

CR-43

FILE COPY

RESTRICTED

Report No. TO-387a

This report was prepared for use within the Bank and its affiliated organizations. They do not accept responsibility for its accuracy or completeness. The report may not be published nor may it be quoted as representing their views.

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT
INTERNATIONAL DEVELOPMENT ASSOCIATION

APPRAISAL OF THE
AZRAQ-IRBID WATER SUPPLY PROJECT
HASHEMITE KINGDOM OF JORDAN

September 16, 1963

Department of Technical Operations

CURRENCY EQUIVALENTS

U.S. \$1.00 = JD 0.357
JD 1.00 = 1,000 Fils
JD 1.00 = U.S. \$2.80
JD 1,000,000 = U.S. \$2,800,000

Abbreviations

M^3 = cubic meter
cu. m. = M^3
km. = kilometer
1 cu. m. = 264 U.S. Gallons
100 Fils per cu. m. = U.S. \$1.00/1,000 U.S. Gallons

APPRAISAL OF THE
AZRAQ-IRBID WATER SUPPLY PROJECT
THE HASHEMITE KINGDOM OF JORDAN

TABLE OF CONTENTS

	<u>Paragraphs</u>
SUMMARY AND CONCLUSIONS	i - vii
I. INTRODUCTION	1 - 3
II. THE PROPOSED BORROWER	4 - 7
III. PRESENT WATER FACILITIES AND CHARACTERISTICS OF IRBID, MAFRAQ, RAMTHA, AND HUSN	8 - 28
Irbid City	8 - 19
Ramtha	20 - 21
Mafraq	22 - 23
Husn	24
Water Quality and Health Statistics	25 - 28
IV. WATER CONSUMPTION AND WATER DEMAND	29 - 45
Present Water Consumption	29 - 35
Population Growth	36
Future Demand	37 - 38
Water Rates, Metering and Policies	39 - 45
V. THE PROJECT	46 - 71
The Transmission Main	46 - 55
Irbid Distribution System	56
Distribution Systems of Mafraq, Ramtha, and Husn	57
New Water Sources	58 - 63
Project Planning	64
Construction and Procurement	65
Management and Supervision	66 - 69
Project Cost Estimates	70 - 71
VI. FINANCING PLANS AND FINANCIAL PROJECTIONS	72 - 80
Source of Funds	72 - 74
Financial Projections	75 - 80
VII. JUSTIFICATION OF THE PROJECT	81 - 84
VIII. CONCLUSIONS AND RECOMMENDATIONS	85 - 87

ANNEXES

1. Organization Chart for Central Water Authority
2. Irbid Municipality - Organization Chart
3. Estimated Revenues and Expenditures - Irbid Water Department
4. Health Statistics
5. Water Consumption
6. Population Growth of All Areas
7. Estimated Per Capita Consumption Per Day
8. Azraq Water Pipeline (Demand Table)
9. Proposed Construction Schedule Azraq-Irbid
10. Project Costs
11. Azraq-Irbid Pipeline - Pro Forma Income Statements
12. Azraq-Irbid Pipeline - Sources and Application of Funds
13. Irbid Distribution System - Pro Forma Income Statements
14. Irbid Distribution System - Sources and Application of Funds
15. Assumptions for Financial Statements

MAPS

1. Azraq-Irbid Water Supply Project
2. Azraq-Irbid Water Project -
Water Distribution System - Irbid

I. INTRODUCTION

1. The Hashemite Kingdom of Jordan, acting through the Jordan Development Board, has requested a development credit from the International Development Association to help finance the Azraq-Irbid Water Supply Project. This project would include works for collecting water from springs near Azraq, pumping facilities, reclamation and partial relaying of an abandoned petroleum pipeline, substantial improvement to the water distribution systems of the cities of Irbid, Mafraq, and Ramtha, and construction of a distribution system for Husn. Provision is made also for supplying an air base and seven desert watering points. Later connection of 46 villages to the pipeline is also foreseen.

2. Total project costs are estimated at JD493,000 (US\$1,380,000). A credit of US\$920,000 from IDA would cover two-thirds of the project costs. The source of capital to cover the remaining costs of JD164,000 (US\$460,000) would be loans by the Municipal Loan Fund.

3. This appraisal is based on documentation prepared by the Central Water Authority (CWA), an agency of the Jordanian Government and field visits by Association staff. Two proposals were made. The first proposed use of water from the Ain Zahar springs located 20 kilometers west of Irbid. Because of the high cost, Association staff suggested another alternative be sought. This second one would provide for utilization of water from the Azraq springs located 130 kilometers southeast of Irbid. The development of a project using Azraq springs is cheaper to operate and maintain, will meet the needs for a longer period, and will benefit a greater number of people. Because an existing petroleum pipeline will be used as the transmission main, it also will have a lower cash cost. It, therefore, has been selected by the Jordan Government.

II. THE PROPOSED BORROWER

4. The proceeds of the credit to the Hashemite Kingdom of Jordan would be made available to CWA for construction of the transmission main and the execution of the distribution system work in the four cities of Irbid, Mafraq, Ramtha, and Husn.

5. CWA would build and operate the transmission main, which would consist of the collection works at the Azraq springs, pumping station, pipeline, desert watering stations, reservoir, and spur lines to the consumer municipalities. It would sell the water in bulk and repay the loans made for the transmission main from the proceeds.

6. The cities of Irbid, Mafraq, Ramtha, and Husn are directly responsible for their water systems and would therefore carry responsibility for repayment of loans made for improvement of their water distribution systems. Upon completion of the work, CWA would transfer same to the muni-

at water rates greater than at present, but similar to the higher water rates in effect elsewhere in Jordan (Paras. 72-80).

vi. The project is necessary to provide for the potable water needs of the four major cities of Jordan by utilization of a water source now flowing to waste. It will contribute to better public health by making available safe water in adequate quantities. Expensive, limited and unsafe haulage of water would be eliminated (Paras. 81-84).

vii. With the conditions agreed to by the Borrower, the project provides a suitable basis for an IDA credit of \$920,000 (Paras. 85-87).

APPRAISAL OF THE
AZRAQ-IRBID WATER SUPPLY PROJECT
THE HASHEMITE KINGDOM OF JORDAN

SUMMARY AND CONCLUSIONS

- i. The Hashemite Kingdom of Jordan, acting through the Jordan Development Board, has requested a development credit from the International Development Association to help finance a comprehensive project to supply water in bulk through a transmission main to Irbid and three other municipalities, desert watering stations, and an air base. The project includes improvements to, and an installation of, municipal distribution systems. The Central Water Authority (CWA), to whom the credit would be relent, would execute the project and operate the transmission main. The distribution works would be transferred to the municipalities with the repayment obligations for appropriate shares of the credit (Paras. 1-7).
- ii. Present water sources are inadequate and undependable. Each municipality now hauls part of its water supply and one is entirely dependent on this method of supply once rain water cisterns are exhausted. Very limited water distribution systems exist in three of the municipalities and none in the fourth. Water quality is unsatisfactory, largely due to the contamination inherent in periodic shutting-off of supply and to the handling of trucked water. Water consumption is very low, from 7 liters per person per day in one city to 29 in another. Water-borne diseases are prevalent in the area (Paras. 8-45).
- iii. The project consists of the reclamation of part of an abandoned petroleum pipeline extending from the Iraq border across Jordan to its western boundary. The pipeline passes by the Azraq springs, now flowing to waste, by Mafraq municipality and air base, and on by the other municipalities to be served. The water would be pumped 137 kilometers to a reservoir from which it would be distributed to Irbid, Ramtha, and Husn. Mafraq, the air base, and desert watering stations would be supplied en route directly from the pipeline. The project also includes extensions to the distribution systems of Irbid, Mafraq, and Ramtha as well as installation of a system in Husn (Paras. 46-63).
- iv. Consultants for the transmission main and pumping stations have been hired by CWA and work on this part of the project has already begun. CWA will operate the transmission main and the distribution systems will be administered by each of the respective municipalities. Management assistance will be obtained by CWA and made available to the municipalities. Total project costs will be \$1,380,000 of which foreign currency costs are estimated at about \$797,000 (Paras. 64-71).
- v. An IDA credit of \$920,000 would cover two-thirds of the project costs. The remaining portion would be financed by loans from the Municipal Loan Fund. Financial projections indicate a financially satisfactory basis

cipalities together with all appropriate assets and liabilities. The cities would carry their proportionate share of the costs of the pipeline and bulk service facilities through the payments made for water taken from the pipeline.

7. The Central Water Authority is an autonomous agency of government and is responsible for all development of water resources in Jordan. Although at present concerned only with the technical development aspects of water supply, provision is made in its charter for taking on administrative and management functions when necessary. CWA would be responsible for operating the transmission main and for providing management assistance to the cities. An organization chart for CWA is shown in Annex 1. The dotted lines on this chart reflect a proposed new division which would be concerned with the Azraq-Irbid transmission main operations and the management supervision and assistance to all municipalities throughout Jordan.

III. PRESENT WATER FACILITIES AND CHARACTERISTICS OF IRBID, MAFRAQ, RAMTHA, AND HUSN

Irbid City

8. Irbid may be considered in two parts. One contains the city in general, with the following water users in addition to domestic consumers:

- a) Industrial - one ice factory, 3 olive presses, 6 flour mills, 12 tile factories, 30 concrete block factories, 2 cotton mills, the electric company.
- b) Commercial - 50 garages, 15 bakeries, 3 hotels, 50 coffee houses and restaurants, 4 cinemas, 10 animal yards, 1,500 various shops.
- c) Institutions - 3 hospitals, 43 schools, 8 mosques, 5 churches, 1 slaughter house, public fountains and municipal buildings.

9. The second part is the refugee camp. There are 13,300 people in this camp at present. Prior to 1948 the population of Irbid did not exceed 20,000. Results from the 1961 national census placed the total population, including refugees, in the camp, at 44,800.

10. Organization charts of the city and its Water Department are shown in Annex 2. An approximate pro forma income statement for the Water Department for the past five years is given in Annex 3.

11. At present, the City of Irbid derives its water from four different springs, three of which are located 15 kilometers east of Irbid. The waters of Um-El-Fruth and Al Farah springs flow by gravity to a wet well in Wadi Rahoub. Shallalla spring water is pumped to the wet well. The collected waters are then pumped to Irbid. The fourth source, which

also is pumped to the city, is Khureibeh spring, 11 kilometers north of Irbid.

12. It is estimated that the minimum yield of the springs, is some 900 cu m per day, with an average daily yield of at least 1,000 cu m. The springs' flow has only recently been properly metered.

13. There are neither pumping stations nor treatment facilities within the city. Pressure is controlled by the main reservoir on top of a small hill in the center of the city. Water is delivered to the reservoir directly from the spring pumping stations.

14. Water storage for the system consists of six reinforced concrete reservoirs with a total capacity of 460 cu m.

15. There is no work plan for preventive or routine maintenance. All such work is performed on a demand basis. Annual maintenance costs are reflected in the Water Department's records of revenues and expenditures. Expenditures have recently averaged JD700 annually.

16. The municipality owns the existing springs. It has the full rights to use all four sources of water. There have been no water right disputes and none are pending.

17. All pipelines are laid either on public lands adjacent to roads or across fields where easement has been granted by right of eminent domain. Reservoirs are on city property.

18. The current value of the assets of the existing water system of Irbid have been estimated by CWA as follows:

1. Pumps and prime movers	JD	15,000
2. Reservoirs in Irbid, Rahoub, Khureibeh and Shallalla		12,000
3. 6-inch pipe from Rahoub to Irbid 10 km		32,000
4. 4-inch pipe from Ain Shallalla to Rahoub 6 km		8,000
5. 4-inch pipe from Khureibeh to Irbid 13 km		16,000
6. Pump station buildings, living quarters for guard and employees		15,000
7. Two chlorinators		1,200
8. Two mobile water tanks and pick-up truck		3,000
9. Existing water mains and distribution network		100,000
10. Tools and spare parts		<u>1,800</u>
Total	JD	<u>204,000</u>

19. There are 4,500 water meters installed. All are $\frac{1}{2}$ -inch diameter except for three 4-inch meters at the Refugee Camp, Army Camp and Teachers' Training School. A 3-inch meter is installed at the Government Agricultural Nursery.

Ramtha

20. According to the 1961 census, Ramtha had a population of 10,790. The Water Department is a part of the city administration under the Mayor and follows a pattern common to all of the small cities of Jordan in which accounting and engineering services are provided from outside the department. At present there are 7 Water Department employees.

21. The present water system consists of a limited distribution system installed in 1954 and since expanded. Supply has been from two makeshift dug wells with antiquated equipment. After various attempts, CWA was able to get a drilled well producing 10 cu m per hour on which has now been installed pumping equipment to deliver 200 cu m daily. The CWA's estimate of the system's worth is JD29,400.

Mafraq

22. The same type of Water Department organization exists for Mafraq as for Ramtha. There are 14 employees.

23. Mafraq obtains its water from 6 drilled wells of poor yield and with unsatisfactory equipment. A recently constructed elevated tank for water storage has not been used because sufficient water is not available to fill it. The distribution system dates from about 1951 and serves the population of 9,500. The current estimated worth of the system is JD31,305.

Husn

24. The City of Husn has a population of about 2,000. At present it has no water system and all water, except that collected in rain water cisterns, must be transported at costs which reach 600 fils per cu m.

Water Quality and Health Statistics

25. Bacteriological tests on water are made by the Ministry of Public Health throughout the country, but they are infrequent.

26. Based on very limited data, the bacteriological results on Irbid, Mafraq, and Ramtha water supplies show varying amounts of contamination to be present. The operational practice of cutting off the supply at intervals due to water shortage can be expected to contribute substantially to the hazard of external contamination entering the system. This will not be eliminated until an adequate quantity of water is available to assure each system of continuous pressure. Transported water is usually subjected to the hazard of contamination through handling.

27. The health statistics for the area to be served by the project show that typhoid and dysentery are among the leading causes of morbidity and mortality. Annex 4 shows the data for the Ajlun District and for Irbid. Specific statistics for Mafraq, Ramtha, and Husn are not available.

28. Other diseases which are related to availability and quality of water, and which are known to be prevalent throughout the project area, include trachoma, parasitic diseases, and skin infections.

IV. WATER CONSUMPTION AND WATER DEMAND

Present Water Consumption

29. Annex 5 shows the water consumption for Irbid and the principal towns of the project area. These figures indicate that for Irbid, 200 cu m of water were hauled per day for seven months in 1962; this volume and that supplied from the distribution system, gave a total of some 26 liters per capita per day. For Ramtha, the consumption shown was 7 liters per capita per day and for Mafraq 29 liters per capita per day. No data are available on consumption of water in Husn, but it is believed that 20 liters is a reasonable estimate of present demand.

30. The only private water sources in Irbid, Mafraq, Ramtha, and Husn are rain water cisterns. There are 186 cisterns in Irbid with a total capacity estimated at 22,000 to 23,000 cu m. They are not always filled during the years of low rainfall.

31. Hauled water for the general population is pumped to roof tanks or to the cisterns and used when required. Hauled water for the refugee camp is placed in the same reservoir with the piped water.

32. The trucked water for Irbid comes from Wadi el' Arab springs 30 kilometers west of the city. It is sold by the municipality at 200 fils per cu m and by private vendors for 500 fils per cu m. The water is obtained free at Wadi el' Arab. Hauled water for the other cities comes from various springs and is sold at rates often higher than 500 fils per cu m.

33. In Irbid, the Water Department shuts the water off by areas at times of water scarcity; the periods of no service sometimes extend to ten or more days.

34. The project area will include a military installation now supplied by water from its own wells. The present supply is estimated to be deficient by 150 cu m per day.

35. No data are available on water consumption in the 46 villages near Irbid which will eventually be supplied by water through the project.

Population Growth

36. Annex 6 shows the censused population of the principal communities of the project area for 1961 and the estimated numbers for the immediate future years. These projections on population growth have been made on an assumed 4 per cent increase per year for Irbid, a growth rate selected because of the good potential of the area due to the irrigation benefits of the new Yarmuk River scheme. The other towns and villages are assumed to have a growth potential of 2.4 per cent annually.

Future Demand

37. Demand for water in Irbid, Mafraq, Husn, Ramtha, and an air base, is rapidly increasing and present sources are unable to meet the projected demand. Annex 7 shows the estimated per capita consumption for the present and for the immediate future in each of the cities and Annex 8 shows the estimated annual demands.

38. Because it will be most economic for Irbid to utilize its existing sources to their full capacity first and to take water from the proposed pipeline only as needed, the average capacity of the present sources has been deducted before calculating Irbid's demand from the pipeline. The new well in Ramtha is also taken into account but the other wells of Ramtha and all the wells of Mafraq are expected to be kept only as standby sources.

Water Rates, Metering and Policies

39. In Irbid the total number of meters in service for the past three years have increased from 2,850 units to 3,410.

40. The meters are of three different makes and are owned by the consumer. Meter repairs are made in privately-owned shops and at the expense of the owner. CWA reports that a new meter operates satisfactorily for about five years, after which annual maintenance is required with average meter life at ten years. An average of 40 meters were repaired and 100 meters replaced in each of the past three years.

41. Metering practices in Ramtha and Mafraq are generally similar to those in Irbid. Metered connections in each city for the past three years have been as follows:

	<u>Ramtha</u>	<u>Mafraq</u>
1959/60	569	1,031
1960/61	604	1,153
1961/62	621	1,280

42. The rates and fees charged for water in each of the three cities for 1961/62 were:

<u>General Service Charges</u>	<u>Irbid</u>	<u>Ramtha</u>	<u>Mafrag</u>
Application	10 fils	Not available	Not available
Subscription	30 fils	50 fils	10 fils
Connection	1 JD	800 fils	750 fils
Deposit	2 JD	500 fils	2 JD
Reconnection	1 JD	250 fils	250 fils
Reinstallation	500 fils	Not available	Not available
Billing period	4 months	4 months	2 months
Minimum charge	600 fils	600 fils	480 fils
<u>Water Rates</u>			
Residential	1-50 cu m @ 60 fils/ cu m, over 50 cu m @ 100 fils/cu m.	Flat rate of 50 fils/cu m.	1-8 cu m @ 60 fils/ cu m, 8-16 cu m @ 80 fils/cu m, over 16 cu m @ 250 fils/ cu m.
Places of worship and municipal buildings	Free	Free	Free
Charity establishments, hospitals, schools	50% reduction	50% reduction	50% reduction

43. From the available data it would appear that the unaccounted-for water of the Irbid system amounts to 30 per cent or more of total water produced. Part of this is no doubt attributable to free water, leaks, and defective meters. It should be possible to reduce these losses to 25 per cent by the first year after project completion and to 20 per cent within five years. To do this will require that all new meters installed be owned and serviced by the Water Department. As a general policy, all existing meters should be serviced by the water departments and, as these meters are replaced, ownership should be taken over by the departments. Policies and procedures for accomplishing the above objectives should be developed as soon as possible but no later than the time when the new project becomes operative.

44. It is proposed by the government to eliminate all free water. Mosque, church and government uses will be charged for water, to be paid for directly or by municipal funds.

45. Water would be given free or for only a nominal price to the Bedouins at the desert watering stations. The quantity is not large and tradition makes difficult any other course. It would be sold to private water carriers and other users.

V. THE PROJECT

The Transmission Main

46. The project consists of two major components, the transmission main and the distribution systems for four municipalities. Each is discussed separately.

47. Map 1 shows the outline of the project. It is proposed to pump water from the springs at Druz Village-Azraq, a distance of 137 kilometers to a high level reservoir west and above Husn and supply water to Mafraq on the way. From the reservoir water would flow to the cities of Husn, Irbid and Ramtha by gravity. There would be 7 desert stations constructed along the way at approximately 17 kilometer intervals to furnish water to nomadic desert tribes and their animals.

48. Aside from the future expansion of water service in the four cities to be served, sufficient water source and pipeline capacity exists to also serve 46 villages containing 31,000 people. Connections to these villages are considered as a future expansion and are not included as a part of the present project.

49. The Iraq Petroleum Company has transferred to the Government for its use the fixed assets of the Company, including pipes, pumps, and pump-houses for, among other things, water development projects. The principal asset is a petroleum pipeline from the western boundary with Iraq on through to the Jordan valley. Also included are certain pumping facilities at the Druz springs at Azraq.

50. Most of the transmission main would be IPC pipe, cleaned and left in place. Hitherto unused, it will now be a productive asset for Jordan and one which will permit utilization of a water source previously flowing to waste.

51. One hundred kilometers of the 16-inch steel petroleum pipeline would be cleared and left in place. An additional 32 kilometers of 16-inch pipeline would be salvaged and relaid from the Druz spring, Azraq, to the now existing pipeline. On the western end of the line, 13 kilometers of salvaged 12-inch pipe would be laid to connect the 16-inch line to Irbid. At an angle point on this 12-inch line some 5 kilometers east of Irbid, a new 6-inch line (10 kilometers) would be laid to supply Ramtha.

52. A single pumping station would be erected at Druz springs-Azraq with the necessary reservoir, supply pumps, and facilities for pumping in one lift to the 2,000 cu m reservoir west of Husn.

53. There will be no necessity for any treatment other than chlorination at the main pumping plant.

54. The work on the transmission main has started and 13 kilometers of 12-inch steel pipe have been moved from its trench west of Husn and relaid from Husn to Irbid and welded in place. The main 16-inch pipeline from 35 kilometers east of a pumping station on the old petroleum line to Husn has been drained of oil. Removal, cutting, and transporting to the Azraq relocation is now under way by force account. Placement and welding is being done by contract. The Jordanian Government has advanced CWA JD100,000 for this work up-to-date.

55. Information supplied by CWA shows the existing pipeline to be constructed of 16-inch pipe having a wall thickness of 0.375 inches and a test pressure of 1,000 psi (pounds per square inch). The pipeline has not been used since its placement in 1948 and it is stated to be in excellent condition. The consultants now employed on the pipeline have stated that it will be satisfactory for the 620 psi working pressure to which it will be subjected.

Irbid Distribution System

56. Consultants employed by the government in 1961 studied the Irbid water supply problem and presented a preliminary study which included major improvements to the water distribution system in that city. It is proposed to follow essentially the design submitted at that time (see Map 2). This involves renovation of pumping facilities on the existing sources, construction of new loop mains and cross mains, and general reinforcement of the entire grid. Extension of branches to sections of the city not now served is also proposed.

Distribution Systems of Mafraq, Ramtha, and Husn

57. After the project was submitted, the government decided to include the improvement of existing distribution systems in Mafraq and Ramtha. They also decided to construct a new system for Husn. Designs for these works have not been started, but the government estimates an amount of JD55,000 should be sufficient to cover all three. Of this amount, it is proposed to set aside an IDA credit of \$103,000, equivalent to JD36,700, representing two-thirds of the total. Designs and cost estimates, pro forma income statements, together with plans for organization and management, would be submitted prior to release of funds.

New Water Sources

58. The pipeline will take water initially from the Druz springs, two of a group in the Azraq area. These springs have a yield of 250 cu m per hour as measured in 1963 by a UN team. A second set of springs, Sheshan, has a

water of somewhat poorer chemical quality than Druz but it can be used when mixed with the Druz supply in proportion of about 1:2. Sheshan has a measured yield of around 1,200 cu m per hour.

59. Water from the springs now flows to waste. The government owns all water rights and CWA anticipates no problem in utilizing the springs for supplying the pipeline.

60. A theory has recently been presented by a UN team working in the Azraq area which suggests the possibility of the springs becoming saline as the result of reducing the flow into the salt marshes created by the spring overflow. The theory is advanced that if water from the Druz spring is diverted to the pipeline it would reduce the level of the salt marsh and this, in turn, might in some way change the pattern of underground water flow upstream of the spring and cause salt water to contaminate the spring water. A study of the risk involved as presented in the theory has led to the conclusion by CWA hydrogeologists that the likelihood of the salting of the springs is extremely remote. Moreover, the level of the salt marsh normally varies over a considerable range seasonally. It is concluded by CWA and IDA staff that diversion of the overflow from Druz spring should in no way jeopardize its quality so long as no drawdown of the spring level is imposed.

61. Because salt layers exist in the area, care should be exercised to insure that random drilling does not cross connect a saline aquifer with a spring aquifer. Assuming that these precautions are taken, it appears that Druz spring can be relied on for at least 6,000 cu m per day of good quality water and that at a future date, when more water is needed, Sheshan spring water could be mixed with that of Druz to dilute the Sheshan salinity to acceptable levels for potable purposes.

62. Chemical tests show the water from Druz spring to be low in chlorides and sulfates and not very hard. Sheshan spring is high in chlorides (620 milligrams per liter) and high in total solids.

63. Bacteriological tests have not been made on these sources but, because of their isolation, little question should exist as to their safety. Chlorination should provide an adequate safeguard in any event.

Project Planning

64. The broad outlines of the project have been developed by the staff of CWA. Consultants have been employed to prepare detailed design and to supervise the construction work on the transmission main and pumping stations. The design of the Irbid distribution system, utilizing the Ain Zahar source, was made in 1961 by a separate firm of consultants; it will be revised for the new source by other consultants still to be selected.

Construction and Procurement

65. A tentative procurement and construction schedule is shown in Annex 9. As previously noted, work on the Husn-Irbid 12-inch line has already been finished except for testing and the relaying of the Azraq line is

proceeding. Orders for pumps and equipment have been placed. Expenditures are being met with funds advanced by the Jordan Development Board. Most of the work on the transmission main should be completed by January of 1964 and on the Irbid distribution system by June 1964. Distribution systems for the other three municipalities are proposed for completion by January 1965. All supply items and construction contracts would be submitted for international competitive bidding. CWA would have responsibility for arranging and coordinating all work on the transmission main and on the distribution systems of Irbid, Mafraq, Ramtha, and Husn.

Management and Supervision

66. CWA will operate the pipeline after construction and will maintain separate accounts and records apart from its other operations. Staff for the pipeline would be paid out of revenues collected from the water sales.

67. The water departments of the four municipalities will require reorganization with additional staff. A policy of departmental ownership of water meters should be initiated and central repair facilities arranged.

68. Because the personnel from CWA who will operate the pipeline and the personnel of the municipal water departments will all require assistance during the first years of operation to insure good administration, provision is made for funds to cover such advisory services. CWA is to create a division to provide for management assistance to water departments throughout the country and the proposed services for Irbid and the other municipalities will be coordinated and channelled through the new division.

69. Contracts are to be made between CWA and each of the municipalities to the effect that they will receive the works when completed and will accept the financial obligations pertaining thereto. They must also agree to maintain adequate rates, separation of accounts, and debt limitations, and to generally conduct their operations in accordance with sound business, financial, and public utility practices. Independent annual audits are to be required.

Project Cost Estimates

70. The project cost estimates total JD493,000 (\$1,380,000) and are summarized below. The costs of the Azraq-Irbid transmission main and the Irbid distribution are presented in more detail in Annex 10.

Azraq-Irbid transmission main	JD	294,000
Irbid distribution system		144,000
Mafraq, Ramtha, Husn distribution system		<u>55,000</u>
Total	JD	<u>493,000</u>

The estimates on the transmission main and Irbid distribution have been submitted by CWA and are quite firm, in some details they reflect actual expenditures. The amount for the distribution systems of Mafraq, Ramtha,

and Husn, are based on an educated guess.

71. Although the IDA credit would cover two-thirds of the total project cost (including interest during construction), foreign currency costs for the transmission main are estimated at \$376,600 (JD134,500), or 46 per cent of the total. In the case of the Irbid distribution system, foreign currency expenditures are estimated at \$308,600 (JD110,200), or 77 per cent. The foreign currency costs for the distribution system works for Mafraq, Husn, and Ramtha, may amount to \$112,000 (JD40,000), or 73 per cent. Total foreign exchange costs for the project are estimated at \$797,200, or 58 per cent of the total.

VI. FINANCING PLANS AND FINANCIAL PROJECTIONS

Source of Funds

72. The financial plan contemplates that two-thirds of the total costs of the project will be financed by the IDA credit. The credit would be relent at 4 per cent interest with a three-year grace period followed by a twenty-year amortization period. Municipal Loan Fund credits would cover the remaining one-third of the project costs and be made available at 4 per cent, two-year grace, and a subsequent eight-year amortization period.

73. The financial projections, Annexes 11 and 12, for the transmission main indicate a bulk sale rate of 60 fils per cu m. This compares with an anticipated bulk sale rate of 100 fils per cu m for the Ein Samiya, Jerusalem supply.

74. Similar projections contained in Annexes 13 and 14 show that Irbid would have to sell its water at an average retail price of 110 fils per cu m. This is less than the rate anticipated in Jerusalem, but almost twice the present Irbid and Zarqa rates. It can also be compared with the 200 fil per cu m price at which the city sells trucked water, and the 500 fil price charged by private trucks.

Financial Projections

75. The pro forma income statement for the transmission main presented in Annex 11, shows a deficit in the first two years of operation after interest payments. The return on net fixed assets, including the present salvage value of the pipeline, in the valuation of the fixed assets, ranges from 0.4 per cent in the 1964/65 financial year to 8.4 per cent in 1974/75. Excluding the salvage value, these rates start at 1.1 per cent initially and reach 26.3 per cent ten years later.

76. The sources and applications of funds for the transmission main, as set out in Annex 12, show an increasingly strong cash position, reaching almost 50 per cent of sales in ten years. Debt service coverage rises from a low of 1.21:1 the second year of operation, but rises quickly thereafter.

77. The price for the bulk sales has been calculated in the financial projections at a single price per cu m regardless of quantity. A more economically sound policy would be to charge each municipality an annual fee, plus a cubic meter water charge to cover direct pumping costs. The fees would have to yield sufficient revenue to cover fixed costs, including depreciation, and additional amounts necessary to service the debt beyond the depreciation account or to earn an adequate return on investment, whichever would be greater. Such a rate structure would tend to encourage greater use of water from the transmission main in the early years.

78. The pro forma income statement for the Irbid distribution system, Annex 13, shows a growing return on net investment of 2.8 per cent in the first year after project completion to 8.4 per cent nine years afterwards. The operating ratio decreases very slowly, reflecting the flat rate pricing policy assumed for the transmission main, i.e., unit water costs do not decrease appreciably with greater volume.

79. Annex 14, illustrates the sources and applications of funds for Irbid. These are minor cash drawdowns in the initial years after completion of the project construction but the cash reserve remains adequate. Debt service coverage begins from an initial low of 1.21:1 but rises satisfactorily thereafter.

80. The financial assumptions used in the calculation of Annexes 10 through 13 are given in Annex 15.

VII. JUSTIFICATION OF THE PROJECT

81. The cities included in this project are major population centers in the northeast section of Jordan. It is an area of some agricultural production and, in the case of Irbid at least, one expected to grow substantially due to the development projects in the area. All the present supplies are very inadequate, and in one case, all water must be brought in by road transport.

82. The project, as proposed, will provide a new source of water in adequate quantity and quality to meet the needs of the entire area for a number of years in the future and, by supplying an entire area, the unit costs would be reduced and would be within the capacity of each municipality to repay.

83. Improvement of the distribution systems in the four municipalities, installation of seven desert watering stations, and provision for later connections to 46 villages will provide that substantial benefits to health, basic needs, and small industry will result.

84. The project is essential for meeting present and continually expanding needs in the entire area and with the existence of an abandoned pipeline which will take water from springs now flowing to waste, presents a combination of factors which will meet these needs with a minimum of investment.

VIII. CONCLUSIONS AND RECOMMENDATIONS

85. The project provides a new source of water which is urgently needed by all of the communities of the area. After completion, a dependable source, adequate in quantity and quality, should exist to meet needs until at least 1975, and additional quantities would be available of somewhat poorer chemical quality to meet needs for many years in the future. Improvements to distribution systems and supplies of water to communities, villages, and desert stations will insure definite public health benefits to the people residing within the area.

86. The Borrower has agreed to the following conditions in respect of this project should the credit be granted:

- (a) Local loan funds will be made available to CWA at an interest rate of 4 per cent, a two-year grace period, and with repayment of capital in eight equal annual installments;
- (b) CWA will construct the project and, at its completion, operate the transmission main and transfer to the municipalities the distribution works together with the liability for repayment of the loans corresponding to these distribution systems;
- (c) Funds will not be withdrawn until written assurances have been submitted from each of the municipalities that they will follow satisfactory financial and managerial policies;
- (d) In the construction of the project, CWA will employ satisfactory consultants and, in the operation of transmission main, CWA will utilize the services of management consultants. In addition, the municipalities will utilize the assistance of management consultants to be provided by CWA;
- (e) The Irbid Water Department will function under satisfactory regulations and have such functions and staff, separation of accounts, and safeguards against diversion of funds as are necessary for diligent and efficient operation and maintenance;
- (f) Water rates will be maintained so as to cover operating expenses, including taxes, if any, interest, maintenance, depreciation, debt repayments in excess of depreciation, normal extensions and a reasonable part of future expansion. To this end, an initial rate of 60 fils per cu m is proposed for the bulk transmission sales with an operating ratio of less than 80 per cent within four years after construction; Irbid would establish an initial rate of 110 fils and maintain from the outset an operating ratio of not more than 90 per cent;

- (g) The municipalities will not incur any long-term indebtedness in respect of their water operation, unless net revenues from water supply operations in any 12 consecutive months in the preceding 15 exceed 1.5 times total projected debt service requirements;
- (h) The accounts of CWA and the municipalities in respect to the transmission main and the water supply system will be audited annually by an outside accountant;
- (i) All necessary action shall be taken to insure protection of the Druz and Sheshan springs against pumpage of water beyond overflow rates and safeguard such springs against damage by hydrological explorations and other acts; and
- (j) The right to use the pipeline and fixed assets of IPC remaining in place will be confirmed to the satisfaction of the Association.

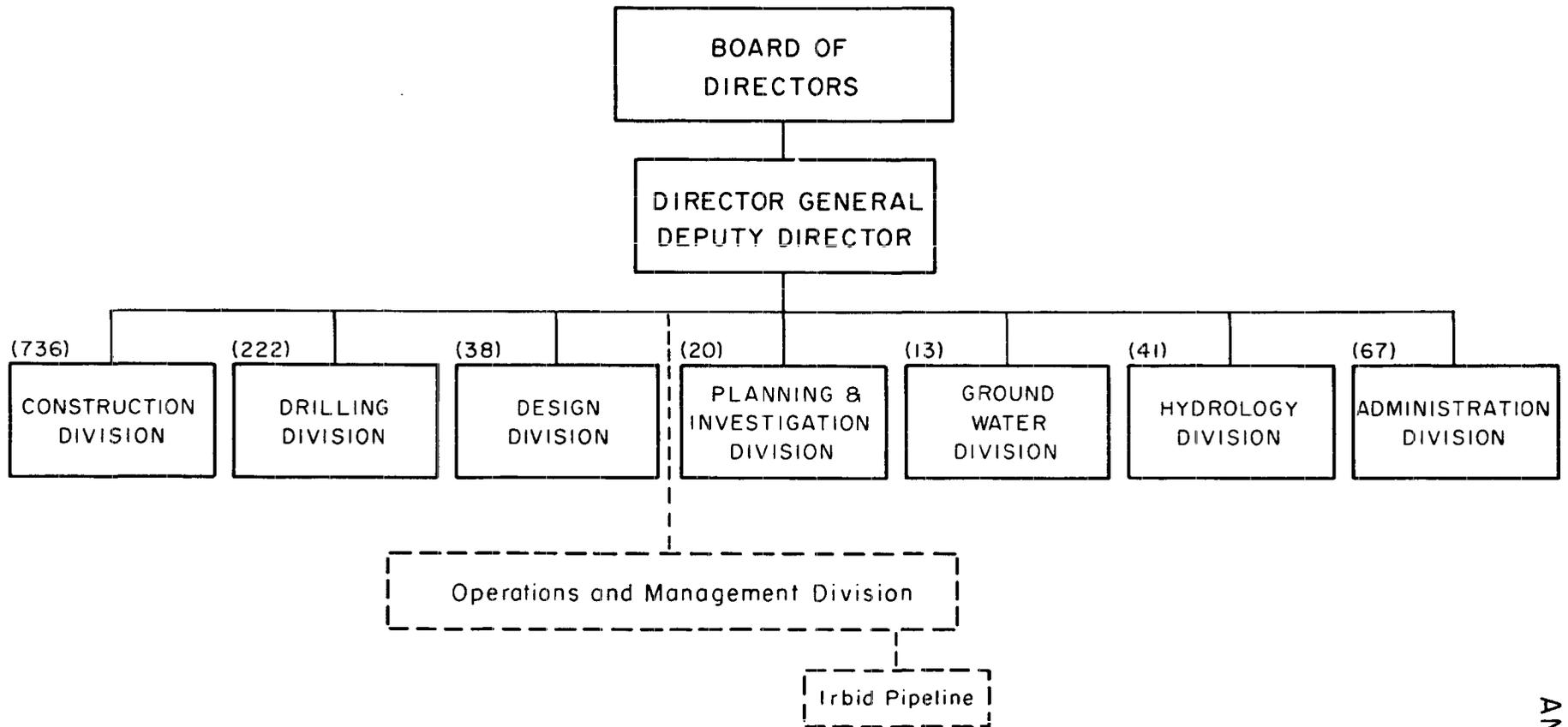
87. The project provides a suitable basis for an IDA credit of \$920,000 to the Hashemite Kingdom of Jordan to be relent to the Central Water Authority at 4 per cent interest, a three-year grace period, and a twenty-year amortization period.

September 16, 1963

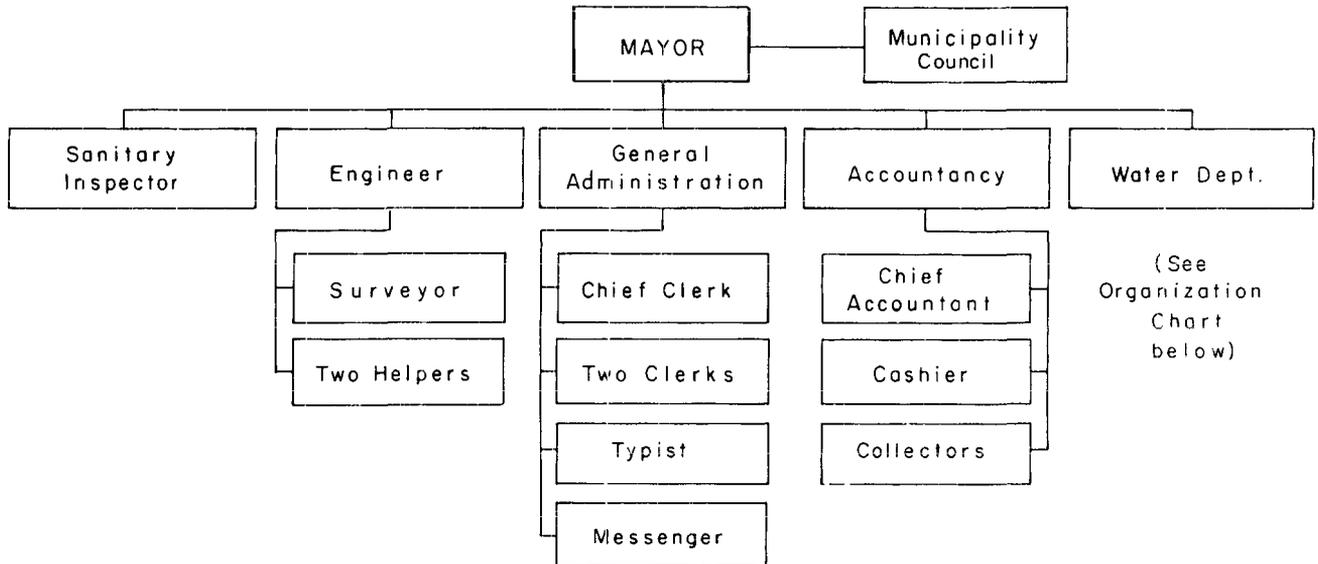
AZRAQ—IRBID WATER SUPPLY PROJECT

JORDAN

ORGANIZATION OF CENTRAL WATER AUTHORITY

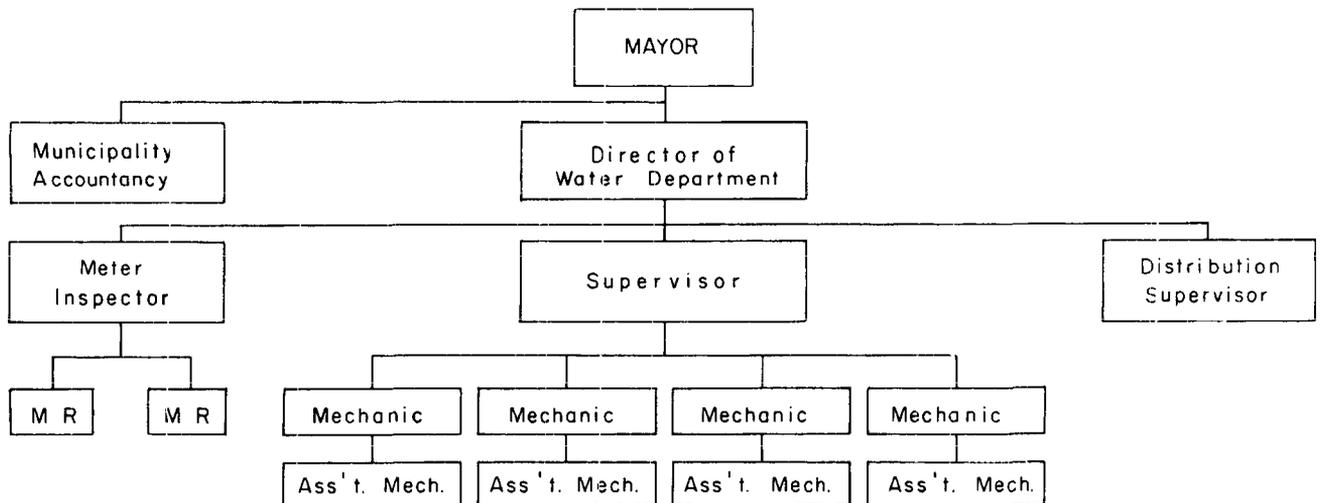


IRBID MUNICIPALITY
Organization Chart



NOTE: Two drivers and two messengers are also employed to serve the various departments of the Municipality.

IRBID WATER DEPARTMENT
Organization Chart



Estimated Revenues & Expenditures
(One Thousand Jordan Dinars)

	FISCAL YEARS						
	A	c	t	u	a	l	Budget
	<u>1958/59</u>	<u>1959/60</u>	<u>1960/61</u>	<u>1961/62</u>	<u>1962/63</u>	<u>1962/63</u>	<u>1962/63</u>
Total water produced (1,000 M ³)	427	427	427	427	427	427	427
Total Water Sales (1,000 M ³)	222	261	258	280	280	300	300
% unaccounted for	48	39	40	34	34	30	30
Average water rates per M ³ - fils	50	50	60	60	60	60	60
<u>REVENUES</u>							
Revenue from water rates	11.2	11.52	13.5	13.7	13.7	15.0	15.0
Meter Registration Fees	.25	.26	.27	.28	.28	.1	.1
Fees for Reconnection of service lines	.06	.08	.10	.10	.10	.1	.1
Water delivery charges (Mobile tanks)	<u>.45</u>	<u>.50</u>	<u>.53</u>	<u>.60</u>	<u>.60</u>	<u>.7</u>	<u>.7</u>
Total Revenues	12.0	12.4	14.4	14.7	14.7	15.9	15.9
<u>EXPENDITURES</u>							
Fuel	3.15	3.2	3.3	3.45	3.45	3.5	3.5
Chemicals	.05	.05	.05	.05	.05	.05	.05
Maintenance	.70	.70	.72	.80	.80	1.50	1.50
Salaries including Cost of Living	2.46	2.47	3.15	3.40	3.40	3.70	3.70
Assumed Admin. Costs (25% of salaries)	<u>.62</u>	<u>.62</u>	<u>.80</u>	<u>.85</u>	<u>.85</u>	<u>.93</u>	<u>.93</u>
Direct Operating Costs	7.0	7.0	8.0	8.6	8.6	9.7	9.7
Interest	n.a.	.76	.84	n.a.	n.a.	.9	.9
Assumed Depreciation	<u>2.2</u>	<u>2.8</u>	<u>3.4</u>	<u>4.0</u>	<u>4.0</u>	<u>4.6</u>	<u>4.6</u>
Total Operating Costs	9.2	10.6	12.2	12.6	12.6	15.2	15.2
Plus Capital Improvement Expenditures	2.3	4.6	2.3	1.2	1.2	2.0	2.0
Less Assumed Administration & Depreciation	<u>2.8</u>	<u>3.4</u>	<u>4.2</u>	<u>4.91</u>	<u>4.91</u>	<u>4.91</u>	<u>4.91</u>
Total Reported Expenditures	8.7	11.8	10.3	8.9	8.9	12.3	12.3
Surplus	<u>3.3</u>	<u>.6</u>	<u>4.1</u>	<u>5.8</u>	<u>5.8</u>	<u>3.6</u>	<u>3.6</u>

n.a. = not available.

AZRAQ-IRBID WATER SUPPLY PROJECT
CASES OF COMMUNICABLE DISEASES IN PROJECT AREA*

Year	Typhoid	Paratyphoid	Dysentery	Total	Population ***	Cases per 1,000 population
1957	129	11	345	485	249,997	1.94
1958	197	3	215	415	261,498	1.59
1959	197	17	253	467	270,446	1.73
1960	181	3	218	402	281,164	1.43
1961	272	1	95	368	258,452	1.42

*Source: Statistical Year Book, Jordan Government
Department of Statistics for Ajlun District.

***Note: A census was made in 1961. Population figures
for prior years represent estimated adjustments
to the 1952 census figure.

CASES OF COMMUNICABLE DISEASES IN IRBID

Year	Typhoid		Paratyphoid		Dysentery	
	Cases	Deaths	Cases	Deaths	Cases	Deaths
1956	101	2	-	-	176	-
1957	85	1	8	-	175	-
1958	146	1	-	-	14	-
1959	115	1	5	-	68	-
1960	82	14	3	-	24	3
1961	132	14	-	-	5	4
1962 **	40	4	5	-	48	-

** 1962 figures are only to the end of August.

AZRAQ-IRBID WATER SUPPLY PROJECTDomestic Water Consumption

<u>Year</u>	<u>Population</u>	<u>Total average metered water per day cu m</u>	<u>Total metered plus water hauled per day (7 mths.) cu m</u>	<u>Liters per capita per day metered</u>	<u>Liters per capita per day metered plus hauled (7 months)</u>
<u>IRBID CITY</u>					
1959/60	28,100	586	789	21	28
1960/61	30,300	598	801	20	26
1961/62	32,500	646	849	20	26
<u>IRBID - REFUGEES</u>					
1959/60	10,400	74	138	7.1	13
1960/61	11,300	62	126	5.5	11
1961/62	12,300	54	118	4.4	9.6

MAFRAQ AND RAMTHA (1961/62)

	<u>Population</u>	<u>Yearly consumption cu m</u>	<u>Liters/capita/day</u>
Ramtha	10,791	29,000	8
Mafraq	9,499	102,000	29

AZRAQ-IRBID WATER SUPPLY PROJECTPopulation Growth Estimates of All Areas

<u>Area</u>	<u>Census 1961</u>	<u>1962/63</u>	<u>1963/64</u>	<u>1964/65</u>	<u>1969/70</u>	<u>1974/75</u>
Irbid Town	32,500	33,800	35,200	36,600	44,500	54,200
Irbid Refugees	12,300	12,800	13,300	13,800	16,800	20,500
Ramtha	10,791	11,050	11,300	11,600	13,000	14,600
Mafraq	9,499	9,730	10,000	10,200	11,500	12,900
Husn	3,728	3,820	3,900	4,000	4,500	5,000
Villages west of Irbid (19)	19,919	20,480	20,000	21,400	24,000	27,000
Villages west of Husn (14)	7,825	8,010	8,200	8,400	9,500	10,600
Villages east of Husn (13)	<u>3,315</u>	<u>3,400</u>	<u>3,500</u>	<u>3,600</u>	<u>4,000</u>	<u>4,500</u>
Total	<u>99,877</u>	<u>103,090</u>	<u>106,300</u>	<u>109,600</u>	<u>127,800</u>	<u>149,300</u>

AZRAQ-IRBID WATER SUPPLY PROJECTEstimated per capita consumption per day

<u>City</u>	<u>Average liters per capita per day</u>		<u>Average daily rate of increase per year</u>
	<u>1961</u>	<u>1964</u>	
Irbid	26	40	2 liters
Irbid Refugees	11	20	1 liter
Husn	n.a.	20	1 liter
Ramtha	7	20	1 liter
Mafraq	29	30	$\frac{1}{2}$ liter

AZRAQ WATER PIPELINE

DEMAND TABLE

1000 cu m/Year

<u>Fiscal Year</u> <u>March 31</u>	<u>Irbid</u> <u>Consumption</u>	<u>Irbid</u> <u>Availability</u>	<u>Needed</u> <u>From</u> <u>Pipeline</u>	<u>Ramtha</u> <u>Total</u> <u>1/</u>	<u>Ramtha</u> <u>Availability</u>	<u>Needed</u> <u>From</u> <u>Pipeline</u>	<u>Mafraq</u> <u>Total</u> <u>1/</u>	<u>Husn</u> <u>1/</u>	<u>Airbase</u>	<u>Pipeline</u> <u>Demand</u>	<u>Desert</u> <u>Watering</u> <u>Stations</u>	<u>Pipeline</u> <u>Production</u>
1964/65	847	365	482	120	73	47	157	41	150	877	50	927
1965/66	913	365	548	130	73	57	165	45	150	965	50	1,015
1966/67	982	365	617	138	73	65	174	48	150	1,054	50	1,104
1967/68	1,055	365	690	147	73	74	181	51	150	1,146	50	1,196
1968/69	1,129	365	764	157	73	84	188	54	150	1,240	50	1,290
1969/70	1,206	365	841	168	73	95	197	60	150	1,343	50	1,393
1970/71	1,306	365	941	180	73	107	202	62	150	1,462	50	1,512
1971/72	1,411	365	1,046	188	73	115	210	67	150	1,588	50	1,638
1972/73	1,521	365	1,156	200	73	127	218	71	150	1,722	50	1,772
1973/74	1,639	365	1,274	212	73	139	227	75	150	1,865	50	1,915
1974/75	1,764	365	1,399	228	73	155	236	80	150	2,020	50	2,070

1/ Ramtha, Mafraq, and Husn total includes 10% other than domestic and 20% system loss.

AZRAQ-IRBID WATER SUPPLY PROJECT

Project Costs

Azraq-Irbid Transmission Main

	<u>Foreign JD</u>	<u>Local JD</u>	<u>Total JD</u>
Pumps and prime movers	26,000	-	26,000
Pump house renovation	-	1,000	1,000
Pump house suction tank	-	2,000	2,000
Chlorinators and master meters	2,000	-	2,000
Valves and manifolds	1,000	2,000	3,000
Auxiliary pumping, pipes from Sheshan	6,000	9,000	15,000
Local transport	-	1,000	1,000
Related civil works at Azraq	-	5,000	5,000
Subtotal collection works and pumping stations	35,000	20,000	55,000
Cutting, removal transport of 14 km 16-inch line	-	21,000	21,000
Cleaning same	5,000	6,000	11,000
32 km Druz-junction line	-	39,000	39,000
Cleaning 100 km in situ	15,000	5,000	20,000
Seven desert watering stations	3,000	4,000	7,000
Husn-Irbid 12-inch line	-	10,000	10,000
Hawara-Ramtha 6-inch line	18,000	2,000	20,000
Bevelling, welding, placing cathodic protection	8,000	2,000	10,000
Steel reservoir	-	7,000	7,000
Valves and meters	1,000	1,000	2,000
Local transportation	-	1,000	1,000
Subtotal pipeline and reservoir	50,000	98,000	148,000
Contingencies 18%	15,300	21,200	36,500
Engineering services 8%	19,200	-	19,200
Management services	10,000	-	10,000
Mobile equipment and spares	5,000	-	5,000
Working capital	-	14,800	14,800
Interest during construction	-	5,500	5,500
Total Transmission Main	134,500	159,500	294,000

Irbid Distribution

	<u>Foreign</u> <u>JD</u>	<u>Local</u> <u>JD</u>	<u>Total</u> <u>JD</u>
Distribution system	70,000	22,000	92,000
Revamp of existing pump station	<u>3,000</u>	<u>1,000</u>	<u>4,000</u>
Subtotal distribution cost	73,000	23,000	96,000
Contingencies 18%	13,100	4,100	17,200
Engineering services 8%	9,100	-	9,100
Management services	10,000	-	10,000
Mobile equipment and spares	5,000	-	5,000
Interest during construction	<u>-</u>	<u>6,700</u>	<u>6,700</u>
Total Irbid Distribution	110,200	33,800	144,000

Mafrag, Ramtha, and Husn

Total Distribution System	<u>40,000</u>	<u>15,000</u>	<u>55,000</u>
Total Project Costs	284,700	208,300	493,000

AZRAQ-IRBID TRANSMISSION MAIN

PRO-FORMA INCOME STATEMENT
(thousands of Jordanian Dinars)

Fiscal Year March 31	<u>1964/65</u>	<u>1965/66</u>	<u>1966/67</u>	<u>1967/68</u>	<u>1968/69</u>	<u>1969/70</u>	<u>1970/71</u>	<u>1971/72</u>	<u>1972/73</u>	<u>1973/74</u>	<u>1974/75</u>
Total Water Pumped (1,000 m ³)	927	1,015	1,104	1,196	1,290	1,393	1,512	1,638	1,772	1,915	2,070
Total Water Sold (1,000 m ³)	877	965	1,054	1,146	1,240	1,343	1,462	1,588	1,722	1,865	2,020
Ave. Water Revenues (Fils/m ³)	60	60	60	60	60	60	60	60	60	60	60
----- In Thousand Jordanian Dinars -----											
<u>Revenues</u>											
Water Sales	52.6	57.9	63.2	68.8	74.4	80.6	87.7	95.3	103.3	111.9	121.2
<u>Operating Cost</u>											
Salaries	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	8.7	8.7
Pumping Costs	10.4	11.4	12.4	13.5	14.4	15.6	16.9	18.3	19.8	21.4	23.2
Chlorine	0.5	0.5	0.6	0.6	0.7	0.7	0.8	0.9	0.9	1.0	1.1
System Maintenance	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Cathodic Protection	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Administrative & General	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	2.2	2.2
Contingencies	2.5	2.6	2.7	2.8	2.9	3.1	3.2	3.4	3.5	3.9	4.1
Total Operating Costs	27.7	28.8	30.0	31.2	32.3	33.7	35.2	36.9	38.5	43.2	45.3
<u>Other Expenses</u>											
Depreciation	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8
Interest - IDA	7.8	7.8	7.8	7.6	7.4	7.1	6.8	6.5	6.2	5.9	5.5
Interest - Local	3.9	3.9	3.4	2.9	2.5	2.0	1.5	1.0	0.5	-	-
Total Other Expenses	33.5	33.5	33.0	32.3	31.7	30.9	30.1	29.3	28.5	27.7	27.3
Total Cost and Expenses	61.2	62.3	63.0	63.5	64.0	64.6	65.3	66.2	67.0	70.9	72.6
Net Income	(8.6)	(4.4)	0.2	5.3	10.4	16.0	22.4	29.1	36.3	41.0	48.6
Net Income before Interest	3.1	7.3	11.4	15.8	20.3	25.1	30.7	36.6	43.0	46.9	54.1
Average Net Fixed Assets	860	838	816	795	773	751	730	707	686	664	642
Return on Net Fixed Assets	0.4%	0.9%	1.4%	2.0%	2.6%	3.3%	4.2%	5.2%	6.3%	7.1%	8.4%
Average Net Fixed Assets excluding IPC Pipeline	276	269	262	255	248	241	234	227	220	213	206
Return on Net Fixed Assets	1.1%	2.7%	4.8%	6.4%	8.2%	10.4%	13.1%	16.1%	19.5%	22.0%	26.3%
Ratio of Cost and Depreciation to Revenues	94%	87%	82%	77%	73%	69%	65%	62%	58%	58%	55%

AZRAQ-IRBID TRANSMISSION MAIN

Sources and Applications of Funds
(thousands of Jordanian Dinars)

<u>Fiscal Year March 31</u>	<u>Construction</u>											
	<u>Period:</u> <u>1963/64</u>	<u>1964/65</u>	<u>1965/66</u>	<u>1966/67</u>	<u>1967/68</u>	<u>1968/69</u>	<u>1969/70</u>	<u>1970/71</u>	<u>1971/72</u>	<u>1972/73</u>	<u>1973/74</u>	<u>1974/75</u>
<u>Sources of Funds</u>												
Net Income before Interest	-	3.1	7.3	11.4	15.8	20.3	25.1	30.7	36.6	43.0	46.9	54.1
Depreciation	-	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8
Total from Operations	-	24.9	29.1	33.2	37.6	42.1	46.9	52.5	58.4	64.8	68.7	75.9
IDA - Credit	196.0	-	-	-	-	-	-	-	-	-	-	-
Local Loan	98.0	-	-	-	-	-	-	-	-	-	-	-
Total Loans	294.0	-	-	-	-	-	-	-	-	-	-	-
Total Sources	<u>294.0</u>	<u>24.9</u>	<u>29.1</u>	<u>33.2</u>	<u>37.6</u>	<u>42.1</u>	<u>46.9</u>	<u>52.5</u>	<u>58.4</u>	<u>64.8</u>	<u>68.7</u>	<u>75.9</u>
<u>Application of Funds</u>												
Total Foreign Cost	134.5	-	-	-	-	-	-	-	-	-	-	-
Total Local Cost	139.2	-	-	-	-	-	-	-	-	-	-	-
Total Project Investment	273.7	-	-	-	-	-	-	-	-	-	-	-
Working Capital (including cash)	14.8	-	-	-	-	-	-	-	-	-	-	-
<u>Debt Service:</u>												
Amortization IDA	-	-	-	3.3	6.7	7.0	7.2	7.5	7.8	8.2	8.5	8.8
Interest IDA	3.9	7.8	7.8	7.6	7.4	7.1	6.8	6.5	6.2	5.9	5.5	5.2
Amortization Local Loan	-	-	12.3	12.2	12.3	12.2	12.3	12.2	12.3	12.2	-	-
Interest Local Loan	1.6	3.9	3.9	3.4	2.9	2.5	2.0	1.5	1.0	0.5	-	-
Total Debt Service	5.5	11.7	24.0	26.5	29.3	28.8	28.3	27.7	27.3	26.8	14.0	14.0
Total Applications	<u>294.0</u>	<u>11.7</u>	<u>24.0</u>	<u>26.5</u>	<u>29.3</u>	<u>28.8</u>	<u>28.3</u>	<u>27.7</u>	<u>27.3</u>	<u>26.8</u>	<u>14.0</u>	<u>14.0</u>
Changes in Cash Position	-	13.2	5.1	6.7	8.3	13.3	18.6	24.8	31.1	38.0	54.4	61.9
Cash End Period	-	13.2	18.3	25.0	33.3	46.6	65.2	90.0	121.1	159.1	213.5	275.4
Debt Service Coverage	-	2.13:1	1.21:1	1.25:1	1.28:1	1.46:1	1.66:1	1.90:1	2.14:1	2.42:1	4.90:1	5.42:1

IRBID DISTRIBUTION SYSTEM

Pro Forma Income Statements

<u>Fiscal Year Ending March 31</u>	<u>1963/64</u>	<u>1964/65</u>	<u>Total Construction Period</u>	<u>1965/66</u>	<u>1966/67</u>	<u>1967/68</u>	<u>1968/69</u>	<u>1969/70</u>	<u>1970/71</u>	<u>1971/72</u>	<u>1972/73</u>	<u>1973/74</u>	<u>1974/75</u>
Total Water Produced, Existing Wells 1000m ³	365	365	-	365	365	365	365	365	365	365	365	365	365
Total Water Purchased, Pipelines 1000m ³	-	482	-	548	617	690	764	841	941	1,046	1,156	1,276	1,399
Total Water Produced	365	847	-	913	982	1,055	1,129	1,206	1,306	1,411	1,521	1,639	1,764
% Unaccounted For	25	25	-	24	23	22	21	20	20	20	20	20	20
Total Sales	273	635	-	694	756	823	892	965	1,045	1,129	1,217	1,311	1,411
Average Water Rate - fils/m ³	60	110	-	110	110	110	110	110	110	110	110	110	110
----- (In thousands of Jordanian Dinars) -----													
<u>Revenues</u>													
Water Sales	16.4	69.9	86.3	76.3	83.2	90.5	98.1	106.2	115.0	124.2	133.9	144.2	155.2
Meter & Connection Fees & Hauled Water	<u>1.0</u>	<u>0.2</u>	<u>1.2</u>	<u>0.4</u>	<u>0.5</u>	<u>0.5</u>	<u>0.5</u>						
Total Revenues	17.4	70.1	87.5	76.7	83.6	90.9	98.5	106.6	115.4	124.6	134.4	144.7	155.7
<u>Operating Costs</u>													
Salaries	3.7	11.5	15.2	11.5	11.5	11.5	11.5	12.4	12.4	12.4	12.4	12.4	12.4
Fuel	3.0	3.0	6.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Maintenance	1.5	4.7	6.2	5.0	5.3	5.6	5.9	6.3	6.6	6.9	7.2	7.5	7.9
Chlorine	0.2	0.2	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Administration	0.9	2.9	3.8	2.9	2.9	2.9	2.9	2.9	3.1	3.1	3.1	3.1	3.1
Contingencies	0.9	2.2	3.1	2.3	2.3	2.3	2.4	2.5	2.5	2.6	2.6	2.6	2.7
Cost of Pipeline Water 60 fils/m ³	-	<u>28.9</u>	<u>28.9</u>	<u>32.9</u>	<u>37.0</u>	<u>41.8</u>	<u>45.8</u>	<u>50.5</u>	<u>56.5</u>	<u>62.7</u>	<u>69.4</u>	<u>76.4</u>	<u>83.9</u>
Total Operating Costs	10.2	53.4	63.6	57.8	62.2	67.3	71.7	77.8	84.3	90.0	97.9	105.2	113.2
<u>Other Expenses</u>													
Depreciation - Old Facilities	6.1	6.1	12.2	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
Depreciation - New Facilities	-	-	-	3.6	3.6	3.6	3.9	4.2	4.6	5.0	5.4	5.9	6.4
Interest - IDA	-	-	-	3.8	3.8	3.7	3.6	3.5	3.3	3.2	3.0	2.9	2.7
Interest - Other New Loan	-	-	-	1.9	1.7	1.4	1.2	1.0	0.7	0.5	0.2	-	-
Interest - Existing Loans	0.6	0.4	1.0	0.3	0.2	-	-	-	-	-	-	-	-
Total Other Expenses	6.7	6.5	13.2	15.7	15.4	14.8	14.8	14.8	14.7	14.8	14.7	14.9	15.2
Total Costs and Expenses	<u>16.9</u>	<u>59.9</u>	<u>76.8</u>	<u>73.5</u>	<u>77.6</u>	<u>82.1</u>	<u>86.3</u>	<u>92.6</u>	<u>99.0</u>	<u>105.7</u>	<u>112.6</u>	<u>120.1</u>	<u>128.4</u>
Net Income	0.5	10.2	10.7	3.2	6.0	8.8	12.0	14.0	16.4	18.9	21.8	24.6	27.3
Add Back Interest	0.6	0.4	-	6.0	5.7	5.1	4.8	4.5	4.0	3.7	3.2	2.9	2.7
Net Income Before Interest	1.1	1.06	-	9.2	11.7	13.9	16.8	18.5	20.4	22.6	25.0	27.5	30.0
Average Net Fixed Assets	201	195	-	331	321	318	321	325	330	336	342	350	359
Return on Net Fixed Assets	0.5%	5.4%	-	2.8%	3.6%	4.4%	5.2%	5.7%	6.2%	6.7%	7.3%	7.8%	8.4%
Ratio of Operating Costs (including depreciation) to Total Water Revenue	94%	85%	-	88%	86%	85%	83%	83%	82%	81%	81%	81%	81%

IRBID DISTRIBUTION SYSTEM

Sources and Application of Funds
(In thousands of Jordanian Dinars)

<u>Fiscal Year Ending March 31</u>	<u>1963/64</u>	<u>1964/65</u>	<u>Total Construction Period</u>	<u>1965/66</u>	<u>1966/67</u>	<u>1967/68</u>	<u>1968/69</u>	<u>1969/70</u>	<u>1970/71</u>	<u>1971/72</u>	<u>1972/73</u>	<u>1973/74</u>	<u>1974/75</u>
Sources of Funds													
Net Income Before Interest	1.1	10.6	11.7	9.2	11.7	13.9	16.8	18.5	20.4	22.6	25.0	27.5	30.0
Depreciation	6.1	6.1	12.2	9.7	9.7	9.7	10.0	10.3	10.7	11.1	11.5	12.0	12.5
Total Funds Generated	7.2	16.7	23.9	18.9	21.4	23.6	26.8	28.8	31.1	33.7	36.5	39.5	42.5
New Meter Deposit	0.4	0.4	0.8	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5
IDA Credit	86.7	9.3	96.0	-	-	-	-	-	-	-	-	-	-
Local Loan	10.2	37.8	48.0	-	-	-	-	-	-	-	-	-	-
Total Loans	96.9	47.1	144.0	-									
Total Sources	<u>104.5</u>	<u>64.2</u>	<u>168.7</u>	<u>19.3</u>	<u>21.8</u>	<u>24.0</u>	<u>27.2</u>	<u>29.2</u>	<u>31.5</u>	<u>34.1</u>	<u>37.0</u>	<u>40.0</u>	<u>43.0</u>
Application of Funds													
Total Foreign Costs	85.0	25.2	110.2	-	-	-	-	-	-	-	-	-	-
Total Local Cost	10.0	17.1	27.1	-	-	-	-	-	-	-	-	-	-
Total Project Investments	95.0	42.3	137.3	-									
Extensions and Improvements	-	-	-	-	-	12.5	13.7	14.8	16.0	17.3	18.7	20.2	21.7
Additions to Working Capital	-	-	-	1.0	1.6	1.7	1.8	1.9	2.0	2.2	2.3	2.4	2.5
Interest - IDA Credit	1.7	3.7	5.4	3.8	3.8	3.7	3.6	3.5	3.3	3.2	3.0	2.9	2.7
Interest - New Local Loan	0.2	1.1	1.3	1.9	1.7	1.4	1.2	1.0	0.7	0.5	0.2	-	-
Interest - Existing Loan	0.6	0.4	1.0	0.3	0.2	-	-	-	-	-	-	-	-
Amortization - IDA Credit	-	-	-	-	1.6	3.3	3.4	3.5	3.7	3.8	4.0	4.2	4.3
Amortization - New Local Loan	-	-	-	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	-	-
Amortization - Existing Loans	3.6	3.6	7.2	3.6	2.9	0.6	-	-	-	-	-	-	-
Total Debt Service	<u>6.1</u>	<u>8.8</u>	<u>14.9</u>	<u>15.6</u>	<u>16.2</u>	<u>15.0</u>	<u>14.2</u>	<u>14.0</u>	<u>13.7</u>	<u>13.5</u>	<u>13.2</u>	<u>7.1</u>	<u>7.0</u>
Total Applications	<u>101.1</u>	<u>51.1</u>	<u>152.2</u>	<u>22.6</u>	<u>17.8</u>	<u>29.2</u>	<u>29.7</u>	<u>30.7</u>	<u>31.7</u>	<u>33.0</u>	<u>34.2</u>	<u>29.7</u>	<u>31.3</u>
Changes in Cash Position	3.4	13.1	16.5	(3.3)	4.0	(5.2)	(2.5)	(1.5)	(0.2)	1.1	2.8	10.3	11.7
Cash End Period	3.4	16.5	16.5	13.2	17.2	12.0	9.5	8.0	7.8	8.9	11.7	22.0	33.7
Debt Service Coverage	1.19:1	1.90:1	-	1.21:1	1.32:1	1.57:1	1.89:1	2.06:1	2.27:1	2.50:1	2.77:1	5.56:1	6.07:1

AZRAQ-IRBID WATER SUPPLY PROJECTASSUMPTIONS FOR FINANCIAL STATEMENTSAzraq - Irbid Transmission Main and
Irbid Distribution System

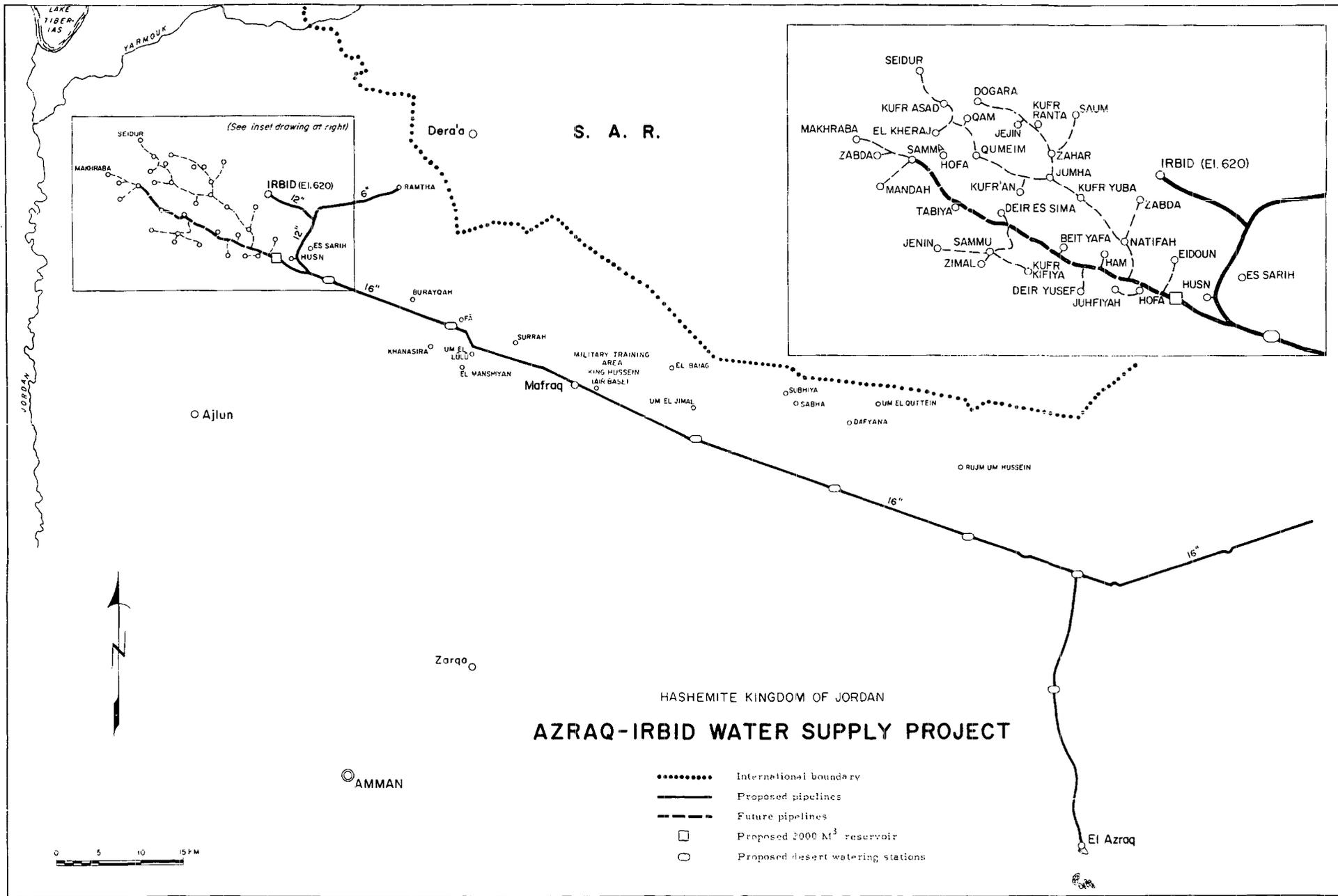
1. The IDA credit will be repaid at four per cent interest, a three-year grace period, and amortization in 40 equal semi-annual installments.
2. Local loan funds will be made available at four per cent interest, a two-year grace period, and with eight equal annual capital repayments.
3. Salary and maintenance costs are CWA estimates.
4. Chlorine costs are based on a dosage of 2 milligrams per liter and a chlorine cost of JD 265 per ton.
5. Administrative and General is estimated at 25 per cent of salaries; contingencies at 10 per cent of other costs.
6. Depreciation of old facilities has been calculated at 3 per cent, new facilities at 2½ per cent.

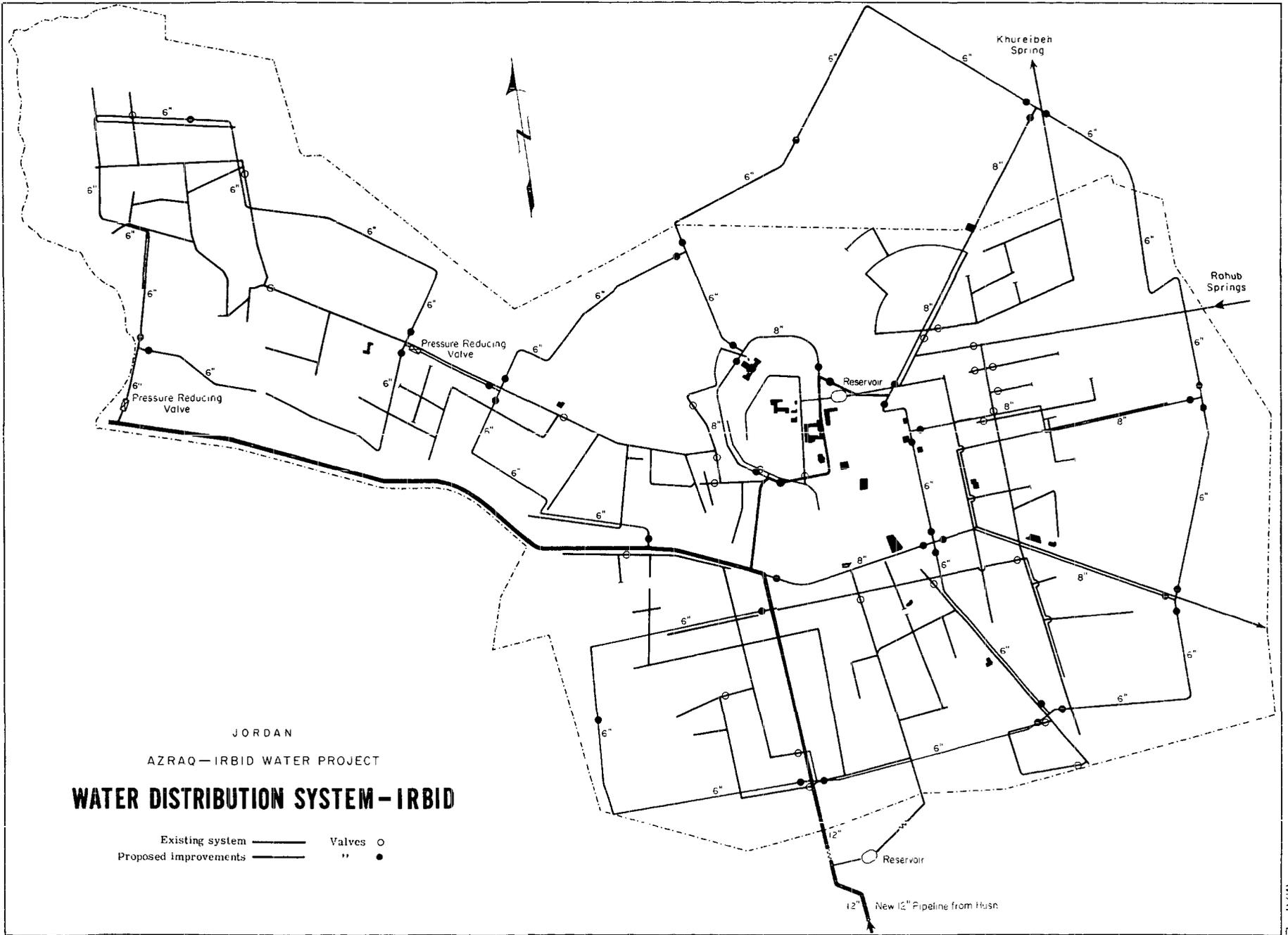
Azraq-Irbid Transmission Main Only

1. The amounts of water pumped and water sold are taken from Annex 8.
2. Pumping at 300 cu.m. per hour is figured to require 2.3 HP hours per cu.m. with a 74 per cent overall efficiency. Fuel consumption equals 200 gms. per HP hour at JD 22.5 per ton; lubricant at 2.4 gms. per HP hours at JD 0.15 per kilogram. Total cost 11.2 fils per cu.m. pumped.
3. For purposes of depreciation and the calculation of net fixed assets, JD 592,000 has been added to project costs to represent the value of 148 kilometers of petroleum pipeline had it been sold for salvage rather than used in this project. It is estimated that it will cost an average of JD 0.7 per meter to renovate and use and that it has a salvage value of JD 4 per meter. The 12-inch pipe which would have been required in lieu, would have cost JD 8 per meter installed.

Irbid Distribution System Only

1. The fuel costs are based on present experience; chlorine costs apply only to water locally produced.
2. Extension and improvements are estimated at 15 per cent of the previous years total water revenues beginning in 1967/68.
3. Extensions and improvements are added for depreciation purposes the year after their installation.
4. Working capital additions are estimated at 25 per cent of the preceding year's increase in total revenue, except for the first year after construction when 10 per cent of the preceding year's total sales were taken.





JORDAN
 AZRAQ—IRBID WATER PROJECT
WATER DISTRIBUTION SYSTEM—IRBID

Existing system ——— Valves ○
 Proposed improvements ——— " ●