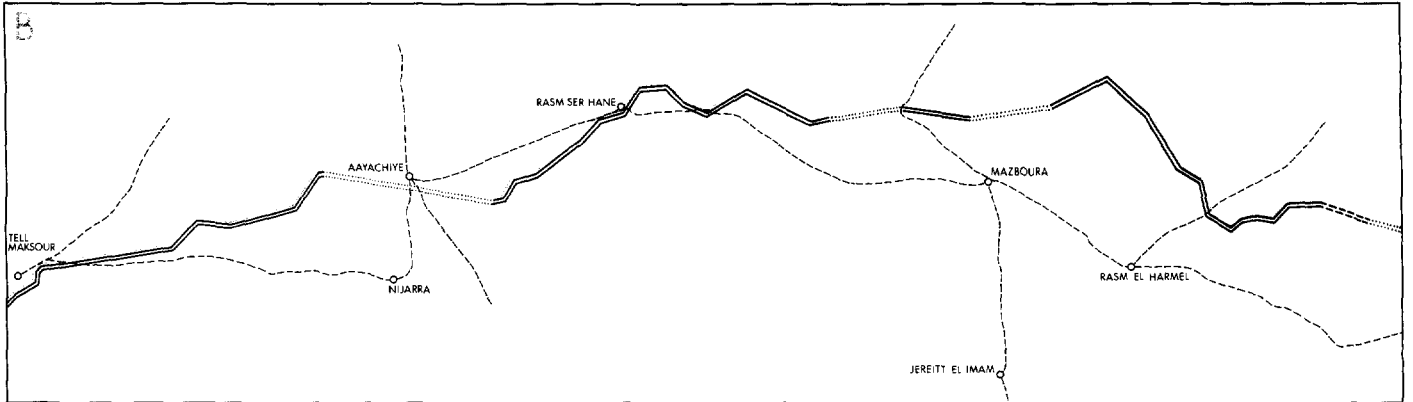
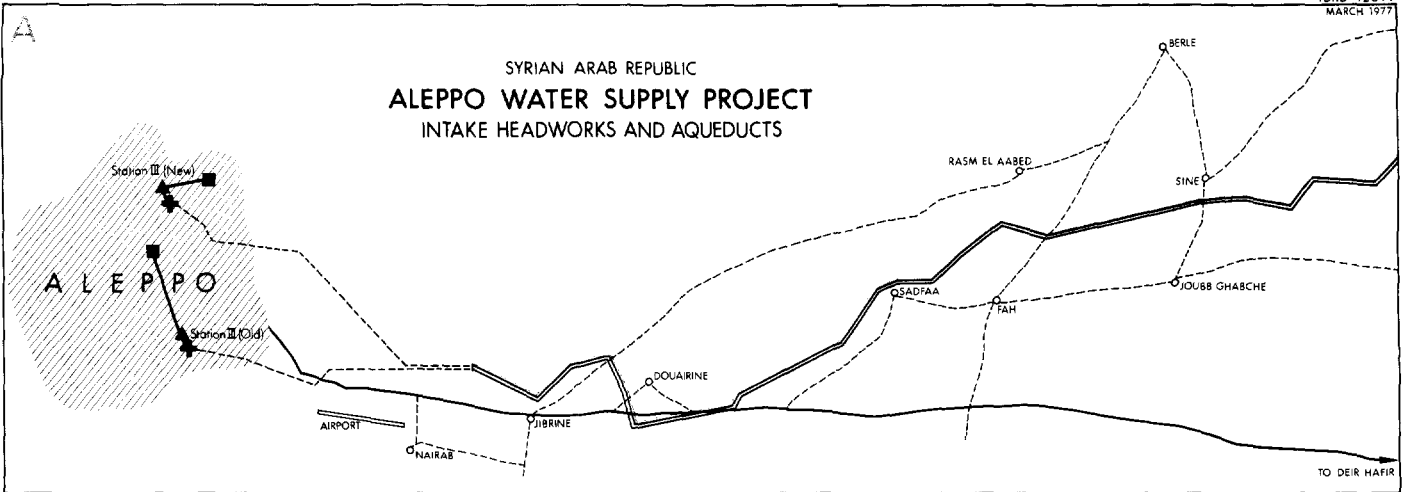
<u>Discount Rate (%)</u>	<u>LTMC (LS/m³)</u>
6	0.73
8	0.92
10	1.14

Internal Rate of Return (9.8%)

^{1/} Based on average revenue at rates introduced in February and May 1977.

June 1977

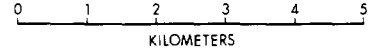
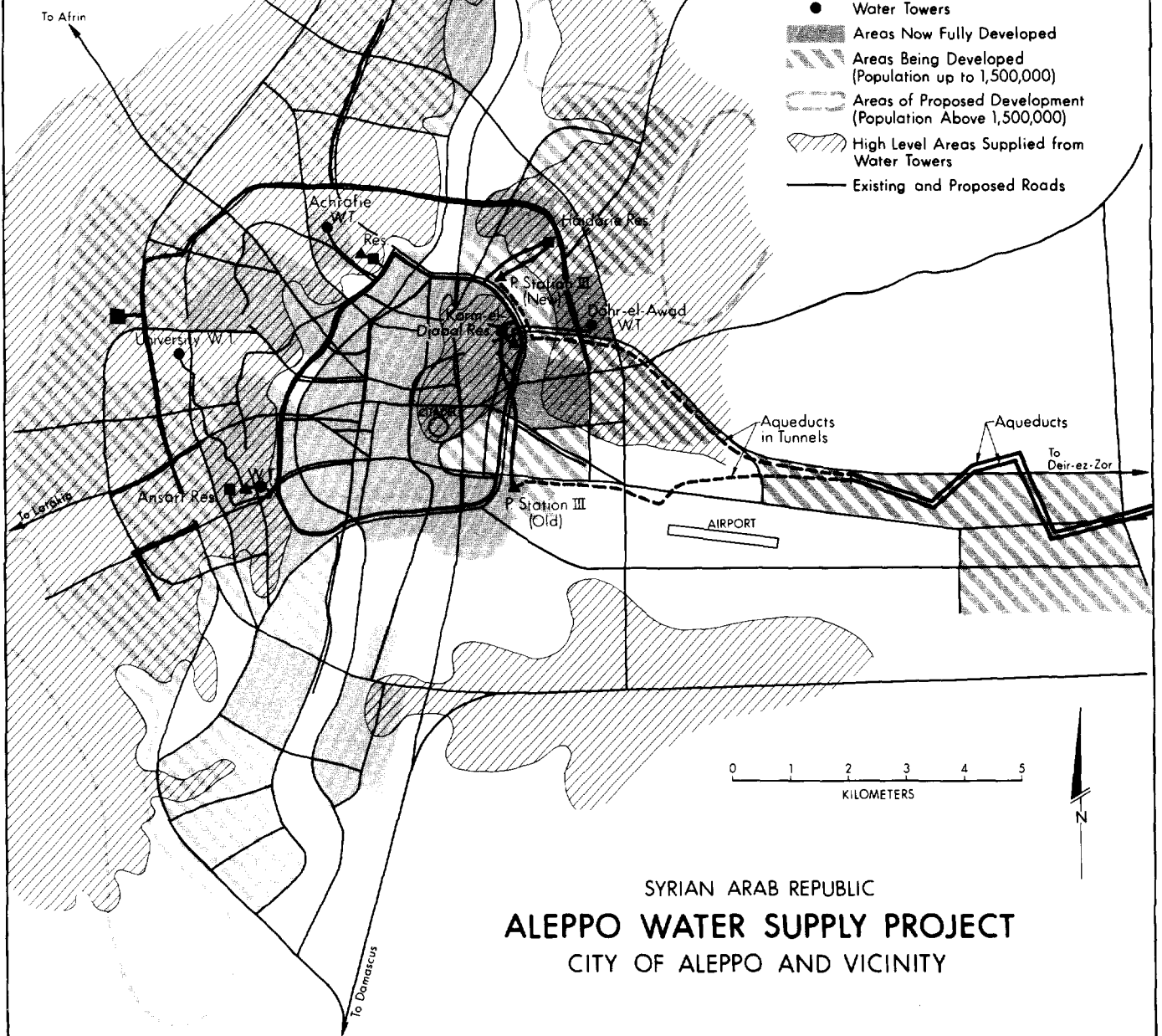
SYRIAN ARAB REPUBLIC
ALEPPO WATER SUPPLY PROJECT
INTAKE HEADWORKS AND AQUEDUCTS





The boundaries shown on this map do not imply endorsement or acceptance by the World Bank and its affiliates.

- Probable Location of Future Mains to Serve Developing High Level Areas
- Probable Location of Future Service Reservoir
- Trunk Mains
- ▲ Pumping Stations
- Service Reservoirs
- Water Towers
- ▨ Areas Now Fully Developed
- ▧ Areas Being Developed (Population up to 1,500,000)
- ▩ Areas of Proposed Development (Population Above 1,500,000)
- High Level Areas Supplied from Water Towers
- Existing and Proposed Roads



SYRIAN ARAB REPUBLIC
ALEPPO WATER SUPPLY PROJECT
 CITY OF ALEPPO AND VICINITY