UNCLASSIFIED

DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D.C. 20523

PROJECT PAPER

Proposal and Recommendations
For the Review of the

JORDAN - AMMAN WATER AND SEWERAGE

AID/BAS-032

UNCLASSIFIED

DEPARTMENT OF STATE
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON D.C. 20523

UNCLASSIFIED
AID/BAS-032
July 25, 1978

MEMORANDUM FOR THE BILATERAL ASSISTANCE SUBCOMMITTEE

SUBJECT: Jordan - Amman Water and Sewerage

Attached for your review are recommendations for authorization of a loan to Jordan (the "Cooperating Country") in an amount not to exceed Thirty-Nine Million United States Dollars ($39,000,000) (the "Authorized Amount") to help in financing certain foreign exchange and local currency costs of goods and services required for the project.

No meeting has been scheduled for this loan proposal; however, your concurrence or objection is requested by close of business on Friday, August 4, 1978. If you are a voting member, a poll sheet has been enclosed for your response.

Working Group on Bilateral Assistance
Office of Policy Development and Program Review

Attachments:
Summary and Recommendations
Project Analyses
Annexes A - K

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER FACESHEET

TRANSACTION CODE: [A] A = ADD, C = CHANGE, D = DELETE

PP

2 DOCUMENT CODE: 3

3 COUNTRY ENTITY: Jordan

4 DOCUMENT REVISION NUMBER:

5 PROJECT NUMBER (7 digits): 278-0220

6 BUREAU OFFICE: A SYMBOL: NE; B CODE: 3

7 PROJECT TITLE (Maximum 40 characters): Amman Water and Sewerage

8 ESTIMATED FY OF PROJECT COMPLETION: FY 82

9 ESTIMATED DATE OF OBLIGATION: A INITIAL FY 78; B QUARTER 4 (Enter 1, 2, 3 or 4); C FINAL FY 79

10 ESTIMATED COSTS ($000 OR EQUIVALENT $1 =

A FUNDING SOURCE	FIRST FY B FX	FIRST FY C L C	FIRST FY D TOTAL	LIFE OF PROJECT E FX	LIFE OF PROJECT F L C	LIFE OF PROJECT G TOTAL
AID APPROPRIATED TOTAL	16,300	12,200	28,500	24,300	14,700	39,000
(GRANT)						
(LOAN)	16,300	12,200	28,500	24,300	14,700	39,000
OTHER U.S. 1.						
OTHER U.S. 2.						
HOST COUNTRY	7,400	20,000	27,400	7,400	20,000	27,400
OTHER DONOR(S)	21,000	12,100	33,100	21,000	12,100	33,100
TOTALS	25,800	44,300	89,000	52,700	46,800	99,500

11 PROPOSED BUDGET APPROPRIATED FUNDS ($000)

A APPROPRIATION	B PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C GRANT	PRIMARY TECH. CODE D LOAN	E 1ST FY 78 F GRANT	E 1ST FY 78 G LOAN	H 2ND FY 79 I GRANT	H 2ND FY 79 J LOAN	K 3RD FY — L GRANT	K 3RD FY — M LOAN
(1) SA	B 720				28,500		10,500		
(2)									
(3)									
(4)									
TOTALS									

A APPROPRIATION	N 4TH FY — O GRANT	N 4TH FY — P LOAN	Q 5TH FY — R GRANT	Q 5TH FY — S LOAN	LIFE OF PROJECT T GRANT	LIFE OF PROJECT U LOAN
(1)						39,000
(2)						
(3)						
(4)						
TOTALS						

12 IN-DEPTH EVALUATION SCHEDULED: MM ___ YY ___

13 DATA CHANGE INDICATOR. WERE CHANGES MADE IN THE PID FACESHEET DATA, BLOCKS 12, 13, 14, OR 15 OR IN PRP FACESHEET DATA, BLOCK 12? IF YES, ATTACH CHANGED PID FACESHEET.

[2] 1 = NO, 2 = YES Primary Purpose Code

14 ORIGINATING OFFICE CLEARANCE

SIGNATURE: [signature]

Selig A. Taubenblatt

TITLE: Director, Office of Project Development

DATE SIGNED: MM 06 DD 31 YY 75

15 DATE DOCUMENT RECEIVED IN AID W OR FOR AID W DOCUMENTS, DATE OF DISTRIBUTION: MM ___ DD ___ YY ___

AID 1330-4 (3-76)

111

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT IDENTIFICATION DOCUMENT FACESHEET

TO BE COMPLETED BY ORIGINATING OFFICE

1. TRANSACTION CODE: [A] (A = ADD, C = CHANGE, D = DELETE)

PID

2. DOCUMENT CODE: 1

3. COUNTRY/ENTITY: JORDAN

4. DOCUMENT REVISION NUMBER:

5. PROJECT NUMBER (7 DIGITS): 278-0220

6. BUREAU/OFFICE: A. SYMBOL: N.E. B. CODE: 3

7. PROJECT TITLE (MAXIMUM 40 CHARACTERS): Amman Water Distribution and Sewage Disposal

8. PROPOSED NEXT DOCUMENT: A. [2] (2 = PRP, 3 = PP) B. DATE: MM YY [0 6 7 8]

9. ESTIMATED FY OF AUTHORIZATION/OBLIGATION: a. INITIAL FY [7 9] b. FINAL FY [7 9]

10. ESTIMATED COSTS ($000 OR EQUIVALENT, $1 = JD.333)

FUNDING SOURCE	LIFE OF PROJECT
A. AID APPROPRIATED	20,500
B. OTHER U.S. 1.	
B. OTHER U.S. 2.	
C. HOST COUNTRY	5,000
D. OTHER DONOR(S)	14,500
TOTAL	40,000

11. PROPOSED BUDGET AID APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	PRIMARY TECH. CODE D. LOAN	E. FIRST FY 79 F. GRANT	E. FIRST FY 79 G. LOAN	LIFE OF PROJECT H. GRANT	LIFE OF PROJECT I. LOAN
(1) SA	502		826		20,500		20,500
(2)							
(3)							
(4)							
			TOTAL		20,500		20,500

12. SECONDARY TECHNICAL CODES (maximum six codes of three positions each)

541 | 245

13. SPECIAL CONCERNS CODES (MAXIMUM SIX CODES OF FOUR POSITIONS EACH): BUW

14. SECONDARY PURPOSE CODE: 720

15. PROJECT GOAL (MAXIMUM 240 CHARACTERS)

To improve the quality of life for the residents of Amman and its environs.

16. PROJECT PURPOSE (MAXIMUM 480 CHARACTERS)

Expand water distribution and sewage collection facilities.

17. PLANNING RESOURCE REQUIREMENTS (staff/funds) Team to develop PRP for June 1978 required April 1978 for 4 to 6 weeks. Include Sanitary Engineer; Environmentalist Loan Officer; Economist/Financial Planner; Social Scientist. AID/W funded.

18. ORIGINATING OFFICE CLEARANCE

Signature: Christopher H. Russell

Title: Christopher H. Russell, Director

Date Signed: MM DD YY [0 5 3 1 7 7]

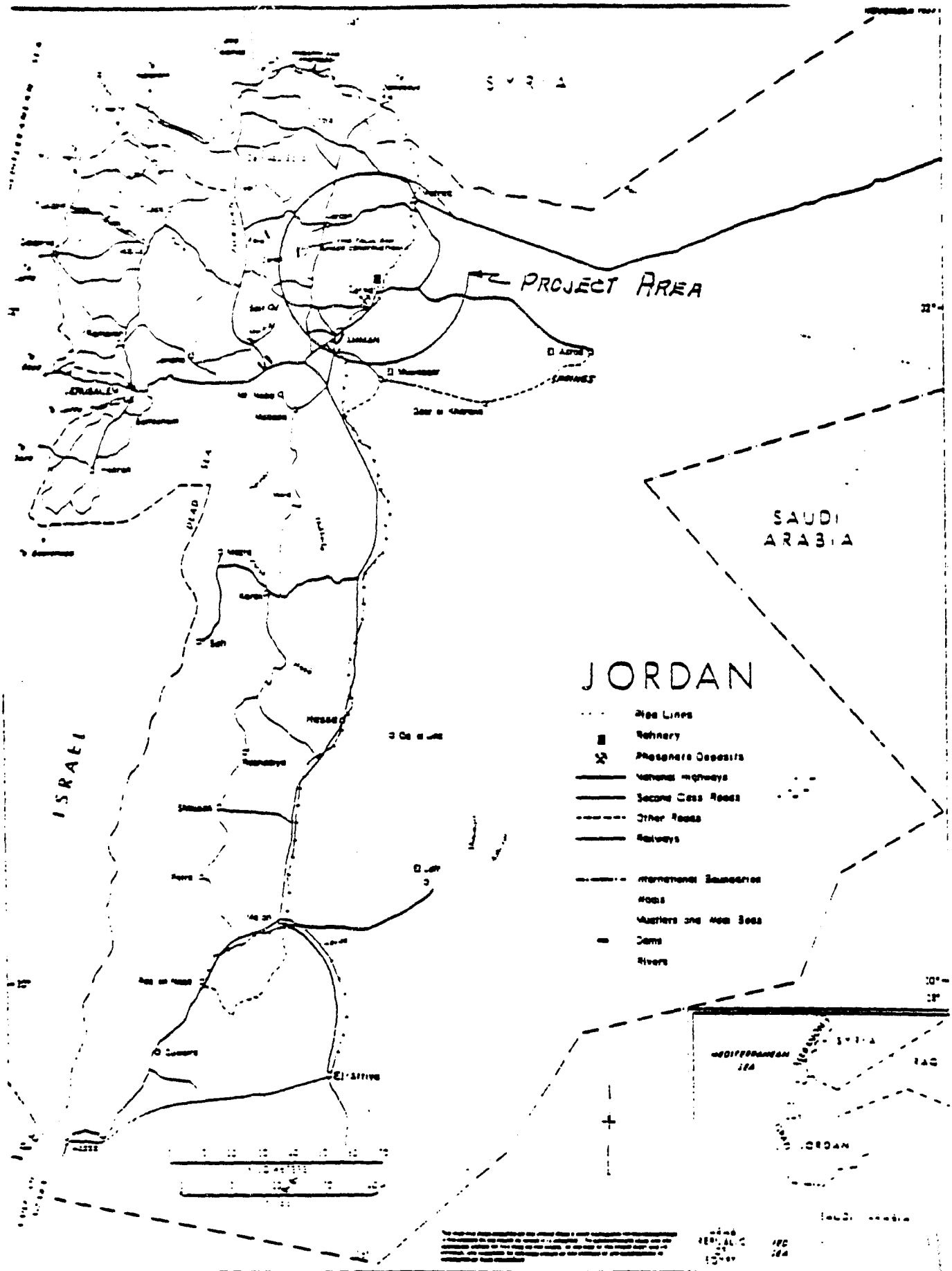
19. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM DD YY

AID 1330-2 (3-76)

ANNEXES TO PROJECT PAPER

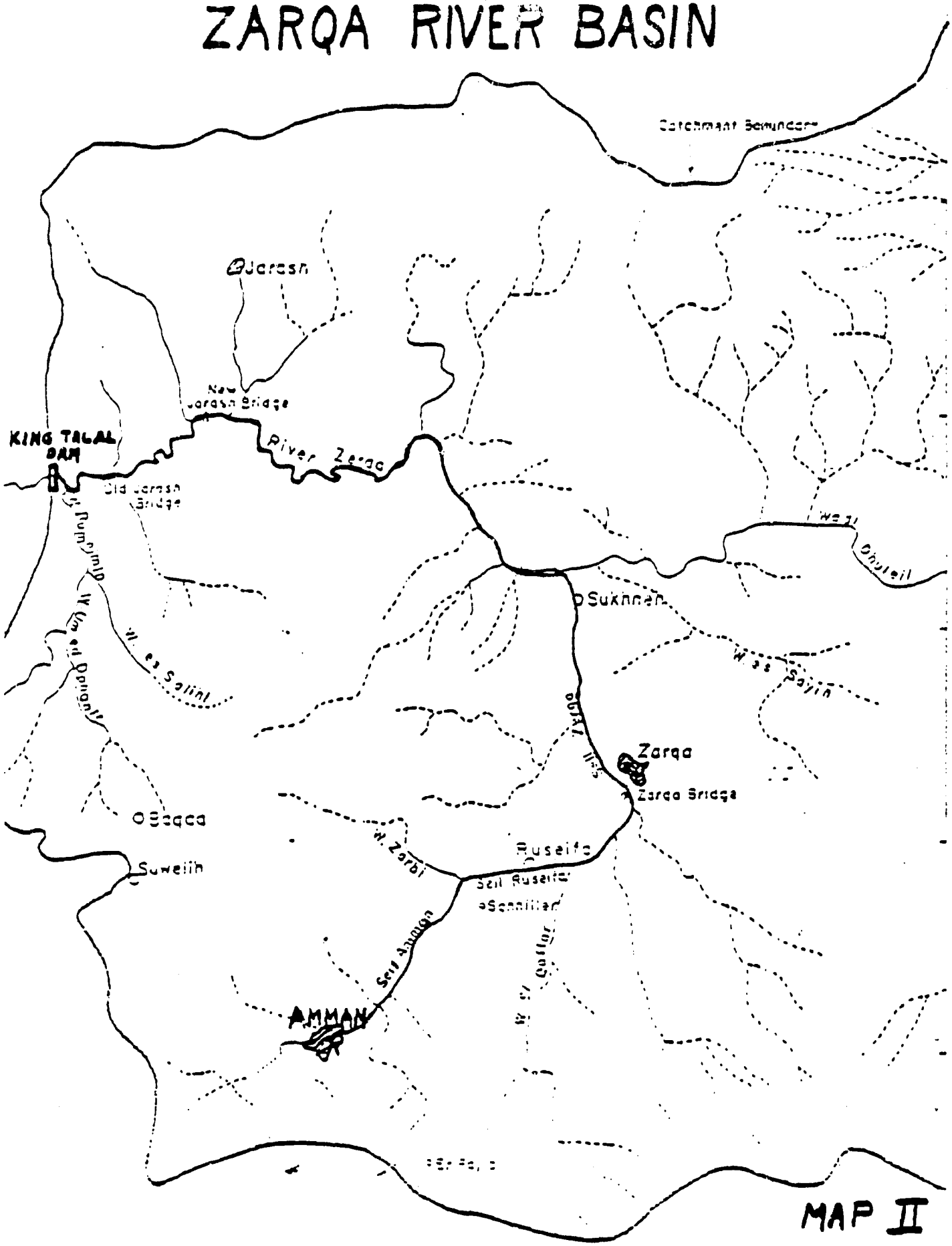
AMMAN WATER AND SEWERAGE PROJECT

MAPS

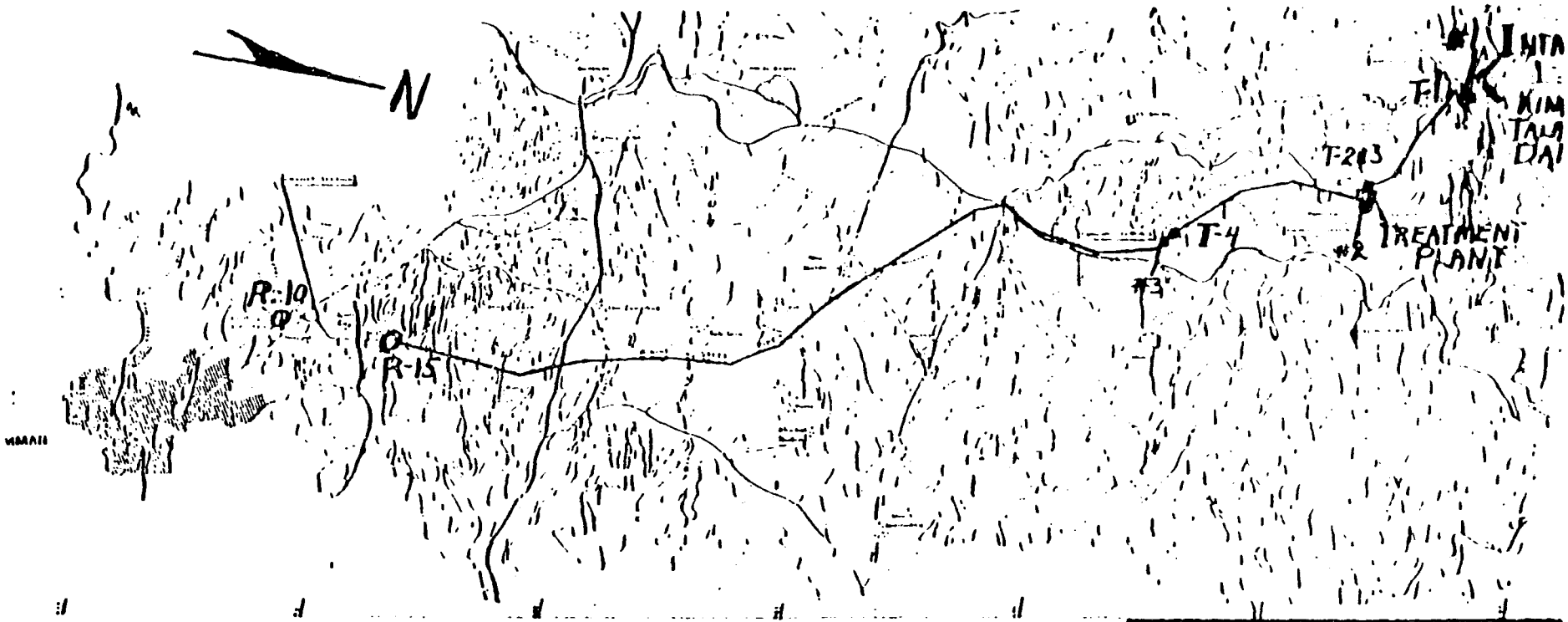

SYRIA
PROJECT AREA
SAUDI ARABIA
JORDAN
ISRAEL
Pipe Lines
Refinery
Phosphate Deposits
National Highways
Second Class Roads
Other Roads
Railways
International Boundaries
Wadis
Mediterranean Sea
Dams
Rivers
MEDITERRANEAN SEA
SYRIA
IRAQ
JORDAN

MAP 1

ZARQA RIVER BASIN



MAP II



PROJECT MAP

PUMPING STA. ------ ■ #1,2,3,
STORAGE TANK ----- T-● #1,2,3,4
RESERVOIR ---- R-10&15 O

MAP III

PROJECT PAPER

HASHEMITE KINGDOM OF JORDAN

AMMAN WATER AND SEWERAGE PROJECT

SUMMARY AND RECOMMENDATIONS

1. **Borrower:** The Government of the Hashemite Kingdom of Jordan (GOJ) which will make the proceeds of the loan available to the Amman Water and Sewerage Authority (AWSA), the public utility responsible for the production and distribution of water and the collection and treatment of sewage in the municipality of Amman, Jordan.

2. **The Loan:** Not to exceed thirty-nine million U.S. dollars ($39,000,000) funded under appropriations for FY 1978 ($28,500,000) and FY 1979 ($10,500,000) to finance the procurement of construction services and selected materials and engineering services. Procurement will be limited to countries included in AID Geographic Code 941, and Jordan.

3. **Loan Terms:** Repayable in U.S. dollars over a period of forty (40) years, including a 10-year grace period for principal payments and interest at an annual rate of two percent (2%) during the grace period and of three percent (3%) thereafter.

4. **Description of the Project:** Amman, the Capital of Jordan, with a population of approximately 700,000 faces a critical problem of supplying adequate water of healthful quality and collection and treatment of sewage. In response, the GOJ has developed a program for overall expansion of the water supply, water distribution, sewerage, and sewage treatment systems for Amman. Part of the program involving the two large refugee camps (with a total estimated population of approximately 165,000 persons) is already underway. The balance of the 1978-81 expansion program has been combined into a multi-donor project, the Amman Water and Sewerage Project.

   The Project, developed by AWSA with assistance from three consulting engineering firms, consists of the following:

a) Construction of a 29 Km (25 Km. of 800 mm; 4 Km of 600 mm) pipeline from the King Talal Dam reservoir to Amman (including water treatment plant, pumps and additional reservoirs). This source will nearly double the total supply of water to Amman;

b) Expansion of the water distribution and sewerage systems within Amman to increase the number of persons connected to piped water from an estimated 52% in 1977 to 75% by 1981 and increase the number of persons connected to sewerage from 17% in 1977 to 54% by 1981.

c) Expanding the capacity of the present sewage treatment plant to handle the anticipated increase in sewage resulting from the expanded sewerage system.

Three international donors are involved in financing the Project: the World Bank, the Saudi Fund, and AID. The World Bank has approved a $14.0 million IDA Credit to assist in financing contracts for expansion of the water distribution and sewerage collection systems. The Saudi Fund signed an agreement with GOJ providing approximately $20.0 million to assist in financing the water intake structure at King Talal and the pipeline to Amman.

The AID Loan will assist in financing part of the King Talal water transmission system, the water distribution and sewerage system, and the expansion of the sewage treatment plant. In addition, construction management technical assistance will be provided to AWSA and engineering design and construction supervision for the system in the Wahdat and Shelieh areas of Amman. The total cost of the Project is estimated to be $99.5 million as follows: (in millions of U.S. Dollars)

	LC	FX	Total
AID Loan	14.7	24.3	39.0
IDA Credit	3.8	10.2	14.0
Saudi Fund	8.3	10.8	19.1
GOJ	20.0	7.4	27.4
Total	46.8	52.7	99.5

5. Summary Findings:

A. Technical Analysis

Detailed feasibility studies including preliminary designs and costs of the various elements comprising the Project have been carried out by AWSA's engineering consultants: VBB (water distribution and sewerage); SOGREAH (King Talal water transmission system); and Binnie and Partners (sewage treatment plant). These have been reviewed by AID and are judged adequate for the purpose of establishing a technical basis for the Project, including reasonableness . Final designs and bid documents are being prepared by these firms for their respective Project components. Final design of the water distribution and sewerage system in the Wahdat and Shelieh areas will be included in the Project and financed under the AID Loan.
To assist in overall coordination of Project construction, AID will finance technical assistance in construction management. Construction supervision, financed by GOJ and IDA credits, will be by SOGREAH, for the King Talal water transmission system, and Binnie and Partners for expansion of sewage treatment plant. Supervisory engineering contracts for the water distribution and sewerage system (excluding Wahdat and Shelieh) are in process and will be financed in part by the IDA credit. An AID-financed engineering consultant will supervise construction of the works in Wahdat and Shelieh.
A cost analysis was made of various pipe sizes for the King Talal transmission line. (See Technical Analysis, Annex B, Pages 14-20). The proposed 800 mm pipe is the least costly approach.

B. Financial Analysis

The short-term financial projections for AWSA appear reasonably good. To continue to operate on a sound financial basis beyond 1984, however, AWSA will be required to increase its income substantially.

C. Economic Analysis

The economic rate of return for the Project is 2.5 percent. However, the analysis does not include the substantial (if non-quantifiable) health benefits resulting from the Project and possible savings to consumers as a result of lower annual costs of piped water and access to sewerage.

D. Social Analysis

The Project will provide approximately 270,000 persons with access to piped water and 316,000 persons with access to sewerage collection. Currently, the AWSA system is providing piped water to 321,000 persons and sewerage service to 108,000 persons. In addition, the substantial increase in total water availability in Amman (house connection or water tanker) will benefit the total population of Amman. Health benefits (resulting from a decrease in the percentage of the population using cesspools) also will be an important (if unquantifiable) benefit. Therefore, the Project will contribute substantially to the quality of life in Amman.

E. Environmental Considerations

A thorough environmental assessment of the Project was completed by Stanley Engineering Associates. Their report is on file in NE/PD. A summary of these findings is included in the Project Paper. Their recommendations have been taken into consideration in the design of the Project.

6. Statutory Checklist:

All statutory criteria have been met.

7. AID's Funding Sources:

Security Supporting Assistance , FY 1978 and FY 1979

8. Mission's Views:

The USAID Mission strongly supports this project. The Mission Director's 611(e) certification is attached as Annex I.

9. Issues:
See appropriate sections of Part II, Detailed Project Description

10. Recommendation:
That a loan be authorized in an amount not to exceed $39 million of which $28.5 million is to be funded from FY 1978 appropriation and $10.5 million from FY 1979 funds subject to the terms and conditions contained in Part V of the Project Paper.

11. Project Committee:

AID/Washington:	Chairperson:	Terrence Brown, NE/PD
	Economist:	Leonard Rosenberg, NE/PD
	Engineer:	James Cassanos, NE/PD
	Social Analyst:	Diane Ponasik, NE/TECH
	Legal Counsel:	Jan Miller, GC/NE
	Jordan Desk:	Ronald Witherell, NE/JLS
USAID/Jordan:		Thomas Pearson

PROJECT BACKGROUND

A. Project Identification

1.01 The availability of adequate quantities of water of acceptable quality for municipal, industrial, and agricultural uses is one of the most serious problems facing Jordan at this time, particularly the more densly settled and developed northern region.

1.02 Most critical, is the supply of water for the city of Amman. During the last two decades, Amman has quadrupled in population to an estimated 700,000 in 1978. This rapid growth can be attributed to significant rural-urban migration and the inflow of refugees (including most recently a temporary influx of Lebanese). As a result of rapid population growth, heavy pressure has been placed on the water supply, water distribution, sewerage, and sewage treatment system and the need for expansion of the overall system continues to accelerate.

1.03 In response to this need, the Government of the Hashemite Kingdom of Jordan (GOJ) acting through the Amman Water and Sewerage Authority (AWSA) has developed a project to increase the supply of water to Amman, expand the water distribution and sewerage system, and improve the sewage treatment plan over the next three years. The total cost of the 1978-81 expansion program is estimated to be approximately $100 million. Given the size of the project, the GOJ and AWSA have requested assistance from several international donors to participate in its financing. To date, the World Bank has approved a $14.0 million IDA Credit to assist in the financing of the water distribution and sewerage expansion program. Approximately $20.0 million will be available from the Saudi Fund for increasing the supply of water to Amman. The proposed AID Loan will assist in financing an increase in the water supply, expansion of the distribution and sewerage collection systems, and improvements to the sewage treatment plant. The overall effort by GOJ with parallel financing from IDA, the Saudi Fund, and AID constitutes Project financing.

1.04 The following summarizes the major elements of the Project, including a description of the current situation and major problems associated with each element.

B. Existing Situation

(1) Water Resources

1.05 Amman is located within the uppermost part of the Zerqa River catchment basin, an area of approximately 350 square Kilometers. Water resources within the basin consist of two aquifers underlying the area (referred to as the upper and lower aquifers) and a major stream, the Wadi Seil which becomes the Zerqa River below Zerqa (See Map II). The Wadi Seil is fed by rainfall run-off and a number of natural springs in the basin fed in turn by the aforementioned aquifers.

All water for municipal and industrial use in Amman is extracted from the upper and lower aquifers. At present, AWSA has 48 wells tapping these aquifers although only 28 are in actual production. Production from these wells, particularly during the summer months, has been unstable. During the past few years, water shortages during the summer have been common as a result of the increased population and drought conditions. The situation has improved somewhat as a result of the easing of drought conditions. However, recent investigation of the potential recharge of the aquifers underlying the Amman-Zerqa basin indicates that current consumption is exceeding the estimated natural recharge rate, at least of the lower aquifer (See Annex B, Technical Analysis). Clearly, mining of the aquifer cannot continue indefinitely and additional sources of water to augment that available from groundwater resources underlying the Amman-Zerqa basin must be developed as rapidly as possible to meet anticipated demand.

(2) Water Distribution

1.06 Approximately 320,000 (52%) of the project area population (619,000) are presently served by house connections to the AWSA Water System. About 75 percent of the water distribution system has been constructed during the last 15 years. The balance of the population is supplied with water from AWSA-owned water tankers or private tankers which periodically fill roof tanks or cisterns. In addition, some households are supplied by neighbors having house connections.

1.07 Due to limited water resources the water system does not provide a continuous flow to all areas and households connected to the system. Piped water is allocated to different neighborhoods on a once or twice weekly basis for durations which vary with the elevation of a particular subscriber. During the summers of dry years, neighborhoods have gone without piped water for several weeks. For that reason, water tankers serve both subscribers and non-subscribers during particularly dry periods.

(3) Water Consumption

1.08 As a result of limited current water resources and an inadequate distribution system, consumption in Amman is relatively low, averaging 43 liters per capita per day (lpcd). By comparison, the neighboring Syrian cities of Damascus and Aleppo average 159 lpcd and 90 lpcd respectively.

Most of the water consumed in Amman is for domestic or small commercial use. Less than 3 percent of total estimated consumption can be attributed to industrial consumption.

(4) Sewerage System

1.09 The existing AWSA sewerage system has been installed during the past 15 years and provides sewage collection to approximately 17% of the population through service connections (an estimated 7,100 connections). Those not served by lines rely upon cesspools (which may be emptied periodically by AWSA tanks and transported to the sewage treatment plant) or create a health hazard by surface disposal. Under the law which established AWSA, all premises which have access to sewer laterals must have a service connection installed and any cesspool closed within three months following notification by AWSA. If the landlord fails to comply, AWSA may install the connection and recover the cost plus a 20 percent penalty. To date, AWSA has had difficulty with voluntary compliance, especially for rental properties. As of June, 1977, approximately 300 properties had been compulsorily connected. AWSA has an ongoing contract to connect most of the premises presently in default.

1.10 All sewage from the AWSA system and from most cesspool pump trucks flows to the Ain Ghazal sewage treatment works. It is designed for complete treatment with the activated sludge process. The treated effluent is discharged into the Seil Amman which flows into the Zerqa River. Activated sludge is anaerobically digested in heated sludge digesters. Approximately 15 percent of the digested wet sludge is dried on sludge drying beds, the rest is transported to the municipal refuse dump.

C. Problem Areas

(1) Water Demand

1.11 As indicated in Paragraph B (3) above, per-capita consumption is relatively low in Amman. As indicated in Annex C, Social Analysis, low per-capita consumption does not appear to be the result of cultural use patterns or cost (at existing AWSA tariff rates). Rather, consumption of water has been and continues to be severely constrained by water availability, i.e., access to the AWSA water distribution system and the quantity of water supplied to that system. Consumption per capita could be expected to increase substantially if supply was not a constraint.

1.12 In addition, with the planned expansion of the water supply system to a larger percentage of the neighborhoods of Amman coupled with the continued expected rate of growth of Amman, demand for water will continue to expand.

1.13 However, with increased supply and proportionate increase in connections, the overall demand will increase but the quantity available per capita will remain constant and still require periods of system shut downs.

(2) Water Supply

1.14 As discussed above, current utilization of available ground water resources is reaching the upper limit of the yield of the aquifers. In addition, recent investigations indicate that the quality of water is deteriorating in both the upper and lower aquifers primarily due to the percolation of sewage from cesspools. In order to expand the supply of piped water to Amman and to keep up with population growth, additional sources of water are urgently needed. Without additonal sources of water, per capita consumption will be forced to decline and the quality of water deteriorate.

(3) Water Distribution

1.15 The water distribution system must be expanded to increase access to a reliable source of water. In addition to expanding access, the distribution system must be improved to decrease water losses in the system. This is the principal operating problem of the system (discussed in detail in Annex B, Technical Analysis) although the percentage of water lost (the percentage difference between water produced and water sold) has been reduced from 47.9 percent of total production in 1975 to 38 percent in 1977. A target of 25-30% is realistic. New meters will contribute to further reduction.

(4) Sewerage System

1.16 The existing system is inadequate to provide service to Amman. Reliance on cesspools and other unsanitary means of human waste disposal contributes to the pollution of ground water resources and otherwise has a deleterious impact upon public health. Expansion of and improvements to the sewage treatment plant will be necessary as the amount of sewage to be treated increases (See Part II E, Environmental Analysis). In addition, the plant is adversely affected by the low flows entering the sewers and to the shock loads from cesspool wastes entering the plant from cesspool pump trucks and from the effluent of two slaughter houses, located close to the plant.

II. DETAILED PROJECT DESCRIPTION

A. Detailed Project Description and Costs

2.01 AWSA, with the assistance of its engineering consultants, has developed a three-year expansion program to address the major problems outlined above. Within the overall expansion program, three areas of major capital expansion have been incorporated into a multi-donor Project consisting of the following elements:

--An increase in the total supply of water to Amman through the construction of a water transmission pipeline from the King Talal Dam Reservoir to Amman;

--Expansion of the water distribution and sewerage system within Amman; and

--Enlargement of the capacity of the sewage treatment plant serving Amman.

2.02 A detailed technical discussion of the various elements of the Project is contained in Annex B, Technical Analysis. The following is a brief discussion of the major elements together with overall Project cost estimates.

1. King Talal Water Transmission System

a) Description

2.03 An analysis of the alternative sources of water which could be utilized to provide an adequate quantity of water of suitable quality to Amman after 1981 (the year in which the estimated total water available from the aquifers will be insufficient to maintain estimated supply requirements) was completed by AWSA's consultant, VBB, in 1976. That study indicated that only water resources from the King Talal Dam reservoir fulfilled the requirements of water quality, quantity, and accessability within the identified time constraint.

2.04 The King Talal Dam is located approximately 34 Km. northwest of Amman on the Zerqa River, downstream from Amman and Zerqa, Jordan's second largest city (see map II). The dam was designed to regulate the flow of the Zerqa River to provide water for irrigation downstream from the dam. The dam was completed recently and the reservoir is filling. It has a live storage capacity of approximately 43 million cubic meters (mcm). The dam and reservoir are under the administrative control of the Jordan Valley Authority (JVA).

2.05 Since the King Talal reservoir is downstream from Amman and within the same catchment basin, a certain amount of water extracted from the reservoir for municipal use in Amman will be recycled back to the reservoir through (a) effluent from the sewage treatment plant which is discharged into Wadi Seil (and thence into the Zerqa River) and (b) from leakages in the water distribution system and percolation from cesspools which enter the upper aquifer and the Wadi Seil. The environmental consequences of this re-cycling are discussed below under Part IIIE, Environmental Analysis.

2.06 Taking the estimated re-cycling of water from the reservoir into account, agreement has been reached between JVA and AWSA that AWSA may extract 12 mcm plus or minus 40 percent per annum from the reservoir (the amount of estimated recycling annually from the reservoir) or a maximum annual pumping volume of 17 mcm.

2.07 The GOJ determined that a maximum "net" annual extraction of 12 mcm. was a reasonable compromise between the water requirements for Amman and potential reduction in the area, approximately 1,200 hectares (2½ acres equal 1 hectare) which could have been irrigated by the lost water.

2.08 The water transmission system is designed to pump a maximum of 17 mcm. annually based upon operation of the system 20 hours per day, 365 days per year at an estimated volume of 650 liters per second (lps). AWSA will be limited to maximum daily use of the pipeline pumps. (Meeting the four hours of H.K.A. power demand in the Amman Zerqa area place this limitation on power from the Jordan Electric Authority (JEA). Of the 17 mcm./year, 2 mcm. will be supplied to villages along the route of the pipeline.

2.09 Water will be drawn from the reservoir via a floating intake structure, then pumped through the pre-treatment and treatment plants and into the transmission pipeline. The total length of the pipeline is approximately 29 kms. Water will be lifted a total of approximately 900 meters from the reservoir to Amman (See Schematic Map III).

2.10 Final engineering designs and bid documents have been prepared by the French engineering firm SOGREAH. Prequalifications of construction firms is in process and tender documents should be issued to pre-qualified firms by August 1. SOGREAH's contract with AWSA provides for its expansion to include construction supervision. It is AID's understanding that the contract will be amended and SOGREAH will supervise construction. This will be a C.P. to disbursement of AID Loan funds for construction services.

(b) Cost Estimates

2.11 Cost estimates have been prepared by SOGREAH based upon their final design. These have been reviewed by AID and are considered reasonable. In addition to AID Loan funds, the SAUDI Fund for Development has made available approximately $20 million for construction of the water transmission system. To permit parallel financing, the transmission system was divided into two major contracts, one to be financed under the AID Loan and the other with Saudi Fund resources. The AID-financed contract includes the water pre-treatment and treatment plants, all electrical and mechanical installations (including pumps) and civil works. The Saudi Fund will finance the water intake structure and the 29 Km pipeline.

2.12 In addition, the Jordan Electric Authority will construct the electrical transmission line to serve the water transmission system. The estimated cost of the line is $1.0 million. AWSA will not be charged for the line but will pay a flat rate per kilowatt hour for power. Therefore, this cost is not included in the Project cost estimates.

Cost estimates and financial plan for the water transmission system are presented in Table II-1a and II-2 below.

2. Water Distribution and Sewerage Collection Systems Expansion

A. Description

2.13 The AWSA expansion program for the Amman water distribution and sewerage collection system was studied and mostly designed by its consultant, VBB. This element of the Project provides for financing discrete contracts into which the expansion program has been divided. VBB identified nine individual contracts, six (numbered 1-6) for construction and three (numbers 7-9) for equipment. Final designs and tender documents are being prepared by VBB.

2.14 The $14 million IDA credit will help finance contracts 2 to 4 and 6 to 9. The AID Loan will assist in financing sewerage(s) contract 1S and 5WS (water & sewerage). Contract 1S includes 54.2 Km. of sewer mains, laterals and house connections. Contract 5WS includes 65.1 Km. of water mains, laterals, and house connections and a booster pumping station; and 56.8 km. of main sewers, laterals, and house connections, and a sewage pumping station.

2.15 Contracts (not detailed by VBB) will provide water distribution and sewage collection in the areas of Wahdat and Shelieh. These areas were included in VBB's feasibility analysis, but final designs will have to be completed by an engineering firm to be financed under the AID Loan. Aid will participate in financing both engineering services and construction. The work in the Wahdat area includes 30 Km. of water mains and 13.5 Km. of sewers while the work at Shelieh includes 6 Km. of water mains and 6 Km. of sewers.

TABLE II-1 a

COST ESTIMATES: KING TALAL WATER TRANSMISSION SYSTEM
(In U.S. $000)

ITEM	LC	FX	TOTAL
A. Contract I			
I.1 Water Intake	814.1	3,256.3	4,070.4
I.2 Pipeline	5,208.0	5,208.0	10,416.0
(Subtotal)	(6,022.1)	(8,464.3)	(14,486.4)
B. Contract II			
II.1 Water for Treatment	115.2	268.8	384
II.2 Water Treatment	2,308.8	5,387.2	7,696.0
II.3 Elect./Mechanical	958.7	3,834.9	4,793.6
II.4 Civil Works	4,854.1	2,080.3	6,934.4
(Subtotal)	(8,236.8)	(11,571.2)	(19,808.0)
C. Misc.			
Supervision	560.0	1,040.0	1,600.0
Land Purchases	2,240.0	-	2,240.0
(Subtotal)	(2,800.0)	(1,040.0)	(3,840.0)
Physical Contingency	1,706.0	2,107.5	3,813.5
Price Contingency	4,230.7	3,612.5	7,843.2
TOTAL	22,995.6	26,795.5	49,791.1

TABLE II-1 b

TOTAL COST BY CONTRACT
(In U.S. $000)

CONTRACT I	3,283.5	10,761.6	19,045.1
CONTRACT II	11,327.9	14,711.7	26,041.6
MISC.	3,382.1	1,322.2	4,704.3
TOTAL	22,995.5	26,795.5	49,791.0

TABLE II-2

FINANCIAL PLANS: KING TALAL WATER TRANSMISSION SYSTEM
(In U.S. $000)

SOURCE	LC	FX	TOTAL
A.I.D.	8,688.3	14,711.7	23,400.0
Saudi	8,283.5	10,761.6	19,045.1
GOJ	6,023.8	1,322.2	7,346.0
TOTAL	22,995.6	26,795.5	49,791.1

3. Cost Estimates

2.16 The final design of construction contracts 1S through 6WS, equipment specifications for equipment contracts 7MW, 8MW, and 9 MW, and cost estimates for those contracts were prepared by VBB based on 1975 prices. The World Bank reviewed these estimates and updated them for its Project Appraisal Report. The revised estimates were reviewed by AID and are acceptable. Cost estimates for those areas in the Project not designed by VBB in the Wahdat and Shelieh areas were prepared by AWSA based upon preliminary design layouts and quantity estimates. These also have been reviewed and are acceptable.

2.17 The division of construction contracts between AID and IDA-financing was based upon joint AID-World Bank-GOJ discussions which took place in Washington in conjunction with GOJ-World Bank negotiations leading to the approval of the IDA Credit for the-Project. At that time, it was agreed that AID would assist in the financing of Contract 1S and 5WS. During these discussions it was agreed further that AID would participate in financing areas selected from AWSA's 1982-84 investment program to be included in the Project. These areas, Shelieh and Wadhat, were identified subsequently by AWSA.

2.18 The foreign exchange cost of construction equipment contracts 7MW, 8MWS, and 9MW will be financed under the IDA Credit. In addition, the foreign exchange cost of construction supervision for construction contracts 1S through 6WS (including two AID-financed contracts 1S and 5WS) will be financed under the IDA Credit.

Engineering services for Wahdat and Shelieh, including construction supervision will be financed under the AID Loan.

2.19 Cost estimates and financial plan for the individual contracts for water distribution and sewerage construction and training and maintenance equipment are shown in Tables II-3 and II-4 below.

TABLE II-3

COST ESTIMATES: WATER DISTRIBUTION AND SEWERAGE
(In U.S. $000)

		LC	FX	TOTAL
A.	Construction Contracts			
	Contract 1S	1,264.0	1,894.4	3,158.4
	Contract 2S	1,449.6	1,187.2	2,636.8
	Contract 3WS	2,019.2	1,539.2	3,558.4
	Contract 4WS	3,113.6	2,419.2	5,532.8
	Contract 5WS	3,248.0	2,486.4	5,734.4
	Contract 6WS	1,587.2	1,232.0	2,819.2
	Wahdat and Shelieh	1,232.3	1,439.7	2,672.0
	(Subtotal)	(13,913.9)	(12,198.1)	(26,112.0)
B.	Equipment[1/]	480.0	6,528.0	7,008.0
C.	Engineering			
	(1S-6WS)	(44.8)	(787.2)	(1,232.0)
	(Wahdat/Shelieh)	(66.9)	66.9	133.8
	(Subtotal)	511.7	854.1	1,365.8
D.	Training	38.4	153.6	192.0
	Subtotal(A+B+C+D)	14,944.0	19,733.8	34,677.8
	Physical Contg.[2/]	1,446.7	1,879.3	3,326.0
	(Subtotal)	(19,468.5)	(24,116.1)	(38,003.8)
	Price Contingency[3/]	3,077.8	2,503.0	5,580.8
	TOTAL	19,468.5	24,116.1	43,584.6

1/ Includes construction materials, water meters, and maintenance equipment.

2/ Physical Contingency = 9.5% average for Items 2,3,4,5,6,8,9,11;
10% average for items 1,7,10
Different rates were used to correspond with
IBRD Appraisal Report Table B1 Pt. 1

3/ Price Contingency = IBRD estimates for Items 2,3,4,5,6,8,9,11
plus detailed PP estimates for Items 1,7,10 as follows:

	LC	FX	Total
a) Total IBRD	752.0	614.0	1,366.0
b) Wahdat/Shelieh	127.7	93.1	220.8
c) 1S	82.1	75.1	157.2
TOTAL	961.8	782.2	1,744.0

TABLE II-4

FINANCIAL PLAN: WATER DISTRIBUTION AND SEWERAGE
(In U.S. $000)

SOURCE	LC	FX	TOTAL
A.I.D.	2,720.6	7,779.4	10,500.0
I.B.R.D.	3,800.0	10,200.0	14,000.0
G.O.J.	12,947.9	6,136.7	19,584.6
TOTAL	19,468.5	24,116.1	43,584.6

3 Sewage Treatment Plant

A. Description

2.20 In 1977, AWSA contracted with the engineering firm of Binnie and Partners to: assess the performance of the Ain Ghazal sewage treatment plant; define precisely the immediate improvements needed in the plant; the necessary expansion of the sewage handling facilities; and to prepare design drawings and tender documents. Binnie confirmed that the main treatment units will generally have sufficient capacity until the end of 1980, but that the facilities for sludge treatment and disposal require immediate expansion.

2.21 In addition, Binnie and AWSA are reviewing possible utilization of mechanical de-watering rather than use of sludge drying beds. Use of mechanical de-watering would increase substantially the sludge handling capacity of the plant and reduce sludge disposal problems.

B. Cost Estimates

2.22 Cost estimates were developed by AWSA's engineering consultant Binnie and Partners in conjunction with their feasibility study for the sewage treatment plant. The costs have been reviewed by AID and are acceptable. The AID Loan will finance all foreign exchange costs generally covering equipment, and a majority of the local currency covering installation. The GOJ will provide the additional local currency necessary for the installation of equipment and all costs of construction supervision under the existing contract with Binnie and and Partners.

2.23 It should be noted that the above design alternative replacing sludge drying beds with a mechanical re-watering process, will not significantly affect Project cost estimates.

2.24 Cost estimates for this element of the project and financial plan are shown in Table II-5 and II-6.

TABLE II-5

COST ESTIMATES: SEWAGE TREATMENT PLANT
(In U.S. $000)

ITEM	LC	FX	TOTAL
A. Sewage Treatment Plant			
1. Sludge Digestion Tank and related costs	1,120.0	320.0	1,440.0
2. Sludge Drying Beds and related costs	1,888.0	89.6	1,977.6
3. Misc. Equipment	15.4	190.0	205.4
(Subtotal)	(3,023.4)	(599.6	(3,623.0)
Physical Contingency	302.3	60.0	362.3
Price Contingency	712.0	81.3	793.3
Subtotal Plant	4,037.7	740.9	4,778.6
B. Supervision	99.2	83.2	182.4
Physical Contingency	9.9	8.3	18.2
Price Contingency	23.4	11.8	35.2
Subtotal	132.5	103.3	235.8
TOTAL	4,170.2	844.2	5,014.4

TABLE II-6

FINANCIAL PLAN : SEWAGE TREATMENT PLANT
(In U.S. $000)

SOURCE	LC	FX	TOTAL
A.I.D.	3,259.1	740.9	4,000.0
G.O.J.	911.1	103.3	1,014.4
TOTAL	4,170.2	844.2	5,014.4

4. Other Project Elements

A. Technical Assistance

2.25 Review of AWSA's capacity to manage effectively all project construction activities (including three separate consulting engineering firms plus at least ten separate construction contracts financed by three international donor agencies) indicates that construction management services to AWSA would facilitate effective Project Implementation. This has been discussed with AWSA and the National Planning Council (NPC) and it was agreed that management assistance would be extremely valuable and should be included in the Project. It is estimated that a team working with AWSA during the Project life will be contracted and financed under the AID Loan. The estimated cost of this contract is $1,100,000.

B. Training

2.26 Staff turn-over at AWSA is approximately 16 percent annually. To overcome this problem, AWSA has undertaken an active training program. Between 1974 and 77, seventy staff members attended courses in Jordan conducted by foreign consultants and local institutions, and a few attended foreign institutions. To continue AWSA's Program, the World Bank will make $180,000 available under the IDA Credit for the foreign exchange costs of training. The emphasis in training will be to upgrade the capability of existing staff in order to meet the additional requirements imposed by the expanded facilities developed under the Project. Training costs are included in Table II-3 above.

2.27 The IDA Project Agreement with AWSA contains a provision that it will implement a staff training program in accordance with a timetable acceptable to IDA to be submitted by September 30, 1978.

2.28 In addition, it is anticipated that training of AWSA staff in the operation and maintenance of the King Talal treatment plant, pumps, etc., included in the water transmission system will be provided either by the respective construction contractors or by the engineering firm responsible for construction supervision.

C. Maintenance

2.29 Present limitations in the number and types of maintenance equipment available for AWSA's use which are reflected in their present, time-consuming, approaches to maintenance, repair and system augmentation will be reduced through the provision of up-to-date equipment under the proposed Project. Routine or preventive maintenance such as scheduled sewer cleaning, will be expedited through the use of mechanical rodding equipment. The availability of well-acidizing equipment will allow for a planned program of well-rehabilitation on a continuing basis.

2.30 IDA will provide approximately $475,000 to purchase additional maintenance equipment. This is included in Table II-3 above.

5 Summary of Cost Estimates and Financial Plan

A. Project Estimates

2.31 The total estimated cost of the Project is $99.5 million; of that total, AWSA will contribute approximately $27.4 million (27 percent). The remaining $72.1 million will come from three donor agencies: The Saudi Fund (up to $20.0 million), the IDA Credit ($14.0 million), and AID ($39.0 million).

2.32 The consolidated cost estimates and overall financial plan for the Project are presented in Table II-7 and II-8 below.

TABLE II-7

CONSOLIDATED COST ESTIMATES: AMMAN WATER AND SEWERAGE PLANT (In U.S. $000)

ITEM	LC	FX	TOTAL
A. King Talal Transmission System (From Table II.1)	22,995.6	26,795.5	49,791.1
B. Water & Sewerage (Table II-3)	19,468.5	24,116.1	43,584.6
C. Sewage Treatment Plant (Table II-5)	4,170.2	844.2	5,014.4
D. Construction Management[1/]	230.0	870.0	1,100.0
TOTAL PROJECT	46,864.3	52,625.8	99,490.1

TABLE II-8

CONSOLIDATED FINANCIAL PLAN: AMMAN WATER AND SEWERAGE PLANT (In U.S. $000)

SOURCE	LC	FX	TOTAL
A.I.D. (Construction)	(14,498.4)	(23,401.6)	(37,900.0)
(Construction Mgt.)	(230.0)	(870.0)	(1,100.0)
IBRD	3,800.0	10,200.0	14,000.0
SAUDI	8,283.5	10,761.6	19,045.1
G.O.J.	20,052.4	7,392.6	27,445.0
TOTAL	46,864.3	52,625.8	99,490.1

1/ Construction Management total $1.1 million not included in AWSA financial analysis. It is assumed these funds will be granted to AWSA by GOJ for this contract only.

B. The A.I.D. Loan

2.33 In order to provide the proposed $39.0 million in AID Loan funds for the Project, it will be necessary to utilize resources authorized for FY 1978 and resources budgeted for FY 1979. In FY 1978, a total of $28.5 million will be obligated for the proposed Project. To avoid split funding of individual contracts, it is anticipated that the AID Loan will finance up to $24.5 million of Contract II for the King Talal water transmission system and up to $4.0 million for the expansion of the sewage treatment plant. In FY 1979 it is proposed that $10.5 million be obligated for the project to help finance three water distribution and sewerage construction contracts. The loan funding will be allocated as follows: Contract 1S $3.6 million, Contract 5WS $3.5 million, and the Wahdat and Shelieh Contract for $3.4 million. Table II-9 presents the detailed cost break-down of AID-financed contracts.

TABLE II-9

AID LOAN BY CONTRACT
(In U.S. $000)

	A.I.D.			G.O.J.			TOTAL		
	LC	FX	TOTAL	LC	FX	TOTAL	LC	FX	TOTAL
King Talal Water Transmission System:									
- Contract II	8,688.3	14,711.7	23,400.0	2,641.6	-0-	2,641.6	11,329.9	14,711.7	26,041.6
Water Distribution and Sewera									
- Contract 1S	1,275.8	2,324.2	3,600.0	377.3	-0-	377.3	1,653.1	2,324.2	3,977.3
- Contract 5WS	-0-	3,500.0	3,500.0	3,587.8	169.2	3,757.0	3,587.8	3,669.2	7,257.0
- Contract Shilieh & Wadhat	1,444.8	1,955.2	3,400.0	392.6	-0-	392.6	1,837.4	1,955.2	3,792.6
(Construction)	(1,350.1)	(1,868.5)	(3,218.6)	(392.6)	-0-	(392.6)	(1,742.7)	(1,868.5)	(3,611.2
(Engineering)	(94.7)	(86.7)	(181.4)	-0-	-0-	-0-	(94.7)	(86.7)	(181.4
(Subtotal 2+3+4)	(2,720.6)	(7,779.4)	(10,500.0)	(4,357.7)	(169.2)	(4,526.9)	(7,078.3)	(7,948.6)	(15,026.9
Sewage Treatment Plant 1/	3,259.1	740.9	4,000.0	911.1	103.3	1,014.4	4,170.2	844.2	5,014.4
Construction	(3,259.1)	(740.9)	(4,000.0)	(778.6)	(-0-)	(778.6)	(4,937.8)	(740.8)	(4,778.6
Engineering	(-0-)	(-0-)	(-0-)	(132.4)	(103.3)	(235.8)	(132.4)	(103.4)	(235.8
Construction Management	230.0	870.0	1,100.0	(-0-)	(-0-)	(-0-)	230.0	870.0	1,100.0
	14,898.0	24,102.0	39,000.0	7,910.4	272.5	8,182.9	22,808.4	24,374.5	47,182.9

III. PROJECT ANALYSES

A. Technical Feasibility:

1. Summary

3.01 A description and associated costs of the technical components ofthe Project are discussed in Part II above. The detailed analysis is included in the Technical Analysis, Annex B. That technical analysis establishes that the project is technically sound and represents a least cost approach to expanding the AWSA water and sewerage system.

2. Technical Issues

3.02 During the course of Project development, a number of issues were identified. These are identified below together with a statement of their resolution for purposes of the Project.

(a) Issue: Source of Water

3.03 Several studies have been undertaken of the potential long-term safe yield of groundwater resources to identify the total annual, sustainable yield from the aquifers underlying Amman. The most recent review of these studies ("Water Use Strategy for North Jordan," Humphreys and Sons - 1978 (draft) indicates that additional work is necessary to more clearly define the yield parameters of the aquifers. Obviously, this information is critical to water resources planning for Amman, indeed for all of North Jordan. Developing better data than is presented in Annex B, Technical Analysis, was not possible for the Project Paper. However, the Loan Agreement will include the requirement that a system for monitoring use of the aquifers be established. This will contribute to the classification of the yield potential of the aquifers.

(b) Issue: The King Talal Reservoir as a Water Source

3.04 Use of King Talal water for municipal and industrial uses in Amman will effect the quantity of water available for irrigation purposes in the Jordan Valley. The Dam was designed to regulate the flow of the Zerqa River to expand irrigation dowrstream from the Dam. A total net extraction of 12 MCM annually will reduce potential irrigation by approximately 1,200 ha. Any additional future drawdown from the reservoir will proportionately reduce downstream irrigable lands. Future irrigation investments should take into account expected extractions from the reservoir for municipal and industrial use.

(c) Issue: Environmental Impact

3.05 As discussed in Environment Analysis, (Part E, below) use of the King Talal Reservoir in amounts exceeding 17 MCM/year may create problems associated with a nitrate build-up resulting from the recycling of

Amman water. It is estimated that 50-70% of the water extracted from the reservoir will return to the reservoir and be reused. If nitrates begin to exceed WHO standards, increased costly water treatment will be necessary. To assure that this and other environmental factors are taken into account if or when extraction from the reservoir increases beyond the 17 MCM/Year envisioned by the Project, the Loan Agreement will require Borrower to submit to AID a study assessing the environmental impact of any such increased drawdown and steps to be taken to alleviate any negative effects resulting from such increase in drawdown rate or quantity. If requested by GOJ, AID can assist in financing this study.

(d) Issue: Water Resources Beyond 1989

3.06 The Technical Analysis points out that even at conservative levels of consumption, additional water resources beyond the quantities identified for Project, will be needed to meet Amman's requirements in 1989. It is probable that this additional water will be needed before 1989 should per-capita consumption increase and full utilization of the system's capacity with its commensurate increase in revenue be sought by AWSA.

3.07 Given the problems associated with additional use of the King Talal reservoir, other sources of water must be identified and developed. Possible sources of water include the Maqarin Dam and construction of a dam south of Amman on Wadi Wala.

3.08 To help assure that timely action is taken to identify other water resources, Borrower will be required by the Loan Agreement to submit a plan identifying water resource alternatives and develop a plan for their exploitation. This should be part of a larger investigation and evaluation of the water resources of North Jordan.

(e) Issue: Determination of Size of Water Transmission Pipe

3.09 As discussed in the Technical Analysis, the justification for installation of an 800 mm. instead of 600 mm. pipeline is to allow for seasonal fluctuations in the quantity of water available to meet Amman's average demand. However, the rest of the system (water treatment and pumps) may not be adequate to handle large fluctuations in pumping rates since the design was based upon a rate not to exceed 650 liters per second. The final design drawings have not been submitted by SOGREAH for final review and approval. One objective of that review will be to determine the flexibility of the system to adjust to seasonal pumping rates and possibly to require adjustment of the design to accomodate fluctuating rates. In addition, a condition precedent to initial disbursement will require Borrower to submit a schedule of monthly withdrawals from the reservoir as part of an overall reservoir operations plan.

B. Financial Analysis

1. General

3.10 Most of the funds borrowed by the GOJ from IDA, Saudi Fund and AID will be onlent to AWSA at the current GOJ onlending terms for water authorities, 25 years, including four years' gract at an interest rate of 6% per annum. It was agreed that IDA funds would be onlent on the same terms. Because of AWSA's major investment program at this stage the GOJ has decided to make an equity contribution of US$20.0 million. These relending terms will also apply to the AID Loan.

3.11 The financial perforance of AWSA during 1974-1976 was unsatisfactory. The income-generating capability of the utility, that is, its tariff rate structure, was inadequate to compensate for the impact of accelerated inflation, in addition to the reduced water sales caused by the drought in 1976.

3.12 The future financial performance, through 1984 should be satisfactory. The projected continuing inflation will, based on the IDA financial projections, require a substantial increase in average water supply tariffs, as well as in sewerage surcharges. The additional water provided by the King Talal transmission line will provide AWSA with both needed water to meet customer requirements and the flexibility to partially ameliorate such substantial rate increases by a more rapid use of the allocation assigned to AWSA. AWSA should have no difficulty in meeting the financial conditions established in the Project Agreement (Section 4.03) related to the recent IDA Credit. (See Annex C, Financial Analysis, Attachment 1)

3.13 On January 1, 1973 AWSA introduced a flat tariff for water supplied of 75 fils/m3 (US$0.23). In April 1975 a progressive tariff system was introduced which maintained the average 75 fils/m^3 rate, but provided for a 20% decrease to 60 fils/m^3 for low consumption to ensure access to potable water supply by poor members of the community. On January 1, 1977 and 1978, AWSA increased the average water tariff by about 50% and 63% respectively, but maintained the 60 fils/m^3 rate for the first block. The average tariff for water sold is presently 196 fils/m^3 (US$0.65). The sewerage surcharge on water consumed has remained unchanged for the last four years but was increased by about 65% to 50 fils/m^3 (US$0.16) on January 1, 1978. At present, AWSA derives 31% of its sewerage income from the surcharge and the balance of 69%, from connection charges (29%), sewerage tax (31%) and other income (9%). The water surcharge is projected to yield 52% of AWSA's sewerage income in 1981 as the present sewerage tax is fixed by law at 4% of the rental value of all property in Amman. (See Annex C-1 for Tariffs and Fees Schedule.

3.14 Although the World Bank assumes substantial rate increases, the timing and extent of the increases is unclear at this time. Based on Annex E, Social Soundness Analysis, the current tariff schedule does not impose an undue burden on the urban poor. Indeed, house connections appear to be less expensive than other available alternatives for obtaining water since public taps are virtually non-existent.

3. Repayment Prospects

3.15 A debt-service analysis was made recently (January-February 1978) by USAID and GOJ for the purpose of projecting the impact of the proposed Maqarin Dam and Potash Projects. The analysis concluded that Jordan's debt service relative to expected foreign exchange earnings is manageable. The analysis shows debt service as a percentage of exports and non-factor services peaking at 13.8 percent in 1979 and declining gradually thereafter (See Amman 1118). This proposed loan, considering the concessionary terms recommended, will not have a significant adverse impact on the debt service ratio. The detailed financial analysis is attached as Annex C.

4. Issues

Two issues were identified during the course of Project development:

a. Issue: Reservoir Withdrawal Schedule

3.16 As indicated in Annex C, Financial Analysis, AWSA may increase its income by increasing average water tariffs, and, over the short run, increasing total water sold through a more rapid draw-down of the King Talal reservoir. At this time, the schedule of monthly and annual withdrawals from the reservoir is unclear. Therefore, as indicated above, a condition precedent to initial disbursement will require the borrower to submit an operating plan for utilization of water in the reservoir.

b. Issue: Tariff Study

3.17 As indicated in Annex E, Social Analysis, the pattern of future expansion of water supply and distribution and sewerage appears to have been developed primarily with a concern for financial return to AWSA. If AWSA is to be encouraged to expand service in poor neighborhoods while remaining a financially viable utility, a careful study of its tariff structure (including connection fees and sewerage surcharges) will be necessary. AWSA will be encouraged to undertake such a study.

C. Economic Analysis

3.18 An economic rate of return calculation for the Project is presented in Tables 1, 2, and 3 in Annex D. Incremental costs and revenues (at 1978 constant prices) from 1979-2031 were utilized in deriving the 2.5 percent economic rate of return. As noted below (and in Annex D) the major sources of benefits are nonquantifiable. This economic rate of return calculation therefore, is unrepresentative of the probable real economic

3.19 The calculation excludes the value of health benefits which could not at this time be estimated nor projected in quantified form. It is clear that without the Project the health conditions of the projected population of Amman would substantially deteriorate.

3.20 The analysis also excludes the probable cost savings to lower income householders derived from switching their supply resource from water tankers to house connections. Neither did the analysis include quantification of health benefits derived from conversion from cesspools to sewerage house connections. Cost savings of house connections versus cesspool construction and pumping were also not included. The illustrative information presented in Annex E, Social Analysis is inadequate to quantify these savings for the total population or provide a basis for consumers surplus calculation.

3.21 In view of the limitation as to benefit quantification noted above no benefit cost ratio was calculated. The least cost solution as to Project feasibility expenditures has already been discussed in the Technical Section above.

D. Social Analysis

1. Introduction

3.22 The city of Amman has a total population of about 700,000. They are distributed in more than 20 relatively distinct areas in a very hilly terrain. These areas can, to some extent, be considered as high, medium or low income neighborhoods, although these categories are less meaningful in Jordan than in western society, for several reasons. Chief among these factors are strong extended family ties which frequently dictate that relatives live near each other regardless of differences in income, and housing shortages which often cause families with high incomes to remain in simple lodgings.

3.23 In April of 1978, AID financed TDY for a Social Scientist to carry out a social soundness analysis of the Amman Water and Sewerage Systems.* The report is on file in NE/PD and pertinent tables have been reproduced in Annex E. Unfortunately, there are almost no firm data in Jordan indicating per capita income, average salaries or cost of living. It is, therefore, difficult to state with precision how much people earn and what constitutes urban poverty. Jordan presently enjoys full employment. The Employment Survey of 1976 lists figures for those employed in establishments with five or more employees in the city of Amman. The survey provides thesefigures by sector, and provides average salaries in each sector. These are given in Table V of Annex E together with the percentage of salaried employees in each sector. These percentages are indicative of the extent to which these

*AID Contract No. AID/NE-C-1493 Project No. 278-0181 "A Social Soundness Analysis of the Amman Water and Sewerage Systems", Dated April 17, 1978, by Jarir S. Dajani, Associate Professor of Civil Engineering, Stanford University.

average salaries are representative of employment in a particular sector, since it is highly likely that those who are self-employed or family-employed work in smaller establishments employing less than five persons. This is indeed the case, since, 83.4% of all those employed are represented in the survey. These figures show that the average salary is JD 316. Considering that minimum wages for government employees run at about JD 500, and considering the high cost of living in Amman, it is reasonable to draw the poverty line at about JD 800 per worker. With an average of 1.27 workers per household, this line can be drawn at about JD 1,000 ($3,000) per household or JD 166 ($500) per capita for an average family of six. Home interviews with a number of poor households have confirmed, albeit subjectively, that households living on this per capita income do indeed represent that sector of the population which finds it hardest to live in Amman. It should be emphasized that this definition of the poverty line should be considered as a crude and rough estimate only, since there are no hard data to support it.

3.24 Of the approximately 430,000* persons who will receive water and sewerage connections during this project, it is estimated that 21.5% can be classified as urban poor, Annex E, Table 1. Although this is a low percentage of poor beneficiaries, it is not inconsistent with estimates of income distribution for Amman shown in Table 2 indicating that about 23% of the 1977 population and 34% in 1981 fall into this category. Furthermore, it should be noted, Table 3, Annex E, that with one exception, Nadiff**, the poorest areas (neighborhoods) will have substantial increases in the percentage of population with access to sewerage from 1977 to 1981, varying from 9% to 53% (see Table 3). In no case, however, will the increase in the percentage of the ponulation with access to sewerage and water be as great as in the higher income areas, where some neighborhoods such as Sports City will have an estimated 85% increase in access to water and sewerage.

2. Ability to Pay

3.25 As shown in Table 6, Annex E, citizens being connected to municipal water and sewerage lines will have a long-term financial benefit in terms of reduced costs for these services. Poorer residents now pay as much as 15% of their income to purchase water from private tankers and to have cesspools emptied every one or two months. After

* In the absence of a recent census or household income survey, all the figures referred to here must be thought of as approximate. A poor household is considered to have an annual income of less than JD 1,000, or per capita of JD 166 or less. See the Social Soundness Analysis in Annex E for more information.

** Although Nadif will receive 3,600 new sewer connections, it will in fact have a lower overall percentage of persons connected in 1981 than at present (dropping from 42.6% to 41% because of the rise in population.

connection, we estimate that yearly payments will cost no more than 6% of a low income, and in many cases, will be even lower. Ability to pay for services should therefore be better than at present. Initial connection costs, however, are sometimes as high as 1/3 of low income salaries, and would be difficult for poorer residents to pay. Solutions to this are proposed below.

3. Benefits to be Expected from the Project

3.26 Not only will Amman's citizens benefit financially from these services, as shown above, but more importantly, they will receive clean city water in place of sometimes polluted water now purchased from private tankers using unauthorized wells. In addition, substitution of piped city sewerage for current cesspools, especially in the denser low income areas, will reduce chances of pollution to city aquifers and ultimately lower risks of waterborne epidemics for the entire city.

4. Problems of Access for Intended Beneficiaries

3.27 A major problem which may inhibit the ability of the poor to take advantage of improved access to water and sewerage is that initial connection costs, especially for sewerage, are sometimes as high as JD 200. This could be as much as one-third the annual salary of a low income family.

3.28 A second problem is that some of the lower income areas either have no roof tanks or an inadequate number in which to store water since even piped water is not and will not be delivered continuously all year round in Amman. Lack of roof tanks is caused either because the owner cannot afford to purchase and install these tanks (cost is $50-$100), or because landlords refuse to install them in rent-controlled areas, since they cannot raise rents to compensate for this expense. Where these water storage facilities are lacking, residents will not benefit fully, since they will either have to store water in unsanitary used petrol or wooden containers, or they will have to supplement their supply with purchases from private tankers during water-short periods. In both cases, they will run the risks of polluted water, and may also face higher costs.

3.29 The most practical solution to facilitate connection payments for low income groups is a system of 12-18 month installment payments. Such a system will be developed by the GOJ in conformity with the requirements of the AID loan agreement.

3.30 Actions which might help alleviate problems caused by lack of water storage facilities include a) investigation of the possibility

of requiring landowners to install roof tanks and plumbing systems with 3-4 faucets and of allowing them small rent increases to cover these costs; b home improvement loans to allow low-income owners to make these necessary improvements.

3.31 These recommended actions will be discussed with GOJ during early project implementation.

5. Impact on Urban Poor

3.32 The consultant's report made a series of recommendations concerning the improvement of project impact on the urban poor. Those considered most feasible are discussed below. The consultant's social soundness analysis noted that AWSA plans through 1990 will still leave many of the dense, low-income areas of Amman with less than 60% connected to sewers. This plan has undoubtedly been influenced by the fact that higher income areas are charged more for connecting, which both subsidizes low income area connections and also contributes to AWSA's overall expenses. However, a main incentive for improving sewerage service in Amman has been the fact that the wide-spread cesspool system is contributing to serious pollution in the city aquifer and is believed to cause summer outbreaks of cholera and other gastro-entereal infections. Since the poorer areas are most dense and also most likely to neglect cesspool maintenance, AWSA will be encouraged to re-evaluate the allocation of sewerage services for the 1981-1990 investment program, and that serious consideration be given to increasing sewerage connections in the denser quarters of Amman.

3.33 The health benefits accruing to all the residents of Amman from increased connections in the most crowded urban areas exceed those of high income area connections, since the risks of epidemics and water contamination are reduced significantly and since appreciably more land per dwelling is available for cesspools in the wealthier areas.

3.34 As shown in Table Three, Annex E, the number of people connected to water in each area will rise, however the final percentages of connections in 1981, relative to the total populations in several areas, will actually decrease in 4 years.

3.35 Many low income areas will continue to have 30% or more not connected to municipal water in 1981. AWSA states that private tanker fees for water are the same as municipal tankers. These rates should be strictly enforced so that unserved residents will not continue to pay excessive rates for water and thus access to services will be improved.

3.36 The need for a tariff study will be discussed with GOJ. One of its purposes will be to determine methods by which low-income group water consumption could be raised and excessive water consumption discouraged through a more steeply graduated tariff structure.

6. Impact on Women

3.37 Since this project will affect households in Amman, it will naturally have an impact on the total population. It is, therefore, considered unnecessary to elaborate on the special benefits which will accrue to women, since they are part of this total population.

E. Environmental Analysis

1. Summary

3.38 In conformity with the recommendations of the Initial Environmental Analysis (Annex A), an Environmental Assessment (EA) was undertaken by Stanley Consultants, Inc. A draft of the EA was submitted at the end of May to AID, copies of which are on file in NE/PD. The major conclusions of the EA are presented in Annex F.

3.39 The following summarizes their major findings:

a. Unavoidable Adverse Impacts

i. Water Quality: There will be long-term decreases in the quality of water in the King Talal reservoir impacting on the Amman water supply and on irrigation (including irrigation along the Zerqa River upstream of the reservoir). Lack of data makes it difficult to quantify long term changes in water quality as a result of water recycling through the Amman system, and pollution of the Zerqa River upstream of the reservoir from agricultural chemical

run-off, industrial wastes, and municipal waste (sewage) from Zerqa, Ruseifa, and Jarash. Based on VBB's analysis, it does not appear that total dissolved solids (TDS) will become a problem until after the year 2000 (and at a higher rate of extraction from the reservoir than that to be developed by the Project). Nitrate build-up may exceed WHO minimum standards after 1990. If nitrates do build up in the reservoir, improved and more sophisticated water treatment will be necessary. However, these conclusions are tentative and based upon inadequate data. For example, build-up of toxins from industrial waste is not quantified.

ii. Domestic vs Agricultural Water Use: Use of water for Amman from the King Talal reservoir will reduce the amount of land which potentially could be irrigated in the Jordan Valley. This is discussed in Section IIIA2 above.

b. Avoidable Adverse Effects:

3.40 The report recommends the following specific measures be taken to minimize possible adverse environmental effects of the Project:

i. Industrial Pollution: The GOJ should establish and enforce minimum quality standards for the industrial discharge into the Zerqa.

ii. Monitoring System: The GOJ should establish a water quality monitoring system to monitor compliance with water quality standards as well as water quality all along the Zerqa and at the reservoir.

iii. Sewage Treatment and Water Treatment Plant: Certain design modifications were recommended regarding the handling of sludge.

3.41 Review of the EA indicates that, with certain design modifications in the water and sewage treatment plants, the Project is environmentally sound at the anticipated level of withdrawal from the King Talal Dam reservoir. Longer term problems such as those cited in Paragraph a i above cannot be properly evaluated at this time. The environmental consequences of delaying the Project to develop a better data base must be weighed against the probability that major questions will remain unclear until the overall system is functioning. Thus delaying the Project for environmental reasons will not serve any anticipated environmental purpose.

3.42 Until the water transmission pipeline is complete and operational, detailed information on changes in water quality will not be available. It is clear, however, that steps can be taken now to reduce the level of pollution of the Zerqa River and thereby retard possible deterioration in the quality of water in the King Talal reservoir. The following has been included in the Project to address this point:

i. Sewage Treatment Plant

3.43 (a) The AWSA consultant preparing the final design for the plant is reviewing the use of mechanical de-watering to increase the capacity of the plant and eliminate the problems created by the sludge drying beds. The final tender documents will reflect the best judgment of AID, AWSA, and the consultant regarding the most efficient operation of the plant. In addition, a plan to improve the disposal of sludge will be a condition precedent to disbursement for the plant.

(b) Borrower will covenant to submit a plan for the proper treatment of all additional sewage which will result from the Project's expended sewerage system to avoid overloading the existing plant.

ii. Water Treatment Plant

3.44 Borrower will submit final designs for the disposal of chemical sludge and waste water as a condition precedent to disbursement for AID's portion of the water transmission line.

iii. Water Monitoring System

3.45 Borrower will covenant to establish an overall water monitoring system to measure changes in water quality over time with respect to the acquifers, the Zerqa River, and the King Talal reservoir. Borrower, as part of that system, will establish minimum industrial waste water quality standards.

iv. Use of King Talal Reservoir

3.46 If Borrower plans to increase annual withdrawal from the reservoir above 17 MCM annually, a revised reservoir operational plan will be reviewed with AID, including an evaluation of the environmental impact of the increased withdrawal.

F. Administrative Feasibility*

1. Borrower Sector Programs and Priorities

3.47 The Government of Jordan's (GOJ) current Five Year Plan (1976-1980) has established the following program for water suppliers and sewerage in Jordan:

---drill new wells to increase the quantity of drinking water produced in various regions;
---expand water networks and construct new storage tanks in the various governorates;
---adopt a progressive water tariff structure to control consumption; and
---undertake sewerage projects to improve facilities in Amman and Salt and sewerage studies in other main cities.

3.48 The sector investment program as presented in the Plan and as revised to reflect the proposed project for Amman and Salt is as follows:

SECTOR INVESTMENT PROGRAM
(in U.S. Dollars 000)

	Water Supply	Sewerage	Total
Area:			
Amman	79.5	29.7	109.2
Jordan Valley	9.9	----	9.9
Governorates			
Amman/Balqa	6.6	4.8	11.4
Irbid	22.5	----	22.5
Karak/Ma'an	41.5	----	41.5
Irbid, Zerqa, Jerash (studies)	----	0.2	0.2
Total	160.0	34.7	194.7

*This section is drawn from the World Bank Appraisal Report, No. 1817a-JO, 1978.

49 By the end of the Plan, it is estimated that 66 percent of the otal urban population of Jordan will enjoy water connection compared with the current 10 percent.

3.50 The continuing major sector objective will be to increase the amount of water available for community water supplies. The scarcity of water, or high cost of its transportation is reflected in the low national per capita consumption, estimated at 28 lpcd (expected to rise to 38 lpcd by 1985). In small villages and refugee camps consumption can be as low as 10-15 lpcd.

3.51 It is clear from the above table that the GOJ is concerned with the expansion of water supplies through Jordan. Over 50 percent of the planned investment will be outside the City of Amman. However, because the concentration of population in Amman and the constant threat of serious epidemics of water-related diseases due to unsanitary conditions, the GOJ's highest priority at present is given to the provision of safe water supplies and waste disposal systems in Amman.

2. Sector Organization

a. Natural Resources Authority

3.52 The Natural Resources Authority (NRA) has overall responsibility for water resources studies and water planning throughout Jordan. In consultation with IDA, the Government created the Amman Water and Sewerage Authority (AWSA) through Law 19 in 1973, which has the responsibility for water supply, sanitary sewerage and surface drainage in Amman.

b. The Water Supply Corporation

3.53 In 1973 the Water Supply Corporation (WSC) was established, succeeding the NRA water Supply Department. WSC assists the smaller municipalities in the design and construction of water supply projects. After commissioning, WSC transfers the system to the municipalities which, in turn, assume maintenance and operation responsibilities. WSC also acts as a bulk supplier of water to a large number of towns and villages. The WSC Board of Directors is headed by a Director-General and is responsible to the Ministry of Rural Affairs (see below). The WSC employs about 700 persons, 70 technicians and 603 unskilled workers. At present, a reorganization is being undertaken

after the departure of some key staff; and it is not clear how the final organization will evolve. In any event, the Corporation will require substantial strengthening of its technical, operational and administrative staff in order to effectively develop and execute the Government's water supply program in WSC's area of responsibility.

c. The Jordan Valley Authority

3.54 The East Jordan Valley is under the jurisdiction of the Jordan Valley Authority (JVA), and domestic water supplies in the valley fall under the jurisdiction of JVA. As a successor to the Jordan Valley Commission (JVC) which had been established in 1973, JVA was incorporated in 1977 to assume JVC's program of development, policy making, project financing, and construction contract administration. In the area of water supply, JVA has three geographical subdivisions: Northern Ghor (10 settlements), Central or Middle East Ghor (18 settlements), and Southwest Ghor (8 settlements).

d. The Ministry of Rural Affairs

3.55 The Ministry of Rural Affairs (MRA) is responsible for design and construction of sewerage systems outside Amman. Responsibility for maintenance and operation of the existing rudimentary systems, principally cesspool pumping, rests with the municipalities. In 1973, consideration was given by the Government to form a National Water and Sewerage Board; and enabling legislation was drafted. However, no further action has yet been taken. The Municipal and Village Loan Fund (MVLF) assists in the WSC with the financing of small projects in some villages, and also lends directly to municipalities and village councils. Established within MRA as a specialized credit institution to provide financing for municipal and village projects, the MVLF depends upon WSC and MRA for technical assistance in processing its water supply and sewerage loans.

3. Implementing Agency

a. General

3.56 The project will be implemented by the Amman Water and Sewerage Authority (AWSA). AWSA was established by law in 1973 as an autonomous authority to take over and operate from the Amman Municipality all

water supply, sanitary sewerage and storm water drainage functions. A new law was enacted on December 16, 1977, the principal function of which was to authorize AWSA's compulsory acquisition of customers' meters and to charge meter rent. The new law was required after a court had held that AWSA did not have this power under its original law. With this modification, the World Bank considers AWSA's legal structure to be adequate. A copy of the Amman Water and Sewerage Authority Law of 1977 is on file in NE/PD.

3.57 Control of AWSA is vested in an eight-member board consisting of the Lord Mayor of Amman as Chairman, the General Manager of AWSA, two members of the Municipal Council, one representative each of the Ministry of Health and the Natural Resources Authority and two representatives of the private sector. The General Manager, appointed by the Prime Minister on the recommendation of the Board, is responsible for implementing the Board's policy and for the day-to-day operation of the Authority.

b. Organization and Management

3.58 In the past, AWSA has been handicapped by poor organization and lack of delegation of authority, and the engineering and accounting units remained weak. The operation and maintenance of water supply facilities suffered from a shortage of trained supervisory, operational and maintenance staff, caused in part by the low salary structure. Substantial progress has been made by AWSA in solving these problems during the last four years, particularly as a result of assistance provided by IDA Credit 18-JO but a considerable amount of work remains to be done to consolidate the progress made and to improve the operational and managerial practices.

c. Personnel

3.59 AWSA has established a salary structure which is competitive with the private sector in Jordan and which has enabled it to recruit qualified staff. Staff turnover is high, averaging 16% per annum during the last three years, due mainly to the high salaries offered in neighboring Arab countries. AWSA, in common with the private sector, cannot attempt to offer competitive salaries to stem this movement and has consequently undertaken an active training program to

maintain the capability of its staff. In addition, AWSA has overstaffed its departments in order to ensure that adequate staff are available at all times. Staff increased by 32 percent in the three-year period ending July 1977, which was not justified by the increased operational responsibility. At present AWSA has 1,040 employees, 770 in the water section and 270 in the sewerage section, compared with 620 recommended by their consultants. AWSA is overstaffed by international standards, but not by the standards of neighboring countries. However, AWSA has an adequate salary structure and so should be able to achiefe increased productivity, thereby reducing overall staff requirements. During negotiations with IDA, it was agreed that prior to December 31, 1978 AWSA will undertake a review of staffing requirements through 1984, prepare a report and discuss the report with IDA prior to implementation and that during the interim, AWSA will maintain its staff level under 1,100. This requirement was included in the IDA Credit Agreement.

d. Training

3.60 During the four years, 1974-77, AWSA undertook an active training program for its staff. Seventy staff members attended courses in Jordan conducted by foreign consultants and local institutions, and ten members attended foreign institutes. With the turnover of staff at 16% per annum, AWSA loses some of the benefits of its training. However, remittances from these emigrant workers contribute substantial amounts of foreign exchange to the Jordanian economy; and eventually the majority are expected to return. To sustain and improve the competance of AWSA's staff, it is essential that an active training program be maintained. Provision has been included in the IDA Credit for U.S. $180,000 for the foreign exchange cost of training. The emphasis in training will be to upgrade the capability of incumbent staff in order to meet the additional requirements imposed by the expanded facilities evolving from the proposed investment program. The British Overseas Development Administration (ODA) has provided three engineers for design, construction supervision and training of counterparts; and training will be provided by the engineering consultants. AWSA also expects to avail itself of other bilateral training assistance. During negotiations with IDA, it was agreed that AWSA would prepare a training program by September 30, 1978 and would implement the program after discussions with the Association.

3.61 To encourage AWSA's training effort, the AID Loan Agreement will require that AWSA submit a staffing and training plan for the operation and maintenance of the King Talal water transmission system as a condition precedent to disbursement for that system. AWSA will be encouraged to include staff training in either the various construction contracts or in the construction supervision contract for the King Talal system.

e. Accounting

3.62 AWSA had the assistance of an accounting advisor from ODA until December 1976. An adequate billing and collection and stores control system is now in operation. However, since the departure of the ODA advisor, difficulties and delays are being experienced in processing of the financial accounts. To overcome these problems, AWSA has signed a contract with its local auditor, Shair and Company, to assist in developing the accounting system and coding the accounts for future transfer to a computer after implementing the manual accounting system. It is planned to introduce the new accounting system next year, but a decision to computerize will not be made until the manual system has been properly established. This arrangement is satisfactory and should enable AWSA to overcome the present accounting problems by mid-1978.

f. Project Management

3.63 AWSA has appointed a full-time project manager for the Project who will be responsible for the day-to-day coordination of construction activities under the Project. In addition, in conformity with the requirements of Section 3.01 (b) of the IDA Credit Agreement, AWSA will appoint a senior engineer who will become responsible for the program to reduce unaccounted-for water consisting of (a) the enforcement of a leak detection measure, (b) the calibration and testing of production meters and (c) the supervision of meter replacement staff.

3.64 As a result of discussions between the AID Mission and GOJ (AWSA and NPC), it was agreed that assistance in the management of Project construction was necessary to assure effective and timely implementation. It was agreed further that this assistance would be financed under the AID Loan. The signing of a construction management contract has been included as a condition precedent under the AID Loan.

3.65 With the addition of construction management assistance, AWSA's management and administrative capacity is sufficient to implement the Project. In addition, AID concurs in the World Bank's judgment that AWSA has the capability to manage the expanded water and sewerage system with the implementation of training activities discussed above.

3.66 The 611(e) certification is attached as Annex I.

IV. PROJECT IMPLEMENTATION AND EVALUATION

A. Project Implementation Schedule

1. Schedule

4.01 Table IV-1 is a summary schedule for the implementation of AID-financed components of the Project.

4.02 It should be noted that significant pre-implementation action has been possible as a result of the completion of the design phase of a major portion of project prior to the scheduled authorization of the AID loan. For that reason, it will be possible to complete the bulk of construction within 3 years following the signing of the AID loan.

4.03 Review of the IDA Schedule indicates that the procurement (under the IDA credit) of construction materials necessary for implementation of the water supply component of AID-financed Contract 5WS will be available when needed for that contract.

4.04 Regarding the Saudi-financed portion of the King Talal water transmission system, it is anticipated that its implementation will parallel the AID-financed contract. Submission of an executed construction contract for this work will be a condition precedent to disbursement for the AID-financed portion of the water transmission system.

4.05 AWSA will be requested to prepare a serviced, integrated implementation plan for the Project as a condition precedent to initial disbursement under the AID loan.

B. Loan Schedule

4.06

Loan Authorization	July 15, 1978
Loan Signing	August 15, 1978
Initial CP's Met	November 15, 1978
PACD	December 31, 1981

Disbursement Schedule (A.I.D. Loan)
(in US$000)

	1978	1979	1980	198.	Total
King Talal Water Trnsmsn	1,170	10,530	10,530	1,170	23,400
Water Dist & Sewerage					
1S	360	2,880	360		3,600
5WS	350	2,800	350		3,500
Wahdat & Shelieh		646	2,754		3,400
Sewage Treatment		3,200	800		4,000
Construction Mgt.	100	400	400	200	1,100
TOTAL	1,980	20,456	15,194	1,370	39,000

TABLE IV -1

AID-FINANCED CONTRACT IMPLEMENTATION SCHEDULE

ACTIVITIES/CONTRACTS	King Talal System	Contract 1S	Contract 5WS	Sewage Treatment Plant	Wahdat & Shelleh	Construction/ Mgt. Contract
I. Pre-Implementation						
CBD Notice for Construction Prequalification Published	1/78	4/78	4/78	3/78		
Draft Construction Bid Documents Submitted	5/78	3/78	3/78	5/78		
Qualified Construction Contractors Selected	5/78	6/78	6/78	6/78		
Contract Documents issued to Qualified Construction Firms	6/78	6/78	6/78	7/78		
II. Implementation						
CBD Notice for Consultant Expressions of Interest Published					7/78	6/78
RFP Issued to Prequalified Firms					9/78	8/78
Consultant Contract Signed					12/78	11/78
Construction Bid Opening	8/78	8/78	8/78	9/78		
Construction Contracts Approved	10/78	10/78	10/78	11/78		
RFP to Construction Contractors Issued	11/78	11/78	11/78	12/78		
CBD Notice for Construction Prequalification for Wahdat/Shelleh Published					3/79	

TABLE IV -1

AID-FINANCED CONTRACT IMPLEMENTATION SCHEDULE (cont.)

ACTIVITIES/CONTRACTS

II. Implementation (cont.)	King Talal System	Contract 1S	Contract 5WS	Sewage Treatment Plant	Wahdat & Shellah	Construction/ Mgt. Contract
Draft Construction Bid Documents for Wadhat/ Shellah Submitted					4/79	
Construction Bid Documents Issued to Pre-qualified Firms					6/79	
Construction Bid Opening					8/79	
Construction Contract Approved					10/79	
NTP to Construction Contractor Issued					12/79	
Construction Completed	10/81	12/80	12/80	4/80	12/80	

C. Host Country Implementation

1. Amman Water and Sewerage Authority

4.07 Overall project management and implementation will be the responsibility of AWSA. Within AWSA, administrative responsibility for the Project will be vested in the Director General and his Technical Deputy Director. A specific Project Manager responsible to the Deputy Director has been named and will coordinate day-to-day project activities. As discussed below, a construction management team will be contracted under the project and work with AWSA to assist in project implementation.

2. Project Engineering Consultants

a. Final Design and Supervision of Construction

4.08 Detailed feasibility and design studies for the Project, excluding the unnumbered contracts for water distribution and sewerage, were carried out by three engineering firms: SOGREAH for the King Talal Water Transmission System; VBB for the water distribution and sewerage systems, and Binnie and Partners for the sewage treatment plant. The three contracts provide for expansion to include construction supervision of the particular components.

4.09 AWSA has decided to amend its contract with Binnie and Partners to cover the supervision of the expansion of the sewage treatment plant. It is the Mission's understanding that the SOGREAH contract also will be amended to include construction supervision for the King Talal water transmission system. For water distribution and sewerage, however, AWSA has opted to request proposals for the supervision of construction from six other engineering firms - (two U.S., three British, and one Danish). Technical and cost proposals are expected shortly with a contract negotiated within three months.

4.10 AWSA will finance the cost of the SOGREAH and Binnie Contracts. The IDA Credit will finance the foreign exchange portion of the contract for the water distribution and sewage system with AWSA financing the local cost portion.

4.11 With the exception of Project works in the Wahdat and Shelieh areas, AID loan resources will not be utilized to finance the engineering supervision contracts. To assure adequate supervision of the

AID-financed construction contracts, AWSA will submit the executed contracts for supervision for review by AID. AID requirements for supervision services have been discussed with AWSA and examples of appropriate scopes of work have been provided. Submission of executed contracts for supervision with scopes of work acceptable to AID will be a condition precedent to disbursement for construction services for the King Talal water transmission system, expansion of the sewage treatment plant, and water distribution and sewerage contracts 1S and 5WS.

4.12 Regarding the unnumbered contracts for water distribution and sewerage, AWSA has requested that the consultant engineering contract for final design, preparation of bid documents, and supervision be eligible for financing under the AID loan. It is anticipated therefore that a U.S. engineering firm will be contracted under the loan to undertake engineering consultant services for these contracts.

b. Construction Management Services

4.13 AWSA will be faced with a substantial administrative/management burden during the Project to service four separate engineering contracts for supervision of construction involving a number of construction contracts financed from four sources (AID, World Bank, Saudi Fund, and GOJ Resources). As indicated in Section III H above, AWSA's management resources will be severely taxed by the Project. This problem was discussed with AWSA and NPC and it was agreed that the inclusion of construction management assistance to AWSA's Project Office would be extremely beneficial. It was agreed that construction management services will be included in the Project and financed under the AID Loan The management team will assist AWSA in overall coordination of Project implementation. This concept also has been discussed with and endorsed by the World Bank. In view of the importance of this project element, it will be included in the Loan Agreement as a condition precedent to disbursement for construction services.

D. Project Monitoring

1. USAID Mission

4.14 USAID/Jordan will be responsible for AID Project monitoring. Within the Mission, primary monitoring responsibility will rest with the Office of Capital Development. It is anticipated that the Project

Manager will be the Mission chief engineer within the Office of Capital Development. No major requirements for direct-hire TDY assistance for Project monitoring activities are anticipated. Project coordination with the World Bank will be handled primarily in AID/W by NE/PD. The World Bank anticipates sending Project review Missions to Jordan approximately twice yearly. It is expected that during these missions a joint USAID, World Bank and GOJ review will be held.

2. Project Procurement

4.15 Procurement under the AID Loan will be handled by host country contracting in conformity with AID Handbook 11. As indicated above, draft bid documents for construction services for all but the unnumbered contracts have been submitted and reviewed by AID. Final procurement documents will require AID legal and technical review prior to approval. Legal review will be undertaken in AID/W. Technical review will require TDY assistance from the engineering office of NE/PD until the arrival in Jordan of the sanitary engineer who will assume responsibility for Project management.

4.16 Prequalification of construction firms already has been completed for the AID-financed contracts for the King Talal Water Transmission System. Eight firms (all U.S. or U.S.-Jordanian joint ventures) have been prequalified. Prequalification for the remaining AID-financed contracts is in progress. No unusual or difficult procurement problems are foreseen.

3. Project Evaluation

4.17 The project will be monitored annually at the output level to determine the rate of progress in constructuion of Project elements. This report will be prepared by AWSA derived from reports of its supervisory engineering firms and the construction management team. Progress toward achievement of the Project purpose (see Log Frame, Annex G), also will be evaluated on an annual basis following completion of construction. A review of the purpose-level assumptions and identification of factors which have or could hinder attainment of the project purpose will also be assessed. AWSA will submit an evaluation report with supporting data such as numbers of connections, meters and consumer billings added to the system and analyses of water and sewerage quality samplings taken to monitor health aspects of the project.

> "It is not now possible to either forecast or retrospectively measure the precise health benefits that can be attributed to the introduction or upgrading of water supply systems. The problem is researchability of the topic." (See John S. Alden, NE/TECH/HND memorandum of February 16, 1978, entitled, "Measuring the Health Benefits of Water Supply" - Memo on file NE/PD).

A joint GOJ-AID review will be held attended by AWSA, NPC, JVA (as appropriate), and USAID. A report of the results of the meeting will be added to the annual evaluation.

Progress toward compliance with the AID Loan covenants will be specifically reviewed during annual project evaluations.

V. CONDITIONS, COVENANTS, AND NEGOTIATION STATUS

A. Conditions Precedent to Disbursement

1. Conditions Precent to Initial Disbursement

5.01 In addition to receipt of Borrower's legal opinion attesting to the validity of the Loan agreement and naming the Borrower's representatives, the following conditions precedent to initial disbursement are recommended:

a. Evidence that the proceeds of the AID Loan have been made available to AWSA;

b. Plan for the utilization of the King Talal Dam reservoir, including:

i. Estimated monthly withdrawal schedule for Amman municipal use and for irrigation to 1989.

ii. Evidence of agreement between AWSA and JVA for the allocation of water from the reservoir development for (i), including the involvement of JVA in regulating extraction from King Talal;

c. Evidence that the overhead power line and other electrical installations not included in the construction contracts under the project but necessary for the operation of the King Talal water transmission system will be installed on a timely basis;

d. Submission of: i) an integrated project implementation schedule; ii) evidence of financial commitments by GOJ, IBRD and Saudi Fund for the King Talal transmission system and the water distribution and sewerage system; and

e. Submission of a contract for assistance in the management of all construction activities under the Project.

2. Additional Conditions Precedent to Disbursement for Construction Services for the King Talal Water Transmission System

5.02 Borrower will be required to submit the following in form and substance satisfactory to AID:

a. Submission of a signed construction contract for the work to be financed under the AID Loan;

b. Submission of a signed contract for construction supervision;

c. Design for disposal of waste water and chemical sludge waste from water pre-treatment and treatment;

d. Training plan for the operation and maintenance of the King Talal water transmission system;

e. Signed contract for the water intake structure and the water transmission pipeline; and

f. Evidence that AWSA has unencumbered use of the right-of-way for the pipeline and all other components of the system.

3. Additional Conditions Precedent to Disbursement for Other Construction Services

5.03 For construction services for areas 1S, 5WS and Wahdat/Shelieh and the expansion of the sewage treatment plant, Borrower will submit the following prior to disbursement for each particular contract.

a. Executed contract for supervisory engineering services for the particular construction contract;

b. Executed construction contract;

c. Evidence of unencumbered use of the right-of-way or other land required for carrying out the particular contract;

d. For construction services related to the expansion of the sewage treatment plant, a training plan for the operation and maintenance of the facilities to be constructed/installed under the Project.

B. Special Covenants

5.05 The following covenants are recommended for inclusion in the Loan Agreement:

1. Borrower covenants that within one year from the effective date of the Loan Agreement, a water monitoring system will be established to monitor the quality and quantity of water in the King Talal reservoir,

the upper and lower aquifers, and the Zerqa River to the King Talal Reservoir. As part of the monitoring system, Borrower agrees to undertake a review of industrial and municipal pollution of the Zerqa River above the King Talal Dam and establish procedures to maintain mutually acceptable standards of water quality of the Zerqa River.

2. Borrower covenants that within one year following the effective date of the loan agreement, a plan for the disposal of dried sludge from the sewage treatment plant will be prepared and within two years following the effective date of the agreement the plan will be implemented.

3. Borrower covenants to undertake, within one year from the effective date of the agreement, a feasibility study to review the requirements for expanding the treatment of the increased quantity of piped sewage which will result from the Project. Upon completion, Borrower, in consultation with AID, will prepare and implement a plan to expand sewage treatment plant.

4. Borrower will undertake, within one year from the effective date of the Agreement, a study of the financial constraints limiting the access of lower income families to the water and sewerage system and identify means of assisting those families as needed. The results of the study will be reviewed by Borrower and AID, following which, Borrower will establish procedures, as agreed between the Borrower and AID and within a mutually-acceptable time frame, to assure access of lower income families.

5. If borrower determines that the total annual withdrawal from the King Talal Reservoir will exceed the level stipulated in the reservoir operational plan submitted in conformity with the conditions precedent to initial disbursement, Borrower agrees to review the proposed revised operational plan with AID, including an assessment of the environmental implications of the anticipated increased total annual withdrawal and to take such steps as may have been agreed in such review.

6. Borrower covenants to undertake, within one year from the effective date of the Agreement, a study of solid waste disposal within Amman, including the relationship between current waste disposal and Amman's water resources. Results of the study will be reviewed by Borrower and AID and the agreed results of such review incorporated in procedures for disposal of Amman's solid wastes.

7. Borrower agrees to review with A.I.D. possible rate schedules for water and sewerage service during the course of the project and devise a rate structure which will make the AWSA financially viable.

C. Negotiating Status

5.05 All the above conditions and covenants have been discussed with and agreed to by NPC and AWSA. No difficulty is foreseen in the negotiation of the loan agreement.

THRESHOLD DECISION BASED ON INITIAL ENVIRONMENTAL EXAMINATION

Project Location: Jordan

Project Title: Amman Water and Sewerage Project

Funding (Fiscal Year and Amount): FY 1978: $28.5 million
FY 1979: $12.0 million

IEE Prepared By: Terrence J. Brown Date: February 7, 1978
NE/CD/SJIL

Environmental Action Recommended: Environmental Assessment

Near East Bureau Decision:

APPROVED: Sally W. Shelton

DISAPPROVED: _____

DATE: 2-10-78

Clearances:

DSB/ENGR: J.Cassanos (Draft) Date: 2/7/78
GC/NE: J.Miller (Draft) Date: 2/8/78

INITIAL ENVIRONMENT EXAMINATION
NARRATIVE DISCUSSION

1. Project Location: Jordan

2. Project Title: Amman Water and Sewerage Project

3. Funding (Fiscal Year and Amount): FY 1978: $28.5 million
   FY 1979: $12.0 million

4. IEE Prepared By: Terrence J. Brown Date: February 7, 1978
   NE/CD/SJIL

5. Action Recommended: Environmental Assessment

6. Discussion of Major Environmental Relationships of Project Relevant to Attached Impact Identification and Evaluation Form:

Project Description

The proposed project consist of the expansion of the water supply system to the City of Amman, Jordan and the expansion of the water distribution and sewerage systems within Amman.

1. Water Supply

Amman now depends on two aquifers in the Amman-Zarqa basin for its water resources. Instability of production typifies the performance of the existing well fields. A review of the performance of the wells was conducted in August 1977, and from examination of the data obtained it can be concluded that the aquifers are being mined.

Thorough investigation of the two aquifers has led to the conclusion that the future demands of Amman cannot be met from these sources. Therefore, studies have been conducted by the Amman Water and Sewerage Authority (AWSA) and its consultants in which alternative potential sources have been examined in order to determine their possible utilization for Amman's water supply. Six groundwater and four surface water sources were studied. Of these sources only the King Talal Dam reservoir is available for development to meet Amman's immediate needs.

The King Talal Dam reservoir is located about 35 Km northwest of Amman on the Zarqa River downstream from Amman and Jordan's second largest city Zarqa. The Dam was recently completed and the reservoir is filling. Total reservoir line storage capacity is approximately 48 Mm3. The project will make possible the transmission of approximately 15 Mm3 per annum to the AWSA system in Amman. The first stage elements in the water transmission system include: floating intake, treatment plant, pumping stations, transmission line and terminal reservoir. Water will be pumped from the intake directly into the treatment plant which has an approximate capacity of 700 lps and thence into an 800 mm transmission line. Three pumping stations will provide the 900 m lift from the dam reservoir to the terminal reservoir in Amman, which has a planned capacity of 35,000 Mm3. This reservoir will be installed at an elevation approximately 100 m below the highest service area in Amman, and the final lift into a high level distribution system will be via booster pumps.

2. Water Distribution and Sewerage System

This aspect of the proposed project, which is part of AWSA's ongoing work program, would consist of extending the Amman water distribution system and the sewage collection system to improve the levels of the service in Amman including those areas in which the urban poor reside. Connections to the water supply system are expected to increase from 41,600 in 1976 to 52,200 in 1980, with a concomitant increase in consumption from 35 liters per capita per day (lpcd) to 48 lpcd. Water produced will increase from 14.21 Mm3/year in 1976 to 20.00 Mm3/year in 1980. Sewerage connections are expected to increase from 7,900 in 1976 to 28,000 in 1980. Sewage flow will increase from 2.7 Mm3/year in 1976 to 8.3 Mm3 in 1980.

Specifically, the project will include:

(a) Construction of approximately 207 Km of water mains, laterals and house connections.

(b) Construction of 225 Km of sewerage mains, laterals and service connections.

(c) Expansion of the sewage treatment plant including installation of a new sludge digestion tank (6,000 Mm3 capacity), sludge drying beds (15,000 Mm3 capacity) and sludge storage (3,000 Mm3).

Total cost of the project is estimated to be approximately $110 million. The Saudi Fund for Economic Development will contribute approximately $20 million to the construction of the water transmission line. The World Bank intends to provide an IDA credit of $14.0 million to finance part of the foreign exchange cost of the water distribution and sewerage systems. AID anticipates lending a total of $40.5 million to contribute to the financing of the water transmission systems (including water treatment), the distribution and sewerage systems, and the expansion of the sewage treatment plant. The Government of Jordan will finance the balance of the cost of the project.

Discussion of Impacts

The following briefly discusses the impact areas and sub-areas summarized in the attached Impact Identification and Evaluation Form:

A. Land Use

1. Changing the character of the land through:

a. Increasing the population: low.

b. Extracting natural resources: As discussed above, Amman is extracting water from available groundwater sources at a rate in excess of the potential recharge of these sources. Until the King Talal water transmission line is installed, AWSA will have to increase its mining of these sources. Since both the upper and lower aquifers are currently evidencing significant levels of pollution from human sources, the short-and long-term impact of the increased draw-down of the aquifers should be evaluated.

c. Land clearing: Construction of the water transmission system will involve clearing of right-of-way. Current information indicates adverse environmental impacts should be limited. This observation should be verified.

d. Changing soil character: low.

B. Water Quality

1. Physical state of water: No information is available currently regarding the present impact on ground water of the dumping of solid waste (sludge from the sewage treatment plant and garbage disposal) and its future impact on groundwater and the King Talal reservoir. This should be evaluated.

2. Chemical and biological states: Pollution of the King Talal reservoir (which lies downstream of Amman and Jordan's second largest city, Zarqa) should be carefully studied since the project will change the use of the reservoir from its intended use for irrigation to the dual purpose of irrigation and water supply for Amman. The study should evaluate the impact of solid waste, industrial sources of pollution, and the effluent from the sewage treatment plant (since a substantial percentage of the water extracted from the reservoir by AWSA may return to the Zarqa River and thus to the reservoir according to AWSA's consultants). The quality of the water to be stored has not been accurately determined since the reservoir is not yet full. Existing information is based upon flowing water at the dam site and upstream of it. The reservoir will be filled with water from groundwater sources in the Amman-Zarqa basin and rainwater. It is expected that rainwater will dilute the relatively saline (TDS average value 950 ppm) groundwater to an estimated 800 ppm. A consultant to AWSA has stated that the expected chemical composition and bacterial contamination of the reservoir should be such that a normal water treatment process will be sufficient. Their findings indicate that up to a rate of extraction from the reservoir of 30 Mm3/year, and without special treatment, TDS and No3 concentrations will be comparably high during 2-3 months of the year, but as a whole acceptable according to WHO standards. The effect of occasional peak concentrations could be reduced, the consultant believes, by using more groundwater during these periods. Their conclusions should be verified and the recommended treatment plant to be constructed under the project should be assessed.

In addition, the impact of anticipated changes in water quality in the King Talal reservoir and its use for irrigated agriculture should be assessed.

3. Ecological balance - Medium

C. Atmospheric

1. Air additives - None

2. Air pollution - None

3. Noise pollution - None

D. Natural Resources

1. Diversion, altered use of water: Since the King Talal Dam and reservoir are in place, no environmental aspects of their construction will be undertaken in connection with the project except changes in the quality of the water in the reservoir noted above.

2. Irreversible, inefficient commitments: None.

E. Cultural

1. Altering physical symbols: None

2. Dilution of cultural traditions: None

F. Socio-Economic

1. Changes in employment/employment patterns: The provision of a dependable water supply (quality and quantity) is essential for the continued economic growth of Amman. Without the project, severe restrictions would be placed on growth and the quality of life would deteriorate.

2. Changes in population: None.

3. Changes in cultural patterns: Little.

G. Health

1. Changing a natural environment: Little.

2. Eliminating an ecosystem element: Little.

H. General

1. International impacts: None.

2. Controversial impacts: None.

3. Other factors: None.

On the basis of the above, it is recommended that an Environmental Assessment be undertaken.

IMPACT IDENTIFICATION AND EVALUATION FORM

Impact Areas and Sub-areas	Impact Identification and Evaluation 1/
A. LAND USE	
1. Changing the character of the land through:	
a. Increasing the population	L
b. Extracting natural resources	H
c. Land clearing	U
d. Changing soil character	L
2. Altering natural defenses	
3. Foreclosing important uses	
4. Jeopardizing man or his works	
5. Other factors	
_____	
_____	
B. WATER QUALITY	
1. Physical state of water	U
2. Chemical and biological states	U
3. Ecological balance	M
4. Other factors	
_____	
_____	

1/ N - No environmental impact
L - Little environmental impact
M - Moderate environmental impact
H - High environmental impact
U - Unknown environmental impact

C. ATMOSPHERIC

1. Air additives	N
2. Air pollution	N
3. Noise pollution	N
4. Other factors	

D. NATURAL RESOURCES

1. Diversion, altered use of water	L
2. Irreversible, inefficient commitments	L
3. Other factors	

E. CULTURAL

1. Altering physical symbols	N
2. Dilution of cultural traditions	N
3. Other factors	

F. SOCIOECONOMIC

1. Changes in economic/employment patterns	H
2. Changes in population	N
3. Changes in cultural patterns	L
4. Other factors	

G. HEALTH

1. Changing a natural environment — L
2. Eliminating an ecosystem element — N
3. Other factors

H. GENERAL

1. International impacts — N
2. Controversial impacts — N
3. Other factors

I. OTHER POSSIBLE IMPACTS (not listed above)

Prepared By: Terrence J. Brown Date: 2/7/78

Project Location: Jordan

Project Title: Amman Water and Sewerage Project

TECHNICAL ANALYSIS

The Project consists of the following major elements:

--- Construction of a 25 km. water transmission pipeline from the King Talal Dam reservoir to terminal reservoirs at the outskirts of Amman, including water treatment facilities, pumping stations and reservoirs;

--- Construction of a 4 km pipeline from the terminal reservoirs to a distribution reservoir in the city;

--- Expansion of the water distribution and sewerage systems within Amman;

--- Up-grading the sewage treatment plant for Amman.

The following sections will summarize the results of the detailed feasibility/design studies completed for the various project elements, including detailed cost estimates.

A. King Talal Dam Water Transmission Pipeline

1. Alternatives Analysis

As a result of the rapid growth of the population of Amman and the limited groundwater resources which now supply the city, chronic water shortages and significant suppressed demand for water have developed. It has been determined that groundwater resources within the Amman area are not adequate to safely meet demand beyond 1980/81 (even this will require mining available groundwater resources); therefore, other water resources must be developed as rapidly as possible. The King Talal Dam reservoir has been identified as the only available source of additional water of adequate quantity and quality which can be brought into Amman within the near future. The following summarizes the data upon which these conclusions are based.

a. Projected Water Demand for Amman

A number of factors make an accurate assessment of the demand for water in Amman to the year 2000 difficult at best,

including: (1) the lack of reliable records on the actual supply and consumption of water; (2) demand for water has been inhibited for a number of years due to the inadequate supply of water; and (3) the population of Amman and its projected rate of growth is a subject of considerable controversy. Two recent studies have been made projecting the demand for water in Amman, the "Feasibility Study for the Amman Water Supply and Sewerage Facilities" by Vattenbyggnadsbyran (VBB) in association with Fawzi and Associates, prepared in 1976 and "North Jordan Water Use Strategy" by Howard Humphreys and Sons in 1978 (draft). The VBB and Humphrey projections are presented in Table B-1.

As indicated in Figure Table B-1, VBB and Humphreys differ considerable as a result of the following:

(1) The average annual rate of growth of Amman from 1975-2000 was estimated to be 3.9 percent by VBB and 4.7 percent by Humphreys. The social and environmental analyses (Annex E and F respectively) support the higher growth rate used by Humphreys.

(2) VBB's projected increases in annual consumption are based upon total estimated rates of actual consumption in 1975 and assume an increase in per capita consumption of 2 lpcd/year. Required production also is based upon the assumption that unaccounted for water will decline from 44% of water production to 30%. Humphreys estimated what consumption would have been without a supply constraint (including suppressed demand) but with a less rapid increase in per-capita consumption.

(3) VBB's baseline population estimate was 30,000 less than Humphreys'.

Although Humphreys may have more accurately estimated demand for water in Amman, VBB's projections for required total water production will be used for projecting water needs for the following reasons. First, it is unreasonable to assume that actual demand can be fulfilled given the shortage of water in North Jordan and the time and cost of developing additional water resources. Second, the data base is extremely weak for the measurement of total demand. In view of the uncertain data base, it appears reasonable to accept the VBB projections as minimum water production requirements with (at best)

TABLE B-1

Projected Non-Agricultural Demand for Water in Amman
1978-1990 (in 1,000 cubic meters/year)

YEAR	VBB WATER SALES	VBB WATER PRODUCTION	HUMPHREYS DEMAND	PROJECT WATER SALES	PROJECTIVE WATER PRODUCTION	(Of which:) (Aquifers)	(K. Talal)
1978	12,022	21,467	28,900	11,700	18,000	(18,000)	------
1979	13,105	22,991	41,700	12,730	19,000	(19,000)	------
1980	14,235	24,543	44,500	13,880	20,000	(20,000)	------
1981	15,431	26,154	47,500	14,700	21,000	(21,000)	------
1982	16,694	27,824	50,700	16,700	23,500	(20,000)	3,500
1983	18,008	29,521	54,200	18,000	25,200	(20,000)	5,200
1984	19,371	31,243	57,900	19,200	26,700	(20,000)	6,700
1985	20,805	33,024	61,800	20,800	28,900	(20,000)	8,900
1986	22,291	34,829	65,400	22,300	31,000	(20,000)	11,000
1987	23,827	36,657	69,000	23,800	33,100	(20,000)	13,100
1988			73,000	25,300	35,100	(20,000)	15,100
1989			71,100	27,000	37,500	(20,000)	15,100
1990	28,846	43,706	81,500	28,800	40,000	(20,000)	15,000

very modest increases in per-capita consumption. To fall below those projections would imply a deterioration in per-capita consumption. It is clear, however, that by the end of the Project and beyond, water demand will continue to be suppressed by limited supply. The projected water sales and water production estimates used for the Project are presented in Table B-1. It should be noted that total water sales are lower than the VBB projections to 1982, reflected lower actual sales in the period 1976-77. Project water production estimates (water sales plus unaccounted for water) is somewhat lower than VBB's projections as a result of lower anticipated water losses.

b. Current Water Resources

All water supplied to Amman is ground water extracted from wells tapping the two aquifers which underlie the Amman-Zarqa basin, the upper aquifer (Amman Wadi Sir) nd the lower aquifer (Hummar). Several detailed investigations of these aquifers have been made. The following analysis is based on that prepared by VBB:

(1) Upper Aquifer

The upper aquifer is unconfined and is recharged naturally by rainfall and wadi floods within the 850 km^2 area of the Amman Zarqa basin. VBB estimates that the natural annual recharge of the aquifer in the Amman area is approximately 12 Mm^3. An additional 9 Mm^3/year enters the aquifer from cesspool effluent and 2 Mm^3/year from leaks in the water distribution system. In 1976, Amman extracted approximately 13 Mm^3 from the upper aquifer. Based on a computer simulation analysis VBB estimates that out of that total 5 Mm^3 were derived from the natural recharge, 6 Mm^3 from cesspool effluent, and 2 Mm^3 from distribution system leakage. As a result of the higher level of cesspool effluent being re-cycled through the upper aquifer, water quality is deteriorating as indicated by increased levels of total dissolved solids (TDS), nitrates, and bacteriological contamination.

(2) Lower Aquifer

The lower aquifer is confined and is recharged from outside the Amman-Zarqa basin by both direct and indirect infiltration. VBB estimates that the total natural recharge of the lower aquifer is on the order of 5 Mm^3/year for the entire basin. Approximately 9 Mm^3/year is being extracted from the aquifer which

represents an overdraft of approximately 4 Mm^3/year. Amman extracted approximately 5.5 Mm^3/year from the lower aquifer in 1976. Water quality is good although some nitrate build-up has been recorded.

As a result of an analysis of the recharge and extraction rates for the upper and lower aquifers, VBB estimated the total sustainable yield from the aquifers assuming that the water and sewerage system discussed below were installed. The sustainable yield from the upper aquifer was estimated to be 10 Mm^3/year once the sewerage system is fully operational. This consists of 8 Mm^3/year from the annual natural recharge of 10 Mm^3/year (2 Mm^3/yr. cannot be extracted for technical reasons) and 2 Mm^3/year from recharge attributable to leaks in the distribution system (normal parameters for water loss from a distribution system are between 15-20% of total production). This will gradually increase to 5 Mm^3/year as the distribution system expands. Regarding the lower aquifer, total yield should not exceed 2-3 Mm^3/year in order to avoid mining of the aquifer. Short-term mining may be necessary however, until additional sources of water are brought into production.

c. Other Resources

VBB also evaluated alternatives for the supply of additional water to Amman to the year 2005. Six ground water and four surface water sources were investigated. Of these, only two were identified which appeared to satisfy the water quantity, quality, and availability requirements necessary to augment Amman's existing ground water resources: the King Talal Dam reservoir and the proposed Upper Wadi Wala Dam.

VBB recommended that the first outside resource to be tapped for Amman should be the King Talal Dam reservoir in an amount of at least 12 Mm^3/year. This was seen as the only resource which can with certainty be brought into operation by 1980-81. King Talal reservoir was to be developed in two stages of 20 and 12 Mm^3/year followed by the Upper Wala Dam with an estimated capacity of 12 Mm^3/year and finally a third stage of the King Talal reservoir of more than 20 Mm^3/year.

Subsequent to the VBB recommendations, problems were identified which have significantly changed the anticipated sources of additional water for Amman. These are as follows:

(1) Use of King Talal Dam Reservoir

The King Talal Dam was built to provide water for irrigation in the Jordan Valley by controlled release of water into the Zarqa River. The Government of Jordan has determined that the first stage of diversion of water from the King Talal reservoir to Amman will not exceed 12 Mm^3/year net abstraction or approximately 17 Mm^3/year gross abstraction.

(2) Other Resources

VBB did not include use of the Maqarin Dam reservoir as a possible source for water for Amman. The GOJ is currently reviewing the possibility of constructing a pipeline from the Maqarin reservoir to Amman which will provide water for municipal and industrial use to North Jordan, including Irbid, Zarqa, and Amman. Such a pipeline could provide an estimated 25 Mm^3 annually to Amman beginning in approximately 1987.

(3) Amman Ground Water

Humphreys indicates that the upper aquifer is not being fully utilized and additional water could be provided. No precise quantification of this resource has been made.

(4) Re-circulation of Waste

The King Talal Dam reservoir on the Zarqa River is downstream of Amman and the industrial center of Zarqa. All effluent from the Amman sewage treatment plant, from Zarqa, and agricultural run-off flow into the Zarqa and thence into the King Talal reservoir. It is estimated that approximately 50% of all water extracted from the reservoir for Amman will return to the reservoir in the form of effluent from the sewage treatment plant. As discussed in detail in the Environmental Assessment, extraction of water from the King Talal reservoir for use in Amman in amounts greater than 17 Mm^3/year will result in a gradual, significant increase in the nitrate level. Reduction of nitrate levels is feasible, but would require complex water treatment. At minimum, additional water of good quality should be tapped prior to the consideration of an increase in the amount of annual withdrawal from King Talal beyond 17 Mm^3.

(5) Upper Wadi Wala Reservoir

Construction of a reservoir in the upper reaches of the Wadi Wala would impound the erratic flood flows in that wadi. Although the hydrology is sufficiently known to make preliminary estimates of yields, the erratic nature of the floods indicates that it would be necessary to store the first four or five years' run-off following completion of the dam prior to extraction of water for Amman. Therefore, water resources would not be available from this source for at least nine years following initiation of the project. In addition, the geology of the area is less than ideal for dam construction and water impoundment.

As can be seen from the above, there is considerable uncertainty about the future sources of water for Amman. It is clear that significant additional resources will be necessary by 1980-81 to meet the minimum needs of the city. It also is clear that the only available source of water is the King Talal Dam reservoir. Beyond that, however, GOJ policy decisions regarding water allocation in North Jordan based upon further studies, including more detailed and specific knowledge about the water balance in the Amman-Zarqa basin, will be necessary. Given the possible other alternatives and in light of the environmental issues, the project is based upon the concept that the maximum withdrawal from King Talal reservoir will be 17 Mm^3/year and that Maqarin reservoir will provide the next increment in water resources. Existing resources from the aquifers plus the King Talal reservoir will provide sufficient water for Amman until approximately 1987 (15 Mm^3 + 18 Mm^3 from aquifers).

2. King Talal Reservoir Water Transmission System

The detailed design study for the pipeline and water treatment facilities was prepared by SOGREAH, a French engineering consultant under contract to AWSA. The final design report was completed in February, 1978. The system is designed to be capable of delivering annually 12 Mm^3 + 40 percent upon completion, or a total maximum volume of 17 Mm^3/year. It is anticipated that a total of 2 Mm^3/year will be provided to villages along the route of the pipeline, although the number and location of these branches have not been defined.

To avoid pumping during periods of peak power consumption in the Amman/Zerqa area, pumps will operate a maximum of 20 hrs/day. Therefore, the system is designed to deliver a maximum of 650 liters/second (lps). The major components of the system as designed by SOGREAH are: water intake structure; approximately 25 km of 800 mm and 4 km of 600 mm diameter pipes; complete water treatment and pre-treatment plants; and two terminal reservoirs with a capacity of 10,000 m^3 each. The following is a summary of the major components of this system.

a. Water Intake Structure

The King Talal Dam was designed only to provide irrigation water to the Jordan Valley through regulation of the release of water into the Zarqa river below the dam. Maximum live storage capacity is approximately 43 Mm^3. The difference between the maximum and minimum height of water in the dam, used for SOGREAH's analysis is the difference between the maximum level with a raised dam and the irrigation water offtake, approximately 48.5 m in the first stage and 58.0 m in the final stage after raising of the dam. Rapid increase in the water level as a result of wadi floods during the early part of the rainy season also can be expected. Several alternatives for the intake structure were considered, including a concrete intake tower in the reservoir, wet or dry shafts beside the reservoir, and a floating platform. For technical and economic reasons, a floating platform was selected. The floating pump station will support variable speed pump units and be held in place by anchorages fixed by means of cables and a constant torque winch on the opposite bank. Water will be pumped from a depth of 3 meters and delivered to a fixed collector on the bank by means of flexible pipes at a discharge rate of approximately 682 lps.

b. Pretreatment Plant

The pretreatment facilities consisting of prechlorination and screening will be constructed close to the intake station at an average elevation of 230 meters above sea level. Prechlorination will not only provide primary disinfection but will also serve to oxidize iron and manganese, if any. Chlorine dosages are expected to be in the range of 2 to 5 mg/l depending on the season. Heavier doses may be employed periodically to produce a shock effect (to oxidize organic matter in the pipe line and to protect it from algal growths). The screening device with 5 mm mesh will remove coarse solids which were not screened out in the water intake.

Since the King Talal reservoir was only completed in 1977, there are no records to indicate the amount of eutrophication that will occur in the reservoir. It is anticipated that, with an increase in the amount of sewage that is recycled, the amounts of algae in the reservoir will also increase. With the intake pipe three meters below the surface of the reservoir the quantity of algae drawn into the system may be minimal, even at times of heavy algal blooms. If algae do become a problem, it may be possible to adequately control them with the application of copper sulfate in the reservoir. Prechlorination will also provide some control. The consultant has, however, provided space for microscreening with 35 micron mesh; but the installation of this equipment has been deferred and will take place only if the presence of important quantities of algae is noted.

At the pretreatment plant there will be a building for the storage and feeding of chlorine. This building will also house the control equipment for the screening and microscreening devices.

c. Treatment Plant

The treatment plant has been designed according to French practice. The description given below includes some comments based on American practice. These comments were discussed with the consultant at his office in December 1977 but he made no changes in design. They will again be considered when AID reviews the final drawings.

The plant consists of the following units:

(1) Four rectangular presettling tanks, which have a dual function:

a. Compensating or regulating function to allow the station to operate with almost constant discharge. This function could also be achieved by constructing a regulating reservoir at the inlet to the treatment plant.

b. Presettling function: during normal periods of light turbidity the tanks will be used to settle the sludge removed from the filters during cleaning to be settled; and during periods of high turbidity, aluminum sulfate will be added to water and the tanks will reduce considerably the concentrations of suspended matter. The first of these functions is unnecessary since the washwater from the filters could be returned to the entrance to the flocculator. The effectiveness of the second function could be enhanced by installing a flocculator ahead of the tanks.

(2) A cascade aerator, made up of a series of weirs, "to oxygenate the water, oxidize the iron and manganese, and strip the dissolved gas". Whether or not this unit is necessary and whether this is the best place to aerate the water are debatable. In any event it uses up 7.5 meters of head. The annual pumping cost to lift the water an additional 7.5 meters is roughly JD 6,850.

(3) A flocculator with a detention time of 10 minutes, where aluminum sulfate, a flocculation aid and, if necessary, powdered activated carbon are added and mixed. The unit should probably be preceded by a rapid mixing device with a detention time of 10 to 30 seconds.

(4) Two circular sedimentation basins, 35 m in diameter, with a settling rate of 1.25 m/hr.

(5) Six rapid sand filters with a surface area of 80 m^2 and a flow rate of 5 to 6 m/h. This is the standard rate for sand filters. With the use of dual media (sand and coal), much higher filtration rates can be achieved. The consultant has allowed for bidding on dual-media filters as an alternate.

(6) The following ancillary structures are planned:

(i) a building beside the filters which will house the filter controls and:

--- equipment for the preparation and distribution of chemicals: containers, mixers, hoppers, dosimeters, etc. The doses of chemicals will be adjusted manually;

--- the monitoring and control room for the station as well as the central control facility for the entire water supply system;

--- fully-equipped offices;
--- sanitary installations, septic tank
--- a workshop for repairs and maintenance
--- other ancillary equipment including:

compressors for the filter gate drive and the regulation of the levels in the anti-water-hammer tanks boosters for filter cleaning; fully equipped laboratory for control tests.

(ii) a building for storage of chemicals

(iii) a building for chlorination comprising 3 rooms:

--- tank room with a monorail
--- chlorinator room
--- a monitoring and control room complete with emergency and first aid equipment.

This building is identical to the one planned at the pre-treatment station. Together, these two buildings can store a month's supply of chlorine. Additional empty chlorine tanks will be supplied to allow for stock replenishing.

There is no provision in the design for the disposal of the sludge produced in the treatment process. This is a matter of environmental concern. AID will not approve the final design until provisions are made for the disposal of sludge.

The plant has been designed for an input of 682 lps and an output of 650 lps. (The difference is the maximum amount that would be unavoidably wasted with the sludge). The flow rate of 650 lps assumes that the plant will operate at 17 Mm^3/yr or less. If the Jordan Valley Authority (JVA), the owner of the King Talal Dam and Reservoir, imposes a seasonal pumping schedule (similar to that proposed in Harza's feasibility study*), AWSA will be able to withdraw a maximum of only 13.81 Mm^3/yr at a pumping rate of 650 lps. (See Table B-2.)

In order to obtain the flexibility required for a seasonal pumping schedule, one additional (standby) pump would be needed at each pumping station and the presettling, flocculation and sedimentation processes would have to be modified. No additional filter

*Harza Engineering Overseas Company, "Jordan Valley Irrigation Project Stage II Feasibility Study, January 1978, Volume II, Appendix C, Table C-7.

capacity would be needed if coal and sand are the filter media. These changes will be discussed again with AWSA and the consultant during the review of the final construction drawings and modifications made, if possible. The additional cost, if any, of the changes would be met from the physical contingency item in cost estimates.

TABLE B-2

Schedule for Seasonal Withdrawals from King Talal Reservoir and Effect of Limiting Pumping to 650 lps

	Net Abstractions - MCM			Net Abstractions + 40%	Maximum Abstractions at rate of 650 lps
	Amman*	Villages	Total		
January	0.30	0.17	0.47	0.66	0.66
February	0.30	0.17	0.47	0.66	0.66
March	0.50	0.17	0.67	0.94	0.94
April	0.72	0.17	0.89	1.25	1.25
May	1.23	0.17	1.40	1.96	1.40
June	1.23	0.17	1.40	1.96	1.40
July	1.33	0.17	1.50	2.10	1.40
August	1.33	0.17	1.50	2.10	1.40
September	1.23	0.17	1.40	1.96	1.40
October	0.83	0.17	1.00	1.40	1.40
November	0.50	0.17	0.67	0.94	0.94
December	0.50	0.17	0.67	0.94	0.94
Annual	10.00	2.00	12.00	16.89	13.81

*Harza Engineering Overseas Company "Jordan Valley Irrigation Project Stage II Feasibility Study, January 1978, Volume II, Appendix C, Table C-7.

d. Pipeline and Pumping Stations

An 800 mm coated steel pipeline, 25 km long, will be installed from the intake station to two terminal reservoirs (R15) of 10,000 m^3 each, to be constructed under this project, at the outskirts of Amman. From the terminal reservoirs a 600 mm coated steel pipeline, 4.035 km long, will be installed to take water by gravity to an existing resevoir (R10), which will feed the distribution system. The foreign exchange costs of the pipe will be funded from the Saudi Fund as part of Contract I. The selection of the pipe diameters of the two pipelines will be discussed later in this section.

The water will be pumped four times: at the intake station, at the pretreatment plant (PS 1), at the treatment plant (PS 2) and at an intermediate point between the treatment plant and the terminal reservoirs (R 15). Each pump station will be equipped with three pumps, one of which is for standby. The pumps for the intake station, which are variable speed pumps operating on direct current, will be installed under Contract I, funded from the Saudi Fund. All the other pumps will be from the same manufacturer and will be installed under Contract II, which is partially funded from the AID loan. Space is provided at each pumping station for the installation of two additional pumps, if a second stage of this project is constructed.

Protection facilities against water hammer have been provided in the form of air-pressurized water chambers for each pumping section, except in the section from the intake station to the pretreatment plant. The protection against water hammer appears to be adequate.

The consultant has provided for cathodic protection of the steel pipeline from the intake station to R 15. The need for this degree of protection against external corrosion in a dry climate will be reexamined in the review of the final documents.

For the pipeline from R 15 to R 10 the consultant considered pipe diameters of 500, 600, 700 and 800 mm. The installation of a 500 mm diameter would lead to high velocity flows (3.3 m/s) at 650 lps and the dissipation of all available energy. The use of 700 mm and 800 mm pipe would require an excessively high dissipation of energy. The 600 mm pipeline appears to be a reasonable compromise: the velocity of 2.3 m/sec is reasonable, the lower head to be dissipated (45 m) makes it possible, by using a bypass system with R 10, to gravity feed the distribution network directly (either occasionally and possibly continuously). This supply line will be fitted with an over-speed

valve and an air inlet device just below reservoir R 15 and a regulating valve to dissipate energy at the entrance to reservoir R 10 and an isolating or bypass valve so that water can be fed directly to the distribution system. The pipeline appears to be adequately protected.

A question has been raised about the selection of the diameter of the King Talal transmission line. The consultant has recommended a 800 mm line on the assumption that there will be a second stage of development during which the flow would be 24 Mm^3/yr $\pm$ 40% or 34 Mm^3/yr. If, however, the output of the system does not exceed an average rate of 17 Mm^3/yr (650 lps), a 600 mm pipeline would be adequate.

Ideally withdrawals should be on a seasonal schedule to conform to the irrigation demands of the Jordan Valley Authority. Assuming that seasonal analysis was made of the power savings that would be realized using an 800 mm rather than a 600 mm diameter (see Tables B-4 through B-8). The installation of an 800 mm pipe would provide the flexibility needed to accomodate a seasonal pumping schedule. If a 600 mm pipe were installed, it probably would not be possible to operate with three pumps at a pumping rate of 975 lps.

TABLE B-4
HEAD LOSSES
FOR VARYING PUMP CONDITIONS

No. of Pumps		One Pump				Two Pumps				Three Pumps			
		600 mm		800 mm		600 mm		800 mm		600 mm		800 mm	
Section	Geometric Head - m	Head Loss	TDH m	Head Loss	TDH m	Head Loss	TDH	Head Loss	TDH	Head Loss	TDH	Head Loss	TDH
IS to PTP	113	1	114	1	114	8	121	2	115	12	125	5	118
PSI to R 15	787	42	829	5	792	174	961	43	830	319	1219	78	865
Total	900	43	943	6	906	182	1082	45	945	331	1344	83	983

IS = Intake Station

PTP = Pretreatment Plant

PSI = Pumping Station No. 1

R 15 = Reservoir No. 15

TABLE B-5
FLOW CONDITIONS
(LITERS PER SECOND)

Flow Conditions - liters/second

	One Pump	Two Pumps	Three Pumps
IS to PTP	341	682	1023
PS1 to R 15	325	650	975

TABLE B-6
POWER SAVINGS
(30-day month - 20 hours per day)

	One Pump	Two Pumps	Three Pumps
Power Requirement-600 mm pipe	485 kw	8652 kw	16,093 kw
Power Requirement-800 mm pipe	466 kw	7559 kw	13,133 kw
Difference	19 kw	1093 kw	2,960 kw
Savings in Energy with 800 mm pipe	11,400 kwh/mo	655,800 kwh/mo	1,776,000 kwh/mo
Value of Savings @ JD 0.015/kwh	JD 171/mo	JD 9837/mo	JD 26,640/mo
	JD 2052/yr	JD 118,000/yr	JD 320,000/yr

TABLE B-7
POWER SAVINGS WITH A SEASONAL PUMPING SCHEDULE

	Net Abstractions - MCM			Net Abstractions	Pumping Schedule-Hrs/day			Savings Pumping
	Amman*	Villages	Total	+40%	One Pump	Two Pumps	Three Pumps	Cost-JD
January	0.30	0.17	0.47	0.66	20	-	-	171
February	0.30	0.17	0.47	0.66	20	-	-	171
March	0.50	0.17	0.67	0.94	7	13	-	6,450
April	0.72	0.17	0.89	1.25	3	17	-	8,387
May	1.23	0.17	1.40	1.96	-	2	18	24,960
June	1.23	0.17	1.40	1.96	-	2	18	24,960
July	1.33	0.17	1.50	2.10	-	-	20	26,640
August	1.33	0.17	1.50	2.10	-	-	20	26,640
September	1.23	0.17	1.40	1.96	-	2	18	24,960
October	0.83	0.17	1.00	1.40	-	20	-	9,837
November	0.50	0.17	0.67	0.94	7	13	-	6,450
December	0.50	0.17	0.67	0.94	7	13	-	6,450
Annual	10.00	2.00	12.00	16.80				184,805

*Harza Engineering Overseas Company "Jordan Valley Irrigation Project Stage II Feasibility Study January 1978, Volume II, Appendix C, Table C-7

TABLE B-8
PIPE COSTS

Maximum Service Pressure	Length**	600 mm Unit Price*	600 mm Total	800 mm Unit Price*	800 mm Total
60 bars	6,649	73	JD 485,377	130	JD 864,370
40 bars	4,840	57	275,880	102	493,680
25 bars	13,508	48	648,384	86	1,161,688
	24,997		JD 1,409,641		JD 2,519,738

Difference in pipe cost - JD 1,110,000

* Price for laid pipeline - From SOGREAH Report, page 15.

**From SOGREAH Report, page 38.

For three-pump operation and a flow of 975 lps, the maximum service pressures for 600 mm pipe will be greater than those computed by SOGREAH for an 800 mm pipe at 1300 lps. The worst condition would be that all the 600 mm pipe would have to withstand pressures of 60 bars. In that case the cost of 600 mm pipe would be JD 1,824,781 and the difference in cost between the two sizes would be JD 695,000.

Thus, the additional investment of installing 800 mm pipe now could range from JD 695,000 to JD 1,110,000. The present worth of a savings of JD 182,000 at a discount rate of 10% is as follows:

Over 5 years - JD 690,000

Over 10 years- JD 1,118,000

e. Civil Engineering Works

This item, Subcontract II-4, includes the construction of earthwork and access roads at the pretreatment plant, housing at the treatment plant for operating staff, three pumping stations and four reservoirs. The civil works for the intake station, pretreatment plant and treatment plant will be built as part of the subcontracts for those units.

f. Electromechanical, Electrical and Control Equipment (Subcontract II-3)

The electromechanical equipment includes: pumps and motors for three pumping stations. The electrical equipment includes transformers with auxiliary switches and circuit breakers at the three pumping stations and at the intake station.

Because of the distance between the water intake and the terminal reservoir and because the pumping installations must be shut down during the peak of power demand so as not to overload the electricity grid, a certain amount of automatic operation is needed. The installations upstream of the treatment plant are regulated from downstream; in other words the pumping stations are "slaved" to the level of the reservoirs to which they are pumping. The installations downstream from the treatment station are regulated from upstream; in other words the pumping stations are "slaved" to the level in the reservoirs from which they are pumping. The consultant has developed sequences for starting and stopping the pumps, which if followed will avoid wastage of water and energy. Each structure will have equipment for the control and regulation of the structure itself.

The general control of all the installations will be effected from a centralized control facility located in the treatment plant building. The

control facility will be connected to all structures and will transmit instructions and record and process all data supplied from the various structures. The types of information that will be transmitted are pumping station discharges, pump start and stop, very high and low levels in reservoirs, manual or automatic operation, operational faults, flow overfeed and chlorine leakage. The equipment will include teletransmission equipment, transmitter-radio for transmission of systematic data and transmitter-receiver radio for telephone links. The teletransmission equipment will be of the "call-and-reply" type, whereby the central control point calls the local control points, which transmit on demand the information stored in memory between two calls.

While this is relatively simple computer equipment, it will still require maintenance by trained mechanics. It is planned that the supplier of the equipment will provide the necessary training of AWSA's employees.

B. Water Distribution and Sewerage

1. GENERAL

The water distribution and sewerage work in this project is an extension of AWSA's ongoing program VBB was responsible for the design of this part of the project. The work is divided into eleven numbered contracts and two unnumbered contracts. Contracts 1S for sewerage and 5WS for water and sewerage and the two unnumbered contracts for water and sewerage in Wahdat and Shelieh will be partially funded from the loan. The other contracts will be financed from the World Bank credit and by AWSA. Contract 1S includes 54.2 km of main sewers, laterals and house connections. Contract 5WS includes 65.1 km of water mains, laterals and house connections and a booster pumping station; and 56.8 km of main sewers, laterals and house connections and a sewage pumping station. The work at Wahdat includes 30 km of water mains and 18.5 of sewers while the work at Shelieh includes 6 km of water mains and 6 km of sewers. The contract documents for 1S and 5WS are ready for bidding. VBB has done the feasibility studies for the work at Wahdat and Shelieh. The engineering for the design and preparation of contract documents will be financed from this loan.

Unaccounted-for Water 1/

2.07 The principa operating problem in the water supply sector in Amman is the high percentage of unaccounted-for water. Details for the period 1975 through 1977 are shown as follows:

Year	Population ('000)	Water Produced ('000 m3)	Water Sold ('000 m3)	% of Unaccounted-for-Water
1975	626	17,560	9,140	47.9
1976	655	14,210	8,330	41.3
1977 /1	685	17,500	10,850	38.0

/1 Projected.

2.08 The leakage survey conducted by AWSA in 1974 estimated an annual loss of 1.9 Mm3/year, or approximately 12% of production, through leakage, above ground defects, and substandard repair methods. In 1975 more than 3,000 leaks were reported and properly repaired; therefore, it is essential that the program should be continued. No illegal connections were detected during the survey. AWSA now estimates that, as a result of the ongoing leak detection and repair program, the annual loss due to leakage is less than 10%.

2.09 Through the installation of improved telephone systems and with the inauguration of the portable radio communication system, AWSA has greatly improved communication between key elements of the water distribution system. This has led to a reduction in losses to less than 1% caused by overflowing reservoirs.

2.10 Inaccurate metering is responsible for the largest element of unaccounted-for water. Production meters were found in 1972 to be over-registering by at least 6% of the gross production. In 1975 over-registration was estimated to have reached 10% of production. While AWSA is now testing and monitoring production meters, the procedures need further improvement. The bulk supply from Wadi Sir to Amman was initially recorded at 80 l/sec, but a recent AWSA check at the point of entry into the Amman system showed the flow to be negligible due to increased off-taking by Wadi Sir Municipality. AWSA pays all the operating costs of the Wadi Sir system in addition to an annual fee to the Municipality of Wadi Sir for the right to use surplus water. During negotiations an assurance was received that the Government shall ensure that the Wadi Sir Municipality and AWSA shall make, by December 31, 1978, arrangements whereunder AWSA shall receive a specific daily supply of water from the Wadi Sir springs in return for operating the facilities and the payment of a specific fee to the Municipality of Wadi Sir.

2.11 Undoubtedly, the greatest determinant of unaccounted-for water is the large number of consumer-owned meters on house services. Since these are generally velocity meters, registration of low flow is inaccurate, particularly in view of the equalizing effect induced by the roof tanks. In 1975

1/ Source: [illegible] Appraisal Report, [illegible]

AWSA's consultants estimated an annual discrepancy of 4.8 Mm3 or 27% of production through unmetered flows. Under Credit 385-JO, AWSA purchased 12,000 volumetric meters to replace the unsatisfactory consumer-owned meters. However, the majority of these meters were in stock until recently as a court decided that AWSA was not authorized to remove private meters install the authority's meters and charge a meter rent. The problem has now been resolved (para 3.[illegible]). Under AWSA's recently established meter replacement program, 5,000 meters were replaced through January 1978. AWSA has initiated a water conservation program among Government agencies. In the program, AWSA is conducting a continuing survey of water meters and replacing defective and inoperative meters in schools, hospitals and institutions. Faulty valves and fittings are replaced by the agencies under AWSA direction.

2.12 As a result of all the above activity, the level of unaccounted-for water has been reduced from [illegible]% in 1972 to 41% in 1976 and is projected as 38% in 1977.1/ During 1975, for example, the total of over 47% unaccounted-for water was based upon the following estimates: 10% due to leakage, 10% to inaccurate production metering and 27% to under registration in users' meters. However, fragmentation of responsibility has precluded the implementation of a successful program for reduction of unaccounted for water. In order to ensure

refugee camps under an ongoing contract (para 2.17) will be installed free of charge. The average connection cost of JD 70.0 has not caused a major problem for owner-occupants. The existing covenant under Credit 385-JO requires that AWSA will take all necessary steps to ensure that all premises for which sewer laterals are constructed under the project will have sewerage service connections made not later than nine months following completion of the sewer laterals. This covenant was repeated in the new Project Agreement. In addition, agreement was reached that AWSA will levy a sewerage surcharge on properties that are not connected to the sewerage system within the statutory three month period.

C. Sewage Treatment Plant

Practically all the sewage of Amman is conveyed by gravity or by truck (cesspool pumpage) to the treatment plant at Ain Ghazal. The plant is designed for primary and secondary treatment by the activated sludge process and disinfection by chlorination. The design of the sewage treatment facilities is based on a connected population of 300,000 persons and a daily sewage flow of 60,000 cubic meters per day (m^3/day). The design criteria assumed a flow of 200 lpcd, which will not be reached until the end of the century, if then. The sludge treatment facilities consisting of thickeners, digesters and sludge drying beds are designed for a connected population of 150,000.

The plant was designed by VBB and construction was completed in . An assessment of plant performance by VBB in 1976 showed that about 135,000 persons were connected to the plant with a sewage flow of only about 10,000 m^3/d (about 74 lpcd). Under these conditions, of low flow and therefore a strong sewage, the sewage treatment part of the plant was operating much below its capacity while the sludge digesters and drying beds were overloaded. VBB estimated that the facilities for primary treatment have sufficient capacity to handle the sewage flow foreseen until 1990 but proposed that design and tender documents be prepared for an extension of the facilities for secondary treatment soon after 1980. VBB recommended an immediate expansion of the sludge handling facilities and some improvements in the treatment facilities.

In 1977 AWSA hired Binnie and Partners of London and Jouzy and Partners of Amman to assess the performance of the treatment units, to define precisely the immediate improvements needed in the plant and the necessary expansion of the sludge facilities, and to prepare design drawings, specifications and tender documents.

The consultants estimated that the population connected to the sewage treatment plant in 1980 will be about 450,000 and confirmed that the main treatment units will generally have sufficient capacity until the end of 1980, but that the facilities for sludge treatment and disposal require immediate expansion.

In a draft report dated January 1978, they recommended the immediate construction of a new digestion tank of 6000 m^3 capacity,

together with the necessary digestion equipment. Their report also provided for the construction of 15,000 m^2 of new sludge drying beds and 3,000 m^2 of sludge storage area (to fit the available space of 18,000 m^2). In addition they recommended a number of changes in the sewage treatment units to improve operation and treatment.

The consultants, however, had the following comments on the construction of additional sludge drying beds:

> The provision of these new drying beds will obviously be an improvement in the present sludge drying arrangements and the combined capacity of the existing and new beds will cope with a large proportion of the sludge depending on the drying cycle which will be achieved with the new beds. However, it is expected that considerable quantities of wet sludge will still have to be tankered to the Municipal dump during the next three years. This can of course only be acceptable in the short term and it will be necessary to study the whole strategy for long term sludge treatment and disposal in the next stage of development of the treatment facilities at the works.

The consultants were then asked by AWSA to consider alternate methods of dewatering the sludge. In a supplemental draft report dated April 1978, they recommended that mechanical dewatering by means of filter belt presses instead of sludge drying beds be provided as part of the immediate improvement program. These mechanical dewatering units will have sufficient capacity to handle the sludge load for several years after 1980; the number of units can be increased at relatively low cost when needed.

The total estimated cost of the immediate improvements incorporating mechanical dewatering equipment is JD 1.09 million (compared to JD 1.25 million for the program with sludge drying beds). The estimated total annual costs for the two methods of dewatering are JD 154,900 for sludge drying beds and JD 161,800 for mechanical dewatering. These estimates, however, are not a true comparison of the two processes of sludge drying by mechanical methods or on open beds since additional drying beds or alternate means of dewatering will be

needed at the end of 1980. If additional drying beds could be constructed to handle all the sludge generated three years from now, the total annual cost would be JD 289,000 as opposed to JD 161,800 for mechanical dewatering. As space is not available for constructing additional beds, it makes sense to go to mechanical dewatering now.

With the completion in 1980 of the expansion of the sewerage system funded by this project, the flow to the treatment plant will be about 30,000 m^3/d, if 450,000 persons are connected to the system. It is expected that the design flow of 60,000 m^3/d, from a connected population of about 900,000 persons, will be reached around 1988 or 1989. Thus the primary treatment units, which are designed on the basis of hydraulic loading, should have sufficient capacity until the end of the next decade. The secondary treatment (activated sludge) facilities however, which oxidize the organic matter, are designed for a biochemical oxygen demand (BOD) load of 25,000 kg/d. The organic loading depends on the number of persons contributing to the sewerage system. According to Binnie the organic loading in December 1980 will be 27,000 kg/d of BOD. Therefore the facilities for secondary treatment should be extended in 1980 or soon thereafter.

D. Conclusion

The proposed project will improve the water supply and distribution, sewage collection and sewage treatment facilities in Amman. Design of the proposed systems is in accordance with sound engineering principles using acceptable design criteria and valid approaches. The cost estimates have been reviewed by AID and are considered reasonable (see discussion of the costs of each element of the project in Section II, Project Description). The criteria of Section 611 (a) of the Foreign Assistance Act have been met. Alternative options were considered for the source of water, the water intake, the pipeline route, the treatment processes, pipe sizes of the water transmission line and water and sewage laterals, and the improvements to the sewage treatment plant. The project works represent the least cost solution for expanding and improving the Amman water and sewerage system.

FINANCIAL ANALYSIS

1. Introductory Statement as to Data Sources

The financial analysis presentation is based almost exclusively on the information and explanatory notes made available by the IBRD. That information provided the financial basis for the IDA Credit, "Amman Water Supply and Sewerage Project III", Report No. 1817a-JO, dated March 2, 1978. Two revisions were made by AID to those IBRD financial statements; one, a change in the presentation and the second, a more current estimate of the 1978-1981 AWSA investment program which had a direct effect on the financial projections.

The presentation change was simple. Since the IBRD had separate financial convenants for the water supply and sewerage sectors of AWSA's operation, the Income and Expenditure Statements were shown separately for both elements of AWSA's operations. These separate statements (Tables 2 and 3) are included but a table was added presenting an income and expenditure statement for AWSA's total operations (Table 1). The AID review of the income and expenditure experience and future performance of AWSA will include the total operations of the water supply and sewerage utility.

The A.I.D. calculation of estimated construction costs for the 1978-1981 AWSA program were about JD 1.4 million lower than those presented in the IBRD Appraisal Paper. The time phasing or implementation plan for the 1978-1981 AWSA investment program as calculated by AID was also different than the IBRD estimates. These revisions affected the financial analysis tables. For example, depreciation and the calculation of average net assets (as well as the rate of return and cash operating ratio) were revised in the various income and expenditure statements (Tables 1, 2 and 3). Construction Costs, and the Balance To Be Financed were revised in the Cash Flow Statements (Table 6) and the calculation of Net Fixed Assets adjested in the Balance Sheets (Table 5).

2. Past Performance 1974-1976 and Estimated 1977

Awsa's financial results during the three years 1974 through 1976 were unsatisfactory, with operating losses (including interest payments) of JD 52,000 in 1975 and JD 557,000 in 1976 exceeding the small surplus of JD 26,000 in 1974 (Table 1). The water supply segment of AWSA was apparently responsible for most of the operating deficits with negative returns in all three years - JD 69,000 in 1974, JD 139,000 in 1975 and JD 509,000 in 1976 (Table 2). The sewerage component of AWSA's operations did provide an operating surplus in 1974 and 1975 (JD 95,000 and JD 87,000 respectively) and a smaller deficit in 1976 of JD 48,000 thereby reducing somewhat the operating deficits generated by the water supply sector of AWSA.

The major cause of these losses has been the high rates of inflation during these years resulting in an increased AWSA operating cost of

about 77 per cent (from JD 953,000 in 1974 to JD 1,690,000 in 1976) with no substantial increase in water sold and only a small increase in average water tariffs (from 68 fils/m3 to 79 fils/m3 or about 16 percent) and no change whatsoever in the water surcharge for sewerage. Water sales in 1976 were almost identical with the 1974 level and caused primarily by the drought in 1976.

On January 1, 1977, AWSA increased the average water tariff by about 50 percent (from 79 fils/m3 to 120 fils/m3). The 1977 estimates (Table 1) do indicate an improved performance over 1976 with a reduction in the deficit before interest to JD 66,000 from the JD 454,000 deficit in 1976. Increased interest payments (from JD 103,000 in 1976 to JD 251,000 in 1977) did offset a significant part of this improvement.

Future Performance 1978-1984

Construction Program - 1978-1981

The most current estimated cost of the AWSA construction program for 1978-1981 is JD 35.5 million or $113.5 million at the JD 1 = $3.20 exchange rate. This total includes capitalized interest of about JD 2.0 million ($6.5 million). The sector details and implementation time phasing of the construction costs are presented in Table 6. From 1974 through 1976, AWSA's construction expenditures totalled JD 4.4 million.

Income and Expenditure Projections

Tables 1, 2 and 3 provide estimates of the projected financial performance for AWSA from 1978 through 1984. The basis for the various calculations are outlined in Table 7, the explanatory note to the financial projections.

The results shown in the income and expenditure statements for 1978-1984 as presented in the tables noted above appear favorable. AWSA as an operating entity will earn an unweighted rate of return on average net fixed assets for 1978-1984 of about 5.5 percent. The weighted average (by average net fixed assets) is approximately 5.3 percent. The water supply sector provides almost the total amounts of surplus before interest for the entire period (Table 2) with a weighted rate of return on average net fixed assets of 10.1 per cent. The sewerage sector of AWSA's operations for 1978-1984 manages to generate revenues approximately equivalent to operating and maintenance costs (a cumulative surplus before interest of JD 44 thousands).

There are two major assumptions made in the 1978-1984 water supply income and expenditure statements (Table 2) that require additional elaboration and discussion. These are (1) the average tariff (fils/m3) for water sold and (2) the quantity of water sold.

The projected average tariff for water sold (revenue per m3) is as follows:

1978 and 1979 - 196 fils/m3
1980 and 1981 - 250 fils/m3
1982, 1983 and 1984 - 355 fils/m3

The 1978 average tariff was calculated by AWSA (and accepted by the IBRD) utilizing the 1977 consumption pattern and the new tariff schedule introduced in January 1, 1978. The percentage increases in the average water for 1980-81 and 1982 to 1984 using 1978 as the base year is 28 percent for 1980-81 and 81 percent for 1982-84. If 1977 is considered as the base year, the increases are more substantial: 1978-79 - 63%; 1980-81 - 103% and 1982-84 - 196%. The information is not available to convert these average tariff rates for water sold into a new tariff schedule for the different block consumption levels adopted in the current water supply tariff.

Financial Impact on 1980-84 Results of Constant 1978 Average Water Tariff

To illustrate the probable need for increases in average water tariffs from current 1978 levels, an illustrative calculation was made holding the 1978 average water tariff constant. Under that illustrative calculation, the following comparative results are recorded (JD thousand):

Surplus Before Interest (Deficit)

	Table 2	Constant 1978 Average Water Tariff	Difference
1980	1060	310	-1370
1981	1513	719	-794
1982	2252	(404)	-2656
1983	1953	(909)	-2962
1983	1836	(1218)	-3048

By 1982, with the average water tariff held at 1978 levels, the operating surplus becomes a deficit and the cumulative deficits are quite substantial. It would appear most likely that substantial increases in AWSA price level for water sold will be required by 1980 given the projected continuing inflation in Jordan and the level of water sales shown in Table 2.

Illustrative Financial Impact of Accelerated Use of King Talal Dam Water

The second major assumption in Table 2, as previously noted, is the level of water sales. The following table details the water production and sales schedules utilized in Table 2 for 1978-1984 (million m3):

	Water Production			Total Water Sales
	Aquifer	King Talal Dam	Total	
1978	18.0	--	18.0	11.70
1979	19.0	--	19.0	12.73

1980	20.0	--	20.00	13.88
1981	21.0	--	21.00	14.70
1982	20.0	3.5	23.50	16.70
1983	20.0	5.2	25.20	18.00
1984	20.0	6.7	26.70	19.20

Given the projected substantial increase in average water tariffs adopted in the IBRD Appraisal Report, the financial incentive to accelerate use of King Talal Dam Water (from the schedule shown above) for Amman so as to ameliorate those average tariff increases may be strong. Table 4 endeavors to roughly estimate the financial impact of drawing down the AWSA allocation of King Talal Dam water (15.3 million m3) over a three year time frame: 1982 - 5.0 million m3; 1983 - 10.00 million m3; and 1984 - 15.0 million m3.

Utilizing the incremental quantities of water sold and water surcharged for sewerage at the water/sewerage rates used in Tables 2 and 3, the incremental net operating revenues were calculated. No effort was made to project other revenue categories or other alternative water use schedules. The approximate methods of calculating the incremental net operating revenues attributable to the accelerated draw down of King Talal Dam water are outlined in the footnotes to Table 4.

As anticipated, the major financial impacts occur in 1983 and 1984 since the water usage difference in 1982 is relatively minor. In 1983, the average water and sewerage surcharge tariffs used in tables 2 and 3 generates total net operating revenues of JD 549,063 (JD 433,290 for water supply and JD 115,773 for sewerage). By 1984, the total is almost twice the 1983 level to JD 1,027,250 (JD 773,220 for water supply and JD 294,030 for sewerage).

In the combined accounts (Table 1), this increase in net operating revenues represents an increase in surplus before interest of 28 per cent in 1983 and 55 percent in 1984. In conclusion, it would appear that the financial incentive to use the 15 million m3 allocated to AWSA from the King Talal Dam as rapidly as feasible will be a relatively strong one. There are unlikely tobe any serious constraints on the demand side given the current low levels of per capita consumption reflecting primarily suppressed demand because of Amman's perennial water shortage.

Balance Sheets

The most significant change in the forecast balance sheets (Table 5) for AWSA is the increase in net fixed assets (excluding work in progress) from about JD 10.1 million in 1977 to about JD 42.3 million in 1982. By 1982, long-term debt is projected to increase to JD 30.4

million from JD 7.4 million in 1978. Equity, retained earnings and capital contributions, was JD 7.1 in 1978; by 1982 it is estimated to increase to JD 13.8 million. The debt equity ratio in 1978 is estimated as 52:48. With the increased quantities of long-term loans required for AWSA's 1978-1981 investment expansion program, the debt - equity ratio in 1979 will become 69:31 and remain at that level through 1984.

Cash Flow Statements

The Cash Flows Statements for 1974 through 1984 are presented in Table 6.

The financial plans and funds statement for the 1978-1981 AWSA planned construction program as currently estimated, appears to be as follows:

	(JD Thousands)	Percent
Construction Program	35,461	100.0
Sources of Funds		
IDA Credits	4,620	13.0
Proposed GOJ Loans	22,008	62.1
GOJ Contribution	5,500	15.5
AWSA Contribution	3,333	9.4
	35,461	100.0

ANNEX C

ATTACHMENT 1

SECTION 4.03 OF IDA PROJECT AGREEMENT

Section 4.03. Except as the Association shall otherwise agree, AWSA shall, on or before September 30, 1979, review its rates for the supply of water and, as from January 1, 1980, AWSA:

(a) shall establish and maintain, and thereafter whenever necessary, adjust rates for the supply of water at such levels as shall provide revenues sufficient:

(i) to cover in each fiscal year all operating expenses including employee compensation, administrative and overhead costs, adequate maintenance costs, interest and other charges on debt and adequate provision for taxes and other contributions provided by law, if any, but excluding depreciation, all on account of water supply services rendered;

(ii) to cover in each fiscal year all repayments of principal of debt related to water supply facilities;

(iii) to provide in each fiscal year for adequate increases in working capital; and

(iv) for the fiscal years 1978 through 1981 to finance not than 10% of the estimated average cost of investments in water supply and sewerage facilities, including interest during construction, to be made during such years, and for each fiscal year thereafter to finance not less than 20% of the estimated average cost of investment in water supply facilities, including interest during construction, for the three-year period comprising such fiscal year, the fiscal immediately preceding and the next following fiscal year;

(b) shall ensure that rates for sewerage services shall be fixed so as to yield sufficient revenue to meet operating and maintenance costs attributable to such services, including provision for depreciation, and debt service requirements to the extent they exceed the provision for depreciation;

ANNEX C

TABLE 7

AMMAN WATER SUPPLY AND SEWERAGE PROJECT

EXPLANATORY NOTE FOR FINANCIAL ANALYSES TABLES

INCOME AND EXPENDITURE STATEMENTS
REVENUE

1. AWSA has a stepped tariff in operation for water supply and a flat tariff for sewerage surcharge. An average of 196 fils/m^3 for water sold was used to claculate water supply revenue.

2. Meter rent was assumed to go into operation on October 1, 1977 at an average rate of JD 0.9 per annum.

3. Connection costs for sewerage were calculated at JD 70.0 per connection based on the average price for 1974-76. Sewerage connection costs in the refugee camp will be provided free of charge.

4. Sewerage tax is based on 4% of the nominal rental value of property in Amman (value used for tax purposes).

5. Other water revenue covers connection fees and miscellaneous income and was increased by 5 percent over and above the annual inflation rates noted below for operating costs. Other sewerage revenue includes charges for cesspool cleaning and contribution to extensions made at the request of customers.

Operating Costs

6. The local inflation rates used are as follows: 1978-79: 11%; 1980-81: 10%; 1982-83: 7%; and 1984: 5%.

7. The King Talal Dam transmission will supply 2 million m^3 of water per annum to villages enroute. The pumping cost of this water was not included as it was assumed that AWSA would be reimbursed for this cost by the GOJ or villages supplied.

8. It was assumed that present workforce manning levels would be maintained until the King Talal Dam water transmission system came into operation in 1982. Salaries and wages were increased by 1½% to cover salary increments in addition to inflation.

9. The increased costs in 1977 reflect the 80% increase in electricity in 1977. Fuel and power was increased in line with volume of water produced and sewerage flows. The increase in cost in 1982 for water supply reflects the cost of treatment and pumping King Talal Dam water to Amman.

10. Chemical costs were increased in line with increased flows.

11. Maintenance materials costs are based on the consultants estimates.

12. Other expenses for water supply were increased to cover inflation only as reduction in tanker operating cost should be achieved as the systems are expanded.

13. AWSA calculates depreciation on the gross value of fixed assets at the beginning of each year using the following rates (%):

Boreholes	6.7
Distribution	2.5
Reservoirs	2.0
Pumps and Machinery	7.0
Buildings	3.0
Office Equipment	14.0
Land	Nil

14. The Average Net Fixed Assets is the average for the beginning and end of year. Surplus before interest provides the numerator for the calculation of Rate of Return on Average Net Fixed Assets.

15. Cash Operating Ratio is calculated as operating costs before depreciation divided by total revenues.

CASH FLOW STATEMENTS

16. It was assumed that the GOJ would assume liability for the following short term loans incurred by AWSA in 1977 to finance the on-going construction program: Housing Bank, JD 500,000 at 8% for 6 years; British Banks, JD 575,000 at 8% for 5 years, and the Municipal Loan Fund, JD 170,000 free of interest and repayable in 1977.

17. The proposed AID loan, the IDA Credit, other loans on lent to AWSA by the GOJ plus direct GOJ loans were assumed to have a maturity of 25 years, 6% interest per annum and a grace period of 4 years.

18. Capitalized interest during the 1978-81 construction period was included only for the King Talal Dam water transmission system. It was assumed that improvement and expansion of the Sewage Treatment and the water supply/sewerage connections in Amman would, for the most part, commence operation the same year in which the construction expenditures were recorded. The King Talal Dam water transmission system would be in operation at the beginning of 1982.

19. Since AID construction cost estimates for the 1978-81 period were lower by JD 1.4 million than those made by IBRD, the GOJ contribution in the form of equity is shown as JD 5.5 million in the Balance To Be Financed section of Table 6. This is JD 1.1 million less than the GOJ contribution assumed in the March 2, 1978 IBRD Appraisal Paper. The additional JD 0.3 was added to the Cash Balance at end of year category on the last line of the Cash Flow Statements and, thereby increased the current assets in cash shown in the Balance

Sheets (Table 5). The distribution of the reduction in construction costs could have been accomplished in a different manner and will probably be revised when a final financial plan is completed.

20. Debt Service Coverage is calculated as Net Revenue Before Depreciation divided by Total Debt Service.

BALANCE SHEETS

21. Accounts payable were calculated at three months of capital expenditure and one month operating costs by the IBRD. No effort was made to adjust the IBRD calculations because of AID's lower construction cost estimates.

22. Accounts receivable were assumed to be maintained at the 1976 average of 20% of total annual revenue.

23. Deposits were calculated at an average of JD 15.0 per water connection.

NOTE: Unless otherwise mentioned, the assumptions as to financial projects were obtained from the IBRD staff and served as the basis for the financial analysis contained in "Amman Water Supply and Sewerage Project III," The Hashemite Kingdom of Jordan, Staff Appraisal Report, March 2, 1978, Report No. 1817a-JO.

AMMAN WATER SUPPLY AND SEWERAGE PROJECT

JORDAN

ANNEX C TABLE 1 - INCOME AND EXPENDITURE STATEMENTS WATER SUPPLY AND SEWERAGE

ending December 31	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
	Actual			Projected							
n Supply											
r Produced (m^3 millions)	15.97	17.56	14.21	17.50	18.00	19.00	20.00	21.00	23.50	25.20	26.70
r Sold (m^3 millions	8.34	9.14	8.33	10.85	11.70	12.73	13.88	14.70	16.70	18.00	19.20
naccounted For	47.8	47.9	41.8	38.0	35.0	33.0	31.0	30.0	29.0	28.5	28.0
l Population	602.	626.	656.	685.	716	748.	780.	813.	847.	881.	915.
mption of Population Served (lpcd)	38.	40.	35.	43.	45.	47.	48.	49.	54.	55.	58.
er of Water Connections	37,003.00	39,024.00	41,607.00	45,600.00	47,800.00	50,000.00	52,200.00	54,000.00	56,000.00	58,000.00	60,000.00
age Water Tariff (fils/m^3)	68.	76.	79.	120.	196.	196.	250.	250.	355.	355.	355
erage											
er of Sewer Connections	4,419.00	6,400.00	7.900.00	11,000.00	18,000.00	24,000.00	28,000.00	31,000.00	34,000.00	37,000.00	40,000.00
r Surcharged (m^3 million)	1.4	2.1	2.3	3.7	4.9	6.1	8.0	9.0	10.5	11.5	12.8
r Water Surcharge (fils/m^3)	30.	30.	30.	30.	50.	50.	50.	80.	80	90.	90
	JD THOUSANDS										
ENUE											
ater Supply	639.	776.	770.	1434.	2476.	2704.	3704.	3937.	6218.	6709	7163.
ewerage	400.	474.	466.	557.	789.	928.	1108.	1372	1524.	1753.	1898.
Total	1,039.	1,250.	1,236.	1,991	3,265.	3,632.	4,812	5,309.	7,742.	8,462	9,061
rating Costs											
ater Supply	650.	846.	1,198.	1,471.	1,671.	2,014.	2,644	2,424.	3,966.	4,756.	5,328.
ewerage	303.	368.	492.	586.	638.	1,073.	1,217	1,351.	1,444.	1,741	1,870.
Total	953.	1,214.	1,690.	2,057.	2,309.	3,087.	3,861.	3,775.	5,410.	6,497.	7,198.
plus Before Interest	86.	36.	(454.)	(66.)	956.	545.	951.	1,514.	2,332.	1,965.	1,863.
erest	60.	88.	103.	251.	257.	353.	449.	441.	1,728.	1,650.	1,562.
Surplus (Deficit)	26.	(52.)	(557.)	(317.)	699.	192.	502.	1,093.	604.	215.	301.
rage Net Fixed Assets											
ater Supply	N.A.	2,614.	2,763.	3,949.	5,353.	6,944.	9,046.	10,029.	18,944.	27,716.	27,431.
ewerage	N.A.	3,360.	3,532.	4,325.	5,762.	8,712.	12,268.	13,782.	14,292.	15,029.	16,041.
Total	N.A.	5,974.	6,295.	8,274.	11,115.	15,656.	21,314.	23,811.	33,263.	42,745.	43,472.

Inued...

ANNEX C TABLE 1 - INCOME AND EXPENDITURE STATEMENTS WATER SUPPLY AND SEWERAGE (CONTINUED)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	[illegible]
	Actual			Projected							
: of Return on Average Net Fixed Assets (%)											
ater Supply	-	-	-	-	15.0	9.9	11.7	15.1	11.9	7.0	6.7
ewerage	N.A.	3.2	-	-	2.6	-	-	-	-	0.6	0.2
Total	N.A.	0.6	-	-	8.6	3.5	4.5	6.4	7.0	4.6	4.3
n Operating Ratio (%)	67.	76.	114.	88.	62.	65.	56.	58.	54.	56.	61.

AMMAN WATER SUPPLY AND SEWERAGE PROJECT

JORDAN

ANNEX C TABLE 2 - INCOME AND EXPENDITURE STATEMENT/WATER SUPPLY

r Ending December 31	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
	Actual			Projected							
er Produced (m^3 million)	15.97	17.56	14.21	17.50	18.00	19.00	20.00	21.00	23.50	25.20	26.70
er Sold (m^3 million)	8.34	9.14	8.33	10.85	11.70	12.73	13.88	14.70	16.70	18.00	19.20
ater Unaccounted for	47.8	47.9	41.3	38.0	35.0	33.0	31.0	30.0	29.0	28.5	28.0
al Population	602.	626.	655.	685.	716.	748.	780.	813.	847.	881.	915.
sumption of Population Served (lpcd)	38.0	40.0	35.0	43.0	45.0	47.0	48.0	49.0	54.0	56.0	58.
ber of Water Connections	37,003.00	39,024.00	41,607.00	45,600.00	47,800.00	50,000.00	52,200.00	54,000.00	56,000.00	58,000.00	60,000.00
rage Tariff (fils/m^3)	68.	76.	79.	120.	196.	196.	250.	250.	355.	355.	355.
	JD THOUSANDS										
ENUE											
ater Sales	566.	696.	659.	1,302.	2,293.	2,495.	3,470.	3,675.	5,925.	6,190.	6,816.
eter Rent	-	-	-	10.	42.	45.	47.	49.	51.	52.	54.
ther Income	73.	80.	111.	122.	141.	164.	187.	213.	238.	267.	293.
Total	639.	776.	770.	1,434.	2,476.	2,704.	3,704.	3,937.	6,218.	6,709.	7,163.
RATING COSTS											
alaries and Wages	244.	374.	499.	674.	758.	852.	959.	1,059.	1,206.	1,308.	1,393.
uel and Power	184.	188.	182.	340.	387.	451.	515.	587.	1,260.	1,506.	1,745.
hemicals	7.	7.	8.	10.	12.	14.	16.	18.	23.	26.	29.
ntenance Materials	42.	74.	184.	161.	194.	236.	285.	341.	401.	470.	543.
ther Expenses	50.	75.	141.	136.	151.	168.	180.	199.	213.	227.	238.
ayment for King Talal Dam Water	-	-	-	-	-	-	-	-	56.	83.	107.
epreciation	123.	128.	141.	150.	169.	293.	689.	770.	807.	1,136.	1,035.
Total	650.	846.	1,198.	1,471.	1,671.	2,014.	2,644.	2,424.	3,966.	4,756.	5,328.
plus Before Interest	(11.)	(70.)	(428.)	(37.)	805.	690.	1,060.	1,513.	2,252.	1,953.	1,836.
erest	58.	69.	81.	183.	175.	204.	241.	222.	1,597.	1,442.	1,361.
Surplus (Deficit)	(69.)	(139.)	(509.)	(220.)	630.	486.	819.	1,291.	745.	511.	475.
rage Net Fixed Assets	N.A.	2,614.	2,763.	3,949.	5,353.	6,944.	9,046.	10,029.	18,944.	27,716.	27,431.
e of Return on Average Net Fixed Assets(%)	-	-	-	-	15.0	9.9	11.7	15.1	11.9	7.0	6.7
h Operating Ratio (%)	82.	92.	137.	92.	61.	64.	53.	56.	51.	54.	60.

AMMAN WATER SUPPLY AND SEWERAGE PROJECT

JORDAN

ANNEX C TABLE 3 - INCOME AND EXPENDITURE STATEMENTS/SEWERAGE

Year Ending December 31	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
	Actual			Projected							
Number of connections	4,419.00	6,400.00	7,900.00	11,000.00	18,000.00	24,000.00	28,000.00	31,000.00	34,000.00	37,000.00	40,000.00
Water Surcharged (m^3 million)	1.4	2.1	2.3	3.7	4.9	6.1	8.0	9.0	10.5	11.5	12.8
Surcharge (fils/m^3)	30.	30.	30.	30.	50.	50.	50.	80.	80.	90.	90.
	JD THOUSANDS										
REVENUE											
Surcharge on Water	42.	62.	67.	111.	245.	305.	400.	720.	840.	1,035.	1,152.
Connection Fees	139.	136.	101.	147.	234.	301.	375.	306.	327.	351.	369.
Sewerage Tax	191.	229.	233.	240.	245.	250.	255.	260.	265.	270.	275.
Other Revenue	28.	47.	65.	59.	65.	72.	78.	86.	92.	97.	102.
Total	400.	474.	466.	557.	789.	928.	1,108.	1,372.	1,524.	1,753.	1,898.
OPERATING COSTS											
Salaries and Wages	110.	168.	222.	289.	325.	366.	404.	447.	485.	526.	560.
Fuel and Power	19.	23.	26.	41.	59.	80.	112.	137.	170.	202.	230.
Chemicals	4.	4.	5.	9.	13.	18.	25.	31.	38.	45.	51.
Maintenance	6.	6.	20.	30.	42.	58.	81.	103.	127.	154.	177.
Other Expenses	32.	34.	75.	69.	88.	108.	134.	154.	177.	200.	218.
Depreciation	132.	133.	144.	148.	112.	443.	461.	479.	447.	614.	627.
Total	303.	368.	492.	586.	638.	1,073.	1,217.	1,351.	1,444.	1,741.	1,870.
Surplus Before Interest	97.	106.	(26.)	(29.)	151.	(145.)	(109.)	21.	80.	8.	28.
Interest	2.	19.	22.	68.	82.	149.	208.	219.	221.	208.	201.
Net Surplus (Deficit)	95.	87.	(48.)	(97.)	69.	(294.)	(314.)	(198.)	(141.)	(200.)	(173.)
Average Net Fixed Assets	N.A.	3360.	3532.	4325.	5162.	8,712.	12,268.	13,782.	14,292.	15,029.	16,041.
Rate of Return on Average Net Fixed Assets (%)	N.A.	3.2	-	-	2.6	-	-	-	0.6	-	0.2
Cash Operating Ratio (%)	42.	50.	74.	79.	79.	68.	68.	64.	65.	64.	65.

AMMAN WATER SUPPLY AND SEWERAGE PROJECT

JORDAN

ANNEX C TABLE 4 - ILLUSTRATIVE CALCULATION OF FINANCIAL IMPACT RELATED TO ACCELERATED AWSA USE OF KING TALAL WATER FOR AMMAN

ITEM	1982	1983	1984
Water Supply			
Accelerated - Water Produced (million m^3)	25.00	30.00	35.00
- Water Sold (million m^3)	17.50	21.30	25.30
- Water Sold (Per Tables 1, 2 and 3) (million m^3)	16.70	18.00	19.20
Incremental - Water Produced (million m^3)	1.50	4.80	8.30
- Water Sold (million m^3) 1/	0.80	3.30	6.10
Incremental Operating Cost 2/ (fils/m^3)	209.0	223.7	234.8
Average Water Tariff	355.	355.	355.
Incremental Net Operating Revenues (fils/m^3)	146.0	131.3	120.2
Incremental Net Operating Revenues (JD)	116,800.	433,290.	733,220.
Sewerage			
Accelerated Water Surcharged (million m^3)	11.0	13.6	18.2
Incremental Water Surcharged (million m^3)	0.50	2.10	5.40
Operating Cost (fils/m^3) 3/	31.90	34.87	35.55
Water Surcharge on Sewerage (fils/m^3)	80.	90.	90.
Net Operating Revenue (fils/m^3)	48.10	55.13	54.45
Net Incremental Operating Revenue (JD)	24,050.	115,773.	294,030.
Total Increase in Net Operating Revenues (JD)	140,850.	549,063.	1,027,250.

1/ Calculated using unaccounted for percentages used in Tables.
2/ Based on SOGREAH estimate of 1978 operating costs for delivery of King Talal Dam water to Rio (Appendix 3 p.123, Cost Per Cubic Meter of Water Delivered to R10, "Amman Water Supply from King Talal Dam", Design Study, Final Report, February, 1978, SOGREAH-VACE, for AWSA). From 1978 through 1984, SOGREAH operating costs escalated using price in-

continued....

AMMAN WATER SUPPLY AND SEWERAGE PROJECT

JORDAN

ANNEX C TABLE 4 - ILLUSTRATIVE CALCULATION OF FINANCIAL IMPACT RELATED TO ACCELERATED AWSA USE OF KING TALAL WATER FOR AMMAN, CONTINUED

/ (continued) flation ratios for operating costs noted in Table 7. Operating costs from KTC to consumers was assumed as 78 percent of total operating costs (excluding depreciation, salaries and wages) for AWSA water supply sector n 1981 before King Talal Dam water is available. That base cost was escalated using the price inflation ratios previously noted above from Table 7.

/ Used average operating ratios per Fils/m^3 (fuel and power, chemicals and maintenance materials divided by quantity f water surcharged) obtained from Table 3 for 1982, 1983 and 1984.

AMMAN WATER SUPPLY AND SEWERAGE PROJECT

JORDAN

ANNEX C TABLE 5 - BALANCE SHEETS

As at December 31	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
	actual			projected							
	JD THOUSANDS										
ASSETS											
CURRENT ASSETS											
Cash	75.	96.	50.	170.	369.	360.	463.	583.	653.	683.	723.
Inventories	287.	438.	489.	562.	620.	690.	750.	820.	900.	940.	980.
Accounts Receivable	275.	629.	258.	420.	600.	860.	940.	1,000.	1,150.	1,500.	1,800.
Accounts Payable			314.	200.	-	-	-	-	-	-	-
Total	637.	1,163.	1,111.	1,352.	1,589.	1,910.	2,189.	2,439.	2,739.	3,159.	3,539.
FIXED ASSETS											
Water Supply	3,112.	3,338.	3,677.	6,000.	6,804.	9,645.	11,986.	12,518.	30,842.	32,008.	32,441.
Less: Depreciation	548.	674.	815.	965.	1,134.	1,427.	2,113.	2,333.	3,140.	4,276.	5,311.
Net Water Supply	2,564.	2,664.	2,862.	5,035.	5,670.	8,218.	9,873.	10,185.	27,702.	27,732.	27,130.
Sewerage (including Storm Drainage)	3,885.	4,299.	4,507.	6,177.	7,640.	12,631.	15,656.	16,601.	17,602.	19,135.	20,368.
Less Depreciation	666.	799.	943.	1,091.	1,203.	1,646.	2,107.	2,586.	3,033.	3,647.	4,234.
Net Sewerage	3,219.	3,500.	3,564.	5,086.	6,437.	10,986.	13,549.	14,015.	14,569.	15,488.	16,594.
Work in Progress	1,614.	2,722.	3,678.	786.	3,041.	10,918.	17,095.	17,624.	832.	733.	1,867.
Total Fixed Assets	7,397.	8,886.	10,104.	10,907.	15,148.	30,122.	40,517.	41,824.	43,103.	44,953.	45,591.
TOTAL ASSETS	8,034.	10,049.	11,215.	12,259.	16,737.	32,032.	42,670.	44,223.	45,806.	47,086.	49,094.
LIABILITIES											
CURRENT LIABILITIES											
Accounts Payable	249.	372.	468.	500.	1,400.	4,200.	2,700.	900.	1,000.	1,100.	1,200.
Deposits	237.	304.	368.	430.	460.	490.	530.	560.	590.	620.	650.
Total	486.	676.	836.	930.	1,860.	4,690.	3,230.	1,460.	1,590.	1,720.	1,850.
LONG-TERM DEBT											
Existing IDA Loans	1,170.	2,311.	2,811.	3,145.	2,971.	2,797.	2,623.	2,449.	2,275.	2,101.	1,927.
Proposed IDA Loans	-	-	-	-	705.	4,160.	4,620.	4,620.	4,510.	4,290.	4,070.
Existing Local Loans	1,280.	1,946.	1,652	1,395.	1,135.	883.	702.	596.	490.	384.	278.
Proposed Government Loans	-	-	-	-	2,958.	10,539.	19,461.	22,008.	21,484.	20,436.	19,388.
Proposed Government Loans (1982-84)	-	-	-	-	-	-	-	-	1,676.	4,160.	6,750.
Total	2,450.	4,257.	4,463.	4,540.	7,773.	18,379.	27,406.	29,673.	30,429.	31,417.	32,413.

continued....

AMMAN WATER SUPPLY AND SEWERAGE PROJECT

JORDAN

ANNEX C TABLE 5 - BALANCE SHEETS, CONTINUED

As at December 31	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
	Actual			Projected							
	JD THOUSANDS										
EQUITY											
Equity, Retained Earnings and Capital Contributions	5,098.	5,116.	5,916.	6,789.	7,104.	8,963.	12,034.	13,904.	13,787.	13,982	14,837.
TOTAL LIABILITIES	8,034.	10,049.	11,215.	12,259.	16,737.	32,032.	42,670.	44,227.	45,086.	47,086.	49,094.
DEBT-EQUITY RATIO	32:68	45:55	43:57	34:66	52:48	67:33	69:31	69:31	69:31	69:31	69:31

AMMAN WATER SUPPLY AND SEWERAGE PROJECT

JORDAN

ANNEX C TABLE 6 - CASH FLOW STATEMENTS

Year Ending December 31	1974	1975	1976	1977	1978	1979	1980	1981	Total 1978-1981	1982	1983	1984
	Actual			Estimated								
	JD THOUSANDS											
INTERNAL CASH GENERATION												
Net Revenue Before Depreciation and Interest												
Water	112.	58.	(287.)	113.	974.	983.	1,747.	1,733.	5,437.	3,115.	3,172.	3,215.
Sewerage	229.	239.	118.	119.	262.	298.	352.	500.	1,412.	527.	626	605.
Total	341.	297.	169.	232.	1,236.	1,281.	2,099.	2,233.	6,849.	3,642.	3,798.	3,870.
OPERATING REQUIREMENTS												
Working Capital	-	315.	(166.)	27.	(892.)	(2,500.)	1,609.	1,900.	108.	100	260.	210.
Debt Service - Interest												
Existing IDA Loans	-	69.	67.	181.	178.	167.	159.	146.	650.	136.	126.	116.
Existing local loans	-	19.	36.	70.	58.	40.	28.	18.	144.	13.	8.	4.
Proposed IDA Loans	-	-	-	-	21.	146.	262.	277.	706.	274.	258.	247.
Proposed Other Loans	-	-	-	-	-	-	-	-	-	1,305.	1,258.	1,195.
Total Interest	-	88.	103.	251.	257.	353.	449.	441.	1,500.	1,728.	1,650.	1,562.
Debt Service Repayment												
Existing IDA Loans	-	27.	26.	100.	174.	174.	174.	174.	696.	174.	174.	174.
Existing local loans	-	169.	295.	256.	256.	256.	181.	106.	799.	106.	106.	106.
Proposed IDA loans	-	-	-	-	-	-	-	-	-	110.	220.	220.
Other loans	-	-	-	-	-	-	-	-	-	524.	1,048.	1,048.
Total Repayment	-	196.	321.	356.	430.	430.	355.	280.	1,495.	914.	1,548.	1,548.
Total Debt Service	-	284.	424.	607.	687.	783.	804.	721.	2,995.	2,642.	3,198.	3,110.
TOTAL OPERATING REQUIREMENTS	-	599.	258.	634.	(205.)	(1,717.)	2,404.	2,621.	3,103.	2,742.	3,458.	3,320.
TOTAL AVAILABLE FROM OPERATIONS	341.	(302.)	(427.)	(402.)	1,441.	2,998.	(305.)	(388.)	3,746.	900.	340.	550.
CONSTRUCTION COSTS												
Project - Water	-	-	-	-	1,068.	3,159.	1,183.	-	5,410.	-	-	-
Project - Sewerage	-	-	-	-	1,441.	4,965.	1,804.	-	8,210.	-	-	-
King Talal Transmission System	-	-	-	-	1,463.	6,362.	6,902.	833.	15,560.	-	-	-
Interest Capitalized	-	-	-	-	44.	469.	614.	906.	2,033.	-	-	-
Total - King Talal	-	-	-	-	1,507.	6,831.	7,516.	1,739.	17,593.	-	-	-
Sewage Treatment Plant	-	-	-	-	-	1,230.	337.	-	1,567.	-	-	-

AMMAN WATER SUPPLY AND SEWERAGE PROJECT

JORDAN

ANNEX C TABLE 6 - CASH FLOW STATEMENTS (CONTINUED)

Year Ending December 31	1974	1975	1976	1977	1978	1979	1980	1981	Total 1978-1981	1982	1983	1984
		Actual				Estimated						
						JD THOUSANDS						
Other Investments - Water	-	1,208.	952.	548.	137.	500.	500.	100.	1,237.	1,100.	1,200.	1,300.
Other Investments - Sewerage	-	544.	556.	553.	752.	194.	298.	200.	1,444.	1,400.	1,600.	1,800.
Total - Water	-	1,208.	952.	548.	2,712.	10,490.	9,199.	1,839.	24,240.	1,100.	1,200.	1,300.
Total - Sewerage	-	544.	556.	553.	2,193.	6,389.	2,439.	200.	11,221.	1,400.	1,600.	1,800.
Total Construction Costs	-	1,752.	1,501.	1,101.	4,905.	16,875.	11,638.	2,039.	35,461.	2,500.	2,800.	3,100.
BALANCE TO BE FINANCED	-	2,054.	1,928.	1,503.	3,464.	13,881.	11,943.	2,427.	31,715.	1,600.	2,460.	2,550.
Financed By:												
IDA Credits	-	1,167.	526.	433.	705.	5,455.	460.	-	4,620.	-	-	-
Existing Local Loans	-	835.	-	-	-	-	-	-	-	-	-	-
Proposed Government Loans	-	-	-	-	2,958.	7,581.	8,922.	2,547.	22,008.	1,670.	2,490.	2,590.
Government Contribution	-	73.	1,356.	1,190.	-	2,800.	2,700.	-	5,500.	-	-	-
Total	-	2,075.	1,882.	1,623.	3,663.	13,836.	12,082.	2,547.	32,128.	1,670.	2,490.	2,590.
Surplus (Deficit)	-	21.	(46.)	120.	199.	(45.)	139.	120.	413.	70.	30.	40.
Cash Balance At End Of Year	75.	96.	50.	170.	369.	324.	463.	583.	-	653.	683.	723.
Debt Service Coverage	-	1.0	-	0.4	1.8	1.6	2.6	3.1	-	1.4	1.2	1.2

Tariffs and Fees - Amman Water Supply and Sewerage Authority (AWSA)
January 1, 1978 Tariffs

Water

Water Tariff

Consumption per Quarter			fils/m^3
0	≤	20 m^3	60
20	≤	40 m^3	80
40	<	100 m^3	180
100	<		260

Minimum charge per quarter (10/m^3) 600

Meter Rent per Quarter		fils/m^3
	1"	75
1"	2"	150
2	3"	300
	4"	450

Water Tanker Charges	JD
4 m^3 Tanker	1.000
7 m^3 Tanker	1.500
10 m^3 Tanker	2.500

An additional charge of JD 1.000 is made for delivery outside the municipality of Amman.

Deposits - Meter Deposits

Size	JD
1/2"	5.000
3/4"	10.000
1"	15.00
1 1/2"	25.000
2"	45.000
3"	60.000
4"	80.000

Account Deposits	JD
High Income Area	15.000
Median Income Area	10.000
Low Income Area	5.000
Factories	60.000

Sewerage

Surcharge on Water for premises connected to sewer system.

30 fils/m^3 (Soon to increase to 50 fils/m^3)

Property Tax (payable whether connected or not)

4% of net value of premises. The basis is an assumed rental value which does not change in line with the current rental value of the property.

Connection Charges	JD
25% of net rental value of premises plus	
Commercial	50
High Income Areas	20
Medium Income Areas	10

ANNEX D

ECONOMIC ANALYSIS

The project as defined in the economic analysis includes the relevant costs and revenues to attain the level of incremental water sales presented in Column 2 of Table 2 in this Annex. This level of water sold uses 1977 as the base year, includes the additional water supply from King Talal Dam(15 million m^3 gross withdrawals); reduction in the unaccounted for category; an additional 1 million m^3 to be made available from wells currently supplying Madaba and a small increase in water from the aquifer.

The incremental water sales estimates extend those provided in the Financial Analysis, Annex C (for 1978-1984) through 1988 when the maximum level is achieved.

The investment costs presented in Table 1 include those required to sustain AWSA operations and are an addition to the main subject of the PP, the 1978-1981 AWSA investment expansion program. The post 1981 investment estimates were obtained from IBRD sources.

Total costs are in constant 1978 prices. The 1978-1981 water supply and sewerage costs shown in Table 1 were in the main derived from the financial costs presented in Annex C deflated for price escalation. The revenue attributable to incremental water sales and sewerage surcharges (Table 2) used the 1978 average tariff revenue (196 fils/m^3) and the proposed water sewerage surcharge (50 fils/m^3). The basis for other revenues are briefly explained in the footnotes to Table 2.

The economic rate of return of the calculations outlined in Tables 1 and 2 are presented in Table 3. The econoic rate of return utilizing this limited economic methodology was 2.5 percent. There are several qualifications worth mentioning in regard to this economic rate of return:

1. It reflects the IBRD annual schedule for utilization by AWSA of water available from the King Talal Dam. An alternative calculation was performed using the King Talal Dam water utilization schedule examined in Table 4, Annex C. (1982 - 5.0 million m^3; 1983 - 10.0 million m^3; and 1984 - 15.0 million m^3). The resulting economic rate of return was about 3.0 percent. The sensitivity of the economic rate of return to accelerated water use from King Talal Dam for Amman does not appear to be significant. No other sensitivity tests were undertaken given the relatively low economic rate of return.

2. Health benefits have been excluded since the basic information is unavailable. There is little doubt that without the project a substantial deterioration could occur in the health environment in Amman.

3. There is a good likelihood that lower income households will have substantial savings in water costs when physical access to water from the AWSA system is available. The cost of water provided by tankers is substantially above any water supply rates included in the financial analysis.

AMMAN WATER SUPPLY AND SEWERAGE PROJECT

JORDAN

ANNEX D TABLE 1 - ECONOMIC ANALYSIS

Year	WATER SUPPLY INVESTMENT COSTS				SEWERAGE INVESTMENT				Total Investment Costs	OPERATING COSTS			Total Costs
	AID-IDA Project	King Talal Dam Water Transmission	Other	Total	AID-IDA Project	Sewage Treatment Plant	Other	Total		Water Supply 5/	Sewerage 6/	Total	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1978	931.	1,087. 1/	130.	2,148.	1,256.	-	714.	1,970.	4,118.	117.	78.	195.	4,313.
1979	2,754.	4,730.	425.	7,909.	4,329.	1,027.	165.	5,521.	13,430.	263.	150.	413.	13,483.
1980	1,032.	5,130.	375.	6,537.	1,574.	281.	223.	2,078.	8,615.	397.	219.	616.	9,231.
1981		619.	65. 3/	684.	-	-	130. 4/	130.	814.	515.	260.	775.	1,589.
1982	-	-	700.	700.	-	-	890.	890.	1,590.	1,050.	296.	1,346.	2,936.
1983	-	-	700.	700.	-	-	933.	933.	1,633.	1,148.	317.	1,465.	3,098.
1984	-	-	700.	700.	-	-	968.	968.	1,668.	1,367.	314.	1,681.	3,349.
1985	-	-	700.	700.	-	-	968.	968.	1,668.	1,450.	340.	1,790.	3,458.
1986	-	-	700.	700.	-	-	968.	968.	1,668.	1,550.	391.	1,941.	3,609.
1987	-	-	700.	700.	-	-	968.	968.	1,668.	1,600.	466.	2,066.	3,734.
1988	-	-	-	-	-	-	-	-	-	1,600.	566.	2,166.	2,166.
1989-1997	-	-	-	-	-	-	-	-	-	1,600.	566.	2,166.	2,166.
1998	-	2,200. 2/	-	2,200.	-	-	-	-	2,200.	1,600.	566.	2,166.	4,366.
1999	-	2,500. 2/	-	2,500.	-	-	-	-	2,500.	1,600.	566.	2,166.	4,666.
2000-2031	-	-	-		-	-	-	-	-	1,600.	566.	2,166.	2,166.

/ Represents 15/17 of the economic investment cost in King Talal Dam water transmission.
/ Investment cost covers replacement of pumps as provided by IBRD sources.
/ Taken directly from Project File B4 "Calculation of Long-Term Incremental Cost of Water" provided by IBRD staff and used in "Amman Water Supply and Sewerage Project III", Report No. 1817a-JO, March 2, 1978.
/ Other investment for 1982 through 1987 was extrapolated from the Cash Flow Statements, Table 6, Annex C. It was assumed that the ratio of Other Investments for 1982-1987 water supply (column 3) to the cash flow investments for water supply was applicable to the Other Investments in sewerage. The 1984 levels of that calculation of economic cost of other investments in sewerage was used for the 1985 through 1987 time frame.
/ Obtained from IBRD Project File B4 (see footnote 3 above)
/ Incremental financial operating costs deflated by IBRD price escalation factor for 1979-1984 (Table 7, Annex C). For 1985-1988, incremental economic operating costs in 1984 were extrapolated by the incremental quantities of water entering the sewage system.

AMMAN WATER SUPPLY AND SEWERAGE PROJECT

JORDAN

ANNEX D TABLE 2 - ECONOMIC ANALYSIS/INCREMENTAL REVENUES

Year (1)	WATER SUPPLY: Incremental Water Sales millions m^3 1/ (2)	WATER SUPPLY: Incremental Water Revenue 2/ JD Thousands (3)	SEWERAGE: Incremental Water Surcharged millions m^3 3/ (4)	SEWERAGE: Incremental Water Surcharge Rev. 4/ JD Thousands (5)	SEWERAGE: Other Sewerage Revenue JD Thousands (6)	SEWERAGE: Total Sewerage Revenue JD Thousands (7)	Total Incremental Revenues JD Thousands (8)
978	0.85	167.	1.20	60.	88.	148.	315.
979	1.88	368.	2.40	120.	143.	263.	631.
980	3.03	594.	4.30	215.	191.	406.	1,000.
981	3.85	755.	5.30	265.	142.	407.	1,162.
982	5.85	1,147.	6.80	340.	153.	493.	1,640.
983	7.15	1,401.	7.80	390.	162.	552.	1,953.
984	8.35	1,637.	9.10	455.	165.	620.	2,257.
985	9.95	1,950.	10.17	509.	170.	679.	2,629.
986	11.45	2,244.	11.17	559.	175.	734.	2,978.
987	12.95	2,538.	12.17	609.	180	789.	3,327.
988	14.45	2,832.	13.17	659.	185.	844.	3,676.
989							
031							

/ Based on Project File B4, IBRD. See footnote 3 on Table 1, Annex D.
/ Column 2 multiplied by 196 fils/m^3. Other water supply revenues are minor and represent only 5 percent of total water supply revenues in the financial Analysis tables, Incremental additions in this category have been ignored.
/ The ratio of water sold to sewage water surcharged was held constant from 1984 onward.
/ Column 4 multiplied by 50 fils/m^3. Other sewage revenue was deflated by the price escalator factor adopted by the IBRD for operating costs - 1979-1984. From 1984-1988, Other Sewerage Revenue (column 6) was arbitrarily increased by JD 5,000 per annum.

AMMAN WATER SUPPLY AND SEWERAGE PROJECT

JORDAN

ANNEX D TABLE 3 - ECONOMIC ANALYSIS/ECONOMIC RATE OF RETURN CALCULATION

Year	TOTAL COSTS	TOTAL REVENUE	NET REVENUE
	JD THOUSANDS		
'78	4,313.	315.	(3,998)
'79	13,483.	631.	(12,852.)
80	9,231.	1,000.	(8,253.)
'81	1,589.	1,162.	(427.)
'82	2,936.	1,640.	(1,296.)
'83	3,098.	1,953.	(1,145.)
'84	3,349.	2,257.	(1,092.)
'85	3,458.	2,629.	(829.)
'86	3,609.	2,978.	(631.)
'87	3,734.	3,327.	(407.)
'88	2,166.	3,676.	1,510.
'89 - 1997	2,166.		1,510.
'98	4,366.		(690.)
'99	4,666.		(990.)
'00 - 2031	2,166.	3,676.	1,510.

RATE OF RETURN 2.5%

Page 1 of 1

SOCIAL SOUNDNESS ANALYSIS

A report entitled "A Social Soundness Analysis of the Amman Water and Sewerage Systems", dated April 17, 1978, is on file in NE/PD. Pertinent tables from that report along with other data compiled from a review of that report are found on the following tables.

TABLE ONE

NUMBER OF RESIDENTS RECEIVING NEW WATER AND SEWERAGE CONNECTIONS IN 1981 BY AREA AND SOCIO ECONOMIC CLASSIFICATION (in 000s)

Area	Water	Sewerage	Number of Low Income Residents* Water	Sewerage
J. Amman[I]	15	14.4	.3	2.8
Sport City	3.6	3.5		
J. Hussein[L]	7	9.5	.7	.9
W. Hadgada[VH]	0	3	0	2
Nazzal[h]	4	11.7	1.2	3.5
Nadif[h]	5	3.6	1.5	1
Ashrafiya[vh]	10	5.3	6.7	3.5
Qussour[m]	3	4	.6	.8
Hashemi[m]	5	24.7	1	4.9
Shamsani	2.2	2.2		
Abdoun	6	2.6		
Smissani	5	5.5		
Marka[m]	10	9.5	.2	1.9
Nuzha[m]	4	11.1	.8	2.2
Tadj[m]				
Manatta[m]	22	25.5	6.3	5.2
Jofeh[h]				
Qala[m]				
Camps[m]	156	170	31.2	34
Shaleh[vh]	9	8	6	5.4
Zuhour[l]	3	2	.3	.2
	269.7	316.1	56.9 (21.1%)	68.6 (21.7%) % total

*The estimated number of poor has been calculated using the table on P. 10 in Annex E. In each category, midpoints were used to calculate numbers of low income residents. Thus very high (vh) groups were calculated at 65%; high (h) at 30%; medium (m) at 20%; low at 10%; and insignificant (I) at 2%.

**Note: In calculating the number of low-income persons who will receive water and sewerage in 1981, we have assumed that services will be distributed to the population without economic discrimination. Since there is no way in which this assumption can be verified, these calculations must be regarded as very tentative.

TABLE T.10

Population of Amman
and Estimated Number
of Low Income Residents

(in 000s)

Neighborhood	1977 Total	1977 Low Income	1981 Total	1981 Low Income
J. Amman[I]	47	9.4	58	11.6
Sport City	3		4	
J. Hussein[L]	40	4.0	50	5.0
W. Haddada[VH]	12	7.8	13	8.4
Nazza[H]	40	12.0	42	12.6
Nadif[H]	30	9.0	40	12.0
Ashrafiya	39	25.3	45	29.2
Qussour[M]	15	3.0	18	5.4
Hashemi[M]	24	4.8	31	5.2
Shamsani	2		3	
Abdoun	6		8	
Smissani	7		10	
Marka[M]	40	8.0	50	10.0
Nuzha[M]	24	4.8	29	5.8
Shaleh[VH]	10	6.5	15	9.7
Zuhour[L]	3	.3	4	.4
Tadj Mahatta[M]				
Jofeh and Qala	112	22.4	176	35.2
Camos[M]	165	33.0	189	37.8
TOTALS	619	141.8 (22.9%)	785	268.8 (34.2%)

TABLE THREE

RELATIVE RATES OF CONNECTION TO WATER AND SEWERAGE IN AMMAN IN 1977 AND 1981
(in %)

Area	Water Connections 1977	Water Connections 1981	Sewerage Connections 1977	Sewerage Connections 1981
Ashrafiya*	51.3	56.6	21.5	30.4
Wadi Haddada*	58.3	53.8	25	46.1
Nassal*	75	80.9	5	32.8
Nadif*	50	50	42.6	41
Shaleh*	30	80	0	53
Tadj*				
Manatta*	51.8	45.6	32.9	45.8
Jofeh*				
Qala*				
Qussour	80	83.3	25.3	43.3
Hashemi	83.3	80.6	0	79.7
Marka	50	50	1	20.4
Nuzha	83.3	82.7	0	38.2
Camps	20	100	0	89.9
J. Hussein	95	90	42.6	53
Zuncur	0	75	0	50
J. Amman	85	94.8	41.4	68.4
Sport City	10	95	10	95
Shamsani	0	73.3	0	73.3
Abdoun	0	75	0	32.5
Smisani	71.4	100	50	90

*Areas with highest percentages of low-income residents.

Note: 2 other areas, Nasr and Webden, will also be affected. They are omitted from IBRD report and data in WSS is incomplete so we have omitted them here.

TABLE [illegible]

NUMBER OF RESIDENTS WITH WATER & SEWERAGE CONNECTIONS IN 1977 AND

EXPECTED INCREASE IN 1981: BY NEIGHBORHOOD & SOCIO-ECONOMIC CLASSIFICATION (in 000s)

Neighborhood	1977 Connections		No. of Low Income		1981 Connections		No. of Low Income	
	Water	Sewerage	Water	Sewerage	Water	Sewerage	Water	Sewerage
J. Amman	40	19.5	.8	.4	55	33.9	1.1	.7
Sport City	.3	.3	0	0	3.8	3.8	0	0
J. Hussein	38	17	3.8	1.7	45	26.5	4.5	2.6
W. Haddada	7	3	4.5	1.9	7	6	4.5	3.9
Nazzal	30	2.1	9.0	.6	34	13.8	10.2	4.1
Wadif	15	12.8	4.5	3.8	20	16.4	6	4.9
Ashrafuja	20	8.4	13.0	5.5	30	13.7	19.5	8.9
Qussour	12	3.8	2.4	.8	15	7.8	3	1.5
Hashemu	20	0	4	0	25	24.7	5	4.9
Shamsani	0	0	0	0	2.2	2.2	0	0
Abdoun	0	0	0	0	6.0	2.6	0	0
Smissani	5	3.5	0	0	10	9	0	0
Marka	20	.7	4	.1	30	10.2	6	2
Nuzha	20	0	4	0	24	11.1	4.8	2.2
Shalen	3	0	1.9	0	12	8	7.8	5.2
Zuhour	0	0	0	0	3	2	.1	.04
Tadj, Mahatta								
Jofeh, Qala	58	36.9	17.4	11.	80	62.4	24	18.7
Camps	33	0	6.6	0	189	170	37.8	34
TOTALS	321.3	108	75.9	25.8	591	424.1	134.3	93.6

TABLE FIVE

CITY OF AMMAN. PERSONS EMPLOYED, BY CATEGORY OF EMPLOYMENT, AND AVERAGE SALARY[1]

Type of Employment	No. Persons	% Persons	Average Annual[2] Salary (JDs)	% salaried[3] in sector
Mining	3486	4.1	1305	95.6
Manufacturing	10099	12.1	846	67.9
Electricity	1071	1.2	1210	93.9
Construction	4373	5.2	980	80.8
Commerce	4616	5.5	818	32.4
Transport	4035	4.8	700	75.9
Financial Services	3391	4.0	1299	85.0
Comunity Services, Public Administration	52648	62.8	740	91.2
TOTALS	83719	99.7	816	83.4

[1] These percentages and numbers are taken from the Employment Survey for Establishments Engaging More than (5) Persons, Dept. of Statistics, December 1976, and represent people employed in establishments of five of more persons. However, the similarity to figures quoted in the Multiple Purpose Survey, listing employment only for the Governorate of Amman, is striking. Nevertheless, the figures must be understood to be approximate only.

[2] Average annual salaries are derived from a sample survey conducted by the Ministry of Labor for the Kingdom of Jordan as a whole. All figures were upgraded by 25%, as private communication from the World Bank indicated this inflation factor between 1976 and 1977.

[3] These figures are extracted from the Multiple Purpose Household Survey, 1976.

TABLE SIX (continued)

House-Hold No.	Before Improvements: Water[4] Cost/Yr. (JD)	Sewerage[5] Cost/Yr. (JD)	Total Cost/Yr. (JD)	% of Income	After Improvements: Water[6] Cost/Yr. (JD)	Sewerage[7] Cost/Yr. (JD)	Total Cost/Year	% of Income	Change in: Annual Cost (JD)	% of Income
1.	50	27	77	13.0	9	27	36	6.0	-41	7.0
2.	50	27	77	13.0	9	4.5	13.5	2.3	-63.5	10.7
3.	27	27	54	9.0	9	27	36	6.0	-31	6.9
4.	50	27	77	12.9	9	11	20	3.3	-57	9.6
5.	50	27	77	12.9	9	11	20	3.3	-34	- 5.7
6.	27	27	54	9.0	21	27	48	2.0	-29	- 1.2
7.	50	27	77	3.2	21	7.5	28.5	1.2	-48.5	- 2.0
8.	50	27	77	3.2	21	7.5	28.5	1.2	-25.5	- 1.0
9.	27	27	54	2.3	21	27	48	2.0	-29	- 1.2
10.	50	27	77	3.2	21	27	48	2.0	-29	- 1.2
11.	50	27	77	3.2	21	27	48	2.0	-29	- 1.2
12.	27	27	54	2.3	21	27	48	2.0	- 6	- 0.3

[4]Assumes that households without municipal water depend completely on tankers, that those with it supplement their supply with tanker purchases.

[5]Assumes that the cost of cleaning the cesspool is JD 4.500, has to be done very two months, and is paid by the occupant. This may be on the high side, since some occupants frequently find illegal means of emptying cesspools.

[6]Assumes that improved system eliminates the need for tanker purchases except in situations of extreme drought, and that water consumption is 60 lpcd for low income households and 100 lpcd for middle income households. Costs are estimated on the basis of the new tariff which is effective April 1, 1978.

[7]Sewerage costs are based on a new surcharge rate of 35 fils/m^3. For owner-occupied dwellings an additional tax of 4% of assessed rent is levied. This is calculated on the assumption that assessed rents are JD 160 for low income households and JD 480 for middle income households.

TABLE SIX

THE IMPACT OF SYSTEM IMPROVEMENTS ON TYPICAL HOUSEHOLDS

House-Hold No.	Rent[1] or Own	Present[2] Service	Future Service	Income	Connection Costs			% of Income
					Water[3]	Sewerage	Total	
1.	R	none	W	600	50	--	50	8.3
2.	R	none	W/S	600	50	--	50	8.3
3.	R	W	S	600	--	--	--	--
4	0	none	W	600	100	--	100	16.6
5.	0	none	W/S	600	100	80	180	30.0
6.	0	W	S	600	--	80	80	13.3
7.	R	none	W/S	2400	65	--	65	2.7
8.	R	none	W/S	2400	65	--	65	2.7
9.	R	W	S	2400	--	--	--	--
10.	0	none	W	2400	110	--	110	4.6
11.	0	none	W/S	2400	110	115	225	9.4
12.	0	W	S	2400	--	115	115	4.4

[1] Rent = R; Own = 0

[2] Water = W; Sewerage = S; Water and Sewerage = W/S

[3] Water costs are based on the assumption that low income renters will pay the costs of the connection with a minimal cost system, while owners will invest in a roof tank and a few more faucets. Sewerage connection costs will be paid by owners.

ENVIRONMENTAL ASSESSMENT

Under an AID contract numbered AID/OTR-C-1628, Stanley Consultants carried out an environmental assessment (EA) of the proposed project. The draft report dated May 19, 1978 was submitted to AID for review. The final report is due in July.

The following pages summarize the findings as reported to AID. The draft report is on file in NE/PD.

From: L. L. Pruitt Date: April 26, 1970

Re: Environmental Assessment
Amman Water and Sewerage Project
Debriefing

At the conclusion of the field investigations in Amman, Jordan, Pruitt, Tagg, and Wolf met with Terry Brown of AID Washington and Bob Davis of AID Amman to discuss the findings of the investigation. This meeting was held on April 16, 1970, in the AID offices in Amman. A similar debriefing was held in the AID offices in Washington, D.C., on April 18, 1970, involving Pruitt, Titus, and AID representatives Robert Fedel, Leonard Rosenberg, and Ron Witherell. The following narrative includes the basic information presented during the debriefings. The arrangement of the following information is in accordance with the Scope of Work outline.

A. Water Supply

1. Temporary and long term impacts of constructing the intake station, treatment plant, pipeline, pumping stations and storage tanks.

   a. Temporary.

      1.) Increased noise and air pollution as a result of construction.

      2.) Increased traffic on local roads leading to the various construction sites. Probable damage to local roads as a result of the movement of heavy equipment.

      3.) Probable increases in runoff and soil erosion as a result of construction until such time as all earth work is completed and revegetation is established.

      4.) Probable disruption to local traffic periodically at points of construction adjacent to local roadways.

      5.) All fauna could easily relocate beyond construction areas as it is not believed that any unique habitat will be disrupted.

   b. Long Term Impacts.

      1.) About 17 hectares of land will be removed from present use and converted to more intensive use for construction of the water treatment plant, pretreatment plant, and pump stations.

2.) All existing flora and fauna in these areas will be totally disrupted with very limited potentials for natural return. This disruption is not felt to be significant except as it removes land from agricultural production.

3.) Approximately 25 hectares of land will be required for the pipeline route including a road and power line. This disruption can potentially be partially returned to existing uses by revegetation of all grazing areas upon completion of the project. Reforested areas will have to be cleared for the ten meter right-of-way plus "fall distances" on either side for protection of the power line. This potentially could remove the 90 meter width along the route through the forested areas. Shrubs and grasses must be established in these areas. Agricultural uses could resume upon completion of the project except in the 10 meter right-of-way. The proposed access road along the pipeline route will provide better access to farm land. The pipeline will displace 9 hectares of agricultural land.

2. Impacts of water treatment plant.

a. Plant site as related to existing and future land uses. Both the pre-treatment plant and the treatment plants sites are situated in the remote undeveloped areas. Existing uses consist of grazing land and agricultural lands. The sites will be removed from these uses, but the development is compatible with the existing police post. It is not felt that these facilities will hinder the surrounding grazing and agricultural uses in the future. Nor is it felt that the development will generate significant additional intensive development to further impinge on the rural nature of the area.

b. Provisions for chemical sludge disposal. The design report for the water treatment plant indicates no provisions for chemical sludge disposal. The project coordinator for AMSA suggested that it might be discharged through a pipeline to the river downstream of King Talal dam. This would add to the pollution load of the Zerqa River, and particularly to the irrigation water to be used in the Jordan River Valley. Some other means of chemical sludge disposal should be provided.

c. Provisions for disposal of filter backwash waters. The final design report provides for settling of the backwash water with the effluent going back to the initial water treatment stage. The underflow would probably be disposed of similar to the chemical sludge discussed previously.

d. Provisions for attaining and maintaining treated water quality. The proposed treatment method appears to be sufficient to attain the required water quality. There will be problems with nitrates and total dissolved solids as the amount of wastewater returning to King Talal dam is increased. Consideration should be given to lowering the raw water intake to avoid growths of algae which is expected near the surface.

3. Social and public health impacts of the increased water supply to Amman.

a. Disposal of increased amounts of wastewater. When the sewage treatment plant is operating properly, good treatment occurs. However, plant

capacity is limited and as the design capacity of BOD is approached, effluent quality will probably decrease. This will have some impact on downstream water users but is not expected to significantly impact the King Talal reservoir quality. An earlier than anticipated expansion of the sewage treatment plant will be required to avoid degrading effluent quality.

b. Social and economic problems.

1.) Social impacts result from added water being supplied to all areas and economic ranks of Amman. This should improve living conditions and health for the urban poor which are connected to the system as a result of the project.

2.) Economically, Amman is the center of commerce and industry in Jordan. About 60 percent of the country's population lives in the study region and is producing 55 percent of the country's goods and services. Without water, economic development will be impinged, however, reaction time would be slow and development would continue for some period of time in the future.

3.) Economically, water diverted from King Talal dam will potentially remove land from irrigation in the Jordan Valley and will limit agricultural productivity. Initially, 15 MCM per year will be diverted. This will remove potentially 1500 hectares of land from irrigation with a production equivalent of 1.5 million JD. There is no way to quantify the monetary equivalent of the water going to Amman.

4.) Potentially, as water becomes available the demand for it will increase. VBB reported a 1975 consumption of 75 lpcd for the Amman area. This is projected to increase to 135 lpcd by year 2005. Indications are that this projection may be low.

c. Population influx to the area. Most of the water and sewer planning has been based on VBB population estimates. These call for a 4 or 5 percent rate of growth in 1975 falling to 3 percent annually by 2005. Past and present trends do not support this estimate. Estimates of annual growth from the Amman Urban Regional Planning Group indicates that Amman has been growing in excess of 5.5 percent annually since 1971. The National Water Plan presents growth of figures which are slightly higher than those of VBB. They appear to be more realistic. The government has talked about decentralization from the Amman area, however, the type of development which is being promoted does not indicate true decentralization. Water demands should be evaluated based on realistic population estimates. Total water consumption and also wastewater flows should be re-evaluated on the basis of more realistic population projections. By the year 2000, it appears that the VBB estimate may be about 30 percent low.

B. Sewerage System and Sewage Treatment Works

1. Environmental effects of extending the sewage collection system. Increasing the service area for the sewage collection system is a necessary step for

improvement of the entire water system in the Amman area. The amount of infiltration from cesspools to the ground water will be significantly reduced. There will also be less open surface flow of wastewaters which currently occur either intentionally or unintentionally. An increased load and flow will be directed to the sewage treatment plant. Characteristics of the effluent will not be changed significantly. Public health benefits will be increased in Amman.

2. Treatment works and outfall.

a. Impacts of the sewage treatment plant effluent. The present sewage treatment plant effluent contains relatively high amounts of nitrogen (three to four times as much as United States sewage). The effluent nitrogen is about two to three times that of the water supply. The nitrate content in King Talal reservoir will increase as the amount of wastewater flows increase. Total dissolved solids levels will also increase but more slowly than the nitrates. Microbial contamination from all sources with the possible exception of Jerash should be negligible. Toxic substances are present and will probably remain in the wastewater. Heavy metals can probably be controlled but agricultural chemicals will remain a problem. Wastewater flows currently make up about 8 percent of the total flow to King Talal reservoir in an average year. As the wastewater flows increase, this percentage is expected to go up to about 35 percent during an average year in 1990. During a dry year, the present wastewater contribution is about 11 percent and is expected to increase to about 46 percent in 1990. Within an average year the monthly variations in stream flows can change the percent of wastewater flows by at least a factor of 2.

b. Existing sewage treatment plant and effects of proposed improvements and the expansion of sludge facilities in terms of meeting future flows and loadings. New sludge drying beds should be provided with a concrete bottom slab or an impervious clay layer to allow collection of the drainage water. There is probably not enough digester capacity being provided to meet the projected solids loadings. By the end of the current expansion program, more volume will be required. Aerobic digestion might be suggested as an alternative for better operational reliability. The existing sewage treatment plant site is limited from a space standpoint. Some consideration should be given to other means of sludge dewatering to minimize the space required. The treatment plant was not initially designed for the strong concentrations of wastewater being received. Studies should be instituted immediately to evaluate future sewage treatment plant requirements.

C. Miscellaneous

1. Effects on water quality in the aquifers and King Talal reservoir. Most of the sludge from the sewage treatment plant is currently disposed on the surface at the municipal dump. Leachates from the sludge and other rubbish in the dump find their way into the ground water of the upper aquifer which serves as the primary water supply for Amman at the present time. Conditions at the dump are deplorable and immediate attention is needed. The primary agricultural development in the Zarqa River Valley is located within the

flood plain. Irrigation water is drawn directly from the Zarqa River. Contamination of the stream flows results from irrigation returns and runoff of agricultural chemicals during flood flows and normal stream runoff. No waste treatment is currently provided for any of the other communities in the Amman-Zarqa basin. A system has been designed for Jerash and a system for Zarqa and adjacent industries is under study. Emphasis must be placed on providing adequate waste treatment and wastewater management for all waste sources in the basin.

2. Effects of the project on archaeological sites. Discussions with the Department of Antiquities indicates that potentials do exist for archaeological sites along the project route. Of most significance would be the El Rumman and Tell Qira areas. However, based on the 12 previously unknown sites found at the King Talal reservoir site it is recommended that a thorough survey of the pipeline route and plant sites be undertaken prior to construction.

D. Potential Modifications or Alternatives to the Project

1. No major modifications were suggested at this time.

2. Alternatives to the project. Development of the water supply from King Talal reservoir will probably provide an adequate quality of water for the first stage of development. As the quantity of diversion from the reservoir and consequent ~~increase in~~ wastewater flows into the reservoir are increased, the quality will decrease. Calculations will be conducted to try to identify an upper limit of safe "recycling" through King Talal reservoir. In view of the increasing demands for water in Amman, steps should be taken immediately to develop additional separate water supplies. The Upper Wala supply appears to be a viable source of additional supply. Studies should be initiated immediately for development of this source. Other ground water sources in the area are not promising. Diversion of water from the proposed project on the Yarmouk River may be the only viable alternative. To meet immediate demands, however, the King Talal diversion project for the first stage appears to be the only reasonable source.

LLP:st:7183-01

cc: R. H. Anderson
cc: R. J. Tagg
cc: K. L. Wolf
cc: L. L. Pruitt

(1) Logical Framework

Project Goal

The goal of the Project is to enhance the quality of life in Amman, including the urban poor. As an indicator of quality of life, it was determined that the only verifiable measure was increased per capita consumption. It is recognized that the ultimate impact of improved water availability and sewerage is a general improvement of public health. As a result of the Project, there should be a decline in the incidence of water-related disease morbidity and mortality relative to other diseases. However, measurement of changes in morbidity of water-related diseases is extremely difficult to quantify and to relate causally to changes in water/sewage only. In addition, health statistics are not adequate to establish a reasonable base-line on morbidity and mortality. Therefore, increasing per capita consumption to approximately 70 liters per capita per day (lpcd) by 1990 from 43 lpcd in 1977 was adopted as a reasonable measure of improvement in the quality of life in Amman.

The assumptions which link the Project goal to Project purpose are

(a) that average per-capita consumption will increase proportionally in poor and non-poor areas, and
(b) additional adequate sources of water to supply Amman will be developed as needed after the project.

(2) Project Purpose

The purpose of the Project is to expand the capacity of the Amman Water and Sewerage Authority to provide a reliable supply of water and increased sewerage service to the City of Amman. The following indicators will be used to verify achievement of the Project purpose:

(a) Water of acceptable quality available on a regular basis to consumers connected to the AWSA System.
(b) Up to 75 million cubic meters (mcm)/year of water of adequate quality supplied to the AWSA system from the King Talal reservoir.
(c) Household water connections reach approximately 82% of the population.
(d) Household sewer connections reach approximately 56% of the population.
(e) Sewage treatment plan operating within acceptable standards in terms of quality of effluent and disposal of sludge.
(f) Uncounted-for water losses reduced from 38% of total water produced in 1977 to 30% by 1981.

AWSA records will be the major source of information for the verification of purpose achievement. For the final Project report, AWSA will be requested to include sufficient information related to the above indicators to allow evaluation of the project at the purpose level.

Assumption for the achievement of Project purposes are as follows:

(a) Estimates of population growth and projected water supply requirements and reasonable (See Annex B, Technical Analysis).

(b) An adequate supply of power will be available on a timely basis for the operation of the water transmission system. (See Part V B below, Conditions Precedent).

(c) Appropriately trained personnel for the water and sewerage treatment will be in place upon completion of the water transmission system and the sewage treatment plant (See Part V, Conditions Precedent).

(d) Households will connect to water and sewerage laterals as they become accessible (see Annexes B and E, Technical Analysis and Social Soundness Analysis).

Based on the analyses provided in the Project Paper referenced in each of the above, the assumptions are considered reasonable.

(3) Project Outputs

Project outputs are as follows:

(a) Construction of a water transmission system from the King Talal Reservoir to Amman, including the water intake structure, pipeline, water treatment facilities, pumping stations, and reservoirs.

(b) Construction of approximately 207 Km. of water mains, laterals house connections, and related pumping stations and reservoirs.

(c) Construction of approximately 225 Km. of sewer mains, laterals, and house connections.

(d) Expansion and improvement of the sewage treatment plant.

(e) Construction management assistance and training provided to AWSA.

Verification of achievement of outputs will be available from periodic reports submitted by AWSA's engineering consultants and from AWSA.

Assumptions linking Project inputs to outputs are as follows:

(i) GOJ resources, including those to be provided by other donors (IDA and the Saudi Fund) will be available as needed.

(ii) The implementing agency will manage the Project adequately.

(iii) Acquisition of the right of way for the water transmission system will proceed on a timely basis.

Based upon the analysis contained in Part III F and the Conditions Precedent to be included in the AID Loan Agreement, the above assumptions are considered reasonable.

(4) Project Inputs

The Project inputs all include all necessary equipment and materials, construction services, and engineering services to complete the anticipated outputs. Resources will be provided by the Saudi Fund, the World Bank, the GOJ, and the proposed AID Loan. A summary of Project outputs and inputs (cost estimates and financial plan) is contained in the following Section.

JORDAN - AMMAN WATER AND SEWERAGE

278-22[illegible]

6C(2) - PROJECT CHECKLIST

Listed below are, first, statutory criteria applicable generally to projects with FAA funds, and then project criteria applicable to individual fund sources: Development Assistance (with a sub-category for criteria applicable only to loans); and Security Supporting Assistance funds.

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

GENERAL CRITERIA FOR PROJECT.

1. App. unnumbered; FAA Sec. 653(b)

(a) Describe how Committees on Appropriations of Senate and House have been or will be notified concerning the project; (b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than $1 million over that figure plus 10%)?

(a) Advice of Program Change will be prepared for this project.

(b) Yes.

2. FAA Sec. 611(a)(1). Prior to obligation in excess of $100,000, will there be (a) engineering, financial, and 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 further legislative action is required.

4. FAA Sec. 611(b); App. Sec. 101. If for water or water-related land resource construction, has project met the standards and criteria as per Memorandum of the President dated Sept. 5, 1973 (replaces Memorandum of May 15, 1962; see Fed. Register, Vol 38, No. 174, Part III, Sept. 10, 1973)?

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 the country's capability effectively to maintain and utilize the project?

The Project Paper contains a 611(e) certification.

A.

6. FAA Sec. 209, 619. 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. If assistance is for newly independent country, is it furnished through multilateral organizations or plans to the maximum extent appropriate?	Project is not so susceptible. Project will not directly encourage regional development programs. Jordan is not a newly independent country.
7. FAA Sec. 601(a); (and Sec. 201(f) for development loans). 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; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.	The technical efficiency of agriculture, commerce and industry should be improved by this project in that it will provide adequate water for municipal, industrial and agricultural uses.
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).	Construction services financed under the project will be procured from U.S. firms or U.S./Jordanian joint ventures.
9. FAA Sec. 612(b); Sec. 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized to meet the cost of contractual and other services.	The Project Agreement will so provide.
10. FAA Sec. 612(d). Does the U.S. own excess foreign currency and, if so, what arrangements have been made for its release?	Jordan is not an excess currency country.

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria	
a. FAA Sec. 102(c); Sec. 111; Sec. 281a. Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production, spreading investment out from cities to small towns and rural areas; and (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions?	Not Applicable.

e. FAA Sec. 202(a). Total amount of money under loan which is going directly to private enterprise, is going to intermediate credit institutions or other borrowers for use by private enterprise, is being used to finance imports from private sources, or is otherwise being used to finance procurements from private sources?

f. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete in the U.S. with U.S. enterprise, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan?

3. Project Criteria Solely for Security Supporting Assistance

FAA Sec. 531. How will this assistance support promote economic or political stability?

This project will promote the economic stability of Jordan by providing adequate water and sewerage treatment to the 700,000 people in Amman.

4. Additional Criteria for Alliance for Progress

[Note: Alliance for Progress projects should add the following two items to a project checklist.]

N/A.

a. FAA Sec. 251(b)(1), -(8). Does assistance take into account principles of the Act of Bogota and the Charter of Punta del Este; and to what extent will the activity contribute to the economic or political integration of Latin America?

b. FAA Sec. 251(b)(3); 251(d). For loans, has there been taken into account the effort made by recipient nation to repatriate capital invested in other countries by their own citizens? Is loan consistent with the findings and recommendations of the Inter-American Committee for the Alliance for Progress (now "CEPCIES," the Permanent Executive Committee of the OAS) in its annual review of national development activities?

UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

AMMAN – JORDAN

وكالة الولايات المتحدة للانماء الدولي

عمـــان – الاردن

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

I, Christopher H. Russell, 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 judgement Jordan has both the financial capability and the human resources capability to effectively maintain and utilize the capital assistance project, Amman Water and Sewerage Expansion.

Christopher H. Russell
AID Director

DRAFT
GC/NE:JMiller:ew
6/20/78

PROJECT AUTHORIZATION
AND REQUEST FOR ALLOTMENT OF FUNDS

PART II

Name of Country: Jordan

Name of Project: Amman Water and Sewerage

Number of Project: 278-0220

Pursuant to Part II, Chapter 4, Section 532 of the Foreign Assistance Act of 1961, as amended, I hereby authorize a Loan to Jordan (the "Cooperating Country") of not to exceed Twenty-Eight Million Five Hundred Thousand United States Dollars ($28,500,000), (the "Authorized Amount") to help in financing certain foreign exchange and local currency costs of goods and services required for the project as described in the following paragraph.

The project consists of assisting the Cooperating Country in the overall expansion of the water supply, water distribution, sewerage and sewage treatment systems for Amman.

I approve the total level of A.I.D. appropriated funding planned for this project of not to exceed $39,000,000, including the funding authorized above, during the period FY 1978 through FY 1979. $10,500,000 will be available for additional increments during that period, subject to the availability of funds in accordance with A.I.D. allotment procedures.

I hereby authorize negotiation and execution of the Project Agreement by the officer to whom such authority has been delegated in accordance with A.I.D. regulations and Delegations of Authority subject to the following essential terms and covenants and major conditions; together with such other terms and conditions as A.I.D. may deem appropriate:

a. Interest Rate and Terms of Repayment.

The Cooperating Country shall repay the Loan to A.I.D. in United States Dollars within forty (40) years from the date of first disbursement of the Loan, including a grace period of not to exceed ten (10) years. The Cooperating Country shall pay to A.I.D. in United States Dollars interest from the date of first disbursement of the Loan at the rate of (a) two percent (2%) per annum during the first ten (10) years, and (b) three percent (3%) per annum thereafter, on the outstanding disbursed balance of the Loan and on any due and unpaid interest accrued thereon.

b. Source and Origin of Goods and Services.

Goods and services financed by A.I.D. under the project shall have their source and origin in the Cooperrating Country or in countries included in A.I.D. Geographic Code 941, except as A.I.D. may otherwise agree in writing.

c. Initial Conditions Precedent

Prior to any disbursement or the issuance of any commitment documents under the Project Agreement, the Cooperating Country shall except as A.I.D. may otherwise agree in writing, furnish in form and substance satisfactory to A.I.D.:

1. Evidence that the proceeds of the Loan have been made available to the Amman Water and Sewerage Authority (AWSA);

2. A plan for the utilization of the King Talal Dam reservoir, including:

   i. Estimated monthly withdrawal schedule for Amman municipal use and for irrigation to 1989; and

   ii. Evidence of agreement between AWSA and Jordan Valley Authority ("JVA") for the allocation of water from the reservoir development for the schedule specified in subparagraph (i), including the involvement of JVA in regulating extraction from King Talal;

3. (i) an integrated project implementation schedule; and (ii) evidence of financial commitments by the Cooperating Country, the International Bank for Reconstruction and Development ("IBRD") and the Saudi Fund for the King Talal transmission system and the water distribution and sewerage system;

4. An executed and delivered contract for project implementation assistance; and

5. Evidence that the overhead power line and other electrical installations not included in the construction contracts under the project but necessary for the operation of the King Talal water transmission system will be installed on a timely basis.

d. Additional Conditions Precedent to Disbursement for Construction Services for the King Talal Water Transmission System

Prior to any disbursement, or to the issuance of any commitment under the Project Agreement to finance Construction Services for the King Talal water Transmission System, the Cooperating Country shall, except as A.I.D. may otherwise agree in writing, furnish in form and substance satisfactory to A.I.D.·

1. An executed and delivered construction contract for the work to be financed under the Loan;
2. An executed and delivered contract for construction supervision;
3. A design for disposal of waste water and chemical sludge from water pre-treatment and treatment;
4. A training plan for the operation and maintenance of the King Talal Water Transmission System;
5. An executed and delivered contract for the water intake structure and the water transmission pipeline; and
6. Evidence that AWSA has unencumbered use of the right-of-way for the pipeline and all other components of the system.

e. Additional Conditions Precedent to Disbursement for Other Construction Services

Prior to any disbursement, or to the issuance of any commitment under the Project Agreement to finance construction services for areas 1S,

5Ws and Wahdat/Shelieh and the expansion of the sewage treatment plant, the Cooperating Country shall, except as A.I.D. may otherwise agree in writing, furnish in form and substance satisfactory to A.I.D. the following prior to disbursement for each particular contract:

1. An executed and delivered contract for supervisory engineering services for the particular construction contract;
2. An executed and delivered construction contract;
3. Evidence of unencumbered use of the right-of-way or other land required for carrying out the particular contract; and
4. For construction services related to the expansion of the sewerage treatment plant, a training plan for the operations and maintenance of the facilities to be constructed/installed under the project.

e. Special Covenants

1. Borrower covenants that within one year from the effective date of the Loan Agreement, a water monitoring system will be established to monitor the quality and quantity of water in the King Talal Reservoir, the upper and lower aquifers, and the Zerqa River to the King Talal Reservoir. As part of the monitoring system, Borrower agrees to undertake a review of industrial and municipal pollution of the Zerqa River above the King Talal Dam and establish procedures to maintain mutually acceptable standards of water quality of the Zerqa River.

2. Borrower covenants that within one year following the effective of the loan agreement, a plan for the disposal of dried sludge from the sewage treatment plant will be prepared and within two years following the effective date of the agreement the plan will be implemented.

3. Borrower covenants to undertake, within one year from the effective date of the agreement, a feasibility study to review the requirements for expanding the treatment of the increased quantity of piped sewage which will result from the Project. Upon completion, Borrower, in consultation with A.I.D. will prepare and implement a plan to expand sewage treatment plant.

4. Borrower will undertake, within one year from the effective date of the Agreement, a study of the financial constraints limiting the access of lower income families to the water and sewerage system and identify means of assisting those families as needed. The results of the study will be reviewed by Borrower and A.I.D., following which, Borrower will establish procedures, as agreed between the Borrower and A.I.D. and within a mutually-acceptable time frame, to assure access of lower income families.

5. If Borrower determines that the total annual withdrawal from the King Talal Reservoir will exceed the level stipulated in the reservoir operational plan submitted in conformity with the conditions precedent to initial disbursement, Borrower agrees to review the proposed

revised operational plan with A.I.D., including an assessment of the environmental implications of the anticipated increased total annual withdrawal and to take such steps as may have been agreed in such review.

6. Borrower covenants to undertake, within one year from the effective date of the Agreement, a study of solid waste disposal within Amman, including the relationship between current waste disposal and Amman's water resources. Results of the study will be reviewed by Borrower and A.I.D. and the agreed results of such review incorporated in procedures for disposal of Amman's solid wastes.

7. Borrower agrees to review with A.I.D. possible rate schedules for water and sewerage service during the course of the project and devise a rate structure which will make the AWSA financially viable.

_____
John J. Gilligan

_____
Date

Clearance:
NE/DP:BLangmaid_____
NE/PD:SATaubenblatt_____
NE/JLS:BRichardson_____
GC/NE:JMullen_____
GC:MBall_____

ANNEX K
Page 1 of 1

THE HASHEMITE KINGDOM OF JORDAN
NATIONAL PLANNING COUNCIL
AMMAN
Tel 41[illegible] 41170
P.O.B 555
Teleg NPC Amman

المملكة الاردنية الهاشمية
المجلس القومي للتخطيط
عمان

No 11-7/8/2899
Date 18/6/1978
Ref

الرقم
التاريخ
الموافق

JUN 19 1978

Mr. Christopher Russell,
Director,
USAID/J,
American Embassy,
Amman.

Amman Water & Sewerage Project.

Dear Mr. Russell,

I refer to our discussions regarding FY 78 and FY 79 programs when the sums of US $ 28.5 million and US $ 10.5 million loans respectively were allocated to the Amman Water and Sewerage projects.

You are kindly requested to make the necessary arrangements for the processing of these loans as soon as possible.

Sincerely yours,

President

CC: H.E. Director General, Amman Water & Sewerage Auth.