

UNCLASSIFIED

DEPARTMENT OF STATE  
INTERNATIONAL DEVELOPMENT COOPERATION AGENCY  
WASHINGTON, D.C. 20523

PROJECT PAPER

JORDAN - ZARQA- RUSEIFA WATER AND WASTEWATER PROJECT

UNCLASSIFIED

PROJECT DATA SHEET

1. TRANSACTION CODE

A = Add  
 C = Change  
 D = Delete

Amendment Number

DOCUMENT CODE

3

2. COUNTRY/ENTITY

JORDAN

3. PROJECT NUMBER

278-0234

4. BUREAU/OFFICE

Near East

5. PROJECT TITLE (maximum 60 characters)

ZARQA-RUSEIFA WATER AND WASTEWATER

6. PROJECT ASSISTANCE COMPLETION DATE (FACD)

MM DD YY  
 1 2 3 1 8 6

7. ESTIMATED DATE OF OBLIGATION  
 (Under 'B' below, enter 1, 2, 3, or 4)

A. Initial FY  3  2 B. Quarter  C. Final FY  8  3

8. COSTS (\$000 OR EQUIVALENT \$1 = JD 333)

A. FUNDING SOURCE	FIRST FY 82			LIFE OF PROJECT		
	B. FX	C. L/C	D. Total	E. FX	F. L/C	G. Total
AID Appropriated Total	10,000		10,000	15,000		15,000
(Grant)	( )	( )	( )	( )	( )	( )
(Loan)	(10,000)	( )	(10,000)	(15,000)	( )	(15,000)
Other U.S.						
1.						
2.						
Host Country	5,643	11,533	17,176	23,910	40,319	64,729
Other Donor(s)						
<b>TOTALS</b>	<b>15,643</b>	<b>11,533</b>	<b>27,176</b>	<b>38,910</b>	<b>40,319</b>	<b>79,729</b>

9. SCHEDULE OF AID FUNDING (\$000)

A. APPROXIMATE RELATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH CODE		D. OBLIGATIONS TO DATE		E. AMOUNT APPROVED THIS ACTION		F. LIFE OF PROJECT	
		1. Grant	2. Loan	1. Grant	2. Loan	1. Grant	2. Loan	1. Grant	2. Loan
(1) ESF	720B	820	820				10,000		15,000*
(2)									
(3)									
(4)									
<b>TOTALS</b>							<b>10,000</b>		<b>15,000*</b>

10. SECONDARY TECHNICAL CODES (maximum 5 codes of 3 positions each)

11. SECONDARY PURPOSE CODE

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

A. Code BU EQTY ENV  
 B. Amount

13. PROJECT PURPOSE (maximum 480 characters)

To construct new wastewater collection and treatment facilities and to improve the existing water distribution system in Zarqa-Ruseifa.

14. SCHEDULED EVALUATIONS

Interim MM YY MM YY Final MM YY  
 1 1 8 4 0 7 8 7

15. SOURCE/ORIGIN OF GOODS AND SERVICES

000  94  Local  Other (Specify)

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of a \_\_\_\_\_ page PP Amendment)

\* The terms of any second increment are as yet undetermined.

17. APPROVED BY

Signature *Walter G. Bollinger*  
 Title Director, USAID/Jordan

Date Signed MM DD YY  
 1 9 1 8 3 2

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION

MM DD YY  
 1 10 2 7 8 2

ZARQA - RUSEIFA WATER AND WASTEWATER

PROJECT PAPER

TABLE OF CONTENTS

	<u>Page</u>
Facesheet	ii
Table of Contents	iii
List of Figures	v
Glossary	vi
Introductory Memorandum	ix
Summary and Recommendations	x
I. PROJECT DESCRIPTION	1
A. Project Background	1
B. The Problem	3
1. General Introduction	3
2. Environmental Considerations	3
3. Health Considerations	4
4. The Water Distribution System	5
C. Description of Proposed Project	6
1. General	6
2. Proposed Wastewater Collection System	6
3. Proposed Wastewater Treatment Plant	7
4. Proposed Water Distribution Improvements	8
5. Proposed Operations and Training Services	8
D. Cost of Financing of Proposed Project	13
E. Beneficiaries	16
II. PROJECT SPECIFIC ANALYSES	17
A. Economic Feasibility	17
B. Social Soundness Analysis	17
C. Technical Feasibility	21
D. Administrative Analysis	26
E. Environmental Concerns	27
III. FINANCIAL PLAN	28
IV. IMPLEMENTATION PLAN	34

TABLE OF CONTENTS  
(Cont'd)

V.	SPECIAL CONDITIONS	39
A.	Conditions Precedent to Disbursement	39
B.	Terminal Dates for Conditions Precedent	40
C.	Special Covenants	40
VI.	ANNEXES	
A.	Feasibility Study and Other Relevant Memoranda	A-1
B.	Maps and Tables	B-1
C.	Technical Analyses	C-1
1.	Social Soundness Analysis	
2.	Economic Analysis	
3.	Financial Analysis	
D.	Logical Framework Matrix	D-1
E.	Statutory Criteria Checklist	E-1
F.	611(e) Certification	F-1
G.	Progress on Special Covenants in Prior Loans	G-1
H.	Application for Project Assistance	H-1
I.	Multidonor Participation and Coordination	I-1

**Note:** The following documents are available in NE/PD's official project files:

- Project Identification Document Facesheet
- NEAC PID Review Reporting Cable and USAID Response
- PP Approval Cable
- Delegation of Authority Cable
- Loan Agreement
- Project Authorization

## LIST OF FIGURES

<u>Figure Number</u>		<u>PAGE</u>
1	Cost Estimate	13
2	Proposed Financing	14
3	Individual Contract Cost Estimates	15
4	Summary Cost Estimates	31
5	Projection of Expenditures by Fiscal Year	32
6	Projection: Pro Forma Income Statement	33
7	Schedule of A.I.D. Actions	34
8	Implementation Schedule	35
9	Zarqa-Ruseifa Water and Wastewater Project Area	B-2
10	Wastewater Collection Planning Sub-areas	B-3
11	Wastewater Collection System	B-4
12	Location of Principal Industries	B-5
13	Wastewater Treatment Plant Schematic	B-6
14	Geographic Distribution of Population and Activities in the Zarqa-Ruseifa Corridor	C-4
15	Project Area and Sub-areas	C-7
16	Income Distribution	C-8
17	Schedules of Debt and Debt Service	C-34
18	Construction Costs of Sewerage Project	C-37
19	Projected Sewage Flow	C-38
20	Cost Recovery - Case I, II and III	C-39
21	Estimated Income Distribution, Water Consumption, and Spending on Water and Sewerage/Zarqa Area 1979	C-41
22	Proposed Phase I Contract Breakdown	H-3
23	Project Cost Estimate and Financing Scenario	I-6

## GLOSSARY

### Abbreviations

A.I.D. (AID)	Agency for International Development
AID/W	Agency for International Development at Washington, D.C.
AURPG	Amman Urban Region Planning Group
AWSA	Amman Water and Sewerage Authority
AWWA	American Water Works Association
CONT	Controller
ENG	Engineer
EO	Engineer Officer
ESF	Economic Support Fund
FAA	Foreign Assistance Act of 1961, as amended
FX	foreign exchange
FY	fiscal year
GOJ	Government of the Hashemite Kingdom of Jordan
IDB	Islamic Development Bank
IRR	internal rate of return
JD	Jordanian dinar
JVA	Jordan Valley Authority
KFW	Kreditanstalt für Wiederaufbau (West German Credit Bank for Development)
km	kilometer
LC	local currency
lpc	liters per capita

GLOSSARY (cont'd)

MMREA	Ministry of Municipal, Rural and Environmental Affairs
lpcd	liters per capita per day
m <sup>3</sup>	cubic meters
MCM	million cubic meters
mm	millimeter
NE	Near East Bureau, Agency for International Development
NE/PD	Office of Project Development, Near East Bureau, Agency for International Development
NPC	National Planning Council
NRA	National Resources Authority
O&M	operations and maintenance
OYB	operating year budget
PACD	project assistance completion date
PID	project identification document
PO	program officer
PROG	program office
RLA	regional legal advisor
SA	water collection planning sub-area
SES	socio-economic status
TDD	terminal disbursement date
TSFS	technical services and feasibility studies
U.S.	United States
USAID, USAID/J	Agency for International Development mission at Amman
WB	World Bank
WSC	Water Supply Corporation

## GLOSSARY (cont'd)

### Measures

1 kilometer	= .62 miles
1 millimeter	= 0.039 inches
1 cubic meter	= 35.4 cubic feet
	= 264 U.S. gallons
1 liter	= .264 U.S. gallons
1 hectare	= 2.471 acres
1 dunum	= 0.2471 acres

### Exchange Rate

1 Jordanian dinar = \$3.00 U.S.



ACTION MEMORANDUM TO THE DIRECTOR

FROM: Dan Leaty, PROG  
THRU: Thomas A. Pearson, PO  
SUBJECT: Zarqa-Ruseifa Project Paper

Date: September 16, 1982

**Problem:** The PP originally approved for this project has been revised to reflect the amount of funding AID proposes to make available for the project. The revised PP requires your approval so that negotiations with the GOJ can be initiated.

**Discussion:** In March 1981, the PP was approved by the USAID Mission Director indicating the life-of-project funding by AID of \$34.0 million (\$20.0 million grant and \$14.0 million loan on standard AID terms). The PP was submitted to AID/W and approved by the NEAC per STATE (81) 138858. Because of the reduction in the planned life-of-project funding by AID and the potential assistance to be provided to the GOJ by the Islamic Development Bank, (IDB) Kreditanstalt fur Weideraufbau and World Bank, AID/W authorized USAID to make the changes in the PP and authorize and obligate funds per STATE (82) 68493.

The project description has not been amended from that included in the 1981 PP, but the funding levels have been changed and a statement included on the participation of other financing agencies (Annex J). The Project Committee, as shown by the clearance of this memo, recommends approval of the PP.

**Recommendation:** That you sign the enclosed 611(e) certificate and the PP face sheet and approve passing copies of the PP and its attachments to the National Planning Council as the initial steps in negotiating the PP.

Clearances:

PROJECT COMMITTEE

PO: Larry Brown  
EC: Jim Cassanos  
PO: SEmonds  
PROG: Gishaq

LB  
JC  
SE  
GA

9/16/82  
9/16/82  
9/16/82  
9/16/82

SENIOR REVIEW COMMITTEE

CONT: Douglas Sheldon  
ENG: Albert Karian  
RLA: Kevin O'Donnell

DS  
AK  
KO

9/16/82  
9/16/82  
9/16/82

APPROVED

Walter J. Bellamy

DISAPPROVED

DATE

Sept. 16, 1982

PROJECT PAPER

HASHEMITE KINGDOM OF JORDAN

ZARQA-RUSEIFA WATER AND WASTEWATER PROJECT

SUMMARY AND RECOMMENDATIONS

1. Recipient: The Government of the Hashemite Kingdom of Jordan (GOJ), which will make the proceeds of the assistance available to the Water Supply Corporation which is the implementing agency.
2. The Loan. Not to exceed Ten Million U.S. Dollars (\$10,000,000) funded under the FY 1982 ESF account and, subject to the availability of funds, not to exceed Five Million U.S. Dollars (\$5,000,000) funded under the FY 1983 ESF account to finance equipment, materials and services. Procurement will be limited to Jordan and countries included in AID Geographic Code 941.
3. Loan Terms. Repayable in U.S. Dollars over a period of forty (40) years, including a 10-year grace period for principal repayments, with interest at an annual rate of two percent (2%) during the grace period and three percent (3%) thereafter for the portion of loan funds provided under the FY 1982 ESF account.

The second increment is subject to the availability of funds and shall be on terms mutually agreed upon at the time of negotiation.

4. Description of Project: The proposed project will provide a wastewater collection system, a wastewater treatment plant and improvements to the water distribution system for the cities of Zarqa and Ruseifa. The project will include the follow major elements:
  - a. Construction of a wastewater collection system servicing densely populated areas of Zarqa and most of Ruseifa's industries;
  - b. Construction of a wastewater treatment plant designed to provide secondary treatment for at least 16,500 cubic meters of sewage per day;
  - c. Repair, replacement and/or construction of the water distribution system throughout Ruseifa and portions of Zarqa to improve the efficiency and decrease the likelihood of contamination of the system; and

d. Assistance and training for the staff responsible for the construction, operation and maintenance of the Zarqa-Ruseifa Water and Wastewater facilities.

5. Summary of Findings:

a. Technical Analysis: A review of the Feasibility Study (Part II.C.) indicated that the project as proposed represents a technically sound and least-cost solution to the problem and adequately serves as a basis for detailed design.

b. Financial Analysis: As summarized in Part III, Financial Plan, the proposed project is estimated to cost U.S. \$79,729,000 (\$35.1 million in foreign exchange costs and \$44.62 million in local currency costs). It is proposed that AID-financing of U.S. \$15.0 million be used to partially fund construction supervision (est. \$5.264 million), operation and training services (est. \$2.368 million), and approximately 55% of the construction costs of the wastewater collection system and improvements to the water distribution system in subareas II, III, IV, and VII (see Figures 10 and 11, Annex B). The GOJ will provide all galvanized steel and ductile iron pipe, including fittings and other appurtenances for the water system works from financing to be provided by the West German KFW.

As more fully explained in Annex I, the World Bank (WB), the Islamic Development Bank (IDB) and the West German Kreditanstalt fur Wiederaufbau (KFW), have all stated their intention to provide funds for carrying out a project encompassing the project described herein but also including subareas beyond this project's perimeters. The expected contributions are \$17.0 million from the WB, \$7.8 million from the IDB and \$14.43 million from the KFW, for a total of \$39.23 million. Of this total amount, approximately \$26.0 million will be applied to project components described under project 278-0234.

The GOJ will be responsible for providing all additional resources required for the timely completion of the project, estimated to be \$64.729 million, which will be reduced to approximately \$38.729 million if the other financiers contribute funds as expected.

The financial analyses indicate continued viability of the water distribution system and viability for the proposed wastewater collection and treatment facilities. The project will significantly increase the costs and revenues required to meet the financial obligations of the Zarqa-Ruseifa water and wastewater system. Based on analyses the financial capability to make the operating utility operationally viable will not be a major project constraint. (See Part III and Annex C.3).

c. Economic Analysis: As the project is primarily designed to provide improvements to the environment and to health conditions, the true economic worth can not be quantitatively calculated. This is especially true as benefits will accrue to areas beyond Zarqa-Ruseifa, i.e., all consumers of water from the ground water resources of the Amman-Zarqa Basin, the surface water of the Zarqa River and the King Talal Reservoir will receive benefits.

An economic internal rate of return (IRR) analysis was conducted. Both the wastewater collection and treatment facilities and the improvements to the water distribution system were shown to have an IRR in excess of 8%. This rate alone is sufficient to support the proposed investment, but should be assumed to be even greater on the basis of the various externalities.

d. Social Analysis: The project will benefit all the residents of Zarqa and Ruseifa by providing improvements in the water distribution system and will benefit principally the lower-income residents that live in the parts of the city that will be sewered. The chief benefits will be in the form of improved water and sewerage facilities, which should result in improved health among the population. It is believed that no aspects of the project will conflict with any of the social norms or cultural patterns of Zarqa-Ruseifa's residents.

e. Environmental Analysis: An environmental assessment was prepared by the consultants based upon the scoping statement prepared in accordance with AID procedures. The basic findings are that the project will have the normal short-run negative effects associated with major construction but that the long-term effects will be positive and substantial. Mitigating measures have been identified and have been addressed by special covenants and/or will be addressed by contract requirements.

6. Statutory Checklist: All statutory criteria have been met (see Annex E).

7. AID Funding Source: Economic Support Fund, FY 1982 and FY 1983.

8. Mission's Views: The USAID Mission supports the project fully. The FAA Section 611(e) certification executed by the Mission Director is included as Annex F. The project directly addresses the priority development objectives of the Government of Jordan of meeting basic human needs in the sectors of water and sanitation. The project also addresses the objective of conserving and protecting Jordan's water resources. The wastewater collection and treatment elements of this project should result in a significant improvement in the environment not only in the Zarqa-Ruseifa area, but also in all areas downstream along the Zarqa River, in the ground water resources of the Amman-Zarqa Basin and the surface water reserves of the King Talal Reservoir.

9. Issues: There are no unresolved issues.

10. Recommendation: That a loan be authorized in an amount not to exceed \$10.0 million from the FY 1982 ESF appropriation and a loan or grant be authorized in an amount not to exceed \$5.0 million from the FY 1983 ESF appropriation.

PROJECT COMMITTEE

Chairperson	Larry Brown
Engineer	James Cassanos
Health Officer	Jack Thomas
Social Scientist	Jarir Dajani
Economist/Financial Analyst	James Hanson
Education/Training	James Turman/Scott Edmonds
Program Officer	George Ishaq

SENIOR REVIEW COMMITTEE

Director	Walter G. Bollinger
Acting Deputy Director	Thomas A. Pearson
Controller	Douglas Sheldon
Regional Legal Advisor	Kevin O'Donnell
Projects Officer	Scott Edmonds
Engineering Officer	Albert Karian
Program Officer	Daniel Leaty

## I. PROJECT DESCRIPTION

### A. Project Background:

#### 1. Introduction:

Zarqa, located about 20 km northeast of Amman, is the second largest city in Jordan with a 1979 population of 216,000 and a projected annual growth rate of 3.5 percent through the year 2000. Ruseifa, which shares a common town plan border, had a 1979 population of about 62,000 with a similar growth rate. These cities share with other main cities of Jordan the characteristic of rapid growth coupled with inadequate facilities, particularly water distribution and wastewater collection services. As the growth of urban areas in Jordan has accelerated, so has the awareness of the absolute necessity of meeting their inhabitants' basic human needs of health and well-being through the provision of adequate amounts of safe water and for wastewater services. The proposed project for water and wastewater services for Zarqa-Ruseifa is part of a program initiated by the Government of Jordan to meet these critical needs in all of the nation's major urban areas. The proposed assistance will be part of an on-going AID effort to support this Government initiative as fully as possible and will respond directly to the AID Country Strategy for Jordan of priority for assistance to the water sector, including wastewater facilities. The proposed project will favorably impact upon the environment, particularly the quality of ground water and surface waters flowing into the King Talal Reservoir.

#### 2. Zarqa-Ruseifa Characteristics:

The Zarqa-Ruseifa conurbation, a part of the Amman-Zarqa conurbation, contains approximately 10 percent of Jordan's population and many of the larger industries.

The climate is characteristic of the western fringes of the inland desert where conditions are generally arid. The most distinctive features are the concentration of rainfall in the cool winter and the drought conditions of the summer. The average annual rainfall is about 140 mm with virtually all of the rainfall occurring between the months of October and April. The mean annual temperature is 17 degrees Centigrade with an average annual relative humidity of 52 percent.

The national census conducted in November 1979 reported the population of Zarqa and Ruseifa as 215,687 and 49,622 persons, respectively. Also included within the conurbation is Al Musheirfeh with a population of 12,052 and the area along the Amman-Zarqa highway between Zarqa and Ruseifa with a population of 1,300. The total population of the conurbation is, therefore, approximately 278,700 persons. The natural growth rate has been determined to be about 3.5 percent.

The Zarqa-Ruseifa conurbation is one of Jordan's principal industrial centers. The industries, many of which are located on the banks of the Zarqa River, include weaving, phosphate mining and production, bottling, food processing, tannery and various chemical industries (See Annex B, Fig. 12, for a partial listing).

3. Zarqa-Ruseifa Water and Wastewater Project History:

Without exception the most important single constraint on the development of the rapidly growing urban areas of Jordan is inadequate water and wastewater services. In the case of Zarqa-Ruseifa, an inefficient and deteriorating water distribution system and non-existent wastewater collection and treatment facilities are the causes. These problems, largely a result of rapid and unplanned growth, are more fully described below under Section I.B., The Problem.

In furtherance of the development plans of Jordan, the National Planning Council (NPC) contracted with Malcolm Pirnie, Inc., in association with Jouzy and Partners, to conduct feasibility studies for the Zarqa-Ruseifa area to formulate recommendations for improving the water and wastewater services to these communities. It was the intention of the NPC that recommendations be developed assuming more than one investment phase. The overall planning period was to be through the year 2000. The original conception was that the initial investment phase should encompass the needs through 1990.

The preliminary recommendations of the consultant covered all needs through 1990 for the initial investment phase at an estimated cost of well over \$100.0 million at 1980 costs. The NPC, consultants, and USAID, in close consultation, discussed the advisability and feasibility of undertaking the scope of effort described to meet all needs of 1990. The proposed project, described below, represents those elements of the original recommendation deemed most appropriate and feasible to undertake as an initial investment phase and which would result in the greatest benefit to the largest area. The scope of the final design was determined at a meeting on September 20, 1980, attended by NPC, MMREA, WSC and the Mayors of Zarqa and Ruseifa. This scope was used as the basis for determining "contract packaging" as recommended by the consultants in their report of January 28, 1981. The proposed project is a result of these project development and design activities which represent the priorities and needs of the GOJ and the affected municipalities.

Primarily as a result of the involvement of the World Bank (WB), Islamic Development Bank (IDB) and West German Kreditanstalt für Wiederaufbau (KfW), the GOJ decided subsequently to proceed with implementation of the recommended initial investment phase providing water and sewerage service needs through 1990. To coordinate the joint involvement of four foreign donors, a series of joint meetings were held in Amman from late 1981 through mid-1982 with the final meeting held June 9, 1982. The areas to which services are to be provided are unchanged. However, to reflect involvement of the other financing agencies, the contract packaging has been modified.

B. The Problem:

1. General Introduction: The following description is derived from the consultants' feasibility study which is available for reference in NE/PD, AID/W. The problem to be addressed by the proposed project is best defined by describing the conditions prevailing in the Zarqa-Ruseifa area. While separation of project elements is necessary for a clear presentation in the project paper format, it must be emphasized that there is overall linkage between the proposed project elements, the improvement and preservation of the environment.

2. Environmental Considerations: The Zarqa-Ruseifa area is one of the principal industrial centers in Jordan. Wastewaters from these industries discharge to the nearest waterway with little or no pretreatment. Neither city has a system for wastewater collection or treatment. Both cities are totally dependent on cesspools which have become increasingly inadequate and unacceptable. Because of the rapid growth of industries and total population in these communities, more emphasis has been placed on disposal per se than on achieving adequate treatment prior to disposal<sup>1/</sup>.

Field observations indicate that sanitary sewage from cesspools moves rapidly into the underlying rock formations and either filters downward into the ground water or appears as seepage on downstream slopes. Seepage characteristics indicate a low degree of treatment during passage through the rock as does the relatively high concentration of nitrates found in the upper aquifer. In addition, cesspools frequently overflow during heavy rains causing raw sewage to flow along walkways and streets and to pool, creating obvious problems. And, so as to delay the need for pumpouts, residents discard grey water and sillage directly into the streets.

With few exceptions, industries in the area discharge untreated wastewater directly into the Zarqa River or side wadis. As there frequently is no surface flow along this portion of the Zarqa River for as much as nine months of the year, these wastes seep into the alluvial soil depositing potentially hazardous solid wastes on the surface of the river bed and receive minimal treatment prior to entering the ground water. When the river then does flow, heavy concentrations of these solid wastes are carried downstream.

Since the primary water source for Zarqa and Ruseifa is groundwater, the above described wastewater disposal situation is of critical importance to these cities. In fact, the problem affects a much larger area, e.g., all consumers of water from the Amman-Zarqa Basin,

<sup>1/</sup> On February 4, 1981, the Council of Ministers approved Jordan Standard Specification No. 202, to become effective on July 1, 1981, that defines the properties of industrial wastes acceptable for discharge into the waterways of the Kingdom.



including the beneficiaries of the King Talal Reservoir. Also, the problem itself is affected by inputs from areas other than Zarqa-Ruseifa, e.g., Amman's Ain Ghazal Sewage Treatment Plant discharges its currently low-quality effluent directly into the Zarqa River bed upstream of the Zarqa-Ruseifa area.<sup>1/</sup>

An effect of the above described situation has been an increasingly deteriorating quality of the upper aquifer ground water (see Annex A). This shallow aquifer is recharged by direct and indirect infiltration of rainfall and by artificial recharge from sewage effluent, leakage from public water distribution lines, cesspools and by return flows from agriculture. Large volumes of water reach this aquifer by indirect infiltration through alluvial deposits of the Zarqa River and associated side wadis. This aquifer is used extensively for industrial and agricultural purposes. The upper aquifer surfaces and discharges at Sukhnah, approximately 7 kms north of Zarqa, and represents most of the dry-weather flow of the Zarqa River into the King Talal Reservoir.

The primary source of potable water for Zarqa and Ruseifa is a lower aquifer which is separated from the upper by a 100m deep aquiclude. Its recharge occurs mainly by direct infiltration in outcrop areas and is relatively uncontaminated at this time. However, nitrate levels have been increasing in recent years indicating infiltration from the upper aquifer possibly through improperly sealed wells. Therefore, if the deterioration of the upper aquifer is not stopped, then the lower aquifer is potentially liable to further deterioration.

3. Health Considerations: Because health aspects can not be considered apart from environmental considerations, reference will be made to the above section throughout this discussion (see also Annex C.1).

The situation described in B.2 above, and more fully in the Feasibility Study, indicates many ways in which the health of the residents of Zarqa and Ruseifa are placed in jeopardy, as well as all beneficiaries of the Amman-Zarqa Basin and the King Talal Reservoir. In Zarqa and Ruseifa alone, the use of cesspools in soils and geologic conditions inappropriate for their use has resulted in soil saturated with human waste; an unhealthy condition worsened during wet periods when cesspools overflow causing pooling of wastewater. There are indications that the soils have become so saturated that their chemical characteristics contribute to the deterioration of the water distribution system. It is primarily during periods of repair to these deteriorating lines that wastewater infiltration can and does occur in the water system. Hence, the need to chlorinate heavily otherwise uncontaminated water.

The use of cesspools, and the resultant need to pay to pump them out, encourages especially lower-income residents to discard grey water and sullage directly into the streets and to use less water for personal hygiene. Standing water and personal uncleanness have obvious adverse health impacts.

<sup>1/</sup> Amman's wastewater treatment plant is presently undergoing improvements. (AID Project No. 278-0220).

Industrial wastewater discharge, as well as seepage, into the Zarqa River may lead to a number of health hazards. Any standing water, or flowing water during the wetter season, would contain high concentrations of known, and potentially, hazardous pollutants. Direct contact, consumption or possibly even use for irrigation purposes could lead to serious health problems.

The continuing deterioration of the upper aquifer could eventually result in its quality being of a standard suitable for industrial users only and could lead to serious deterioration of the lower aquifer through infiltration.

All of these adverse health conditions could be applied to Sukhnah, particularly, and to all other users of water from the Zarqa River, Amman-Zarqa Basin and the King Talal Reservoir. (See further discussion of health considerations in Part II.B.3 and Annex C.1.)

4. The Water Distribution System: Most residents of Zarqa and Ruseifa are connected to municipal water distribution systems which normally provide continuous service. The water is provided from the lower aquifer and is within the WHO drinking water standards at the well.

Because of the rapid and largely unplanned growth of the Zarqa-Ruseifa conurbation, the water distribution system is the result of expediency and personal initiative. While the distribution system normally functions continuously and while most residents have household taps, the system "design" is highly inefficient and a substantial portion of the system's material is sub-standard. Inefficiency derives primarily from the lack of loops in the distribution system network. Sub-standard material results primarily from the previous practice of households being responsible for running relatively long house connections from municipally-owned lines in the main streets, i.e., individual owners used low quality pipe that is subject to rapid deterioration.

Some of the consequences of this sort of water distribution system are:

(a) 40 percent of all water distributed is unaccounted for with the presumption that 20 percent is lost through system leakage, primarily faulty house service connections;

(b) When there is a break in the system, large areas must go without water due to inadequate loops; and

(c) When the pressure is off for repairs, the wastewater in the saturated soils infiltrates the system not only where the repairs are taking place, but also anywhere else in the area where there is a break or faulty joint, particularly along the household connections.

C. Description of Proposed Project:

1. General: The proposed project to be undertaken by the GOJ is designed to significantly impact upon the problems described above in Section B. Of particular concern to the GOJ are actions intended to protect the Kingdom's most serious constraint to continued development - water. The present situation is such that if nothing is done, the ground water sources of the Amman-Zarqa Basin and the surface water (Zarqa River) will be only useable for industrial purposes without expensive water treatment. This includes an area far larger than the Zarqa-Ruseifa area which is being addressed by this particular project (See Figure 9, Annex B.)

The GOJ has recognized this growing problem and began addressing it under the Amman Water and Sewerage Project (AID Loan 278-K-023). That is, the Amman Project includes an expanded sewerage system and an improved wastewater treatment plant. This is an important step because the Amman sewerage system discharges its treated effluent into the Zarqa River above Zarqa-Ruseifa.

The proposed Zarqa-Ruseifa Project is a continuation of this GOJ initiative and serves as an indication of the GOJ's response to one of the covenants under AID Loan 278-K-023. This covenant calls upon the GOJ to address the issue of water quality of the Amman-Zarqa Basin, the Zarqa River and the King Talal Reservoir.

As a result of the consultant's feasibility study, the GOJ determined that the Zarqa-Ruseifa conurbation must be provided with a wastewater collection system and a wastewater treatment plant. In addition, primarily in an effort to conserve water and, concomitantly, to reduce contamination, improvements must be made to the municipal water distribution systems to reduce their deficiencies. As the overall purpose is to improve environmental and health conditions through the protection and conservation of water resources, the scope of this project includes those elements of a longer range plan which will provide the most significant immediate impacts.

2. Proposed Wastewater Collection System: The proposed GOJ project includes the following significant components:

(a) The construction of 30 Km of trunk sewer ranging in diameter from 200 to 1200 mm;

(b) The construction and equipping of a 1175 cubic meter per hour wastewater pumping station;

(c) The construction of 3 Km of 500 mm force main;

(d) The construction of 58 Km of collection and subtrunk sewer ranging in diameter from 200 to 300 mm; and

(e) The construction of 100 Km of 150 to 200 mm sewers with provision for about 26,000 house laterals.

The above wastewater collection system will allow for services to be provided for residents within subareas II, III, IV, VII and X (industrial zone) as well as for the Army Base<sup>1/</sup> and the Ruseifa industries along the Zarqa River from Zarqa to the Hussein Industrial City. (See Figures 10, 11, and 12, Annex B).

3. Proposed Wastewater Treatment Plant: The proposed GOJ project includes the construction and equipping of a wastewater treatment plant with a capacity of approximately 16,500 cubic meters per day (see Figure 11 for location). The plant will use primary clarifiers, plastic-media trickling filters, final clarifiers and chlorination to achieve the high degree of treatment required for effluent discharge into the Zarqa River. The plant will be constructed in modular units to facilitate phased expansion. Sludge treatment will be by anaerobic digestion and drying beds. Ultimate disposal may involve landfilling or the use of the material as a soil conditioner. The methane obtained from the digestion process will be used to power internal combustion engines which will drive generators for electrical power for plant operation. (See Part II.C., Technical Feasibility and Feasibility Study for further details and discussion of alternatives.)

Significant components of the proposed wastewater treatment plant as designed include:

- (a) Mechanically cleaned influent screens and aerated grit chambers;
- (b) Two primary clarifiers;
- (c) Two plastic-media trickling filters;
- (d) Two final clarifiers;
- (e) Post chlorination contact tank and aeration facility;
- (f) Plant effluent pumping station and sewer outfall to Zarqa River;
- (g) Filter effluent recycle pumping station;
- (h) Sludge pumping facilities;
- (i) Two primary anaerobic sludge digesters;
- (j) Two secondary anaerobic sludge digesters;
- (k) Eight sludge drying beds;
- (l) Septage reception facility;
- (m) Methane pumps, coolers, scrubbers and appurtenant equipment;
- (n) Dual-fuel internal-combustion gas-engine-drive generator;

<sup>1/</sup> The Army will be responsible for the wastewater collection system within the Army Base (see Part V, Special Covenants).

- (o) Chlorine storage facility;
- (p) Engine generator building and fuel storage facility;
- (q) Administration building; and
- (r) All necessary piping and site development.

It is expected that the World Bank (WB) will partially finance the wastewater treatment plant construction contract. As a result of this intent, the GOJ has agreed to the WB request that alternative "turnkey" bids be permitted. The consulting engineer will be required to conduct an extensive evaluation of any such alternative designs submitted so as to assure USAID that, should any alternative be selected for award, the product is, in fact, equivalent to or better than that which was designed by the consulting engineers after evaluating a number of different processes. The requirement that such an evaluation be made a part of the bid documents for the wastewater treatment plant is included as a condition precedent to disbursement for construction services under the proposed loan agreement.

4. Proposed Water Distribution Improvements: The proposed GOJ project includes the following significant components:

<u>Pipe Size (inch)</u>	<u>Length (Km)</u>
2	11.5
4	13.8
6	4.7
8	3.8
10	0.5
12	<u>7.0</u>
TOTAL	41.3

5. Proposed Operations and Training Services: As noted in the project specific analyses section which follows, there is presently only one large-scale operational sewerage system in Jordan. Other systems are being developed in Aqaba, Irbid, and smaller towns. In Jordan, there is an absence of professionals and technicians capable of managing, operating and maintaining the above facilities as well as those proposed under this project. Further, the administrative analysis in this paper indicates that the WSC, as the project implementing agency, has limited capability to manage and operate the new project facilities in addition to those for which the WSC is presently responsible. While the concept of establishing a national water and wastewater training center is being discussed within the GOJ, this is not expected to be operational in time to significantly benefit this project alleviating needs for trained personnel at all levels.

After a full consideration of the administrative capability of WSC, its efforts to staff and train people for the Aqaba project and various proposed training programs underway in Jordan, USAID believes that, despite these efforts, WSC's projects cannot be effectively

managed, operated and maintained without considerable support from outside Jordan. Therefore, USAID proposes that \$2.368 million of the loan funds for this project be used for assistance to WSC. Although intended primarily to ensure the success of the Zarqa-Ruseifa project, these funds may be used to support any training programs by WSC and other GOJ agencies that will train personnel for the Zarqa-Ruseifa project. The funds may be used for, but not be limited to, the following types of activities:

	<u>Estimated Cost</u>	
	<u>FX</u>	<u>LC</u>
(i) Consulting services to improve administrative and fiscal management of WSC and to establish the Zarqa-Ruseifa Water and Wastewater Agency (48 person-months).	\$ 480,000	--
(ii) Short-term consulting assistance to assess project training needs, developing training plan and programs (12 person months)	\$ 120,000	--
(iii) Start-up and Operations assistance and training (36 person months)	\$ 360,000	--
(iv) Implementation of in-country training (estimated total 96 person months)	850,000	\$20,000
(v) Specialized familiarization training out-of-country for selected management and operating personnel. (48 person-months). The International Travel to be provided by GOJ.	\$ 375,000	\$70,000
(vi) In-country Training Materials	75,000	\$10,000
(vii) Contingency & Escalation (5%)	108,000	\$ 5,000
	<u>\$2,368,000 AID</u>	<u>\$100,000 GOJ</u>

(a) Staffing and Training

(i) Staffing the Zarqa-Ruseifa System

The consultant estimated that 89 persons will be required to manage, operate and maintain the Zarqa-Ruseifa wastewater system in addition to the 194 staff already managing the water systems. Fewer people may be determined to be required for the project when the staffing plan is finalized and when WSC's Zarqa-Ruseifa Office is established (for purposes of this paper, it is assumed that project staffing will require 283 persons, as recommended by the consultant).

The Zarqa-Ruseifa Water Department now employs about 194 persons, most of whom will be absorbed by the WSC Zarqa-Ruseifa Office. Those in routine jobs (accountants, clerks, secretaries, surveyors, mechanics, repair technicians, meter readers and drivers) will continue to do similar work and with a minimum of additional responsibilities in the new system and will need minimal training. The remaining vacancies in the top positions could be filled from the staff at WSC headquarters or experienced people seconded from AWSA and by new recruitment.

(ii) Training for the Zarqa-Ruseifa

It is clear that this project will require training inputs in order to start up, maintain, and manage the proposed Zarqa-Ruseifa system. Of the estimated number of 283 persons which will be required to staff the project, about 32 percent of this total will require varying amounts of specialized training in management, technical and operational aspects both in-country and out-of-country. The remainder of the project's Zarqa-Ruseifa staff (secretaries, clerks, drivers, helpers and laborers) who will require on-the-job, practical types of training can receive it in Jordan through existing programs or those to be developed in conjunction with overall water sector manpower development needs on a scale broader than the projected needs for this project. AWSA, WSC, and other water sector entities can make available to this project their training infrastructure and experiences in cooperation with the proposed national training program. Training for personnel for the Zarqa-Ruseifa system will be accomplished by one or more of the following means: (1) Non-degree training under the Government's proposed training program; (2) On-the-job training at other water and wastewater facilities in Jordan and for some categories of personnel, during construction at Zarqa-Ruseifa; (3) Familiarization trips and/or on-the-job training in a third country; and (4) Training by the operations consultant during start-up and during plant operation. In its report, the consultant has outlined a program for training for wastewater treatment plant operators. During development of earlier water and sewerage projects USAID has given considerable attention to the magnitude of training problems and valuable experience has been gained in subsequent project implementation. For example, the mode used in the Aqaba Water Project is applicable to this project. In the Aqaba water Project, the WSC selected the project manager and the senior engineers to be in charge of various parts of the system prior to construction. WSC assigned them to work with the consulting engineer on the supervision of construction. Other personnel recruited for the Aqaba wastewater project will get similar on-the-job training. They will also get operational training during start-up. Additional classroom and managerial training will also be required for key personnel in technical areas.

A similar arrangement should be initiated as soon as possible at Zarqa-Ruseifa. Because Zarqa-Ruseifa has an existing water system that is only being improved, most of the staff is in place for the water portion of the project. The proposed head and some of the technicians for the wastewater collection system could be recruited before construction starts to work with the consulting engineer on supervision and construction. At some stage during the construction period, the heads of the water and wastewater collection sections, as well as the head of the administrative section, should receive training in management and supervision, possibly under the Government's proposed training program (described in the Irbid PP pg. 26-27). The head of the financial section could also be given on-the-job training at AWSA, which has an experienced American financial advisor, under a two-year AID-financed host-country contract, or USAID may provide the services of another American Financial Advisor.

The greatest need is to train people in the operation and maintenance of the wastewater treatment plant. Fulfillment of this need probably will mean classroom and on-the-job training and possibly familiarization trips to third countries. Such training will be project funded. Plant operators could receive academic training under the Government's proposed training program and on-the-job training, possibly at Amman's wastewater treatment plant that is similar to the one proposed for Zarqa-Ruseifa.

To approach training requirements systematically and to compile data applicable to the planned national training program, it is proposed that initially an early-on assessment of training needs be financed under the grant to determine among others: the magnitudes and types of specific training required in both water and wastewater components; an inventory of national training resources, programs and facilities either existing or proposed; training program development and design including recommendations for a proper ratio of host-country to out-of-country training; courses to be taught, skills to be mastered, content, structure and materials needed; cost estimates of such programs projected over life of project; adaptability and compatibility to other training requirements in the national water sector; and, public education campaigns for users to maximize efficient and proper use patterns for systems to be provided under the project. It is expected that the American Water Works Association (AWWA) or equivalent, qualified organization or institution would be an effective conduit for the provision of the consultant services required for the proposed assessment and training requirements described above. Following a professional determination of training needs and the design of training programs, the AWWA or an equivalent organization or entity can provide continuing and intermittent consultant services for training implementation.

It is expected that an organization such as the AWWA will be invited to assist in arranging for or conducting training programs using



established organizational networks and linkages. It is further estimated that about 48 person-months of practical training will be project-financed for programs in areas of management, operations, and maintenance of project systems for which local training is not suitable or available. The project will provide an estimated total of \$375,000 for this purpose over the life of the project. Every effort will be made to use local training resources and institutions to minimize costs and to permit maximum application of on-the-job, on-site practical training programs. It is expected that the proposed training needs assessment to be financed under the project will provide necessary and explicit base-line data for training needs with accompanying recommendations for types and where the training can best be accomplished in terms of situations existing at various phases of project implementation.

The above are the staffing and training requirements of the project that are identifiable at this time. A Special Covenant will require the Government to furnish staffing plans for supervision of construction and startup and for administration, operation and maintenance and a training plan for operating as well as administrative personnel. Assistance in developing and implementing staffing and training plans will be project funded.

(b) Operations Services

In addition to the specific training needs discussed above, consulting services may be necessary to assist WSC's Zarqa-Ruseifa Office in fulfilling Special Covenants concerning revenues and tariff (Sections 6.4 and 6.5, respectively) and in developing financial management functions including records keeping, billing and other financial accountability requirements. A portion of the project funds may be utilized for this purpose.

It should be further noted that the specialized operations consultants made available for training purposes under this project will also be responsible for assisting the Zarqa-Ruseifa staff in starting up, operating and maintaining the project facilities for up to one year following completion of construction of the wastewater treatment plant. Only a limited number of consulting technicians would be required for this activity and would primarily oversee the WSC staff's functioning. Sufficient funding has been provided for in the above cost estimate.

D. Cost and Financing of Proposed Project:

FIGURE 1

COST ESTIMATE

PROPOSED GOJ PROJECT

ZARQA-RUSEIFA WATER AND WASTEWATER

(U.S. \$ 000)

<u>Description</u>	<u>Amounts</u> <sup>1/</sup>		<u>TOTAL</u>
	<u>FX</u>	<u>LC</u>	
Construction	\$ 24,638	\$ 24,470	\$ 49,108
Contingency @ 10%	2,464	2,448	4,912
Construction Supervision (G) <sup>2/</sup>	2,632	2,632	5,264
Inflation <sup>3/</sup>	2,213	2,245	4,458
Land	-0-	4,500	4,500
Interest during Construction <sup>4/</sup>	-0-	7,079	7,079
Operations & Training Services (G) <sup>5/</sup>	2,368	100	2,468
Financial Contingency (G) <sup>6/</sup>	782	1,158	1,940
<b>GRAND TOTAL</b>	<b>\$ 35,097</b>	<b>\$ 44,632</b>	<b>\$ 79,729</b>
	=====	=====	=====

<sup>1/</sup> JD 1.00 = U.S. \$ 3.00

<sup>2/</sup> Services to cover the project area plus other areas as described in Annex J.

<sup>3/</sup> Assumes 8% inflation applied to early 1982 cost estimates.

<sup>4/</sup> Assumes Reloan Agreement Terms of 8%, 24 years with 4 years grace.

<sup>5/</sup> See C.5 above for details.

<sup>6/</sup> Adjustment: JD 1.000 = U.S. \$3.08 (average exchange rate 1980-1982)

FIGURE 2  
PROPOSED FINANCING  
ASSUMING U.S. \$ 15.0 MILLION AID CONTRIBUTION  
(U.S. \$ 000)

<u>Description</u>	<u>AID</u>		<u>Amounts 1/</u>		<u>TOTAL</u>
	<u>FX</u>	<u>LC</u>	<u>GOJ</u>	<u>LC</u>	
Construction <sup>2/</sup>	5,053	3,113	19,585	21,357	49,108
Contingency @10%	504	311	1,960	2,137	4,912
Construction Supervi- sion	2,632	-0-	-0-	2,632	5,264
Inflation <sup>3/</sup>	469	289	1,744	1,956	4,458
Land	-0-	-0-	-0-	4,500	4,500
Interest during Construction <sup>4/</sup>	-0-	-0-	-0-	7,079	7,079
Operation & Training Services <sup>5/</sup>	2,368	-0-	-0-	100	2,468
Financial Contin- gency <sup>6/</sup>	161	100	621	1,058	1,940
<b>GRAND TOTAL</b>	<b>11,187</b>	<b>3,813</b>	<b>23,910</b>	<b>40,819</b>	<b>79,729</b>

<sup>1/</sup> JD 1.00 = U.S. \$3.00

<sup>2/</sup> Assumes AID financing of Contracts 3, 4 and 5 see Figure 3.

<sup>3/</sup> See footnote 2 Figure 1.

<sup>4/</sup> See footnote 3 Figure 1.

<sup>5/</sup> See C.5 above for details.

<sup>6/</sup> Adjustment: JD 1.000 = U.S. \$3.08 (average exchange rate 1980-1982).

For construction the project has been divided into seven separate contracts to facilitate implementation and increase competitiveness. The seven contracts and their construction cost estimates are summarized below. The figures include construction cost plus 10% contingency plus inflation.

FIGURE 3

INDIVIDUAL CONTRACT COST ESTIMATES  
(U.S. \$ 000 @ JD 1.00 = U.S. \$ 3.00)

<u>Contract No.</u>	<u>Description</u>	<u>FX</u>	<u>Amounts</u>	
			<u>LC</u>	<u>TOTAL</u>
1	Wastewater Treatment Plant	\$16,974	\$ 5,659	\$ 22,633
2a	Trunk Sewers (incl. SA X)	2,570	7,705	10,275
2b	Pump Station and Force Main	728	728	1,456
3*	SA II and VII Water and Sewerage	2,547	5,095	7,642
4*	SA III Water and Sewerage	2,684	5,368	8,052
5*	SA IV Water and Sewerage	795	1,590	2,385
6	SA I, VI, VIII, XII Water	1,231	1,230	2,461
7	SA XIII, XVI, XVII Water	<u>1,787</u>	<u>1,787</u>	<u>3,574</u>
	Sub-Total	29,316	29,162	58,478
	Financial Contingency <sup>1/</sup>	<u>782</u>	<u>778</u>	<u>1,560</u>
	Grand Total	<u>\$30,098</u>	<u>\$ 29,940</u>	<u>\$ 60,038</u>

<sup>1/</sup> Adjustment: JD 1,000 = U.S. \$ 3.08 (average exchange rate 1980-1982)

\* Contracts to be partially financed by AID.

1. Proposed Utilization of AID Financing:

The above Table B is based on AID providing U.S. \$15.0 million in assistance. On this basis, AID will be providing approximately 19% of total project costs with the GOJ responsible for providing all additional resources required. It is anticipated that the World Bank (WB), Islamic Development Bank (IDB) and West German Kreditanstalt fur Wiederaufbau (KfW) will provide approximately \$26.0 million of the funds required by the GOJ, or about 33%, leaving the GOJ to provide only the remaining 48%. It is proposed that AID funds be utilized to finance :

(a) Construction supervision for the project, plus other areas as described in Annex J, estimated to cost U.S. \$5.264 million;

(b) Operations & Training Services costs estimated to be U.S. \$2.368 million; and

(c) Construction Contracts 3, 4 and 5; the wastewater collection and water distribution system improvements to subareas II, III, IV, and VII. (See Figures 10 and 11, Annex B).

2. AID Financing Rationale:

In determining the allocation of AID funds as proposed above, USAID selected those elements of the proposed GOJ project believed to be critical to its success (item c above) and for which the United States is an appropriate source (items a and b above).

3. GOJ Contribution:

In accordance with standard AID assistance agreement terms, the GOJ will be responsible for providing all additional resources required for the timely completion of the project - in this case, approximately \$65.0 million. The GOJ will provide these resources either totally from its own budget or, as expected, through receipt of additional assistance from other foreign donors or institutions. The GOJ will be required to provide a firm financing plan prior to disbursement of AID funds for construction.

E. Beneficiaries:

See Part II-B., Social Soundness Analysis and the related Annex C.1.

## II. PROJECT SPECIFIC ANALYSES

### A. Economic Feasibility:

1. General: The details of the economic analysis are contained in Annex C.2. The analysis for the wastewater collection and treatment elements of the proposed project was prepared by Dr. James Hanson. He explains his methodology in the Annex. The analyses prepared by the consultants, and contained in the Feasibility Study, while valid, describe the wastewater elements as recommended through the year 2000 and are believed to be inappropriate for an evaluation of the proposed project.

Due to the relatively insignificant capital costs of the water distribution system improvements element, Dr. Hanson was not requested to revise the work of the consultants. Therefore, the consultants' analysis has been summarized and is contained in Annex C.2. For complete details the Feasibility Study should be consulted.

2. Summary Findings: The Hanson analysis shows that the economic internal rate of return can be expected to substantially exceed 8%, and will probably exceed 10% for the wastewater collection and treatment element. This is a most favorable economic result.

The consultants' analysis of the water system improvements through the year 2000 shows a similar return, i.e. 8%.

It should be noted that quantification of health and environmental benefits have been excluded since the state-of-the-art does not permit calculation of those benefits. The proposed project, therefore, is justified.

### B. Social Soundness Analysis:

#### 1. General:

The main purpose of the project is to improve the quality of life in the Zarqa-Ruseifa corridor, through the provision of a sanitary and economic wastewater disposal system and a rehabilitated water distribution network. The present dependence on cesspools and the age and condition of the water network are contributing to water contamination, health problems, poor environmental conditions and often excessive costs to the consumer. The flow in the Zarqa River is contaminated by industrial and domestic effluent, and is contributing to the reduction of the quality of water stored in the King Talal Reservoir and the aquifers supplying the Amman region. It is expected that the proposed project will alleviate many of these problems. The socio-economic and health aspects of the proposed project are discussed in detail in the Social Soundness Analysis reproduced in Annex C.1 of this report. A summary of the findings of this analysis is given in the following paragraphs.

## 2. Benefits and Beneficiaries:

The proposed water distribution system improvements and sewage collection and treatment facilities are designed to benefit the ultimate population of the Zarqa-Ruseifa corridor. The rehabilitation of the water distribution network, which will cover all of Ruseifa and the old parts of Zarqa, will not only allow for future system expansion, but will also provide water service to the about 10% of the population (30,000 residents) which does not presently have access to it. The replacement of old and broken pipes will help save a leakage of about 0.5 million cubic meters per year, at 1981 consumption levels. The health of the residents of the area will stand to benefit from the improved quality of water which is expected to result from reduced contamination levels. These reductions in contamination levels will result from both water network improvements and from the phased elimination of cesspools which will occur as the sewerage network is put in place.

The initial phase of the sewerage network will serve a total population of about 170,000 residents. The areas served include the densely developed downtown area of Zarqa, the adjacent refugee camp, and the squatter area of Janna'ah. The latter two include the poorest and most disadvantaged residents of the city. They are also the people who have to pay the highest percentages of their incomes for the regular cleaning of cesspools. About 40,000 people reside in those two areas.

An analysis of the income distribution of the population and of the ability of the poorest of the poor to pay for water and sewerage services, reveals that even if water and sewerage rates are set at levels that will recoup the capital and operating costs of the systems, this group of residents will be able to afford the service and will not pay more than 5 percent of their gross income for it. Cost savings will accrue to those who do not presently have water connections, and who are thus forced to purchase it from tankers and to pay an exorbitant price for it. Savings will also accrue to those who experience frequent cesspool problems. People in latter category often resort to street dumping with its resulting environmental and health problems, and are frequently fined by the city for such practices. The sewerage system will eliminate both the nuisance and the cost. Experience in Amman, and an attitude survey in Zarqa, both indicate that even the poorest of the poor will be both willing and able, and indeed often anxious, to connect to the sewerage system.

Another aspect of the benefits of the system relates to the downstream beneficiaries. The improved quality of the flow in the Zarqa River will be a benefit to downstream users of the water. It will particularly contribute to the quality of the water stored in the King Talal Reservoir, and thus benefit those using it for irrigation. An

optimistic scenario may pose the possibility of reviving plans for using this water for domestic distribution. The phasing-out of cesspools will also undoubtedly contribute to improving water quality in the upper aquifer, with concomitant benefits to all the residents of the Amman region.

The training component of the proposed project will benefit not only those being trained, but also other water and sewerage systems in Jordan. There is presently only one large-scale operational sewerage system in Jordan: that of Amman. The systems of Aqaba, Irbid, and a score of smaller towns are presently at different stages of development. The Zarqa training program will undoubtedly benefit other utilities in the country. The need for training in this area and the absence of professionals and technicians in the field, has been recognized by both the GOJ and AID, and the concept of establishing a National Water and Wastewater Training Center is presently being discussed. It is expected that the project, once operational, will provide employment for about 100 persons. Many more will obtain both employment and expertise during the construction phases. This expertise will undoubtedly also benefit other proposed systems in the country.

The provision of adequate water and sewerage systems can be expected to contribute positively to the overall quality of life in the Zarqa-Ruseifa corridor. It will also help in encouraging an orderly growth of industry and thus the provision of employment for both the present and future residents of this vitally important industrial corridor.

### 3. Health Effects:

The availability of a safe, dependable, fully-pressurized water distribution system coupled with an efficient wastewater collection, treatment and disposal system will do much to improve the health status among the poorer residents of Zarqa-Ruseifa. The primary public health hazards involved are water-related diseases. It is generally accepted that an adequate, clean water supply for drinking and personal hygiene and a working wastewater system lead to improvements in public health and well-being. Under the present situation, the area has a relatively high potential or actual incidence of such water-related diseases as typhoid, amoebiasis, bacillary dysentery, infectious hepatitis, other forms of gastroenteritis and some skin infections. These can all be related to poor water distribution and inadequate wastewater collection and disposal systems, combined with an increase in population density and a corresponding lack of knowledge or practice of good hygiene. (See 1982 Water Sector Paper for Jordan.)

Many water-related diseases are endemic to Jordan, and the occurrence of frequent out-breaks of several such diseases often goes unnoticed. Good data to measure the size of the water-related health



problems are nonexistent, with perhaps as few as 20% of the actual occurrences being reported. Diagnosis of these diseases is often inadequate because the frequently-used public clinics do not have the facilities or staff to identify the cause of illness, nor an adequate health information system for reporting. The USAID-funded Health Planning and Services Development Project (278-0208), and should ameliorate this situation prior to the completion of this project. In addition, USAID provided partial funding of a World Bank - Population Council baseline survey of the health and social status of the target population of an urban-upgrading project in Amman, which provides an index of the health status of lower-income groups in a typical urban environment.

The proposed project can thus be expected to benefit public health for the following reasons:

- (1) A rehabilitated water distribution network will reduce the risks of contamination caused by broken and leaking pipes.
- (2) A reliable water distribution network will eliminate, or at least reduce, the need for roof-top and/or ground-level storage tanks, thus eliminating a potential source of contamination.
- (3) The sewerage system will eliminate the use of cesspools, and thus reduce the danger of contamination in the water pipes, and in both ground and surface waters.
- (4) The replacement of the high cesspool cleaning costs by reasonable sewer charges which are based on water use rather than septage quantities will encourage both higher water use and less illegal dumping by both residents and haulers. This is particularly applicable to lower income households.

#### 4. Impact on Women:

The benefits of the project are expected to accrue to men and women on an equal basis, as both sexes seem to suffer equally from the debilitating effects of illnesses that affect their productivity, be it in the home or outside. However, young children, who are especially susceptible to enteric disease, will possibly gain the most from reduced exposure to water-borne diseases.

5. Conclusion: In concert with the statements made above on improved health and living conditions, this project is believed to be socially sound.

C. Technical Feasibility:

1. General: The feasibility study for the project was carried out by the professional consulting firm Malcolm Pirnie Inc. in association with Jouzy and Partners, a Jordanian firm. The consultants' feasibility and initial design reports provide a thorough, in-depth analysis and explanation of the bases for detailed design. A detailed review of these reports indicates the project as proposed represents a technically sound and least-cost solution to the problems of wastewater collection and treatment and to improving the efficiency and reducing the possibility of contamination of the water distribution system in Zarqa and Ruseifa. Annex A provides a complete listing of all volumes of the consultants' feasibility study and related materials, all of which are available in NE/PD, AID/W. These materials should be consulted for specific design details and for detailed discussions of alternative designs. The remainder of this section describes briefly certain technical design aspects of the proposed project.

2. Wastewater Collection System: The Zarqa-Ruseifa Project Planning Area (Figure 9, Annex B) was divided into twenty subareas (Figure 2, Annex B) on a geographical basis, i.e., within each subarea wastewater can be collected by gravity flow. All subareas, except III and IV, flow toward the Zarqa River. Subareas III and IV flow toward Wadi Salda (the northeastern corner of the planning area). Wastewater in any given subarea will not flow by gravity into any other subarea.

As previously mentioned (page 2), the NPC, MMREA, WSC and municipal representatives evaluated the recommendations of the consultants as contained in the Feasibility Study and memoranda and selected those areas which will receive priority attention under this initial investment phase. The decision was based upon development planning priorities and the availability of capital and manpower resources.

With the wastewater treatment plant to be located at the "upper Zarqa River" site (see Section 3 below and the Feasibility Study), the initial investment phase (i.e., the proposed project) includes wastewater collection for subareas close by. These subareas are II, III, IV, VII, and the Army Base. In addition, as industries contribute significantly to the pollution problem (see Feasibility Study, Industrial Effluent Report), subarea X, an industrial zone, and the Ruseifa Industries along the Zarqa River up to the new Ruseifa Bridge (Figure 12, Annex B) have been included.

With the proposed project defined by development priorities the design of the wastewater collection system to be constructed is relatively simple. Trunk sewer locations and sizes are based upon

geographic and hydraulic factors and population levels (current and projected). Sub-trunk sewer system design is based upon the same factors with further criteria concerning population density factors affecting network design (see Feasibility Study).

The choice of materials is based upon wastewater characteristics, cost and the desire for standardization within Jordan. The Feasibility Study discusses the advantages and disadvantages of the various alternatives.

The incorporation of a wastewater collection pumping station and force main into the design resulted from a thorough analysis of the various alternatives as discussed in the Feasibility Study. The design is based upon projected flow requirements and has been determined to be technically sound as well as the least-cost alternative.

3. Wastewater Treatment Plant: There are as yet no national wastewater treatment effluent standards in Jordan on which to base the design of a wastewater treatment plant. Therefore, effluent standards are based upon ad hoc analyses of the particular locale. In this instance, the GOJ has required a relatively high quality effluent standard requiring a treatment plant providing secondary treatment with post-chlorination and reaeration before effluent discharge into the Zarqa River watercourse.

Various wastewater treatment processes will provide the quality of effluent required. The consultants considered all alternatives, as discussed fully in the Feasibility Study, and determined the least-cost alternative to be the treatment system using the plastic trickling filter secondary treatment process with anaerobic digestion and on-site power generation to meet all power needs (see Part I.C.3 for a description of the process). The consultant compared power costs of the recommended system with the power costs of a system using trickling filters, aerobic digestion and purchased power. Assuming 7.5 percent inflation, the average power savings with the on-site system are \$1.08 million in 1990 and \$3.36 million in the year 2000. This comparison, that was made for the two systems that were most seriously considered for design, is indicative of the energy conservation that can be achieved by using methane gas from sludge digestion for power generation. The power savings for the recommended alternative are also greater than for any of the other alternatives studied. USAID, has also determined that the design is technically sound in all respects. (See Annex B, Figure 13, for Schematic).

As mentioned above, para 2, several sites were considered for the wastewater treatment plant. One alternative included a separate treatment plant for wastewater which drains toward Wadi Saïda. The site chosen, the "upper Zarqa River" site, is the largest (28.5 hectares) and

allows for the construction of a single treatment plant with sufficient capacity to meet the needs through the year 2000. It has been shown to be the least-cost alternative even when considering the cost of the pumping station and force main.

The treatment plant is designed considering the characteristics of the wastewater to be treated. The domestic wastewater characteristics of Amman have been used as there are no alternative means for determination. The industrial wastewater characteristics are thoroughly described in the Industrial Effluents Report of the Feasibility Study. Plant capacity is based upon flow estimates, which will be metered for industry and the Army, and which were estimated to be 80% of the target of an average water consumption level of 80 liters per capita per day (lcd) for domestic users.<sup>1/</sup>

The proposed treatment plant is designed for an ultimate capacity of about 41,500 cubic meters of wastewater per day. The design includes five trains with each train a modular unit. The proposed project will consist of only two trains (about 16,500 M<sup>3</sup>/day). The modular unit concept will permit relatively inexpensive expansion when required.

Anaerobic digesters are included on the basis that the methane produced can be used to power dual-fuel engines to drive power generators making the treatment plant self-sufficient for power needs, thereby significantly reducing operating expenses. The Feasibility Study and related memoranda discussed in detail the alternatives and show clearly that this is the least-cost alternative even when subjected to various sensitivity analyses.

In addition to determining that the design is technically sound, USAID considered the level of technical sophistication required to operate this type of system. Operators of Amman's Ain Ghazal Wastewater Treatment Plant, which also uses anaerobic digesters producing methane for use, have provided a reasonable assurance that the process is not so technically sophisticated as to not be feasible. In addition, the proposed project includes provision for training to assure the proper operation and maintenance of the system.

An additional benefit of using methane for power needs, having been shown to be the least-cost, technically sound alternative, is the resultant savings in demand for power from the national power grid. This savings could be translated into a savings in fuel requirements for generating power and a savings in foreign exchange expenditures for imported fuel.

As mentioned previously, and as more fully explained in Annex J, the world Bank (WB) is expected to partially finance the construction of the wastewater treatment plant. The WB has requested that alternative

<sup>1/</sup> Financial and economic analyses were based upon actual levels, with adjustments, which are less than this target.

designs bid on a "turnkey" basis be permitted. USAID will require that any such alternative designs be subjected to an evaluation as comprehensive as that conducted on the USAID approved design described above as a condition precedent to disbursement of AID funds for construction services as evidenced by acceptable evaluation procedures incorporated within the wastewater treatment plant bid documents.

4. Water Distribution System Improvements: Again as a result of the discussions of NPC, MMREA, WSC and municipal representatives concerning the consultants' recommendations, priorities were established for determining the scope of the proposed project. It was decided that subareas XI through XX, i.e., virtually all of Ruseifa, and subareas I through IV, VII, VIII and XII in Zarqa are to be included (Figure 10, Annex B).

As previously described in Part I.B.4. and more thoroughly discussed in the Feasibility Study, the problems to be addressed include (a) correcting flow distribution inefficiencies, (b) replacing faulty pipes and (c) replacing many household connection lines which will be necessarily destroyed during sewer construction.

Design decisions are based upon using the present municipal distribution network and simply creating "loops" to improve flow distribution efficiencies. Where necessary, municipal lines will be replaced with properly sized pipes to maintain proper pressure throughout the network. The network will include valves to limit the area of discontinued service during periods of repair and thereby reduce the extent of possible system contamination through infiltration.

As previously described, municipal water mains are not existent in alleys or walkways. Households off the primary streets must construct their own, sometimes lengthy, household connection lines. During construction of the wastewater collection system, these household connections will be destroyed. Therefore, it has been decided that the municipal water distribution network will be expanded to include primarily 2-inch service mains in these alleys and walkways. While not good practice and not in accordance with Jordanian construction codes, some of those 2-inch service lines will be constructed in the same trench as the sewer lines. This can not be avoided because of the narrowness of these walkways.

The selection of the water distribution materials after a thorough analysis of the alternatives, is fully discussed in the Feasibility Study.

USAID has determined that the proposed design is technically sound and the least-cost alternative.

5. Statutory Criteria

The feasibility report and preliminary engineering studies of the consultant provide the engineering, financial and other plans necessary to carry out the assistance. The project meets the criteria of FAA Section 611(a)(1) which requires that no obligation may be entered into until engineering, financial and other plans necessary to carry out such assistance have been established and reasonably firm estimates of cost have been calculated. The cost to the U.S. will be fixed at \$15.0 million. The Borrower will agree to provide funding for any additional costs.

The project will be implemented by the Water Supply Corporation, which is charged by law to build and operate water and sewerage systems. No other legislation is necessary to the approval or authorization of this project and thus the project meets the criteria of FAA Section 611(a)(2).

Jordan's national economic development program, as set forth in its Third Five-Year Plan (1981-1985), places a high priority on increasing the availability of safe water and of providing for wastewater disposal on an equitable basis to its residents. The Government, its consultants and AID have considered numerous alternatives for each element of the project and have selected the alternative that is technically sound and can be built at the least cost. The wastewater treatment system designed by the consultants and approved by AID, which would generate power from methane gas produced during sludge digestion, would be essentially self-sufficient in energy and would therefore contribute to energy conservation. As will be established by the evaluation criteria and formula, any alternative designs bid will be compared to the designed plant, and to be selected, must be equivalent to or exceed these performance of the designed plant, taking into account all financial and economic costs. This project will satisfy requirements for water as a final good to domestic and municipal users through improvement in water quality and an improvement in the reliability of both quantity and quality. The wastewater elements of the project will have beneficial effects on the environmental quality of Zarqa and Ruseifa and of the Zarqa River and the King Talal Reservoir. Mitigation measures have been identified (Feasibility Study, Chapters 4 and 11) to minimize any potential adverse effects to the environment and will be the subject of covenants in the Agreement (see Section V). In addition, the GOJ is aware that water conservation is the least costly means of extending its limited groundwater resources. The technical assistance component of the project will improve the capability of WSC to manage, operate and maintain the water and wastewater facilities in Zarqa and Ruseifa. Water conservation and technical assistance are non-structural interventions that will improve the benefits derived from the project. The Social Soundness Analysis (Annex C.1) addresses the community impacts of the project. The criteria of FAA Section 611(b) and, even though no longer applicable, the Principles and Standards for Planning Water and Related Land Resources dated October 23, 1973, as amended on August 14, 1974 and by the proposed rules of April 14, 1980 have been applied in the project design and review.

D. Administrative Analysis:

1. General: The GOJ has determined that neither Zarqa nor Ruseifa, individually or jointly, has the staff or expertise to implement and operate the project. And while the GOJ remains committed to establishing a national water authority<sup>1/</sup> which would permit a decentralized organization to be formed to implement and operate the project, the law establishing such a national water authority has yet to be enacted. Therefore, the GOJ has designated the Water Supply Corporation (WSC) as the implementing agency.

2. The Water Supply Corporation: The WSC was established by Temporary Law No. 56 of 1973 (a copy of a translation of the law is available in NE/PD files). The law delegates to WSC the responsibility to "plan, design, construct, operate and maintain water supply projects for drinking purposes and domestic uses; to develop, purify and distribute water, sell water, drain water and undertake all works related thereto within the area of supply and boundaries of supply."

According to the law, WSC is an independent organization, both administratively and financially. The Minister of Municipal, Rural and Environmental Affairs (MMREA) is chairman of WSC's Board of Directors which includes the Director General of WSC, as vice-chairman, and members from the National Planning Council (NPC), NRA, MMREA, the Amman Water and Sewerage Authority (AWSA) and the Ministries of Health and of Interior.

3. Administrative Capability of WSC: The WSC has existed as a semi-autonomous corporation for about eight years, inheriting the staff and responsibilities of its predecessor organizations, the NRA and the Central Water Authority; the latter was organized with U.S. assistance more than twenty years ago and both organizations have received considerable support from the U.S. over the years. The WSC's experience includes the installation, operation and maintenance of water supply systems throughout Jordan. It is constructing the water supply and distribution system at Aqaba and will soon begin construction of the AID-financed wastewater project there (AID Loan 278-K-026). It will construct the AID-financed Irbid Water and Sewerage project (AID Loan 278-K-028). It has also built many other water distribution systems.

While WSC has the background needed to implement the project successfully, it is clear that new personnel must be recruited to staff the wastewater elements of the project and possibly to strengthen the water elements. WSC's prepared employment regulations permitting relatively high pay were approved by the Council of Ministers and became effective on 1 August 1980. As a result, recruitment of new employees and retention of trained and experienced staff has become easier.

<sup>1/</sup> See AID Loan 278-K-028 Project Paper, Jordan - Irbid Water and Sewerage Project, pgs. 27, 28.

After full consideration of the administrative capability of WSC, USAID believes that WSC will not be able to effectively manage, operate and maintain the proposed project without technical assistance from outside Jordan. Therefore, USAID has proposed that approximately \$2.37 million of the project funds be used for assistance to the WSC.

E. Environmental Concerns:

1. Scoping Statement:

During project design and development, environmental concerns received considerable attention. A meeting was held on 12 March 1980 attended by representatives of all relevant GOJ agencies, the municipalities involved, the consultants and USAID to develop a scoping statement in accordance with AID's Environmental Procedures. This resultant scoping statement, forwarded to the NE Bureau Environmental Officer on 14 April 1980 and subsequently approved on 10 May 1980, is contained in Chapter 4 of the Appendix of the Feasibility Study. It identifies the following potentially significant issues: (i) industrial discharges; (ii) sewage treatment plant discharge; (iii) economic concerns; (iv) construction impacts; (v) land use; and (vi) ground water. Minor impacts include: (i) air quality; (ii) flora fauna; (iii) antiquities; and (iv) sludge disposal.

2. Environmental Assessment:

The Feasibility Study contains in Chapter 4, the Description of the Affected Environment, and in Chapter 11, the Health-Related and Environmental Consequences of Alternatives. Chapter 11, Section 6, pages 11-12 through 11-19, discuss Impacts of Proposed Action and Mitigating Measures.

USAID believes that the information contained in the Feasibility Study represents an adequate and thorough environmental assessment, as required by Regulation 16, Section 216.6, of the proposed project as defined by the scoping statement and that no further analysis is required. Further, USAID has proposed appropriate covenants, to be included in the Assistance Agreement (see Part V, Special Conditions) in accordance with the recommended mitigations and will require appropriate contract language where contracting requirements are the appropriate mitigating measures.



### III. FINANCIAL PLAN

#### A. Introduction:

This section contains the Summary Cost Estimate (Figure 4 ), the Projection of Expenditures by Fiscal Year (Figure 5 ) and a Pro/Forma Income Statement for the joint Zarqa-Ruseifa Water and Wastewater organization (Figure 6 ). Further information concerning Figures 4 and 5 are contained in Part I.D., and Annex C.2 and 3. Figure 6 is based upon Tables 4 and 5 as well as analyses prepared by the consultants and contained in the Feasibility Study and by Dr. James Hanson, Brown University, and contained in Annex C.2 and 3.

#### B. Summary Cost Estimate (Table III-A):

Total costs of the project are estimated to be \$79,729,000 equivalent. Of this amount \$10,000,000 will be financed by the AID Loan and \$5,000,000 by either an AID Loan or Grant.

Total project foreign exchange costs are estimated to be \$35,097,000. Of this amount, \$6,187,000 is estimated to be required for contracts 3, 4 and 5 (see Part I. D., and Annex A for description). USAID proposes to fully finance these foreign exchange costs.

\$5,000,000 in AID funds will be used to partially finance the costs of construction supervision (\$5.264 million) and other services including training (\$2.468 million).

The remaining \$3,813,000 in AID funds will be used to finance eligible local currency costs of construction services.

The GOJ will be responsible for providing the remaining resources estimated to be \$64.729 million. Of this amount, an estimated \$4.5 million is for land purchase and \$7.079 million for interest expense during construction. A total of \$53.150 million is estimated to be required for construction costs.

The World Bank (WB), Islamic Development Bank (IDB) and West German Kreditanstalt fur Wiederaufbau (KfW) have indicated their intention to contribute approximately \$26.0 million in foreign exchange to this project. If this assistance is received, the GOJ will be required to provide approximately \$2.91 million in foreign exchange to the project and an additional \$24.24 million in Jordanian Dinars for local currency costs. The proposed AID assistance agreement (Annex K) contains as a condition precedent to disbursement for construction costs a requirement for a firm financing plan to be submitted by the GOJ illustrating the sources and uses of all project funds.

It should be noted that in Annex H, the GOJ application for assistance, the estimated foreign exchange and local currency costs differ from those which have been reflected in this project paper. This is because the GOJ has considered foreign exchange costs in the way the World Bank considers them and USAID has not. USAID has determined foreign exchange needs on the basis of whether or not a particular project component will be procured with Jordanian Dinars. USAID has not

considered whether or not foreign exchange may have been expended earlier for a part of the raw material making up an item to be procured with Jordanian Dinars for the project, e.g., the foreign exchange cost of reinforcing steel used in sewer pipes manufactured and sold in Jordan has not been termed a foreign exchange cost to this project by USAID while it has been so considered by the GOJ.

C. Projection of Expenditures by Fiscal Year ( Figure 5 )

This table is self-explanatory. Construction expenditures have been generally projected to be disbursed on an equal basis for each of the CYs 1983, 84, 85 respectively. All construction cost estimates have been inflated at 8% per annum starting from June 1982.

D. Pro Forma Income Statement ( Figure 6 )

Financial data provided by both the consultants (Feasibility Study) and Dr. Hanson (Annex C.2 and 3) have been used as the basis for this projected income statement.

It must be clearly understood that Figure 6 reflects one of many possible scenarios which could be conceived of by varying the assumptions. USAID has selected this particular scenario because it presents what, in USAID's opinion, is the most probable worst case. It is USAID's view that by reviewing the worst probable case during project development and design, appropriate actions can be taken to improve the situation.

The water sales figures are from municipal projections as reported by the consultants. While probably somewhat optimistic, actual sales would have to drop more than 15% from those used for these calculations before remedial measures would have to be taken, such as increasing the proposed tariff. The sales of 1990 are projected as 10,203,000 cubic meters. This implies a connected population of 372,712 if the average per capita consumption is 75 lpcd which represents 95% of the projected 1990 population of 393,134. USAID believes a more probable connected population would be about 334,164 (85%) resulting in sales of 8,659,860 assuming consumption of 71 lpcd on average. This reduction in projected sales approximates a 15% drop from those used in Figure 6 but still permits a positive cash flow at the proposed tariff of JD 0.165/M<sup>3</sup>. There are adequate water supplies to meet these expected requirements including an allowance for continued losses of approximately 20% in the year 1990. The consultants have recommended an average fixed water tariff of JD 0.165/M<sup>3</sup> starting in 1984 and continuing until 1990. Assuming 8% inflation through 1984, this would not be a significant tariff increase (see Annex C.1). While a fixed average tariff of JD 0.165/M<sup>3</sup> provides an adequate contribution to revenues, the organization might consider applying the constant real tariff suggested by Dr. Hanson. This would significantly improve the situation without placing an undue burden on consumers.

Figure 6 assumes no grant or equity contribution for capital costs. While this is contrary to USAID's proposed financing plan, and while the GOJ may provide financing in the form of equity, this assumption was made to illustrate the organization's financial viability against the prevailing cost of capital, i.e., the most recent reloan agreement terms extended by the GOJ for a project of a similar nature.

Figure 6 assumes the application of a constant real tariff for sewerage service starting at JD 0.345/M<sup>3</sup> of sewage in 1985 as recommended by Dr. Hanson (Annex C.3). This appears to USAID to be the most reasonable means to recover capital costs while minimizing the cost to the consumer. It should be noted that Jordan Standard Specification No 202 (see footnote 1/ page 3, Environmental considerations), could result in reduced connections by industry for sewerage service because of the requirement for the industries themselves to treat their wastewaters prior to discharge. USAID has conveyed its concern regarding the potential effects of this Standard Specification to NPC and will continue with discussions. The effect of a reduced rate of connection, which is what is implied, on financial viability has been addressed by Dr. Hanson in Annex C.3.

Figure 6 assumes total debt for construction costs of \$67.271 million borrowed with terms of 8% interest per annum, 24 year repayment period with 4 years of grace. These are the same terms as recently applied to Irbid (278-0233).

The Figure 6 scenario indicates that there will be a negative cash flow in the first four years of operation. This is not surprising considering the magnitude of capital investment required prior to being able to gradually increase revenues through the wastewater collection system connection process. However, this situation could be completely changed if the debt were incurred under terms such as those applied to Aqaba (278-0206), i.e., 8%, 37 years, 6 1/2 years grace.

Conclusion: USAID believes that Figure 6, the most probable worst case, illustrates that the proposed project is financially viable. In this worst case, short term financing, or a subsidy, would have to be provided totaling approximately \$7.7 million with the largest burden (\$3.6 million) in the first year. By recognizing that the possibility of a shortfall exists, and the likelihood that the GOJ would be called upon for a subsidy, it is probable that either the debt terms will be improved or a sufficient amount of funds for capital costs will be contributed in the form of equity by the GOJ.

Recommendation: USAID has recommended that the Assistance Agreement require, as a condition precedent to disbursement, the GOJ to provide to USAID, for approval, the terms and conditions applied to AID funds being made available to the implementing agency.

**SUMMARY COST ESTIMATES**  
(U.S. \$ 000)  
(JD 1.00 = U.S. \$3.00)  
**ZARQA-RUSEFIA WATER AND WASTEWATER PROJECT PAPER**

Use	Source	A.I.D.		A.I.D. Total	G.O.J.		G.O.J. Total	Grand Total
		FX	IC		FX	IC		
A. Wastewater Treatment Plant and Pumping Station		-0-	-0-	-0-	14,901	5,376	20,277	20,277
B. Wastewater Collection System		4,549	2,802	7,351	2,153	12,754	14,907	22,258
C. Water Distribution System Improvement		504	311	815	2,531	3,227	5,758	6,573
D. Contingency @ 10%		504	311	815	1,960	2,137	4,097	4,912
E. Construction Supervision		2,632	-0-	2,632	-0-	2,632	2,632	5,264
F. Inflation @ 8% per annum		469	289	758	1,744	1,956	3,700	4,458
G. Land		-0-	-0-	-0-	-0-	4,500	4,500	4,500
H. Interest During Construction		-0-	-0-	-0-	-0-	7,079	7,079	7,079
I. Operations Management and Training Services		2,368	-0-	2,368	-0-	100	100	2,468
J. Financial Contingency		161	100	261	621	1,058	1,679	1,940
<b>GRAND TOTAL</b>		<b>11,187</b>	<b>3,813</b>	<b>15,000</b>	<b>23,910</b>	<b>40,819</b>	<b>64,729</b>	<b>79,729</b>

Figure 4

PROJECTION OF EXPENDITURES BY FISCAL YEAR  
((\$000)<sup>1/</sup>)

ZARCA-RUSEIFA WATER AND WASTEWATER PROJECT PAPER

Fiscal Year	Source	A.I.D.		A.I.D. Total	G.O.J.		G.O.J. TOTAL	Grand Total
		FX	LC		FX	LC		
1983		2,158	779	2,937	5,643	11,533	17,176	20,113
1984		3,143	1,037	4,180	6,404	9,793	16,197	20,377
1985		3,780	1,038	4,818	6,030	11,385	17,415	22,233
1986		972	259	1,231	1,508	2,957	4,465	5,696
	Inflation <sup>2/</sup>	469	289	758	1,744	1,956	3,700	4,458
	Physical Contingency <sup>3/</sup>	504	311	815	1,960	2,137	4,097	4,912
	Financial Contingency <sup>4/</sup>	161	100	261	621	1,058	1,679	1,940
	<b>TOTAL</b>	<b>11,187</b>	<b>3,813</b>	<b>15,000</b>	<b>23,910</b>	<b>40,819</b>	<b>64,729</b>	<b>79,729</b>

1/ U.S. Dollars Equivalent; JD 1.00 = U.S. \$ 3.00

2/ Inflation @ 8% per annum

3/ Contingency @ 10% of construction costs.

4/ Adjustment: JD 1.000 = U.S. \$ 3.08 (average exchange rate 1980-1982).

**PROJECTION: PRO FORMA INCOME STATEMENT**  
**ZARQA-RUSEIFA JOINT WATER AND WASTEWATER AGENCY**  
 (U.S. \$1000; JD 1.00 = U.S. \$3.25)

Figure 6

Sources and Expenses	CALENDAR YEAR									
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Total Water Sales (x10 <sup>3</sup> M <sup>3</sup> )	4,953	5,334	5,729	6,158	7,574	8,065	8,573	9,123	9,643	10,203
<b>Revenues</b>										
<b>Water</b>										
Zarqa @ JD 0.120/M <sup>3</sup>	1,580	1,700	1,823	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Other	124	127	130	133	137	140	143	146	150	15
Ruseifa @ JD 0.115/M <sup>3</sup>	337	365	394	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Other	6	6	7	8	8	9	9	10	11	11
Joint Zarqa-Ruseifa @ JD 0.165/M <sup>3</sup>	-0-	-0-	-0-	3,302	4,062	4,325	4,597	4,892	5,171	5,471
<b>Sewerage</b>										
Joint Zarqa-Ruseifa @ JD 0.345/M <sup>3</sup> of sewage, i.e. 80% of water use	-0-	-0-	-0-	-0-	2,650	4,507	6,011	7,413	8,749	9,406
<b>TOTAL</b>	<b>2,047</b>	<b>2,198</b>	<b>2,354</b>	<b>3,443</b>	<b>6,857</b>	<b>8,981</b>	<b>10,760</b>	<b>12,461</b>	<b>14,081</b>	<b>15,041</b>
<b>Operating Expenditures</b>										
<b>Water</b>										
Water	1,421	1,594	1,786	1,997	2,405	2,683	2,992	3,332	3,710	4,124
<b>Sewerage</b>										
Sewerage	-0-	-0-	-0-	-0-	1,190	1,310	1,440	1,583	1,742	1,914
<b>Net Operating Income</b>	<b>626</b>	<b>604</b>	<b>568</b>	<b>1,446</b>	<b>3,262</b>	<b>4,988</b>	<b>6,328</b>	<b>7,546</b>	<b>8,629</b>	<b>9,003</b>
<b>Debt Service</b>										
<b>Existing - Zarqa</b>										
Existing - Zarqa	79	79	79	79	79	79	79	79	-0-	-0-
<b>Existing - Ruseifa</b>										
Existing - Ruseifa	57	55	54	31	30	12	11	11	10	-0-
<b>Proposed Project</b>										
Proposed Project	-0-	-0-	-0-	-0-	6,903	6,903	6,903	6,903	6,903	6,903
<b>TOTAL</b>	<b>136</b>	<b>134</b>	<b>133</b>	<b>110</b>	<b>7,012</b>	<b>6,994</b>	<b>6,993</b>	<b>6,993</b>	<b>6,913</b>	<b>6,903</b>
Capital Improvements-Water	437	470	505	542	583	627	676	724	779	838
<b>Net Income</b>	<b>53</b>	<b>-0-</b>	<b>(70)</b>	<b>794</b>	<b>(4,333)</b>	<b>(2,633)</b>	<b>(1,341)</b>	<b>(171)</b>	<b>957</b>	<b>1,262</b>
Cumulative Cash	53	53	(17)	777	(3,556)	(6,189)	(7,530)	(7,701)	(6,764)	(5,502)
Debt Service Coverage	4.6	4.5	4.3	13.1	0.47	0.71	0.91	1.08	1.25	1.3
Depreciation	108	123	139	115	1,411	1,425	1,441	1,458	1,477	1,496
Net Fixed Assets	3,464	3,811	4,177	11,583	69,011	69,108	69,357	69,512	69,688	69,888
Rate of return (%)	16.10	13.20	10.70	18.70	5.00	5.15	7.06	8.77	10.28	10.75

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#### IV. IMPLEMENTATION PLAN

##### A. Project Implementation

The following Implementation Schedule (Figure 7) below summarizes key actions and dates for implementation of the project.

##### B. AID Loan Schedule: Figure 7

The anticipated schedule for AID action is as follows:

Congressional Notification-Advice of Program change	September 3, 1982
Project Authorized	September 16, 1982
Agreement Signed (\$10.0 million)	September 25, 1982
Amendment Signed (\$5.0 million)	November 15, 1982
Initial Conditions Met	January 23, 1982
Interim Review	October 1984
PACD	December 31, 1986
TDD	September 30, 1987
Final Evaluation	July 1987

##### C. Implementing Agencies:

1. Implementing Agencies: WSC will be the implementing agency and, as such, will be responsible for all facets of project implementation, subject only to normal Government procedures, such as final approval of all contracts by the Office of the Prime Minister. The GOJ will be required by the AID Assistance Agreement to confirm its designation of the implementing agency and to ensure its adequacy.

2. Supervisory Engineering: All technical and engineering services for the implementation phase - including tendering, construction and installation supervision -- are expected to be provided by Malcolm Pirnie, Inc., and its associates. This same firm has done the feasibility study and is preparing the final design with funding from TSFS Grants 278-0181 and 278-0224.

3. Procurement: All procurement actions using AID provided funds will be conducted by Host Country contracting procedures in conformity with AID Handbook 11.

Implementation Schedule

	FY 82	FY 1983	FY 1984	FY 1985	FY 1986	FY 1987
<b>AID FINANCED ACTIVITIES</b>						
1. Prequalification Process						
2. Bid Document Preparation						
3. Bidding, Evaluation, Award						
Contract 3						
Contract 4						
Contract 5						
4. Construction						
Contract 3						
Contract 4						
Contract 5						
5. Construction Supervision						
6. Operations Training						
7. Financial Advisor						
<b>WORLD BANK FINANCED ACTIVITIES</b>						
1. Prequalification Process						
2. Bid Document Preparation						
3. Bidding, Evaluation, Award						
Contract 1						
Contract 6						
4. Construction						
Contract 1						
Contract 6						

--AID AGREEMENT SIGNED

-1st Amendment signed

Initial IDCP

Final IDCP

INTERIM REVIEW

PACD

FINAL EVALUATION



Figure 8  
Implementation Schedule (Cont'd)

	FY 82	FY 1983	FY 1984	FY 1985	FY 1986	FY 1987
<b>KFW FINANCED ACTIVITIES</b>						
1. Prequalification Process		—				
2. Bid Document Preparation		—				
3. Bidding, Evaluation, Award						
Contract 2a		—				
Contract 2b		—				
Contract 8a		—				
Contract 8b		—				
Contract 14		—				
4. Contract Implementation						
Contract 2a			—	—	—	
Contract 2b			—	—	—	
Contract 8a		—	—	—	—	
Contract 8b			—	—	—	
Contract 14			—	—	—	
<b>IDB FINANCED ACTIVITIES</b>						
1. Prequalification Process		—				
2. Bid Document Preparation		—				
3. Bidding, Evaluation, Award						
Contract 7		—				
4. Construction						
Contract 7			—	—	—	

The GOJ and the consulting engineers understand that all tender documents will be written with U.S. standards and specifications and that all construction services and materials financed by the AID loan will have their source and origin in AID Code 941 countries and Jordan. Any AID grant funds will only be used to finance materials, services and technical assistance of Jordanian and U.S. source and origin.

Given the standard nature of the equipment and materials and the routine nature of the construction, no unusual or difficult procurement problems are foreseen.

4. Project Monitoring: USAID/J will be responsible for AID project monitoring. Within the Mission, primary monitoring responsibility will rest with the Engineering Office.. The Project Manager will be the Mission's Chief Engineer. The Chairperson will be changed to the Chief Engineer.

Construction progress will be monitored continuously by the implementing agency and USAID. Monthly progress reports will be prepared by the consulting engineer and submitted through the implementing agency to AID. The submission and expected content of these reports will be clearly delineated in the contracts.

5. Project Evaluation: Evaluation of the project for purposes of determining whether its intended beneficiaries are, in fact, reached by the completed project will be conducted by the Government and AID. In accordance with the standard AID evaluation covenant to be included in the Agreement, the two parties are jointly pledged to develop an intensive evaluation of physical progress to be conducted during project implementation and at project completion. The interim review scheduled for October 1984 will review not only physical implementation but also evaluate progress towards satisfying the special covenants on such matters as organization staffing, training, the tariff study and water conservation. To the degree feasible at that time, it will also evaluate the development impact of the project.

A final AID evaluation will be scheduled for July 1987, at which time all of the project facilities should be in full operation. The evaluation will determine the progress that has been made in connections to the wastewater collection system. During this evaluation, an assessment should be made as to availability and functioning of trained staff to operate and maintain the facilities provided by the project. With regard to the administrative structure of the utility, the evaluation should focus on its demonstrated management functions including records keeping, billing, and other financial accountability requirements of the utility. The final evaluation will also examine more

thoroughly the effects of user charges on the beneficiaries and of their willingness and ability to pay. It will also evaluate the operation of the total system, the effectiveness of water conservation measures, including the education of the public in conservation, and of the water quality monitoring systems.

6. Negotiation Status: USAID officers have discussed the preparation of the Project Paper with appropriate officials of the Government of Jordan at various stages during its development and have made them aware of the conditions precedent and special covenants which are being included in the Project Agreement. No difficulty is foreseen in negotiation of the Agreement or the conditions precedent and covenants.

7. Congressional Notification: It is necessary that AID/W initiate an Advice of Program Change for the proposed project.

3

V. SPECIAL CONDITIONS

A. Conditions Precedent to Disbursement:

1. First Disbursement: Prior to the first disbursement of the assistance, or to the issuance by A.I.D. of documentation pursuant to which disbursement will be made, the Borrower shall, except as the Parties may otherwise agree in writing, furnish to A.I.D. in form and substance satisfactory to A.I.D.:

(a) An opinion of counsel acceptable to A.I.D. that this Agreement has been duly authorized and/or ratified by, and executed on behalf of, the Borrower and that it constitutes a valid and legally binding obligation of the Borrower in accordance with all of its terms;

(b) A statement of the names of the persons holding or acting in the office of the Borrower specified in Section 9.3 and a specimen signature of each person specified in such statement;

(c) Evidence that an implementing agency responsible for implementing and managing all aspects of the Project, a statement as to the qualifications of such agency and name and qualifications of the Project Director; and

(d) A copy of an executed and delivered agreement between the Borrower and the implementing agency, by which the Borrower agrees to make available to the implementing agency the Assistance provided under this Agreement.

2. Disbursement for Construction Services

Prior to the disbursement of the Assistance, or to the issuance by A.I.D. of documentation pursuant to which disbursement will be made for construction services included under the Project, the Borrower shall, except as the Parties may otherwise agree in writing, furnish in form and substance satisfactory to A.I.D.:

(a) an executed contract for supervision of construction services.

(b) a firm financing plan indicating the sources of all Project funds; the anticipated dates such funds will be available to the Borrower; the estimated dates such funds are required in order to assure the timely implementation of the Project; and assurance that the funds indicated therein to be provided by the Borrower are or shall be provided to the implementing agency in a timely manner; and

(c) a copy of the final draft tender documents to be issued to obtain construction services for the wastewater treatment plant which shall include an acceptable tender evaluation formula assuring a fair comparison of tenders based on the proposed design.

B. Terminal Dates for Conditions Precedent:

(a) If all the conditions specified in Section A.1 have not been met within 120 days from the date of this Agreement, or such later date as AID may agree to in writing, A.I.D., at its option, may terminate this Agreement by written notice to the Borrower.

(b) If the conditions specified in Subsection A.2 have not been met within 180 days from the date of this Agreement, or such later date as AID may agree to in writing, A.I.D., at its option, may cancel the then undisbursed balance of the advance, to the extent not irrevocably committed to third parties, and may terminate this Agreement by written notice to the Borrower. In the event of such termination, the Borrower will repay immediately the Principal then outstanding and any accrued interest, on receipt of such payments in full, this Agreement and all obligations of the Parties hereunder will terminate.

C. Special Covenants: The Borrower undertakes the performance of the following covenants within times and for durations satisfactory to A.I.D. as further specified in Annex I and in subsequent Project Implementation Letters.

1. The Organization of the Zarqa-Ruseifa Water and Wastewater Operation:

(a) The Borrower undertakes to furnish, or cause to be furnished, to A.I.D. in form and substance satisfactory to A.I.D. :

(i) Evidence that the designated implementing agency has formally taken over the organizations now operating the water systems in Zarqa and Ruseifa and that such agency has established its own water and wastewater organization in those cities; and

(ii) A plan showing the organization and staffing of such agency's Zarqa-Ruseifa office which will manage the construction activities to be carried out, including the staff needed for contract administration, accounting and budgeting, and including the names and qualifications of the Project manager and key assistants.

(b) The Borrower undertakes to furnish, or cause to be furnished, to A.I.D. in form and substance satisfactory to A.I.D., information concerning the organization levels and staffing to be established for the operation of the Zarqa-Ruseifa Water and Wastewater System after completion of construction, including all technical and administration functions and the names and qualifications of the manager of that system and key assistants.

(c) The Borrower undertakes to furnish to A.I.D. in form and substance satisfactory to A.I.D., evidence that the Zarqa-Ruseifa Water and Wastewater System has been staffed as described pursuant to C.1. (b) above.

2. Training:

(a) The Borrower undertakes to furnish, or cause to be furnished, to A.I.D. in form and substance satisfactory to A.I.D., a plan showing the arrangements made or to be made for training all categories of personnel needed for operation of the Zarqa-Ruseifa Water and Wastewater System. Such plan should show all positions appearing on the staffing plan for operation of said system, specify, by position, the number of incumbents or prospective nominees requiring training and include a description of the length and type of training to be given.

(b) The Borrower undertakes to initiate implementation of the training plan referred to in Subsection 2 (a) within six (6) months after approval by A.I.D. of such plan.

3. Revenues:

The Borrower undertakes to provide to A.I.D. in form and substance satisfactory to A.I.D., a plan to establish, and cause to be established, a system of rates, fees, taxes and/or charges designed to generate sufficient revenues to cover all costs of operating and maintaining the Zarqa-Ruseifa Water and Wastewater System, including, if applicable, the amortization of all debts contracted to construct, expand or modify such system.

4. Tariff: To determine a tariff permitting the collection of rates, fees, taxes and/or charges indicated as required under Subsection 3 above, the Borrower undertakes or will cause to be undertaken the following:

(a) To carry out, or cause to be carried out, studies examining, in adequate detail, demographic and socio-economic characteristics of Zarqa and Ruseifa, relating such characteristics to revenue generation requirements, i.e., ability to pay, and to submit the terms of reference for such studies to A.I.D. for comment; and

(c) To furnish to A.I.D. for comment a draft of the tariff schedules developed pursuant to Subsection 3 above, together with a time frame for implementing them; charges included in such tariff should be demonstrably consistent with the findings of the studies referenced above.

5. Quality and Quantity of Wastewater: The Borrower undertakes to furnish or cause to be furnished to A.I.D., in form and substance satisfactory to A.I.D., plans for monitoring the quality and quantity of wastewater discharged by the Zarqa-Ruseifa Wastewater facility into the Zarqa River, and to implement on a continuous basis such plans upon completion of the Project.

6. Sewer Use Ordinance: The Borrower undertakes to submit, or cause to be submitted, to A.I.D. for comment the draft of an ordinance requiring and regulating the discharge of sewage and industrial waste into the Zarqa-Ruseifa Wastewater system and to promulgate such ordinance in a timely manner so that the benefits to be derived by construction of the sewer system will be realized.

7. Water Conservation The Borrower undertakes, or causes to be undertaken, the following:

(a) To establish a unit responsible within the Zarqa-Ruseifa Water and Wastewater organization staffed in numbers, training and experience to carry out a continuing program for detecting leaks and malfunctioning meters and to make appropriate arrangements for repairing promptly any leaks or malfunctioning meters reported by such unit;

(b) To develop and carry out a program designed to educate the public in preventing losses of water caused by leaking taps and pipes on private premises and similar causes of waste; and

(c) To develop and carry out a program designed to encourage industries to conserve water through recycling and/or such other means as appropriate.

8. Financial Obligations: The Borrower undertakes to provide all funds needed, in addition to revenues earned by the designated implementing agency, to operate, improve, modify or expand the Zarqa-Ruseifa Water and Wastewater System; such funds shall be provided on terms consistent with section 3 and 4 herein.

ANNEX AFeasibility Study and  
Other Relevant Memoranda

The below listed materials are referenced throughout this project paper and are to be considered an Annex. All listed materials have been provided to, and are available from, NE/PD, AID/W.

I. ZARQA-RUSEIFA Water Distribution, Sewerage and Stormwater Systems Feasibility Study; Malcolm Pirnie, Inc. in association with Jouzy and Partners, 22 December 1980.

- (a) Summary Report.
- (b) Investigations, Preliminary Engineering Design, Financial and Socio-Economic Analysis Report.
- (c) Appendix to (b) above.
- (d) Industrial Effluents Treatment Report.
- (e) Map Atlas for (b) above.

II. Relevant Memoranda

- (a) Memorandum on Initial Project Options, 14 September 1980; Malcolm Pirnie, Inc. (MPI) to National Planning Council (NPC).
- (b) Memorandum on Additional Project Options, 23 September 1980; MPI to NPC.
- (c) Unofficial translation of NPC memorandum dated November 1980 defining the initial project investment priorities and containing the Minutes of Meeting when all relevant agencies discussed options and priorities (meeting of 9/20/80).
- (d) Conservative Estimate of Savings with On-Site Power Generation, November 1980; draft MPI memorandum to NPC.
- (e) Final Design - Municipal Water Distribution, Improvements and Sewerage and Stormwater Drainage Systems in Zarqa and Russeifa - Jordan, 24 January 1981, MPI letter to NPC.



**B - 1**

**ANNEX B**

**MAPS AND TABLES**

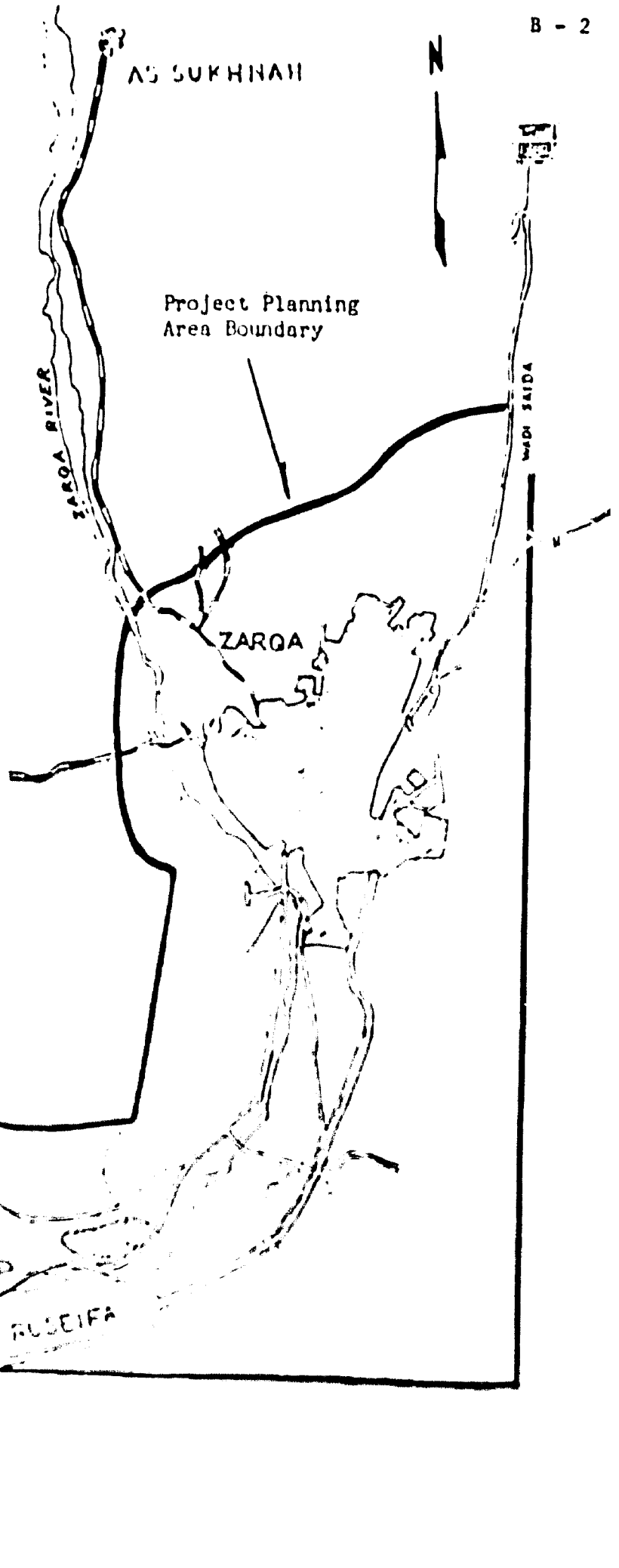
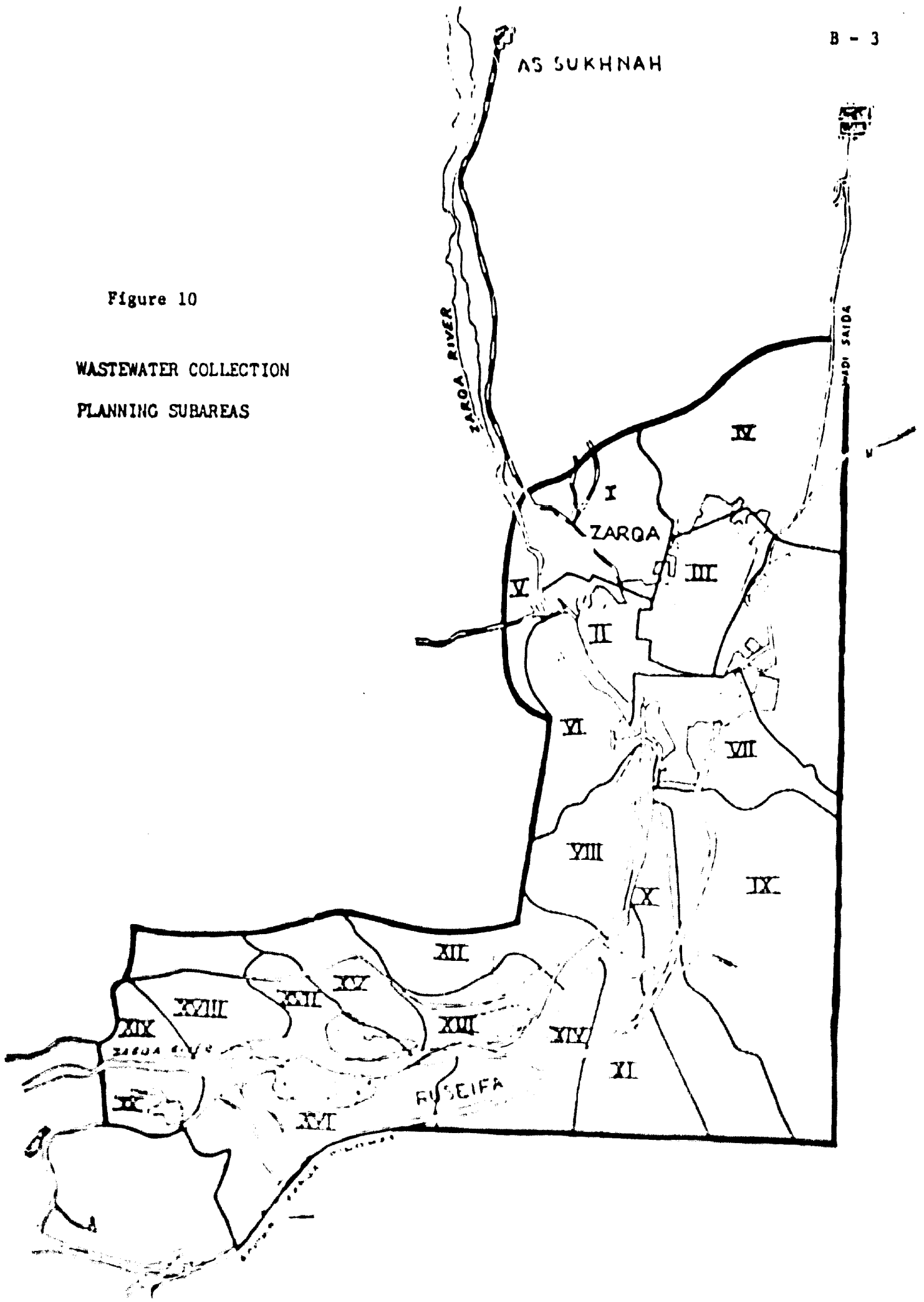


Figure 9  
ZARQA-RUSEIFA  
WATER AND WASTEWATER  
PROJECT AREA



Figure 10

WASTEWATER COLLECTION  
PLANNING SUBAREAS



AS SUKHNAN

Wastewater Treatment Plant

Pumping Station

Force Main

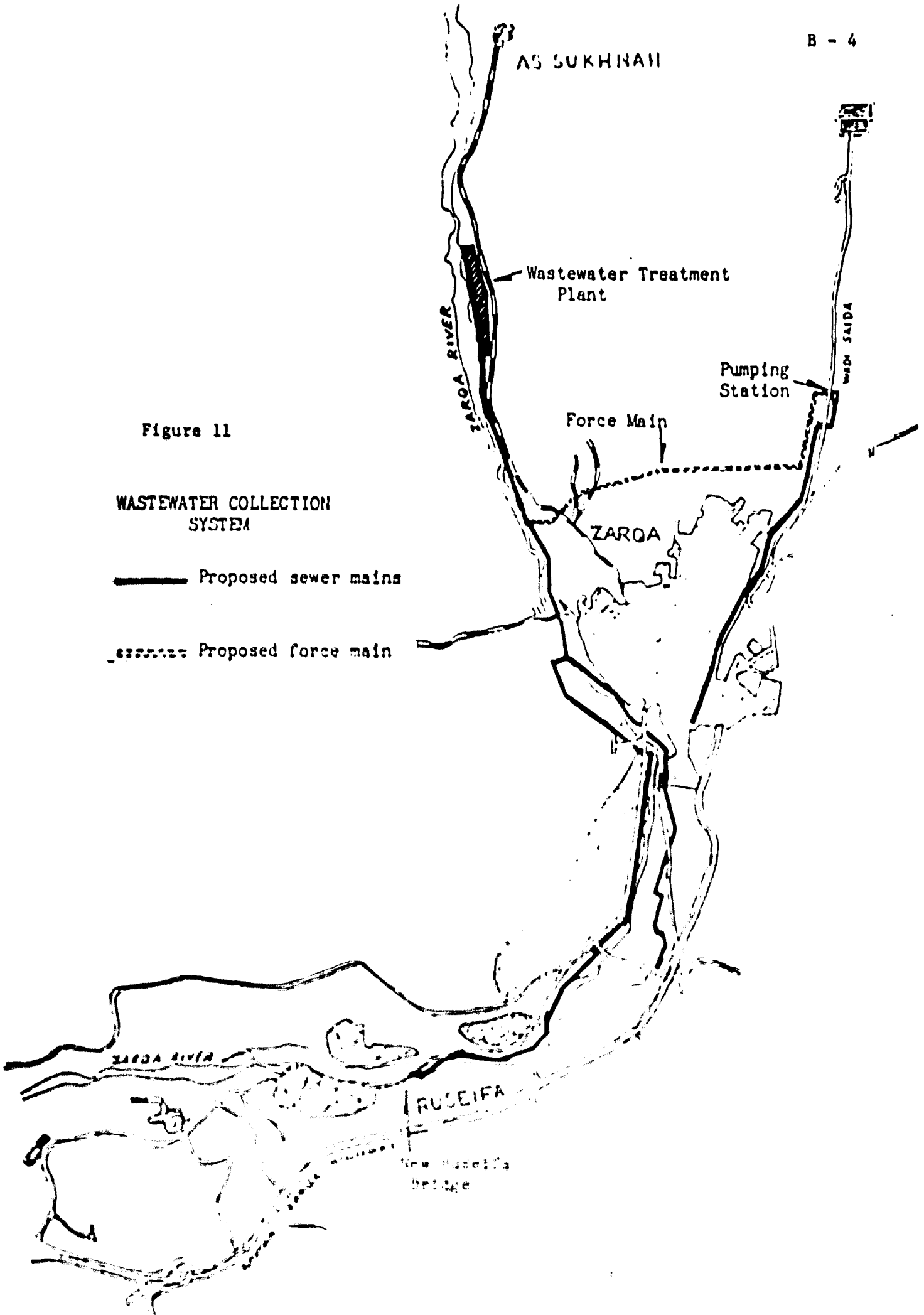
ZARQA

Figure 11

WASTEWATER COLLECTION SYSTEM

— Proposed sewer mains

- - - - - Proposed force main

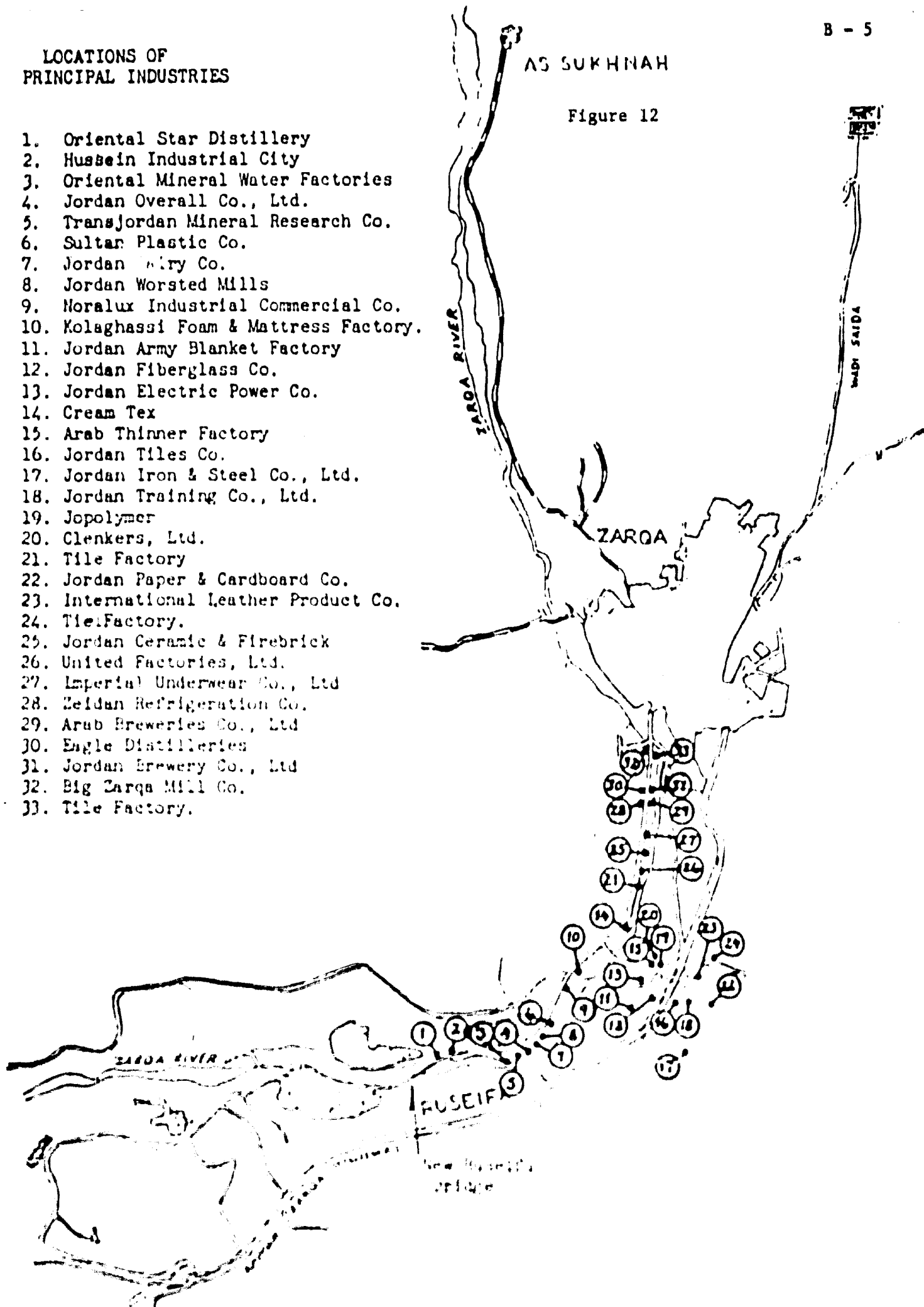


LOCATIONS OF  
PRINCIPAL INDUSTRIES

AS SUKHNAH

Figure 12

1. Oriental Star Distillery
2. Hussein Industrial City
3. Oriental Mineral Water Factories
4. Jordan Overall Co., Ltd.
5. Transjordan Mineral Research Co.
6. Sultar Plastic Co.
7. Jordan Wire Co.
8. Jordan Worsted Mills
9. Noralux Industrial Commercial Co.
10. Kolaghassi Foam & Mattress Factory.
11. Jordan Army Blanket Factory
12. Jordan Fiberglass Co.
13. Jordan Electric Power Co.
14. Cream Tex
15. Arab Thinner Factory
16. Jordan Tiles Co.
17. Jordan Iron & Steel Co., Ltd.
18. Jordan Training Co., Ltd.
19. Jopolymer
20. Clenkers, Ltd.
21. Tile Factory
22. Jordan Paper & Cardboard Co.
23. International Leather Product Co.
24. Tile Factory.
25. Jordan Ceramic & Firebrick
26. United Factories, Ltd.
27. Imperial Underwear Co., Ltd
28. Zeidan Refrigeration Co.
29. Arab Breweries Co., Ltd
30. Eagle Distilleries
31. Jordan Brewery Co., Ltd
32. Big Zarqa Mill Co.
33. Tile Factory.



ZARQA - HUSEIFA  
WASTEWATER TREATMENT PLANT  
SCHEMATIC

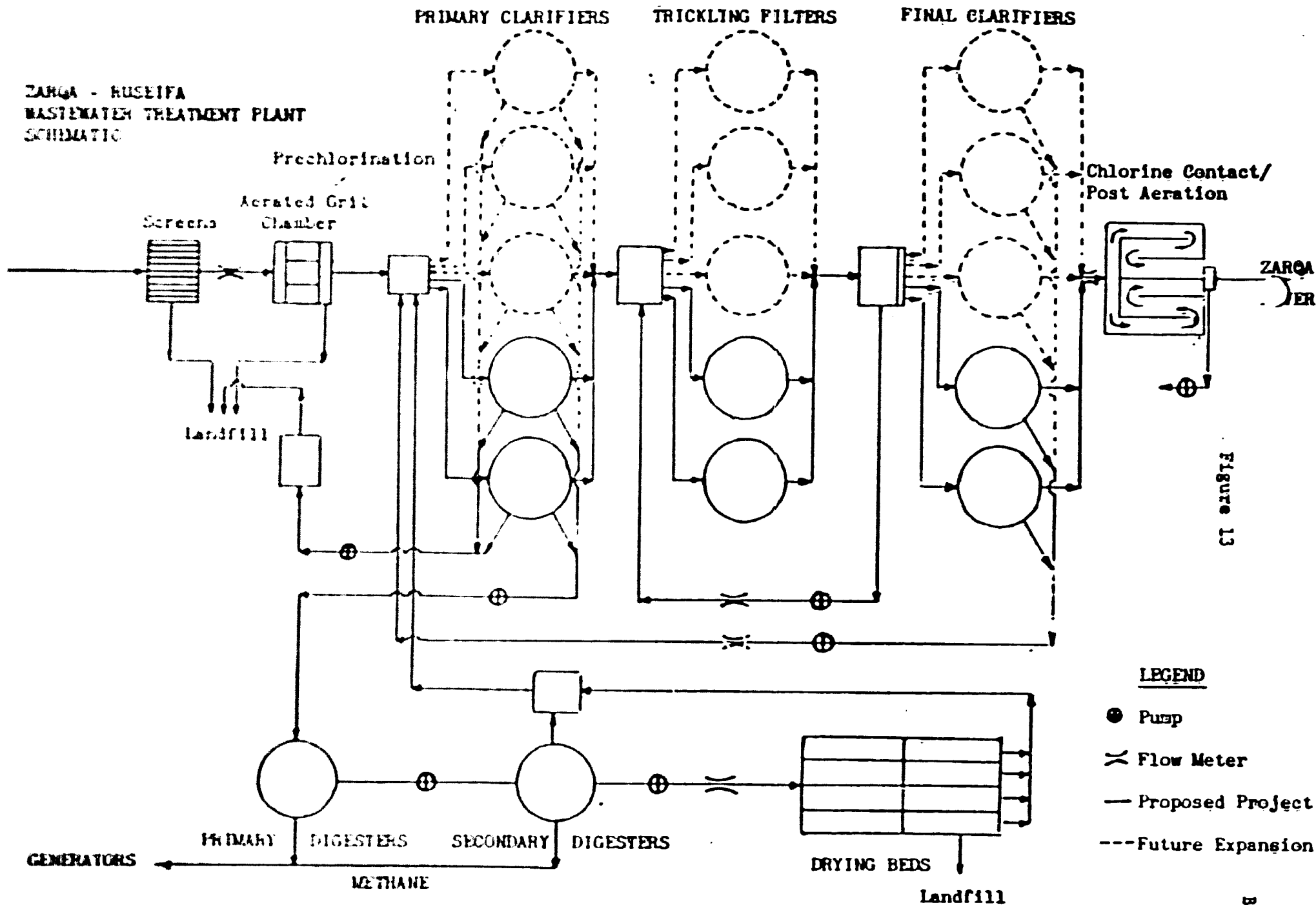


Figure 13

LEGEND

- Pump
- X Flow Meter
- Proposed Project
- Future Expansion

C - 1

ANNEX C

TECHNICAL DETAILS

SOCIAL SOUNDNESS ANALYSIS

Prepared by: Dr. Jarir S. Dajani, February 1981

1. Introduction

The Zarqa-Ruseifa corridor is one of the major industrial centers in Jordan. It is located on both banks of a 15 km stretch of the Zarqa River, and comprises the cities of Zarqa and Ruseifa, with a 1979 population of 216,000 and 62,000, respectively. Their combined population is expected to rise at an annual rate of 3.5 percent, and to reach 586,000 in the year 2000, and 840,000 in the year 2020. The latter date was used as the planning horizon for this project. The present population consists of about 40,000 households averaging about 7 persons per household. The residents of these two cities represent one eighth of the population of Jordan, and are generally characterized as middle and low income families. The heads of households are mostly unskilled or semi-skilled workers who are employed in construction, local manufacturing, retail shops, civil service or the army. When compared to the capital, Amman, a smaller percentage of the population of this corridor is involved in high level managerial, professional, and entrepreneurial occupations. Consequently, the proportion of the population in upper income groups is smaller than it is in Amman.

While water distribution networks reach most of the residents of these two cities, no sewerage system is in existence. Parts of the water distribution network are outdated and plagued with leakages. Cesspools and pit-latrines have resulted in aquifer contamination, costly cesspool maintenance, unsightly and unsanitary sillage disposal, health problems, and pollution of surface water in the Zarqa River, both within and downstream of the cities. The proposed project, when completed, will provide sewerage services to about 65%, 71% and 83% of the total population by the years 1990, 2000, and 2020 respectively. It will also replace parts of the older water distribution networks which no longer provide a satisfactory level of service. Adequate treatment of the collected sewage is also planned in order to alleviate existing health and environmental pollution problems.

The initial phase of the project will provide for the construction of the sewage treatment plant and for sewerage serving a present population of 170,000 in areas where the population is expected to reach 254,000 in the year 2000. It will thus serve about 60 percent of the present combined population of Zarqa and Ruseifa. It will also serve some of the industrial areas in the two towns, expand and improve the water distribution system of Ruseifa and rehabilitate 50% of the water distribution system in Zarqa.



The only two censuses conducted in Jordan were for 1961 and 1979. The information contained in the former is too old to be of more than historic value, while the results of the latter are not yet available except in a preliminary and highly aggregated form. The facts that no demographic information is available from the census on a disaggregate level, and that no income questions are provided for in the census, result in two major gaps in the available data base. It was thus necessary for the purposes of this analysis to obtain approximations to both the spatial distribution of the population and their relative economic status, on the basis of observation, judgment, expert opinion, and conclusions and inferences which are derived from other studies.<sup>1/</sup>

For design purposes, the Zarqa-Ruseifa corridor has been divided by the Consultants into 20 subareas, on the basis of topographic and drainage characteristics. The Army Base represents a twenty-first subarea. These subdivisions are shown in Figure 15 and briefly described in 14. As can be seen, most of the population of Zarqa resides in subareas I, II, III, IV and VII, while most of the population of Ruseifa resides in subareas XVI, XVII and XX. The army base has a population of 35,000 residents. Subarea VII includes a densely populated refugee camp. Most of the population of the two towns is of low to moderate income. Pockets of high income residents can be found in subareas I, IV, and IX. Most growth is expected to occur in subareas I, IV, V, VI, VIII, IX, XII, XV, and XVII. The population of the area is expected to increase by 90 percent by the year 2000, and by 170 percent by the year 2020.

The initial phase of the sewerage project covers subareas II, III, IV, VII and the Army Base. These areas have a combined population of 170,000. They include the very dense downtown district and the adjacent areas of the Refugee Camp and Janna'ah. The initial phase of the water distribution project includes the rehabilitation and expansion of the water distribution system in some very poor and squatter areas in Ruseifa.

<sup>1/</sup> These studies include (1) Pirnie and Jouzy, Feasibility Study for Zarqa-Ruseifa, 1980; (2) Montgomery and DMJM, Preliminary Study and Master Plan for Wastewater Disposal for Greater Amman Area, 1980; (3) Dajani, A Social Soundness Analysis of the Amman Water and Sewerage Networks, 1978; (4) Weston International, Irbid Municipal Water Distribution, Sewerage, Storm Drainage and Solid Waste Disposal Project, 1980; (5) Amman Urban Region Planning Group, Planned Development in Balqa-Amman Region, 1979; (6) Halcrow-Fox, Amman Urban Project Reports, 1978

**GEOGRAPHIC DISTRIBUTION OF POPULATION AND ACTIVITIES  
IN THE ZARQA-RUSEIFA CORRIDOR**

C - 4

<u>Subarea</u>	<u>Development Pattern</u>	<u>Estimated 1979 Population</u>	<u>Forecast 2000 Population</u>	<u>Economic Level of Residents</u>	<u>Local Names</u>
I.	90% developed in south eastern portion, mostly vacant in northern and western portions.	27,600	61,900	Generally low-income to lower middle-income with one small pocket of upper income	Hai Ramzi & Ma'sum
II.	85% developed	41,100	45,000	Mostly middle income	Hai Shaker
III.	95% developed includes most of Zarqa commercial District	58,000	60,000	Low-income and lower middle income.	
IV	Mostly vacant in northern section zoned for industrial growth.	14,800	82,000	High income in east central portion. Low income in south eastern portion.	Hai esh-Shiukh Hai Bani Hassan
Army Base		35,000	40,000		
V	Sparsely developed but has high potential for rapid growth	2,400	30,000	Mostly low-income	Hai es-Zawhreh
VI	Mostly vacant with the exception of narrow strip west of River.	17,000	36,700	Mixed low and middle income	Jabals al-Abiad
VII	Very densely developed	23,000	27,000	Mixed low and lower middle income includes Refugee Camp and surrounding low income squatter areas.	Refugee Camp Hai Janna'ah

Figure 14  
(cont'd)

<u>Subarea</u>	<u>Development Pattern</u>	<u>Estimated 1979 Population</u>	<u>Forecast 2000 Population</u>	<u>Economic Level of Residents</u>	<u>Local Names</u>
VIII	Industries including two breweries and a distillery. Relatively low density. Some commercial activity.	12,500	30,000	Alternating middle and lower income areas	Awjan al-Gharbi
IX	Very sparsely developed. Includes some major industries. (Ceramics, papers, matches, leather.)	4,200	16,600	Mostly high income areas with pockets of very low income residents	Hai Wadi al-Hajar
X	Very sparsely developed. Also includes some major industries. Southerly portion is zoned for future development.	5,800	10,800	Small populated area of mixed low and middle income residents.	Awjan al-Sharqi
XI	Only around 100 homes	800	4,700		Wadi Ushush
XII	Densely developed along River. Some major industries. Govt. housing under construction.	9,700	30,300	Lower and middle income	Awjan al-Jamabi
XIII	Densely developed along River. Some major industries.	12,800	18,000	Low income along River. Middle income in other areas.	Awjan al-Jamabi
XIV	Vacant, with potential for growth.	100	7,800		Hai al Aradfeh
XV	Undeveloped with potential for growth.	800	17,500	Low income	Jabal al-Shamali.

<u>Subarea</u>	<u>Development Pattern</u>	<u>Estimated 1979 Population</u>	<u>Forecast 2000 Population</u>	<u>Economic Level of Residents</u>	<u>Local Names</u>
XVI	Central Riseifa & Phosphate Mines. AURPG proposal for parks and open space. Dense population in northern sector. Commercial and public buildings.	22,900	25,400	Mostly low-income	Riseifa
XVII	Includes Hussein Industrial City. Dense residential area. Developing rapidly.	13,100	25,000	Low income	Hussein industrial City
XVIII	Phosphate screening and drying.	100	6,700		C-1-6
XIX	Designated for open space by AURPG	100	100		
XX	Residential. Incomplete development	8,600	10,000	Mixed low and middle income	Al-Musheiref

Source: Based on data provided in Malcolm Pirnie, Inc., and Jouzy and Partners, Feasibility Study for Zarqa-Riseifa, Amman, 1980.

Note: These subareas are those used for the design of the sewerage system, and are thus based on the topographic and drainage characteristics of the area. In the absence of specific spatially disaggregated socio-economic data, the information provided herein is indicative of the spatial distribution of people and activities in the planning area. This Table is to be read in conjunction with Figure 1, which shows the location of these subareas.

Figure 14  
(cont'd)

C - 7

Figure 15

AS SUKHNAH

ZARQA-RUSEIFA  
WATER AND WASTEWATER  
PROJECT AREA AND  
SUBAREAS

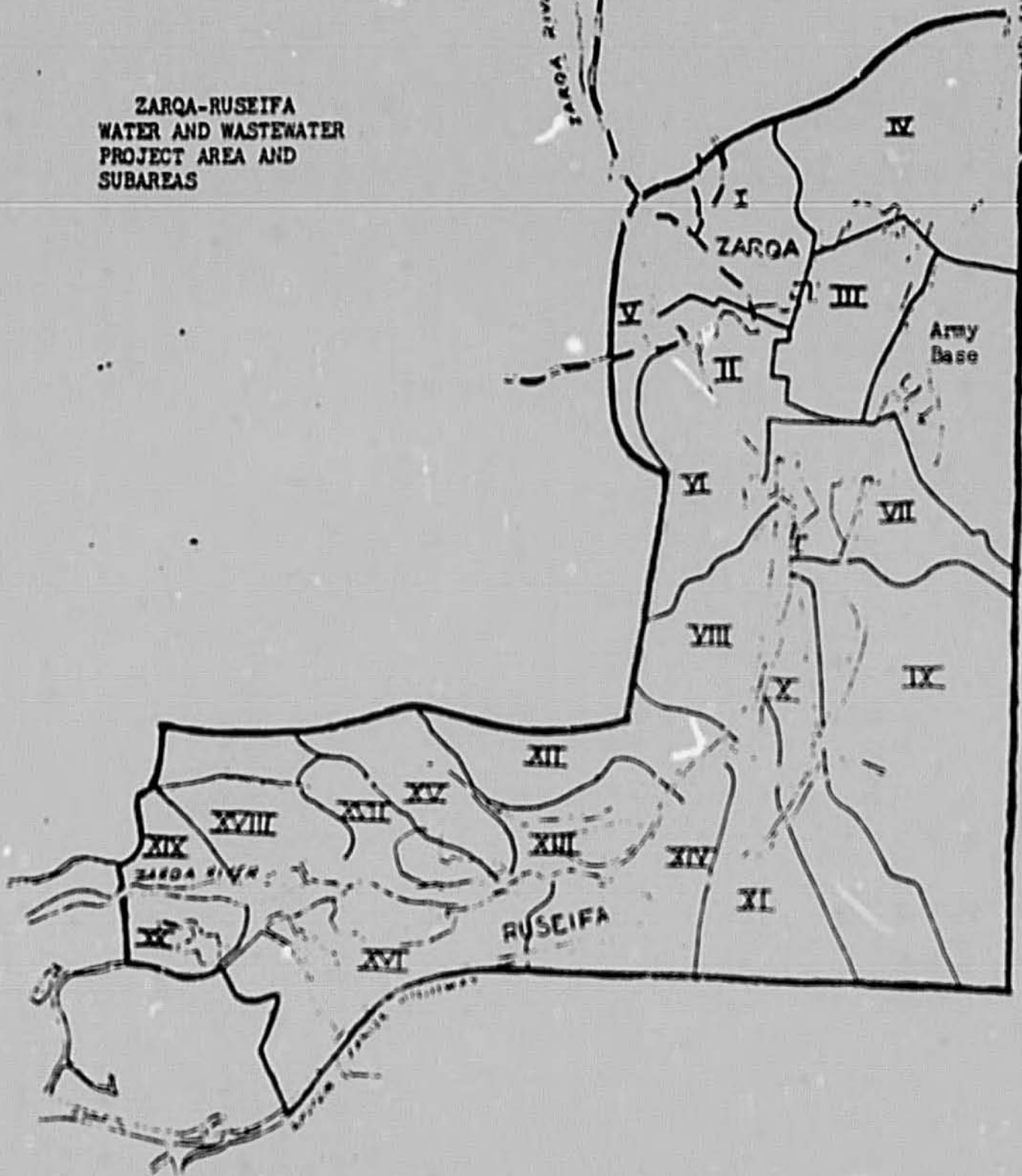


Figure 16

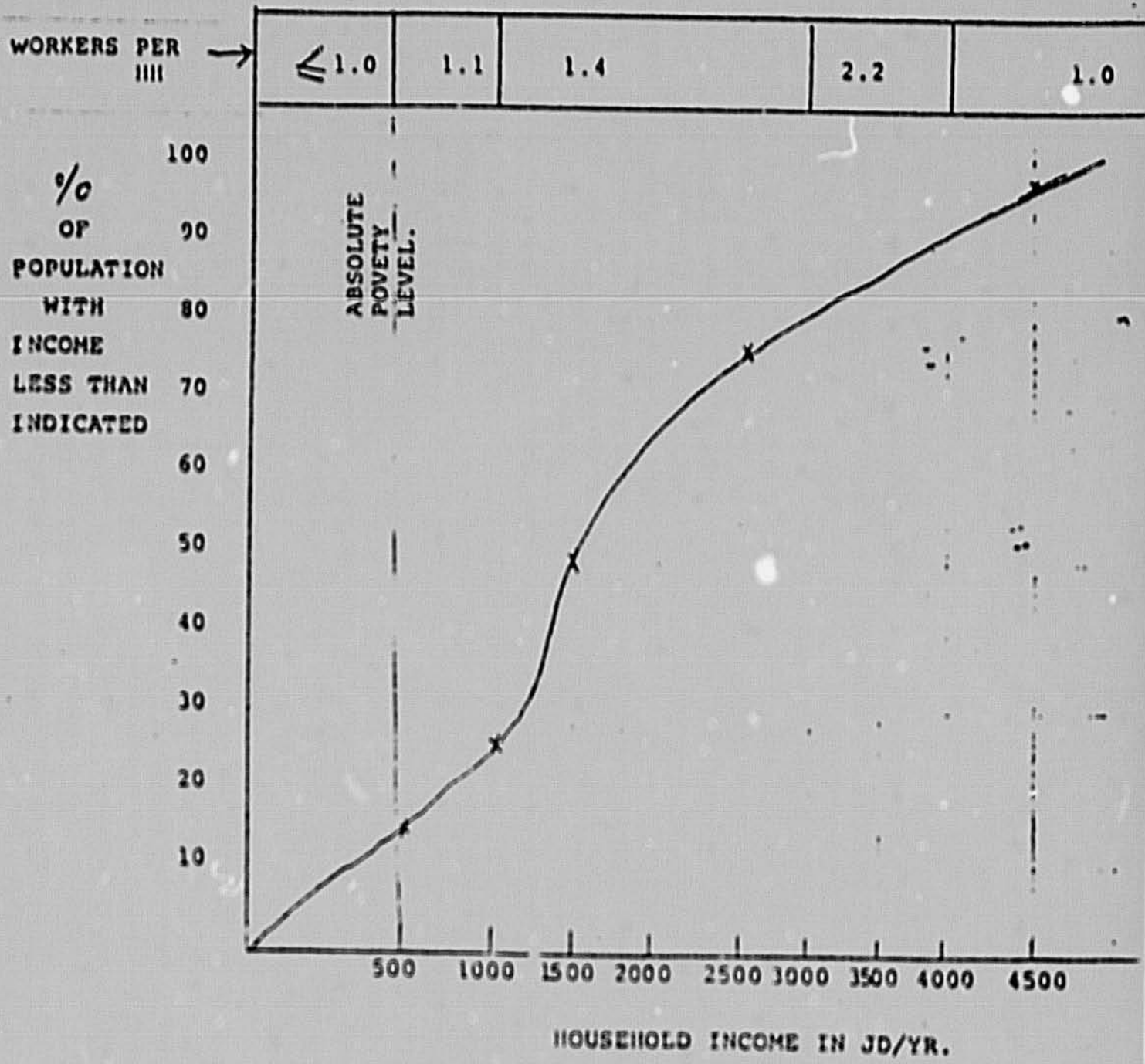


FIGURE 16: INCOME DISTRIBUTION.

There are no accurate statistics on the income distribution of the population of the Zarqa-Ruseifa corridor. It is reasonable to expect, however, that it is similar to that of Irbid, and to middle and low income areas of Amman. Inferences about this distribution have thus to be made on the basis of limited sample surveys which have been conducted in these two cities.<sup>2/</sup>

These studies suggest that the income distribution in Zarqa-Ruseifa is similar to that shown in Figure 16. The median annual household income is JD 1500 (\$4800) or about \$700 per capita. The upper quartile has an annual household income in excess of JD 2500 (\$8000) while the lower quartile earns less than JD 1000 (\$3200). About 15 percent of the households earn less than JD 600 (\$1900) or \$270 per capita per year. The poverty line should probably be drawn at the JD 1000 per annum level, while the poorest of the poor are represented by those households with an annual income of JD 600 or less.<sup>3/</sup> If an average inflation rate of 8% is assumed for the period 1981-1985, then it can be expected that the annual income level of families at the poverty line will rise during that period from JD 1000 to JD 1500. The poorest of the poor will be defined in 1985 as those earning JD 900 or less.

AID strategy, as expressed in the 1981 and 1982 CDSS's, is to support the Government of Jordan in its program to provide the minimum supply of water for daily use and provide for wastewater disposal on an equitable basis. Particular emphasis is on the more heavily populated areas of the country. The ultimate objective will be to provide a water distribution system under continuous pressure from which an average family can draw 80 liters per capita per day for a price not to exceed five percent of its income (in urban areas), along with an associated system for collecting and treating wastewater at a reasonable cost before returning it to the national water cycle. The Zarqa-Ruseifa Project will be designed so that it can be expanded to accommodate, eventually, the demands for water distribution of the saturation population which will be reached early in the 21st century.

<sup>2/</sup> These surveys are reported in Refs 3, 4 and 5 listed in Footnote (1) above.

<sup>3/</sup> Dajani, Jarir, A Social Soundness Analysis of the Amman Water and Sewerage Systems. AID Contract AID/NE-C-1943 (Jordan), 1978.

## 2. Water Distribution

Most of the residences of Zarqa and Ruseifa are connected to piped water supply. In 1979 there were 23,700 service connections in Zarqa and 6,100 in Ruseifa. The number of service connections has increased by 50 percent between 1970 and 1979. In Ruseifa, it has increased by 30 percent in the last three years alone. If it is assumed that 20 percent of all connections serve non-residential locations, and that each connection serves 10 persons, then 88 percent of the residents of Zarqa and 80 percent of the residents of Ruseifa receive piped municipal water. It can thus be expected that a more complete distribution system coverage will provide water service to an additional 30,000 residents who presently do not receive it. The initial phase of the project calls for the expansion and reinforcement of the existing water distribution systems in Zarqa and Ruseifa. It is expected that the proposed expansion will allow the system to reach most of the unserved households in the corridor.

The amount of water pumped in Zarqa is 75 litres per capita per day (lpcd), and in Ruseifa is 39 lpcd. The amount actually sold is 40 and 25 lpcd, respectively. Most major industries are presently pumping upper aquifer water from their own privately-owned wells. Considering that industrial and commercial water use accounts for about 20 percent of the total, and that half of the difference between the pumped and the sold quantities is due to network leakage while the other half reaches the user unmetered because of meter malfunctions, it could be concluded that actual domestic water use in the two cities is about 45 and 26 lpcd, respectively. These numbers are in line with current Jordanian water use. The recent study of Irbid showed that water use was 36 lpcd city-wide, and 21 lpcd in the Refugee Camp. The differences in water consumption between the two cities (or between Irbid and the refugee camp, for that matter) is due to the fact that (1) the residents of Ruseifa are generally of lower socio-economic status and (2) a smaller proportion of the population of Ruseifa have water connections. The improved distribution system will be designed to allow for an increase in water use at the rate of one lpcd per year, and for the introduction of flush toilets. The plan is based on an average water consumption of 88 and 76 lpcd in Zarqa and Ruseifa, respectively, in the year 2000. These figures are consistent with expected water use in other Jordanian cities, and with WHO recommended standards for minimum necessary water consumption. The Irbid system is being designed for a water use of 95 lpcd in the year 2000. The proposed system will allow for the possible doubling of water consumption in Zarqa, and a tripling of that consumption in Ruseifa.



Through the replacement of old pipes and the conduct of a careful leak survey it should be possible to reduce network leakage from 20 to 10 percent. This saving amounts to more than 0.5 million cubic meters of water per year, at 1980 usage levels. The project also includes the institution of improved metering practices, which can be expected to result in a 10-20 percent increase in water revenues. The replacement of some of the older parts of the system with a new system which is designed for a higher capacity will also allow for the accommodation of future population growth, which is inevitable. Future generations are thus definite beneficiaries of the proposed improvements. Improvements in water quality and their concomitant impacts on health are another significant benefit of the proposed system. These will be discussed later in this paper.

Water customers are billed on a bi-monthly basis. The present graduated rate structure is as follows:

<u>Water Consumption Group (cu. m./2 months )</u>	<u>Unit Cost (JD/cu.m.)</u>
0-10 (0-330 l/d)	0.080
11-30 (330-1000 l/d)	0.120
31-50 (1000-1660 l/d)	0.220
More than 50 (more than 1660 l/d)	0.300

A minimum bi-monthly payment of JD 0.480 is imposed on customers using less than 6 cubic meters during the billing period. For a poor family of 10, using the present Ruzeifa average of 26 lpcd, the annual water bill would amount to JD 9.420. At a water consumption close to the Zarqa average of 45 lpcd, their annual water bill would amount to JD 17.040. These outlays represent 1.5 and 2.8 percent, respectively, of the incomes of the poorest residents.

Present water revenues amount to an average of JD 0.120 per cubic meter, using the graduated scale given above. This is 50 percent above the minimum rate charged on the "life line" amount of 5 cubic meters per month. In order to cover the water authority's projected costs for water distribution, it will be necessary to charge JD 0.165 per cubic meter, on the average. For the purpose of this analysis, it will be assumed that the rate structure is changed to one which will generate an average revenue of JD 0.165 per cubic meter of water, and which maintains the present relationship between this average revenue and the rate charged

for the first two consumption categories. This will mean raising the rates for these two categories from JD 0.080 and JD 0.120 to JD 0.110 and JD 0.165, which in turn raises the annual bills of the two households discussed above to JD 12.150 and JD 23.430, respectively. These bills will represent 1.4 and 2.6 percent of the expected income of the poorest of the poor, in 1985. Thus charging these higher rates will not make this group any worse off. People at the 1985 poverty level of JD 1500 per year will have to pay 1.6 percent of their 1985 income for water, if they use an average of 45 lpcd. Since most houses in the study area are already connected to the water network, no major expenditures by these households are expected for initial connections and/or the installation of indoor plumbing and fixtures.

### 3. Wastewater

Zarqa and Ruseifa currently have no system for the collection, treatment and disposal of municipal wastewater. The corridor has become totally dependent on individual wastewater disposal systems, i.e., cesspools, which have become increasingly inadequate and have posed a potential health problem as both cities have grown. Regardless of proposed improvements to the water distribution system, a well-designed wastewater collection, treatment and disposal system is essential to eliminate the potential health hazards of the present situation.

All the households of Zarqa-Ruseifa presently depend on cesspools or pit latrines for wastewater disposal. Each dwelling has a drain to an individual or to a common cesspool. At best, a cesspool provides only a limited degree of wastewater treatment. In many cases, the volume of wastewater is reduced by leaching through cesspool walls and bottoms, eventually seeping downward to the ground water level. It is believed the wastewater from the 30,000 or so cesspools is contributing to the contamination of drinking water through leakages into the water distribution system. If the leaching rate is low and a cesspool fills up, the owner must have a septage hauler pump out and dispose of the contents. The area is served by forty tankers, only eight of which are municipally owned. They charge about JD 3,500 for each load. It is estimated that each pumpout requires two loads and that each cesspool needs to be emptied twice a year. This leads to an annual pumpout cost of JD 14,000 per cesspool. The cost of constructing a cesspool is about JD 250,000. These are by necessity rough estimates, since the quantity and frequency of cleaning are dependent on the age, size, and construction of the cesspool; and on the ground conditions in that particular location. The relatively high cost of cleaning has led some residents to resort to illegal and generally unsanitary means for emptying their cesspools. Thus for a poor family of ten which consumes an average of 26 lpcd (about 100 cubic meters of water per year), pumpout costs will average JD 0.140 per cubic meter of water consumed. This

represents the actual equivalent surcharge which that family is paying for waste disposal. When conservatively considering a 10 year life for the cesspool, the total cost of wastewater disposal amounts to JD 0.390 per cubic meter of water used. These expenditures presently represent 6.5 percent of the income of the poorest households. The combined annual water and wastewater cost is about JD 50 or about 8 percent of the household's income. If it is considered that the poorest residents dig their own cesspools at no cost to them, then the combined water and wastewater costs would amount to JD 26 or 4 percent of their income. If the income of this category of residents climbs to JD 900 in 1985, and if the cost of water and sewerage is to be kept to 5 percent of their income, the per capita water consumption is to increase at the modest rate of 1 lpcd per year, and if the average proposed water rate of JD 0.165 per cubic meter is charged, then a sewerage surcharge of JD 0.300 per cubic meter of water could be charged. If the total expenditure is not to exceed the 4 percent level which is presently incurred, exclusive of the cost of the cesspool, then a sewer surcharge of about JD 0.210 per cubic meter of water could be charged. The poorest residents can be expected to be better off in 1985 than they are today, even at such seemingly high sewerage surcharges. Institutional and public acceptance impediments to the application of such a fee stem from the fact that a much lower fee of JD 0.030 is being charged in Amman. Using a much higher fee, however, is necessary, if the cost of the system is to be recouped. The above analysis shows that the imposition of a surcharge of this order of magnitude will not harm the poorest of the poor in the Zarqa-Ruseifa area. Unless that fee is also charged in Amman, its imposition will discriminate against this category of the population who live in the Zarqa-Ruseifa area.

User charges for the sewerage system of Amman, which is the only such large-scale operational system in Jordan, include: (1) a one-time application fee, (2) a one-time connection charge; (3) an annual sewerage tax; (4) a connection cost, and (5) a surcharge on water consumption. The first three charges are indirectly pegged to the consumer's income and thus his ability to pay. The one-time application fee varies with the type of residence. It is collected at the rate of JD 10 for class A residential buildings, JD 5 for class B residential buildings, JD 3 for class C and D residential buildings and JD 25 for commercial structures. Classes C and D are typical of lower income areas. The one-time connection fee is fixed at 25% of the assessed annual rent of the structure. The overall average of all assessed annual rental values in Zarqa and Ruseifa is JD 50 with the lower income areas having an assessed rental in the JD 30-40 range, mostly in type C and D buildings. Rent assessments are obviously low; a situation which is at least partially attributable to rent control which is exercised by the Government in all parts of the country. Once connected to the sewerage system, the owner will continue to pay an annual property tax surcharge of 4% of the assessed rental. The owner will also have to pay the cost of the house

connection itself to the property line, which amounts to between JD 18 to 25 per meter-run. These connections average 3.5 meters in high-density areas, and in are generally longer than 5.00 meters low-density areas. Connection to the sewer system will result in the payment of a consumption surcharge which is applied to the consumers water bill. The first four charges are normally payable by the owner, while the surcharge is payable by the renter or owner-occupant. Thus, typical costs on a type C or D residence (low income) are as follows (assuming an annual assessed rental of JD 40):

I.	<u>Owner Costs</u>	<u>(one time)</u>	
	Application Fee	JD	3.000
	Connection Charge	JD	10.000
	Connection Cost		
	3 meters at JD 20)	<u>JD</u>	<u>60.000</u>
	Total one-time costs	JD	73.000
II.	<u>Owner Costs</u>	<u>(annual)</u>	
	Sewerage Tax	JD	1.600
III.	<u>Occupant Costs</u>	<u>(annual, assuming JD 0.200</u>	
		<u>sewerage surcharge)</u>	
	10 persons at 30 lpcd.	JD	21.600
	10 persons at 40 lpcd.	JD	28.800
	10 persons at 50 lpcd.	JD	36.000

It is estimated that 70 percent of all households in the Zarqa-Ruseifa corridor are owner-occupants. For the poorest of these households, the connection costs of JD 73 represents 8 percent of their 1985 annual income. While this could be an undue burden to be carried by very poor families, it should be noted that it is paid by owners or owner-occupants, who either collect rents or do not pay rents themselves. It should also be remembered that these households may require improvements in their plumbing system in order to fully benefit from the connection. Judging by similar experiences in Amman, it is not expected that major problems will arise as a result of the inability of even the poorest of the home-owners to pay these charges and costs.

The above analysis is based on the assumption that charges similar to those levied in Amman will be applied to Zarqa. While this may not be the case, there is no reason to believe that major deviations from present practices will occur in the near future.

#### 4. Health

The availability of a safe, dependable, fully-pressurized water distribution system coupled with an efficient wastewater collection, treatment and disposal system will do much to improve the health status among the poorer residents of Zarqa-Ruseifa. The primary public health hazards involved are water-related diseases. It is generally accepted that an adequate, clean water supply for drinking and personal hygiene and a working wastewater system lead to improvements in public health and well-being. Under the present situation, the area has a relatively high potential or actual incidence of such water-related diseases as typhoid, amoebiasis, bacillary dysentery, infectious hepatitis, other forms of gastroenteritis and some skin infections. These can all be related to poor water distribution and inadequate wastewater collection and disposal systems, combined with an increase in population density and a corresponding lack of knowledge or practice of good hygiene. (See 1980 Water Sector Paper for Jordan.)

Many water-related diseases are endemic to Jordan, and the occurrence of frequent out-breaks of several such diseases often goes unnoticed. Good data to measure the size of the water-related health problems is nonexistent, with perhaps as few as 10% of the actual occurrences being reported. Diagnosis of these diseases is often inadequate because the frequently-used public clinics do not have the facilities or staff to identify the cause of illness, nor an adequate health information system for reporting. Both problems are being addressed through the USAID-funded Health Planning and Services Development Project (278-0208) and should be greatly improved prior to the completion of this project. In addition, USAID will be providing partial funding of a World Bank - Population Council baseline survey of the health and social status of the target population of an urban-upgrading project in Amman, which should provide an index of the health status of lower-income groups in a typical urban environment.

In order to obtain some feel for the situation, the analyst can assess available data on patients who have been hospitalized in Jordan. 18 percent of all infants hospitalized in 1977 were diagnosed to have some form of entirities, while a full three percent of those hospitalized at all ages suffered from a water or food-borne disease. Two thirds of the working adults who were hospitalized and who were suffering from

enteritis and diarrheal diseases were classified as having low-income jobs, while 20% and 13% belonged to medium-income and high-income occupations, respectively. Water supplies have been found to be bacteriologically unsatisfactory in tests which were conducted at various points in the distribution system. 23.4% of all samples tested at consumer's premises in Zarqa between 1971 and 1978 were found unacceptable, in spite of the fact that water is usually chlorinated at the source.

Although there is no doubt that the project will contribute to a healthier environment, improved sanitary conditions will not eliminate "behaviorial deficiencies" on the part of all beneficiaries. It is clear from AID's experience that health education leading to improved personal, community, and food hygienic practices is a necessary complement to the provision of safe drinking water in adequate amounts. USAID's FY 1980 Health Education Project (278-0245) should provide the basis for the corrective programs which must be introduced if the Zarqa-Ruseifa Project, and other water and sewerage projects, are to achieve the full impact on health conditions.

There are further health hazards associated with the necessity to clean and maintain cesspools. Some residents purposefully reduce their water consumption in order to avoid the additional cost of more frequent maintenance of their cesspools. This self-enforced reduction in consumption results in poorer sanitation and individual hygienic habits. Additionally, when cesspools are pumped out by tanker trucks, it is known that, in order to save time and fuel and to service as many customers as possible, the drivers do not travel the full distance to the authorized septage dumping areas. Instead, they often empty their loads on agricultural land not far from residential areas. The installation of a municipal wastewater system will eliminate the need to over-conserve in order to avoid cesspool cleaning fees. It will also stop the unsanitary dumping of cesspool contents in unauthorized areas.

The proposed project can thus be expected to benefit public health for the following reasons:

- (1) A rehabilitated water distribution network will reduce the risks of contamination caused by broken and leaking pipes.
- (2) A reliable water distribution network will eliminate, or at least reduce, the need for roof-top and/or ground-level storage tanks, thus eliminating a potential source of contamination.

(3) The replacement of the high cesspool cleaning costs by reasonable sewer charges which are based on water use rather than sewage quantities will encourage both higher water use and less illegal dumping by both residents and haulers. This is particularly applicable to lower income households.

(4) The sewerage system will eliminate the use of cesspools, and thus reduce the danger of contamination in the water pipes, and in both ground and surface waters.

The quantification of the relationship between sanitation improvements and health is not an easy task. A recent study suggests a threshold-saturation paradigm for the assessment of the health impacts of these improvements<sup>4/</sup>. The paradigm proposes, and empirically demonstrates, that environmental interventions alone, at the low end of the socio-economic status (SES) scale, will produce little health improvement, unless they are supplemented by a variety of complementary investments in such areas as health education and nutrition, such as the ones referred to above. These health benefits, however, are expected to materialize much more dramatically as the socio-economic status of the population improves. This hypothesis uses literacy rates as a measure of SES and life expectancy at birth as a measure of health status. According to this paradigm, Jordan with an adult literacy rate of 62% appears to have a socio-economic development position in which high expectation of health benefits from sanitation projects is reasonable.

#### 5. Willingness to Pay

The cost for connecting to the water and/or sewerage system is borne by the property owner, while the monthly consumption costs are borne by the occupant, either owner or renter. There seems to be a general willingness to pay for these services in Jordan, and people are in fact usually anxious to connect to the systems. According to the law governing the operation of the Amman Water and Sewerage Authority, which runs the only operational large-scale system in Jordan, the responsible governmental agency publishes an official notice requiring property

<sup>4/</sup> Shuval, H., R. Tilden, and R. Grosse, "The Effect of Sanitation Investments on Health Status: A Threshold-Saturation Theory mimeographed paper, School of Public Health, University of Michigan, Ann Arbor, Mich., June, 1979.

owners in a sewered area to connect to the system within three months of that notification. If the owner fails to do so during that period, the agency will carry out the necessary work at the owner's expense and collect from him an additional administrative fee of 20% of the cost. In a recent study of one high income and one low income area in Amman, it was found that 78.6% of all those required to connect in the high income area did actually connect within a four month period (a one month extension was granted). The corresponding percentage in the low income area was 92.1 percent. During the following four months these percentages rose to 90.0 percent and 95.4 percent, respectively. No applications for installment payments were made, although such an arrangement can be negotiated. No connections were actually constructed by the Agency. Of the 21 owners who did not connect, 3 had their houses under construction, 12 resided in the Gulf area, and 5 were negotiating an arrangement with tenants in order to share connection costs. These figures indicate both the ability and willingness to pay of the majority of the people. The only cases where some difficulties arise concern the unwillingness of some owners of rent-controlled residences to carry the full cost of connection, because of their perception that such payments represent a benefit to the renter, to whom the costs would not be passed on. In the Amman sample described above, these cases represent about 2 percent of the sample. The fact that only 30% of the residences in Zarqa-Ruseifa are rented suggests that the magnitude of this problem will not be significant. Also note that the rate of connection in the low income areas in Amman was higher than that in the high income areas. This is probably a result of the deteriorating sanitary conditions in the poorer and denser low-income areas. The result of an attitudinal survey which was conducted in Zarqa-Ruseifa area concludes that lower income families believed that sewers will save them both money and time. They believed that they will save them the inconvenience of having their cesspools pumped out, and help them avoid the municipal fines which are imposed for dumping water in the streets. In one low income area, 58 percent of the households surveyed cited sewage disposal as a major disadvantage of their neighborhoods.<sup>5/</sup> It thus seems reasonable to expect that connection to the sewerage system will be favorably perceived by even the poorest residents, and that actual connection will progress at a fast pace. It is not unreasonable to expect that 90% of the households in a given area will be connected to the system within the six-month period following the official notice to do so, and that the remaining 10% will be connected before the passage of one year. The obnoxiousness of the cesspool situation in poor dense neighborhoods provides an additional strong incentive for connection by even the poorest households.

<sup>5/</sup> Pirnie and Jouzy, Feasibility Study of the Zarqa-Ruseifa Water Distribution and Sewerage Systems. Amman, 1980, p. 3-5



## 6. Housing and Land Use

Housing and land development in the Zarqa-Ruseifa corridor, and indeed in all other parts of Jordan, suffer from poor control and from the virtual absence of coordination between housing and land-development on the one hand, and the provision of physical and social infrastructure on the other. Great disparities between neighborhoods exist with respect to both the density of development and the availability of services. While the average density in the built-up areas in the Amman-Balqa region is about 30 persons/dunum, high income areas are developed at a density of 5 persons/dunum, while low income areas may have as many as 100 persons/dunum. Only a small percentage of the population resides in planned developments which are usually undertaken by cooperative ventures of professional groups, government or private sector employees. Even though such housing estates generally cater for upper middle income groups, they still provide the only way that these groups can afford good housing. All other development is unplanned, albeit controlled by local zoning regulations. More often than not, especially in growth areas, housing construction precedes the development of any type of social and physical infrastructure. Land speculation, and skyrocketing prices, have forced those seeking housing to leapfrog and those owning more accessible land to hold on to it for speculative purposes. Both of those factors have resulted in an increase in the cost of the provision of infrastructure networks, and in the concomitant lag in the construction of these networks.

A major problem in the areas of housing and land development is that of squatter settlements. These are usually inhabited by Palestinian refugees. While many refugees reside in "official camps" which are served and maintained by UNRWA, others have just squattered on vacant land, thus developing what is often referred to as "unofficial camps". Residents of these "camps" do not have the benefit of UNRWA services. While in some of the poorest squatter areas in Amman, the residents are not eligible to obtain municipal services because they do not hold title to the land, this is not the case in Zarqa and Ruseifa. The two largest such areas are the Janna'ah district in Zarqa, and the South Ruseifa area. Both of those areas are served by water, electricity, and telephone. They dispose of their wastewater into cesspools, and often also dump it in the streets. It is obvious that not holding title to the land has not deterred them from making home improvements, nor has it deterred them from buying and selling those houses, or from renting them out if and when they decide to move out of the squatter area. The Janna'ah squatter area, for example, was established in 1967, at which time the land owner "sold" the lots to the new arrivals, albeit without actually subdividing and duly recording the purchases. Houses are presently being sold for JD 3000-5000. A two room house rents for about JD 120 per year.

It is estimated that 55,000-65,000 persons live in such camps in Zarqa and Amman<sup>6/</sup>. There are probably 2,800 households in the Janna'ah area of Zarqa, 2,000 in various other Zarqa locations, and 2,000 in Ruseifa. It should be noted, however, that the Government of Jordan has initiated urban development projects at a number of locations, one of which is in Ruseifa, in order to rehabilitate these squatter areas. The World Bank is partially financing this project. This project will provide a resolution of the land tenure problem, wherever it exists. It will also provide assistance with sites, services, and core housing projects. The success of this pilot project will undoubtedly determine the extent to which this type of service is to be extended to other areas in Zarqa and Ruseifa.

#### 7. Benefits and Beneficiaries: A Summary

The proposed water distribution system improvements and sewage collection and treatment facilities are designed to benefit the ultimate population of the Zarqa-Ruseifa corridor. The rehabilitation of the water distribution network, which will cover all of Ruseifa and the old parts of Zarqa, will not only allow for future system expansion, but will also provide water service to about 10% of the population (30,000 residents) which do not presently have access to it. The replacement of old and broken pipes will help save a leakage of about 0.5 million cubic meters per year, at 1980 consumption levels. The health of the residents of the area will stand to benefit from the improved quality of water which is expected to result from reduced contamination levels. These reductions in contamination levels will result from both water network improvements and from the phased elimination of cesspools which will occur as the sewerage network is put in place.

The initial phase of the sewerage network will serve a total population of about 170,000 residents. The areas served include the densely developed downtown area of Zarqa, the adjacent refugee camp, and the squatter area of Janna'ah. The latter two include the poorest and most disadvantaged residents of the city. They are also the people who have to pay the highest percentages of their incomes for the regular cleaning of cesspools. About 40,000 people reside in those two areas.

An analysis of the income distribution of the population and of the ability of the poorest of the poor to pay for water and sewerage services, reveals that even if water and sewerage rates are set at levels that will recoup the capital and operating costs of the systems, this group of residents will be able to afford the service and will not pay more than 5 percent of their gross income for it. Cost savings will

<sup>6/</sup> Halcrow-Fox, Jordan Urban Project, Interim Report, May, 1979.

accrue to those who do not presently have water connections, and who are thus forced to purchase it in tankers and to pay an exorbitant price for it. Savings will also accrue to those who experience frequent cesspool problems. People in this latter category often resort to street dumping with its resulting environmental and health problems, and are frequently fined by the city for such practices. The sewerage system will eliminate both the nuisance and the cost. Experience in Amman, and an attitude survey in Zarqa, both indicate that even the poorest of the poor will be both willing and able, and indeed often anxious, to connect to the sewerage system.

Another aspect of the benefits of the system relates to the downstream beneficiaries. The improved quality of the flow in the Zarqa River will be a benefit to downstream users of the water. It will particularly contribute to the quality of the water stored in the King Talal Dam, and thus benefit those using it for irrigation. An optimistic scenario may pose the possibility of reviving plans for using this water for domestic distribution. The phasing-out of cesspools will also undoubtedly contribute to improving water quality in the upper aquifer, with concomitant benefits to all the residents of the Amman region.

The training component of the proposed project will benefit not only those being trained, but also other water and sewerage systems in Jordan. There is presently only one large-scale operational sewerage system in Jordan; that of Amman. The systems of Aqaba, Irbid, and a score of smaller towns are presently at different stages of development. The Zarqa training program will undoubtedly benefit other utilities in the country. The need for training in this area and the absence of professionals and technicians in the field, has been recognized by both the GOJ and AID, and the concept of establishing a National Water and Wastewater Training Center is presently being discussed. It is expected that the project, once operational, will provide employment for about 100 persons. Many more will obtain both employment and expertise during the construction phases. This expertise will undoubtedly also benefit other proposed systems in the country.

The provision of adequate water and sewerage systems can be expected to contribute positively to the overall quality of life in the Zarqa-Ruseifa corridor. It will also help in encouraging an orderly growth of industry and thus the provision of employment for both the present and future residents of this vitally important industrial corridor.

The benefits of the project are expected to accrue to men and women on an equal basis, as both sexes seem to suffer equally, from the debilitating effects of illnesses that affect their productivity, be it in the home or outside. However, young children, who are especially susceptible to enteric disease, will possibly gain the most from reduced exposure to water-borne diseases.

ECONOMIC ANALYSIS ZARQA-RUSEIFA SEWERAGE PROJECT  
 Prepared by: Dr: James Hanson, February 2, 1981

1. Internal Rate of Return on the Project

The project will provide significant environmental benefits and significant health benefits. Improved sewage treatment will substantially reduce the growing pollution of ground water supplies in the Zarqa-Ruseifa area. The likely result will be a substantial reduction in water-borne diseases, especially enteritis which is a major cause of infant mortality in Jordan. Unfortunately these benefits are impossible to quantify given existing data in Jordan.

An alternative calculation of the net benefits and thus the internal rate of return can be based on an inter-temporal comparison of revenues and costs of the sewerage project. This approach is based on the assumption that the payment of the sewerage charges measures the benefits which households and industry perceive they receive from the provision of sewers.

Although no exact calculations have been made of the internal rate of return which would equate the streams of revenues and benefits it is clear that the internal rate of return substantially exceeds 8%, provided tariffs are charged which cover the full capital cost, i.e. costs at 100% Loan financing (Case I)<sup>1/</sup>. This is because the calculated average charge equates the discounted stream of net operating revenues with the present value of construction costs over 20 years. Since the project will last at least 40 years, there will be 20 additional years of net benefits, implying a substantial, positive present value for the project at 8%. Indeed a similar result always would occur provided that the rate of growth of the charge was equal to the internal rate of return.

Additional calculations indicate that the internal rate of return also would substantially exceed 10% based on the charges described in Table 6 for Case IA, i.e., an average real charge of .345 JD/M<sup>3</sup>.<sup>2/</sup>

<sup>1/</sup> See Figure 4 for these charges. Note: All tables are at the end of Annex C.3.

<sup>2/</sup> This can be easily seen by using the .345 JD/M<sup>3</sup> charge and noting that:

$$\begin{aligned} \text{Net Pres. Value} = & - \text{Pres Value of Const. Cost (7/1/85)- 366 (40)} \\ & + \sum_{t=0}^{t=19} \text{Pres. Value of Revenues}_{1985+t} \\ & + \sum_{t=20}^{t=39} .347 (5400) (1.08)^t (1.1)^{-t} \end{aligned}$$

Substitution yields a net present value of 9639 thous. JD. Using the .308 JD/M<sup>3</sup> and the higher rate of sewage flow would produce a similar net present value.

Alternatively it can be calculated that an average charge for sewerage in 1985 of .279 JD/M<sup>3</sup>, which then grows at the rate of 8% each year, would equate the present value of costs and revenues over a 40 year horizon at a discount rate of 10%. That is, at an average sewerage charge which begins at .279 JD/M<sup>3</sup> in 1985 and grows at 8%, the project has an internal rate of return of 10% on its full capital cost.<sup>1/</sup>

2. Repayment Prospects:

Repayment prospects are judged very good. The World Debt Tables indicate that in 1979 Jordan has an outstanding debt of about 1 billion dollars and additional undisbursed commitments of about 900 million dollars, about 38 and 35% of GNP respectively. Loan terms are favorable, averaging less than 6% interest and about 19 years maturity. Debt service amounted to only about 5.5% of exports of goods and services. The proposed project will not have a significant impact on the debt service ratio given its relatively small size and its terms.

3. Further consideration on Sewerage Surcharges and Other Means of Cost Recovery;

Annex C.3 concluded that operating costs plus full capital costs (@ 8% interest) could be recovered in 20 years with a constant real fee which averages .300 to .350 JD per M<sup>3</sup> of sewage in 1985 (Case 1.b. and Case 1.a respectively). If some of the capital for the sewerage system is donated, then financial costs could be recovered with even lower average charges per M<sup>3</sup> of sewage, as low as .200 JD if 44% of the capital cost is covered by grants of \$30 million. A second major conclusion is that only a growing tariff would permit charges for sewerage which are more readily acceptable; a flat nominal fee would imply too great an initial burden for the consumer.

For simplicity the calculations of the required fee neglected the fact that on average industrial wastes will contain more BOD and thus should require a somewhat higher average charge for greater use of the treatment plant. If this were done, then household charges could be lowered somewhat. However, it does not seem worthwhile to factor this higher charge into calculations for two reasons: first, an additional charge based only on differential use of the treatment plant would be small, and second, use of an increasing block rate for sewerage or for water usage, as discussed below, would imply both greater average charges for industry and a gradual reduction in usage of the sewer system by industry as conservation measures are employed. Indeed one of the factors favoring an increasing block rate would be the encouragement of such conservation measures involving recycling and the corresponding required in-plant treatment.

<sup>1/</sup> The required tariff can be computed by substituting for the average charge in the previous footnote.

The use of an increasing block fee for sewer use is contrary to current institutional arrangements, but may be desirable for equity considerations. Some simple schemes would involve a two tiered fee structure, or even three tiers, corresponding to small household users, large household users and industry. However, the deviation of the various rates/M<sup>3</sup> from the average fees computed above is limited by:

- 1) The percentage of water used by the poor,
- 2) The maximum disparity which is feasible politically, and
- 3) In the case of industry, by both the degree to which sewage is reduced and the fact that charges will either be passed on to consumers if the industry is protected, or reduce international competitiveness if the products are exported or face imported competition.

The larger the percentage of connections which are poor families, the smaller the politically feasible disparity, the smaller the industrial usage, and the faster conservation measures are adopted by industry in response to sewerage charges, the smaller will be the difference between the rate charged to the poor and the calculated average rates.

For example suppose the poor represent one half of the connections and use one half as much water per person as wealthier households. Such conditions are similar to those in Zarqa. Then let the first block rate be based on the usage of a poor family and charged at one half the rate for the next block. On this basis the first block must still be 75% of the average tariff, while the tariff on the second block is 150% of the average<sup>1/</sup>. If the water use by the poor and the rich is not so dissimilar then the poor will have to pay a rate even closer to the average.

<sup>1/</sup> The relationship between the average tariff and the tariff for the first and second block rates is similar to a weighted average:

$$t_a = t_1 (C_p/C) + t_1 (C_p/C_r)(C_r/C) + t_2 (1 - C_p/C_r)(C_r/C)$$

Where  $t_1$  = tariff,  $a$  = average,  $1$  = block 1,  $2$  = block 2

$C_1$  = Water consumption by poor (p) or rich (r)

$C$  = total water consumption

Letting  $D = t_1/t_2$  = the ratio of the tariff on the first block to that on the second block

and solving we get:

$$t_1/t_a = 1 / ((C_p/C) + (C_p/C_r)(C_r/C) + D(1 - (C_p/C_r))C_r/C)$$

As argued above, the larger the consumption of the poor, relative to either the total or to the rich, and the smaller  $D$ , the politically feasible disparity, the closer the tariff for the poor is to the average tariff, i.e.  $t_1/t_a$  is near one.

Substituting the figures implied in the text -

$$C_p/C = 1/3, C_r/C = 2/3, C_p/C_r = 1/2, D = 2$$

we get

$$t_2/t_a = 1 / (1/3 + 1/3 + 2(1/2) 2/3) = .75$$

Factoring an industrial charge into the equation, or assuming that industry pays the second block rate, could permit a somewhat lower sewerage surcharge for the poor groups, relative to the average charge per M<sup>3</sup> of sewage. This is because the fraction of usage by the poor declines. Thus they have to cover a smaller fraction of the project's total costs. However, as mentioned above, while a high industrial tariff would have the desirable environmental effect of encouraging conservation and recycling, it would correspondingly reduce billable industrial sewage flow, throwing more of the project's cost burden to households. Also, it would raise prices of goods produced and/or reduce international competitiveness.

A second alternative for reducing sewerage charges would be based on the decreasing cost nature of a sewerage system. At anything less than system capacity the cost of an additional M<sup>3</sup> of sewage is near zero, the cost of an additional household only that of the required lateral. From the standpoint of economics the pricing for an additional M<sup>3</sup> of sewage should then also be near zero, with capital costs recovered in other ways - some combination of connection fees, general taxation or outright grant. These are discussed in turn below.

a. **Connection Fees:** In previous sewerage projects the GOJ has imposed an application fee of 3 JD and a connection fee of 25% of assessed rent for each household connected. Such a one-time fee could be used to improve significantly the cash flow of the sewerage agency and/or reduce rates to the consumer. For example, based on a one-time connection fee of 12.5 JD and a 3 JD application, rates of connection in Figure 19 and the total of 28 JD per connection, would yield over 8 million JD in the period 1985 to 1989.

b. **Taxes:** At present the municipalities collect a 4% sewerage tax on the assessed values of rents. However these taxes are already part of municipal revenues and probably cannot be diverted to financing the project. Additional taxes would thus have to be applied. In many countries a one time frontage tax or fee is assessed for installation of sewers, justified by the observation that a sewer system seems to increase the value of property by 5% to 10%. Such a tax would thus capture part of the previously untaxed increase in urban land values which results from the provision of infrastructure, and which worsens the distribution of wealth. Such a tax might be a useful supplementary way to finance the project. However, it would have to be based on frontage or some similar indicator because the current assessed base for the sewerage tax in the project area obviously bears no relation to the rental value of all housing in the area. Thus a new assessment of one sort or another would be required to obtain much additional revenue from taxation at the municipal level.

c. **Grant:** The figures in Figure 20 indicate that each additional \$10 million of grant would reduce the average charge necessary to recover costs by about .050 JD.

In this way a larger grant component reduces the financial burden of the sewerage project. However, the economics of such a grant are less straight-forward. From an economic standpoint the substantial current inflow of foreign aid to Jordan should be channelled into infrastructure and long-lived productive investment. This is the best way to ensure future living standards against the possibility of future reductions in foreign aid. Once this decision is made, the question becomes one of comparing investment alternatives. Is the sewerage project one of the best projects for maintaining future living standards, i.e., does it have a high internal rate of return relative to other projects? If it has, then it will raise future consumption levels more than other projects and should be undertaken.

As shown above, the internal rate of return is fairly high. Further, there are health and environmental benefits to the project, which, though not quantitatively measurable, would probably add substantially to the benefits measured by cash revenues. Thus the sewer project should be undertaken and its financing by grants is simply one of the best ways of using foreign aid.

Viewed in this light there would seem to be no need to recover the grant portion of the financing through charges on sewage flow. However, charges still must cover operation, maintenance and debt service on the non-grant financing. In addition, a charge should be assessed to cover depreciation on that portion of the sewerage system financed by grants. Otherwise today's consumers, in effect, are consuming today's foreign aid while future consumers will get no benefit. Assuming a 40 year lifetime for the system, such depreciation should amount to at least 2 1/2% of grant financing, perhaps more depending on the actual pattern of physical depreciation, replacement cost and interest rates. (From an economic standpoint charges for depreciation on the non-grant portion of financing are not required, the assumption being that today's consumers pay debt service for their usage of the system and future consumers could also borrow to replace the system.)

These considerations suggest that from an economic standpoint the average financial charges calculated earlier for Case II and III, are somewhat low. Economic cost recovery would require a charge of roughly 2 1/2% of the grant component to cover depreciation. However, since this charge amounts to only about 1% of the debt service shown in Table 2 or about 3% of the debt service shown in Table 3, the effect of accounting for depreciation of the grant component would be small.

To summarize this discussion on charges, the most fundamental issue is whether a constant nominal fee or a constant real fee (growing nominal fee) will be used to recover costs. Only the growing fee seems politically feasible. Once the concept of a growing fee is accepted, then consideration should be given to reducing the charges for sewerage through grants by the GOJ as well as international donors, and through



either collections of one-time fees or of taxes. Given the probable size of these measures, they are unlikely to have as much effect on required fee levels as the choice between a growing tariff and a fixed nominal tariff, although their impact could still be substantial. Finally, equity considerations may indicate a two or three tiered rate structure. Such a structure would subsidize the poor's access to the sewerage system. Calculations indicate a reasonable subsidy might amount to about 25% of the average tariffs. Such differential pricing would also encourage conservation and recycling by industrial users.

#### 4. Expanding the System and the Rate Structure:

As shown in Figure 19, the sewer connections will reach the capacity of the two train treatment plant between 1989 and 1991. Thus construction of a third train (costing about 1 million JD in 1980 prices) should begin about 1987. In addition, trunk lines and collection systems will be required in new zones of the Zarqa-Ruseifa area.

Customary practice in the water and sewerage industry would imply financing these expansions out of current revenues. However, there is no economic reason why current consumers should in effect subsidize additional consumers. Thus expansion of the system should probably be based on additional borrowing, to be covered by sewerage surcharges on water usage. These charges per M<sup>3</sup> of water usage should be similar to those already calculated for households connected during the period 1985 to 1990, especially since the third treatment train would raise plant capacity by 50% but cost only about 20% of the construction plus land costs for the first stage, two-train plant.

#### 5. Addendum to Economic Analysis

##### Water Distribution System Improvements

A. General - The economic analysis prepared by the consultants and contained in the Feasibility Study, Chapter 10, has been accepted by USAID as adequate for the water distribution system improvements element of the project.

B. Consultants' Methodology - The consultants determined the internal economic rate of return by comparing incremental benefits against incremental costs. The incremental benefits are the increased revenues if the project is implemented and the incremental costs are the estimated increases in operating costs. The consultants included all recommended improvements which includes the proposed project, the remainder of the recommended Phase I and Phase II. Their analysis was then carried to the year 2024.

C. Consultants' Conclusion - The results of this analysis are presented in Table 10.1 of the Feasibility Study. This analysis indicates an internal economic rate of return of 7.8 percent which is satisfactory.

D. Discussion - USAID Views - The consultants analysis shows the proposed project to be economically justified. However, other considerations should be taken into account.

There are a variety of benefits associated with the provision of convenient and safe water. The more important benefits are improved health, water quality, and general living environment. These benefits partially include reduced medical costs, general improvement in individual well-being, increased productivity, lower employee and student absentee rates, increased property values, and improved living conditions. These benefits cannot be accurately quantified, but should be recognized as additive to the rate of return calculated.

There is also an alternative means to determine economic justifiability. As discussed previously by Dr. Hanson, if revenues are generated such that all operating and debt service costs are covered as is proposed in the accompanying financial analyses (Annex C.3, Part III, Financial Plan), then the proposed projects rate of return must exceed the assumed cost of debt financing. This is true because it has been assumed that the debt repayment period will be less than the useful life of the project facilities, i.e., benefits will continue to accrue even after the debt is fully repaid.

E. USAID Conclusion - USAID has concluded that under all assumptions taken by the consultants, the water distribution system improvements element of the proposed project is economically justified.

ANNEX C.3  
FINANCIAL ANALYSIS OF ZARQA-RUSEIFA SEWERAGE PROJECT.

Prepared by: Dr. James Hanson, February 2, 1981

1. Loan Terms:

The basic assumption is that lending for construction carries average terms of 8% per annum, 24 years, 4 years grace on interest and principal, with interest charges only on outstanding balances. Three cases were considered - 100% financing on these terms (Figure 17)<sup>1/</sup>, a \$9 million grant with the rest of the financing on the above terms (Table 2), and a \$30 million grant with the rest of the financing on the above terms (Figure 17). The funds represent a combination of an AID loan and grant package and GOJ funds, either from the budget or from other lenders.

2. Cost Estimates:

Construction cost estimates were based on the Pirnie - Jouzy consultants' report and their memo of 1/28/81. Following their assumptions the basic cost figures at 1980 prices were inflated by 10% to cover contingencies. Engineering and management fees were assumed to be 17% of the construction cost plus contingencies figure. Inflation was assumed to be 8% per year. Construction expenditures were assumed to begin in January 1982 with 40% occurring in 1982, 40% in 1983 and 20% in 1984. (Figure 18 ) All land costs were assumed to be incurred before construction begins (1981) and engineering, management and training costs were spread evenly over 1981, 1982 and 1983. Operating costs were based on the consultants' estimates including a reduction in electricity costs through auto-generation based on gas generation from sludge digestion.

3. Cost Recovery Through Charges for Sewerage:

Average charges per M<sup>3</sup> of sewage were calculated so as to equate sewerage revenues (appropriately discounted) with operating costs plus debt service (appropriately discounted) over the terms of financing specified in paragraph 1. above. For industry the generation of sewage would be directly measured and charges would be based on the volume of sewage; for households and commercial users the charges would be covered by a surcharge on metered water usage. Since household water usage is about 25% larger than sewage flow, the surcharge per M<sup>3</sup> of household usage would only be 80% of the calculated average charge for sewage.

To give some feel for the charges required, two different assumptions were made regarding the flow of sewage. Under Case "a" major industrial users were not assumed to be connected and other usage was assumed to build up to a maximum of 5.4 million M<sup>3</sup> of sewage by 1989.

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<sup>1/</sup> Note: All tables are at the end of Annex C.3.

(see Figure 19). This is 90% of treatment plant capacity. Under Case "b" major industrial users were connected but assumed to gradually enact conservation measures because of high fees. By 1989 this would imply a sewage flow of 6.2 million M<sup>3</sup>. Since this exceeds plant capacity, the capacity figure of 6.015 million M<sup>3</sup> was used in 1989 and thereafter. Finally, as also shown in Table 5, if the flow from the army base is charged at 45% of the calculated average charge to reflect construction of their own collection network, but major industrial users are connected, the revenues will be roughly halfway between Case "a" and Case "b".

For simplicity in calculating the required average charge, industry and households were assumed to pay the same fee per M<sup>3</sup> of sewage generated, although industrial wastes will involve a higher BOD content. From a financial standpoint, higher charges to industry might not recoup much additional revenue, if, as is hoped, they induced conservation measures by industry (See also the discussion in Annex C.2.).

Finally in calculating the required average charge per M<sup>3</sup> of sewage, operating and maintenance costs were assumed to rise at 10% per annum from the consultants' estimate of 363 thousand JD in 1985. No provision was made for financing extensions of sewer lines out of current revenues.

Two types of charges were calculated: a constant nominal charge and a constant real charge, i.e., a growing charge which keeps pace with inflation. While tariffs are conventionally calculated as a flat nominal fee, in a world of inflation this procedure leads to a high initial charge to the consumer in real terms, relative to his income, but one that declines rapidly both in real terms and as a percentage of income. This type of charge would create difficulties for many consumers in the project's initial years. In contrast, the constant real tariff starts at a much lower percentage of income, but grows at the same rate as inflation, thus maintaining a more constant relationship to the consumer's ability to pay. The growing tariff also corresponds more closely to water industry practice.<sup>1/</sup> Since the required average charge is computed so as to equate the present values of revenues and costs, the total debt plus interest charges would eventually be covered.

As shown in Table 6 the constant nominal average charge required to cover total discounted costs ranges from about 0.740 JD/M<sup>3</sup> to 0.415 JD/M<sup>3</sup> of sewage, with the lower figure resulting from the

<sup>1/</sup> The formula used to calculate the required average charge is:

$$\frac{\text{Charge}}{1.04} \left( \sum_{t=0}^{t=19} \text{Sewage Flow}_{1985} \cdot (1+r)^t \cdot (1+d)^{-t} \right) \\ = (\text{Pres. Value of Debt})_{1/1/1985} \cdot \sum_{t=0}^{t=19} \frac{366}{1.04} (1.1)^t (1+d)^{-t}$$

where  $r$  = annual growth of charge, and  $d$  = discount rate. The discount rate was set equal to the loan terms of 8% and  $r$  set equal to zero (constant nominal tariff) or, for simplicity, 8% (constant real tariff).

combination of \$30 million grant and the attainment of plant capacity by 1989. The corresponding household surcharges per  $M^3$  of water usage range from about 0.590 JD/ $M^3$  to 0.333 JD/ $M^3$ .

The corresponding constant real charge (growing in nominal terms by 8% per annum) ranges from a 1985 figure of about 0.345 JD/ $M^3$  of sewage to a low of about 0.200 JD/ $M^3$  of sewage. Again the low figure results from the combination of a \$30 million grant and the attainment of plant capacity by 1989. The corresponding household surcharges per  $M^3$  of water in 1985 range from about 0.275 JD to 0.160 JD.

These calculations suggest that the most important step in cost recovery would be to implement a policy of steady growing tariffs, in line with the average consumer's ability to pay. As argued in the economic section (Annex C.2), the required constant real tariff is well within the poor's ability to pay. In contrast, the constant nominal charge probably represents too high an initial burden and might be unacceptable. Either constant nominal charges or constant real charges at the calculated rates would make the project financially viable under the loan terms described in paragraph 1 above.

#### 4. Sensitivity Analysis of Financial Terms:

This section will examine briefly the sensitivity of the average charges required for cost recovery to the following:

- a) 10% variation in construction costs.
- b) A slower rate of household connection.

A 10% variation in construction costs from the consultants' estimates could result from over or under-estimate of the basic construction cost, a difference between actual contingencies and the allowance or an error in estimating the rate of inflation. For example, a 12% rate of inflation during construction, as opposed to an 8% rate, would raise the inflation adjustment in Table 4 by about 2 million JD or about 10% of the value of the project.

Since construction costs represent between 60% and 75% of the present value of debt service plus operating costs that must be recouped (corresponding to the \$30 million grant case and the 100% financing case respectively) a 10% difference between actual construction costs and estimated construction costs would produce a 6% to 7.5% change in the required tariff.

A 10% lower rate of household connections over the project's life would lower the average flow of sewage by 10% in each year. This in turn would imply that a 10% higher charge would be required to cover costs. In fact, the effect of a 10% lower rate of connection in the first 5 years would be much less, postponing capacity utilization by one year

at the most. Even a 30% slower rate of connection in the first 5 years would reduce the total present value of sewage flow in the first twenty years of project by less than 5% in the case of constant real charge. Thus the impact of a slower rate of connections on the required average charge would not be great.

## 5. Addendum to Financial Analysis

### Water Distribution System Improvements

A. General The financial analysis prepared by the consultants and contained in the Feasibility Study, Chapter 9, has been accepted by USAID as adequate for the water distribution system improvements element of the project.

B. Consultants' Methodology - The consultants' analysis includes expenditures sufficient to construct all elements recommended for Phase I which involves an increased investment of about \$3.25 million over what is included in the proposed project. The consultants have also assumed full debt financing with terms of 6 percent annual interest, 24 years repayment period with 4 years of grace. An 8 percent interest rate and some grant or equity financing is more probable. The consultants have also projected a somewhat higher project cost than seems reasonable to either USAID or the G.O.J.

These assumptions were combined with projections based upon existing municipal water department records to develop a pro forma income statement through 1990 (see Feasibility Study, Table 9.7). This analysis indicated that current water tariff rates would generate insufficient revenues by 1983 and thereafter; the current average tariff being JD 0.120/M<sup>3</sup> and JD 0.115/M<sup>3</sup> in Zarqa and Ruseifa, respectively.

C. Consultants' Conclusion - Further analysis indicates that increasing the average rate to JD 0.165 M<sup>3</sup> in 1984 would provide a positive cumulative cash flow; a satisfactory result. Table 9.8 in the Feasibility Study shows a pro forma income statement assuming such a rate increase.

D. USAID Views - An increase in the average water tariff rate was found to be essential for financial viability. The increase is necessary because (a) operating expenditures will rise faster than water sales because inflation is rising faster than the estimated growth, (b) of the continual capital improvements, and (c) of the increased debt service cost. The analysis indicates that a rate increase would be necessary by 1984 even without implementation of the proposed project.

The determination that an average rate of JD 0.165/M<sup>3</sup> would be necessary to cover costs was straightforward. The reasonableness of this proposed rate was determined by escalating the current average rate of JD 0.120/M<sup>3</sup> from 1979 to 1984 at 7.5 percent ( a conservative inflation rate). This analysis indicates that a rate of JD 0.172/M<sup>3</sup> would be reasonable; the proposed rate equates to only a 6.6 percent annual inflation rate.

E. USAID Conclusion - USAID has concluded that under all assumptions taken by the consultants, the water distribution system improvements element of the proposed project is financially justifiable if the water tariff rate will be increased sufficiently. As the proposed project will have a lower capital cost than assumed by the consultants and as the structure of the financing may be more favorable, USAID believes that the average water tariff may not need to be increased as much as estimated. However, as revenues generated by both water and wastewater services may be utilized by this Zarqa-Ruseifa utility to maintain financial viability, it may be appropriate to charge an average of JD 0.165/M<sup>3</sup>, or more. The amount of increase should not, however, exceed whatever rate would exist if regularly escalated at the inflation rate (the equitability of this is discussed in Annex C.1, Social Soundness Analysis). The AID Assistance Agreement will require the Government to study, develop and establish an appropriate and acceptable tariff schedule prior to the completion of the project.

SEWERAGE PROJECT  
 SCHEDULE OF DEBT AND DEBT SERVICE - FIRST TEN YEARS  
 CASE 1 - 100% LOAN FINANCING

(000 JD: JD 1.00 = U.S. \$ 3.25)

	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>
Debt (begin. Year)	--	5227	30838	60407	78389	76676	74826	72828	70670	68340
Const. Expend.	5026	24224	26060	12644	--	--	--	--	--	--
Interest	201	1387	3509	5338	6271	6134	5986	5826	5654	5467
Capital Repay	--	--	--	--	1713	950	1998	2158	2330	2517
Debt Service	--	--	--	--	7984	7984	7984	7984	7984	7984
Debt (Year End)	5227	30838	60407	78389	76676	74826	72828	70670	68340	65823

C - 34

Figure 17



SEWERAGE PROJECT  
 SCHEDULE OF DEBT AND DEBT SERVICE - FIRST TEN YEARS  
 CASE 11 - \$ 9 MILLION GRANT

(\$000, 10 1,000 = U.S. \$ 1.25)

	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>
Debt (Begin. Year)	--	2488	25231	51703	67666	66187	64591	62866	61003
Const. Expend.	5026	24224	26060	12644	--	--	--	--	--
Grant Expend.	2634	2547	2547	1272	--	--	--	--	--
Interest	96	1066	2959	4591	5413	5294	5167	5029	4880
Capital Repay	--	--	--	--	1479	1597	1725	1863	2012
Debt Service	--	--	--	--	6892	6892	6892	6892	6892
Debt (Year End)	2488	25231	51703	67666	66187	64591	62866	61003	58991

C - 35

Figure 17 (cont'd)

**SEWERAGE PROJECT**  
**SCHEDULE OF DEBT AND DEBT SERVICE - FIRST TEN YEARS**  
**CASE 111 - \$ 30 MILLION GRANT**

(1000 ₪ = 10 1.000 = U.S. \$ 3.75)

	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>
Debt (begin. Year)	--	2488	16495	33532	43673	42719	41688	40575	39373
Const. Expend.	5026	24224	26060	12644	--	--	--	--	--
Grant Expend.	2634	10947	10947	5472	--	--	--	--	--
Interest	96	730	1924	2969	3494	3417	3335	3246	3149
Capital Repay	--	--	--	--	954	1031	1113	1202	1298
Debt Service	--	--	--	--	4448	4448	4448	4448	4448
Debt (Year End)	2488	16495	33532	43673	42719	41688	40575	39373	28074

Figure 18

CONSTRUCTION COSTS OF SEWERAGE PROJECT  
(000 JD Unless Noted)

	<u>4/</u> Const.	% <u>5/</u> Local	Contingency.	Engineering & Management	Inflation Adj. <u>8/</u>	Total	Dollar <u>9/</u> Equiv. (\$000)
Plant <sup>1/</sup>	4082	49.5	408	763	1084	6337	20595
Collection <sup>2/</sup>	8921	68.6	892	1668	2355	13836	44976
Sub-Total	13003	62.6	1300	2431	3439	20173	65562
Land <sup>3/</sup>	736	100	-	-	-	736	2392
Total						20909	67954

<sup>1/</sup> Two treatment lines Pirnie-Jouzy Memo 1/28/81

<sup>2/</sup> Omits water lines JD 670,000 which will be constructed along with sewers.

Pirnie-Jouzy Memo (1/28/81). (Trunk lines are JD 2,138,000, collection JD 6,738,000.

<sup>3/</sup> Pirnie-Jouzy, Zarqa-Ruseifa Feasibility Study, Table 9-2 and pg. 9-12

<sup>4/</sup> Pirnie-Jouzy Memo 1/28/81, June 1980 prices

<sup>5/</sup> Pirnie-Jouzy Memo 1/28/81

<sup>6/</sup> 10% of raw construction costs, Pirnie-Jouzy pg. 9-1

<sup>7/</sup> 17% of construction plus contingency Pirnie-Jouzy pp. 9-1, 9-2

<sup>8/</sup> Based on 40% of construction & contingency in 1982, with inflation factor of 16.6%, 40% of construction & contingency in 1983 with inflation factor of 26%, and 20% of construction and contig. in 1984 with inflation factor of 36%.

<sup>9/</sup> 1 JD = \$3.25

Figure 19

PROJECTED SEWAGE FLOW  
(000 M<sup>3</sup>/yr)

<u>Users</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>
Domestic & Commercial	427	1302	2278	3127	3635
Army Base	348	705	715	726	736
Ind. (a)	<u>393</u>	<u>846</u>	<u>907</u>	<u>968</u>	<u>1029</u>
Total (a)	1148	2853	3900	4821	5400
Ind (b) <sup>1/</sup>	<u>1416</u>	<u>1274</u>	<u>1132</u>	<u>990</u>	<u>848</u>
Total (b)	2554	4127	5032	5721	6248 <sup>3/</sup>
Total (c) <sup>2/</sup>	2363	3738	4639	5322	5843

1/ Includes Tanning Plant, Iron and Steel Plant and Paper Plant, assumes gradual introduction of conservation measures.

2/ Total b modified for Effect of charging Army Base 45% of average fee to account for self construction of collection network.

3/ For purposes of estimating the average sewerage charge the maximum capacity of 6015 M<sup>3</sup>/yr was used.

Assumptions:

1. Connection Rate -19 households per day.
2. Average of 7 persons per household
3. Flow/c/d= .068 M<sup>3</sup> (1985), .069 M<sup>3</sup> (1986), .070 M<sup>3</sup> (1987), .071 M<sup>3</sup> (1988), .072 M<sup>3</sup> (1989).
4. Army Base connection rate = 96 persons per day with flow as above.

COST RECOVERY  
AVERAGE CHARGE PER M3 OF SEWAGE

CASE I  
100% Loan Financing

	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>
Oper. Cost	366	403	443	487	536	580
Debt Ser.	7984	7984	7984	7984	7984	7984

Constant Nominal Tariff/M3 of Sewage

Case Ia - Excludes major industrial users, flow in 1989 and thereafter equals 5400 M<sup>3</sup>/yr - .738 JD/M<sup>3</sup>.

Case Ib - Includes major industrial users, flow in 1989 and thereafter equals 6015 M<sup>3</sup>/yr (plant capacity) - .625 JD/M<sup>3</sup>.

Constant Real Tariff - Nominal Tariff Growing at Interest Rate

Case Ia - .345 JD/M<sup>3</sup>

Case Ib - .301 JD/M<sup>3</sup>

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CASE II  
\$ 9 Million Grant

	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>
Oper. Cost	366	403	443	487	536	589
Debt Ser.	6892	6892	6892	6892	6892	6892

Constant Nominal Tarrif

Case IIa - .656 JD/M<sup>3</sup>

Case IIb - .557 JD/M<sup>3</sup>

Constant Real Tariff - Nominal Tariff Growing at Interest Rate

Case IIa - .307 JD/M<sup>3</sup>

Case IIb - .267 JD/M<sup>3</sup>  
-----

C - 40  
Figure 20 (cont'd)

CASE III  
\$ 30 Million Grant

	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>
Oper. Cost	366	403	443	487	536	589
Debt Ser.	4448	4448	4448	4448	4448	4448

Constant Nominal Tariff

Case IIIa - .491 JD/M<sup>3</sup>  
Case IIIb - .416 JD/M<sup>3</sup>

Constant Real Tariff - Nominal Tariff Growing at Interest Rate

Case IIIa - .230 JD/M<sup>3</sup>  
Case IIIb - .200 JD/M<sup>3</sup>

**ESTIMATED INCOME DISTRIBUTION, WATER CONSUMPTION AND SPENDING ON WATER  
AND SEWERAGE/ZARQA AREA 1979**

Group	Range Annual Income (JD)	Av. Metered Water Use (M <sup>3</sup> /mo.)	Av. Annual Water Expend. (JD)	% of Income on water	% of Income on Cesspool <sup>1/</sup> Installation	% of Income Cesspool Pumpout
Lowest 20	0-1000	5.0	4.8	over .5	over 5.0	over .3
next 20	1001-1320	6.5	7.0	.5 to .7	3.8 to 5.0	.4 to .5
next 20	1321-1620	8.9	10.6	.7 to .8	3.1 to 3.8	.4 to .5
next 20	1621-2460	12.2	14.9	.6 to .9	2.0 to 2.1	.4 to .6
next 20	2461 or more	15.0	19.2	under .8	under 2.0	under .6

Figure 21

C - 41

<sup>1/</sup> Calculated at replacement cost of 250 JD every 5 years.  
Poorer families probably reduce costs by digging the cesspool pit themselves.

Source: Pirnie-Jouzy, Zarqa-Ruseifa Feasibility Study Pg. 10-9, 10-11

Life of Project:  
From FY 82 to FY 86  
Total U.S. \$ Funding \$ 15.0 Million  
Date Prepared: July 27, 1982

PROJECT DESIGN-SUMMARY

LOGICAL FRAMEWORK

Project Title & Number: Zarqa - Ruseifa Water and Wastewater - Project 278-0234

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>A. Program or Sector Goal: The broader objective to which this project contributes:</p> <p>Improved access to safe water supply and wastewater collection and treatment facilities in all major urban areas.</p>	<p>Measures of Goal Achievement.</p> <p>Numbers and percentages of urban residents provided with services.</p>	<p>Government of Jordan Records.</p>	<p>Assumptions for achieving goal targets:</p> <p>None - Achievement of project purpose will directly assist in sector goal achievement.</p>



PROJECT DESIGN SUMMARY

LOGICAL FRAMEWORK

Project Title & Number: Zarqa - Ruseifa Water and Wastewater - Project 278-0234

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>B. Project Purpose:</p> <p>Improved water and waste-water facilities available to residents of Zarqa and Ruseifa at affordable rates.</p>	<p>Conditions that will indicate purpose has been achieved: End of Project status.</p> <p>About 85 percent of residents are receiving water on a more reliable basis and with improved quality.</p> <p>About 60 percent of households and businesses are sewered.</p> <p>Environmental quality of Zarqa-Ruseifa region enhanced because of sewage collection and treatment.</p> <p>Zarqa-Ruseifa water office of WSC a viable entity with fully trained staff.</p>	<p>WSC records</p> <p>Chemical, biological and bacteriological tests.</p>	<p>Assumptions for achieving purpose.</p> <p>Systems completed and operated as designed.</p> <p>Water quality monitoring program for Zarqa-Ruseifa established and sewer ordinance promulgated.</p>

PROJECT DESIGN SUMMARY

LOGICAL FRAMEWORK

Project Title & Number: Zarqa-Ruseifa Water and Wastewater - Project 278-0234

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>C. Outputs:</p> <p>Improved water distribution system.</p> <p>Installed and operating wastewater collection system.</p> <p>Operating sewage treatment plant.</p> <p>Improved administrative capabilities of WSC and Zarqa-Ruseifa Office. Tariff Study completed.</p> <p>Training programs established.</p>	<p>Magnitude of Outputs:</p> <p>About 41 km of new water pipe, pressure reducing valves and other valves including addition of service mains.</p> <p>About 191 km of sewer pipe installed, about 26,000 sewer connections. Cess-pools eliminated when households are connected to sewers.</p> <p>Facilities capable of treating effluent from connected population and septage from population not sewered.</p> <p>Zarqa-Ruseifa Office established.</p> <p>Water and Sewerage rates set.</p> <p>All employees of Zarqa-Ruseifa Office have received training.</p>	<p>Construction progress reports.</p> <p>WSC and AID monitoring</p>	<p>Assumptions for achieving Outputs:</p> <p>Technical design adequate to provide services at desired levels.</p> <p>WSC will supervise project implementation adequately.</p> <p style="text-align: center;">D - 3</p> <p>Progressive rate schedule enables access to system and contributes to cost recovery.</p> <p>WSC will be able to hire and train sufficient skilled people to operate system component correctly.</p>

PROJECT DESIGN SUMMARY

LOGICAL FRAMEWORK

Project Title & Number: Zarqa-Ruseifa Water and Wastewater - Project 278-0234

NARRATIVE SUMMARY	OBJECTIVE VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>D. Inputs:</p> <p>All necessary equipment and materials, construction and engineering services to build and start up anticipated outputs.</p> <p>Technical assistance and training.</p>	<p>Implementation Target (Type and Quantity).</p> <p>Wastewater Treatment Plant and Pumping Station.</p> <p>Sewerage</p> <p>Water</p> <p>Construction Supervision</p> <p>Land</p> <p>Interest during Construction</p> <p>Operations and Training Services</p> <p>Consulting services to assist JWC improve its administrative capability and prepare rate studies.</p> <p>Short-term technical assistance to set up training programs in Jordan.</p> <p>Short-term observation &amp; training of about 4 employees at waste water utility.</p>	<p>Budget and Implementation schedule:</p> <p>(Million Dollars)</p> <p>20.277</p> <p>22.253</p> <p>6.573</p> <p>5.264</p> <p>4.273</p> <p>7.074</p> <p>2.462</p> <p>29.727</p> <p>Bid Document issued 12/53</p> <p>Contract awarded 4/53</p> <p>Construction completed 1/56</p>	<p>Assumptions for Providing inputs:</p> <p>All AID and GOJ funds made available in full on a timely basis.</p> <p>(Million Dollars)</p> <p>AID- 25.000</p> <p>GOJ- 4.727</p> <p>29.727</p> <p>D - 4</p>

E - 1

PROJECT CHECKLIST

Listed below are statutory criteria applicable generally to projects with FAA funds and project criteria applicable to the individual funding source: Economic Support Fund.

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

A. GENERAL CRITERIA FOR PROJECT

1. FY 1982 Appropriation Act Section 523; FAA Sec. 634A; Sec. 653(b).

(a) Describe how authorizing and appropriations Committees of Senate and House have been or will be notified concerning the project;

Committees have been notified through the normal Congressional Notification process; see STATE 250595. The assistance is within the USAID/Jordan OYB.

(b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than \$1 million over that amount)?

2. FAA Sec. 611(a)(1). Prior to obligation in excess of \$100,000, will there be (a) engineering, financial or other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?

Yes.

3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?

No legislative action required.

4. FAA Sec. 611(b); FY 1982 Appropriation Act Sec. 501. If for water or water-related land resources construction, has project met the standards and criteria as set forth in the Principles and Standards for Planning Water and Related Land Resources, dated October 25, 1973? (See AID Handbook 3 for new guidelines.) Yes.
5. FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed \$1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project? Yes, certification included in Project Paper as Annex F.
6. FAA Sec. 209. Is project susceptible of execution as part of regional or multilateral project? If so why is project not so executed. Information and conclusion whether assistance will encourage regional development programs. Project does not lend itself to regional adaptability. However, multilateral funding is anticipated.
7. FAA Sec. 601(a). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; and (c) encourage development and use of cooperatives, and credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions. Project will encourage efforts under (b) as the project will be built by the private sector under competitive bidding. Project will assure some increase in the flow of international trade as various engineering services and possibly commodities of U.S. origin will be procured.

8. FAA Sec. 601(b). Information and conclusion on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise). U.S. private enterprise is expected to furnish virtually all of the engineering services performed under the project as well as possibly a portion of the equipment required in the project.
9. FAA Sec. 612(b), 636(h); FY 1982 Appropriation Act Sec. 507. Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized in lieu of dollars. The Assistance Agreement will so provide.
10. FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release? Jordan is not an excess currency country.
11. FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise? Yes.
12. FY 1982 Appropriation Act Sec. 521. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity? Not such a project.
13. FAA 118(c) and (d). Does the project comply with the environmental procedures set forth in AID Regulation 16? Does the project or program take into consideration the problem of the destruction of tropical forests? The project does comply with Reg. 16 and will not affect any tropical forests.

14. FAA 121(d). If a Sahel project, has a determination been made that the host government has an adequate system for accounting for and controlling receipt and expenditure of project funds (dollars or local currency generated). Not a Sahel project.

B. FUNDING CRITERIA FOR PROJECT

Project Criteria Solely for Economic Support Fund

- a. FAA Sec. 531(a). Will this assistance promote economic or political stability? To the extent possible, does it reflect the policy directions of FAA Section 102? The project will promote the economic and political stability of Jordan by contributing to fulfillment of the country's five year development plan. The provision of safe water is consistent with Section 102.
- b. FAA Sec. 531(c). Will assistance under this chapter be used for military, or paramilitary activities? No.
- c. FAA Sec. 534. Will ESF funds be used to finance the construction of the operation or maintenance of, or the supplying of fuel for, a nuclear facility? If so, has the President certified that such use of funds is indispensable to nonproliferation objectives. The project will not involve a nuclear facility.
- d. FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made? Not applicable.

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

AMERICAN EMBASSY  
AMMAN - JORDAN

وكالة الولايات المتحدة للامم المتحدة  
السفارة الاميركية  
عمان - الاردن

F - 1

CERTIFICATION PURSUANT TO SECTION 611(e)  
OF THE FOREIGN ASSISTANCE ACT OF 1961  
AS AMENDED

I, Walter G. Bollinger, the principal officer of the Agency for International Development in Jordan, having taken into account, among other things, the maintenance and utilization of projects in Jordan previously financed or assisted by the United States, do hereby certify that in my judgment Jordan has both the financial capability and the human resources capability to effectively maintain and utilize the capital assistance project, Zerqa-Ruseifa Water and Wastewater.

Sept. 16, 1982  
Date

Walter G. Bollinger  
Walter G. Bollinger  
Director, USAID/Jordan



PROGRESS ON SPECIAL COVENANTS IN PRIOR LOANSA. Amman Water and Sewerage - Loan 278-K-023

There are eight special covenants in the loan agreement signed in August 1978. In the amendment to the agreement signed in September 1979, three of the special covenants were amended. The status of compliance with the commitments of each covenant is as follows:

Section 6.1. Project Evaluation. Scheduled for December 1983.

Section 6.2. Water Monitoring System. The AID-financed consultant studying wastewater collection and treatment at Zarqa and Ruseifa has prepared a detailed report on the source and treatment of industrial effluents in the project area. A copy of this report is on file at NE/PD. The Royal Scientific Society, in conjunction with the University of Jordan and the Ministry of Health, has been monitoring the physical, chemical and the biological parameters of water quality in the Zarqa River and the King Talal Reservoir since mid-1980. The report of an AID-financed team that has reviewed this work is due in October 1982. In addition, the Natural Resources Authority, as part of the AID-financed Ground Water Resources Investigations Project, 278-0243, will undertake a comprehensive study of the hydrogeological parameters of surface and ground waters in the Amman-Zarqa basin.

Section 6.3. Sludge Disposal. The problem has been addressed in two studies. A British consultant on solid waste disposal (see covenant in Section 6.7) has considered the option of composting sewage with solid wastes. The problem of sludge disposal has also been considered as part of the Greater Amman Wastewater study (see covenant in Section 6.4). USAID has discussed the various options suggested in these studies with GOJ officials. AWSA will start producing dried sludge from the improved facilities financed by this project in May 1983.

Section 6.4. Increased Sewage Treatment. Met. The AID-financed Greater Amman Wastewater Study provides a plan for expanding the treatment of the increased quantity of piped sewage that will result from the project. USAID is now financing the design of facilities to expand the wastewater treatment plant at Ain Ghazal and of facilities on the outside of Amman to treat the increasing amounts of waste water in the metropolitan area. Funding for construction of these facilities has been included in the Government's Second Five-Year Plan.

Section 6.5. Access of Lower Income Families. Met. A survey has shown that the problem of sewer connections is not as critical as anticipated at the time of project approval.

Section 6.6. Sufficient Water. Met. JVA has completed studies to determine the best method of supplying water to AWSA's distribution system from JVA's terminal reservoir. In satisfaction of Condition Precedent Section 5.2(h), JVA has committed a minimum of 30 million cubic meters (MCM) of water per year to municipal uses in the Amman-Zarqa areas until the Maqarin Dam is constructed and 45 MCM per year thereafter.

Section 6.7. Solid Waste Disposal. A study of solid waste disposal in the Greater Amman area has been completed by a British consultant. The Government is considering the consultant's recommendations.

Section 7.8. Water Rates. At AWSA's request AID has financed the services of a financial advisor to help it improve its fiscal management and to provide the information on which to base water rates. There have been two rate increases since the loan was authorized.

B. Aqaba Wastewater Project - Loan 278-K-026

Progress toward compliance with the commitments in six special covenants in the loan agreement is as follows:

Section 6.1. Evaluation. This was originally scheduled for August 1982, but will need to be delayed.

Section 6.2. Water and Wastewater User Charges. The Government expects to have developed a preliminary schedule of water and wastewater tariffs by the time construction of the systems is completed.

Section 6.3. Staffing and Training. The WSC has hired senior staff to work on construction supervision with the consultant. Additional staff will be recruited to fill other positions. Aqaba's training plan will be part of the National Training Program, which is being developed with AID assistance.

Section 6.4. Effluent Irrigation System. The effluent irrigation system described in the Project Paper will not be constructed since the method of treatment has been changed to waste stabilization lagoons. The revised project has proposed a simpler effluent irrigation system with no significant health or other hazards to Aqaba's inhabitants.

Section 6.5. Qa Disi Water Supply and Distribution Project. Met. Construction of the water project has been completed.

Section 6.6. Sufficient Borrower Financial Support. Since construction has not yet started, it is too early to judge the Borrower's performance on this covenant. There is no reason to doubt that, to the extent not available from revenues, the Borrower will make available, from its own resources, sufficient funds to allow WSC to meet the operating capital needs and to carry out necessary extension and improvements of the wastewater system on a continuing basis.

C. Irbid Water and Sewerage Project - Loan 278-K-028

Because of delays caused by the redesign of the project, it is too early to report significant progress toward compliance with the special covenants.

THE HASHEMITE KINGDOM  
OF JORDAN  
NATIONAL PLANNING  
COUNCIL  
AMMAN  
Tel. 44466 - 44470  
P. O. B. 555  
Teleg. NPC — Amman



ANNEX H  
المجلس القومي للتخطيط

البيان : ١١١٦٦ - ١١١٧٠  
عمان  
ص.ب ٥٥٥

No. ....128/9/916.....

Date .....26./2/1981..

ANNEX H

H - 1

الرقم .....  
التاريخ .....

Dr. Edgar C. Harrell,  
Director,  
USAID/J,  
American Embassy,  
Amman.

Dear Dr. Harrell,

Subject: Zarka/Ruseifa Water and  
Wastewater Project.

As you know, the National Planning Council has engaged the firm of Malcolm Pirnie Inc., in association with Jouky and Partners, to study the technical and economic feasibility of water distribution system improvement, wastewater collection and treatment and stormwater drainage in the municipalities of Zarqa and Ruseifa. Copies of their report have been made available to you with our letter No. 128/9/136 dated January 10th, 1981. We have accepted the recommendations of the consultants for Phase I and have instructed them to proceed with the design of the projects.

The estimated cost of the recommended Phase I of the Project (for the needs of the cities through 1980) is JD 37,359,000. Because Phase I represents a large investment, we convened a meeting of representatives of the National Planning Council, the Ministry of Municipal, Rural and Environmental Affairs, the Water Supply Corporation and the municipalities involved to determine priorities.

The participants decided to modify the recommended Phase I investment to provide only for the immediate construction of those elements considered the highest priority needs. The description of these elements is listed below.

1. Construct the sewage treatment plant northwest of Zarqa at the proposed site adjacent to the Zarqa - Sukhnah road with two treatment trains.
2. Construct the sewage collection systems for the populated portions of Subareas II, III, IV, VII, and the Army Base.
3. Construct trunk sewers to collect industrial wastewater in Subarea X and another trunk sewer to the Ruseifa Bridge to serve the major industries along the Zarqa River in Zarqa and Ruseifa.

4. Construct the water distribution system expansion and reinforcement for Ruselfa.
5. Construct about 50% of the water distribution system improvements for Zarka.

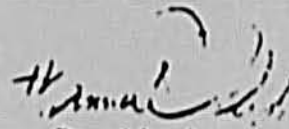
Therefore, the estimated cost of the project has been reduced to JD 25,876,000, which is divided into several Construction Packages as shown in the attached table.

In our subsequent discussions you indicated that the United States would be able to finance a portion of the cost of the Project. For this purpose, therefore, I hereby request that the USAID provide a total of U.S.\$ 40.0 million for this project, of which U.S.\$ 30.0 million would be a loan and U.S.\$ 10.0 million, a grant. The elements that would be financed from the loan and grant will be the subject of further discussions between our staffs.

The Government of Jordan undertakes to provide or cause to be provided the balance of the funds necessary for the construction of the project.

I am pleased to inform you that the Water Supply Corporation will be the implementing agency for this project.

Yours sincerely,

  
President

ZARQA AND RUSEIFA - JORDAN

MUNICIPAL WATER DISTRIBUTION IMPROVEMENTS AND SEWERAGE AND STORMWATER DRAINAGE SYSTEM

PROPOSED PHASE I CONTRACT BREAKDOWN (1981-1990)

Contract No.	Description	Construction Cost (1000 JD)	Other Project Cost (1000 JD)	Total Cost (1000 JD)	Local Cost (1000 JD)	Foreign Cost (1000 JD)
<b>INITIAL CONSTRUCTION (1981-1984)</b>						
W-S-1A	Subarea III Sewer & Water	3,492	2,300	5,792	2,678	3,114
S-1B	Subarea IV Sewer	1,004	661	1,665	799	866
S-2A	Zarqa & Ruseifa Trunk - Subarea X Sewer	1,703	1,122	2,825	1,356	1,469
W-S-2B	Subareas II & VII Sewer & Water	3,392	2,234	5,626	2,492	3,134
S-5	Two Train Plant & E. Side Pump Station	4,092	3,414	7,496	1,874	5,622
W-1	Ruseifa Water	830	547	1,377	275	1,102
W-2	Subareas I, IV, VIII, & XII Water	660	435	1,095	219	876
<b>Subtotal</b>		<b>15,163</b>	<b>10,713</b>	<b>25,876</b>	<b>9,693</b>	<b>16,183</b>
<b>DEFERRED CONSTRUCTION (1984-1990)</b>						
S-3	Subareas I, VI, VIII, XII Sewer	2,025	1,334	3,359	1,612	1,747
S-4	Subarea XIII, XVI, XVII Sewer (Ruseifa)	2,115	1,393	3,508	1,654	1,854
S-6	One Train Plant Addition	1,061	699	1,760	440	1,320
W-3	Subarea V Water	120	-	120	24	96
W-4	Subarea VI Water	160	-	160	36	124
W-5	Subarea IX & X Water	100	-	100	20	80
W-6	Water Transmission Facilities	400	-	400	50	350
-	Unallocated Water	350	-	350	70	280
ST-1	Stormwater Drainage (Zarqa & Ruseifa)	1,030	676	1,706	819	887
<b>Subtotal</b>		<b>7,351</b>	<b>4,102</b>	<b>11,453</b>	<b>4,755</b>	<b>6,698</b>
<b>Total</b>		<b>22,514</b>	<b>14,815</b>	<b>37,329</b>	<b>14,448</b>	<b>22,881</b>

H - 3

Figure 22

ANNEX IMultidonor Participation and CoordinationI. Introduction

This annex summarizes the events which have taken the GOJ from its request to USAID to finance the highest priority elements of the recommended initial investment phase for water, sewerage and stormwater drainage services for Zarqa and Ruseifa (Annex H) to its decision to undertake implementation of the entire recommended initial investment phase with the financial involvement of the World Bank (WB), West German Kreditanstalt fur Weideraufbau (KfW), and Islamic Development Bank (IDB) and outlines the relationship between these donors and AID as it relates to the implementation of the GOJ's development efforts in Zarqa and Ruseifa.

II. Background

Page 2 of this Project Paper (Part I, Section A.3) summarizes the history of this project. As reported therein, the GOJ decided in September 1980 to implement only a portion of the initial investment phase as recommended by the consulting engineers. The consultants then prepared appropriate "contract packages" for implementation of this project and presented these in a report on January 28, 1981. On February 26, 1981, the GOJ formally requested \$40.0 million (\$30.0 million loan and \$10.0 million grant) in financial assistance from AID for the implementation of "those elements considered the highest priority needs." This request and description of those elements constitutes Annex H. This Project Paper was completed and presented to AID/W for approval in March 1981 and recommends AID support for only that portion of the initial investment phase the GOJ decided was its highest priority need and for which AID assistance was requested. USAID's project was approved by AID/W in April 1981, but USAID was advised that the \$34.0 million requested by USAID would probably not be forthcoming and that \$15.0 million would be the more likely contribution.

During the summer of 1981, Jordan was afflicted by a relatively serious cholera outbreak. While the specific source(s) of this outbreak could not be determined, the known linkage of poor sanitation to cholera resulted in the priority of projects such as

Zarqa-Ruseifa being raised significantly by the highest levels of the GOJ. The Office of the Prime Minister made it known that all relevant GOJ agencies or authorities should accelerate, if possible, any projects that could impact positively on potential health and sanitation problems. The NPC, as one example, responded by reconsidering the decision to implement only a portion of the recommended initial investment phase for Zarqa and Ruseifa for which AID assistance had been requested. Ultimately, the GOJ decided that the health risks of not implementing fully the recommendations were too great and that it would endeavor to attract sufficient financial resources for complete implementation. The GOJ and USAID agreed that AID's assistance would be applied to those project areas where the effects of the project had the greatest potential beneficial impact.

The GOJ had begun seeking additional sources of financial support prior to the decision to implement the entire initial investment phase and prior to learning that AID would probably not be able to provide more than \$15.0 million. The WB expressed some interest as early as late 1980, but because of its project development process, could not be committal at the time of USAID's Project Paper presentation to AID/W. The GOJ continued in its efforts to obtain additional financing and succeeded in attracting the WB, KFW and IDB. Each of these donors began its own project development process with the WB assuming appraisal responsibilities for the KFW.

In assessing how support could best be provided, the WB and KFW, and to some extent the IDB, were constrained by the inability to finance local currency costs. This constraint was mollified somewhat by the definition of foreign exchange costs used by the WB and KFW; stated simplistically, each applies a sort of componentry rule to a commodity or service in determining if it is a foreign exchange or local currency cost, e.g., if Jordan is a net importer of cement and steel, then locally manufactured steel reinforced concrete pipe is considered a foreign exchange cost to the extent of the value of the net imported components. As a further complication, over 55 percent of the KFW contribution was required to be tied to procurement from West Germany.

As a result of the appraisal process, it became apparent to the WB, and consequently, the other donors, and the GOJ that, with the potential availability of over \$54.0 million in financial assistance (including AID) subject to various constraints, the entire recommended initial investment phase could now be implemented, as strongly desired by the Prime Minister's Office, if a financing formula could be devised to maximize the use of all available funds. That is, in the first instance, USAID was

to provide \$ 34.0 million toward an \$ 80.0 million project costing the GOJ \$ 46.0 million and, in the second instance, the four donors would be providing \$ 54.0 million toward a \$ 100.0 million project still costing the GOJ \$ 46.0 million, i.e., no net change.

Therefore, in late 1981, the WB, KFW and IDB were each requested by the GOJ to base appraisals on the entire initial investment phase providing services to Zarqa and Ruseifa through 1990 (see Annex H) and providing a more immediate mitigation of the potential health risks. A number of meetings were held involving all donors, in both Amman and Washington, culminating in the decisive March 17, 1982, meeting in Amman where individual contracts were defined and assigned to the various donors. The WB, cum KFW, appraisal team arrived in May 1982, and a final multidonor meeting was held during the first week of June 1982. The IDE was not present for the June 1982 meeting but the decisions reached during the March 1982 meeting were largely unaffected.

### III. GOJ Zarqa-Ruseifa Project Description

As mentioned above, the GOJ has decided to implement the entire initial investment phase recommended by the consulting engineer in its feasibility study (Annex A). A summary description of what is included in this phase is contained in Annex H. Generally, this phase will provide for water distribution, sewage collection, sewage treatment, and stormwater drainage services for the cities of Zarqa and Ruseifa through 1990. Figure 23 illustrates all that is included within this project as defined by the GOJ and appraised by WB, KFW and IDB. The total cost of this effort is estimated to be about \$ 100.0 million.

Also as mentioned above, the various constraints under which the various donors operate necessitated the final contracting configuration defining donor participation in this project. USAID, which had desired the application of U.S. technology, reluctantly conceded the financing of the wastewater treatment plant to the WB so as to maximize the use of financial resources available to the GOJ, but has provided for obtaining an assurance that the treatment plant to be constructed will be equivalent in all respects to the one USAID was to finance. USAID will partially finance construction services for water distribution and wastewater collection services in the "highest priority needs" areas of Zarqa. USAID retained for partial AID-financing the provision of construction supervision services, to be performed by the AID-financed consulting engineer which prepared the feasibility study



and final designs, as well as the provision of technical assistance for operations, management and training services.

#### IV. Multidonor Relationships

Figure 3 of the Project Paper illustrates the several construction contracts that constitute the AID Project 278-0234. The components to be constructed and the sub-areas of Zarqa and Ruseifa to be affected are indicated. These sub-areas can be seen more clearly by referring to Annex B, Figure 10. As indicated in the GOJ's request for AID assistance (Annex H), these components represent the highest priority needs as determined by the GOJ and the municipalities of Zarqa and Ruseifa. The GOJ has not altered its request for AID assistance, and USAID continues to believe AID assistance should be provided for these highest priority needs. Consequently, USAID, with AID/W concurrence, has not altered the scope of its project to include any construction activities beyond those requested by the GOJ (Annex H) and listed in Figure 3.

A comparison of Figure 3 to Figure 23 of this annex will show in what ways and to what financial extent the WB, KFW and IDB are contributing to the AID-financed project (278-0234). The Figure 3 Implementation Schedule further illustrates the interrelatedness of these various activities. The effect of the involvement of the WB, KFW and IDB is the extension of water distribution and sewage collection further through Ruseifa. This can be seen by examining Annex B, Figure 2, and comparing the sub-areas affected as indicated in Table 1 of this annex.

As indicated by Annex I (Project Description) to the AID Assistance Agreement USAID will commit the GOJ to the completion of the project as described by this Project Paper, i.e., including only those construction activities as indicated in Figure 3. While USAID is supportive of the larger undertaking, USAID's Project Paper has not analyzed this larger effort and therefore USAID can not consider it as the project to which AID is providing assistance. Conversely, as the WB, KFW and IDB undertaking can not be implemented without the successful implementation of the USAID described project, it is appropriate for those donors to consider AID as a donor in their project.

There is one exception to this clear separation of project undertakings; USAID has agreed to partially finance the construction supervision services which will include services affecting construction activities in areas beyond those described in Figure 3. USAID believes it to be important to maintain the

services of the same U.S. consulting engineer that prepared the designs for construction supervision. This U.S. consultant has been providing services under a three stage AID-financed (278-0181 and 278-0224) contract with the third stage to be that of construction supervision. All alternatives to USAID financing such services for the benefit of the other donors were either infeasible, e.g., joint financing with the WB, or unacceptable to USAID, e.g., the WB would finance such services after international competition to obtain such services. Of even greater significance in making the decision was the GOJ's own expression of its preferences to maintain a U.S. consultant, to maintain the same U.S. consultant, and to apply AID-provided grant funds to the provision of such services. Thus, the AID Project 278-0234 will involve itself in the larger undertaking of the WB, KFW and IDB to the extent that AID will partially finance construction supervision services for all contracts listed in Figure 23.

Although not particularly relevant to the decision, USAID estimates that there will be only a slight increase in foreign exchange costs of construction supervision as a result of expanding the area of service over what it would have been for AID's project alone.

ZARC RUSEIFA WATER SUPPLY & SEWERAGE PROJECT  
PROJECT COST ESTIMATE AND FINANCING SCENARIO

Figure 23

Contract Package	Dec. 1982 Cost 1/ (IDx1000)	Cost at Current Prices		Financing Agency	
		Total	Local		Foreign
1. Sewage Treatment Plant (24,000 kg B.O.D.)	5,498	6,282	1,571	4,711	WB
2a. Trunk sewers	2,362	2,702	1,297	1,405	KFW
2b. P/S & F.M. (Civil Works)	219	260	130	130	KFW
3. Supply & Lay Collection sewers, lay water pipes SA II & CII	2,232	2,634	1,271	1,363	USAID
4. Ditto S.A. III	2,390	2,820	1,354	1,466	USAID
5. Ditto S.A. IV	719	323	395	428	USAID
6. Ditto S.A. I, VI, VIII & XII	2,938	3,466	1,676	1,790	WB
7. Ditto S.A. XIII, XVI & XVII	3,260	3,347	1,864	1,983	IDB
8a. Supply Water Pipes for S.A. I, II, III, IV, V, VI, VII, VIII, IX, X, XII, XIII, XVI, XVII and transmission main	1,284	1,439	72	1,367	KFW
8b. Supply P/S Equip. & F/M Pipes Lay water transmission main & distr. in S.A. V, IX & X	261	293	15	278	KFW
9a. Storm drainage	1,380	1,471	706	765	IDB
9b. O&M Depot/workshop	95	107	53	54	WB
10a. Consultants - supervision	1,467	1,760	520	1,240	USAID
10b. " - start-up	100	120	12	108	USAID
10c. Financial experts	208	239	24	215	USAID
10d. WSC project staff	464	520	520	-	-
10e. Management/technical experts	150	180	18	162	WB
11. Tariff study	66	69	7	62	WB
12. Training	60	70	35	35	USAID
13. Meters & operating equipment	414	454	23	441	KFW
14. Land	1,500	1,500	1,500	-	
<b>Sub Total</b>	<b>27,537</b>	<b>31,536</b>	<b>13,323</b>	<b>18,263</b>	
15. Interest during construction		2,960			
<b>Total</b>		<b>34,546</b>			

- 1/ Includes 15% physical contingency on items 1 to 10
- 2/ Current price total includes escalation during construction at following inflation rates: 8% for 1982 and 1983, 7.5% for 1984, 7.0% for 1985, 6.0% for 1986 and beyond.

Financing Available		'DOCO'
WB	\$17 million	5,891
USAID	\$15 million	5,198
KFW	\$14.43 million (DM 35 million)	2,200 + 2,800 +
IDB	\$7.8 million	2,702
		<u>15,992 + 2,800 +</u>

1/ tied to procurement of German goods and services