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APPRAISAL OF THE  
AMMAN WATER SUPPLY AND SEWERAGE PROJECT - II  
JORDAN

May 4, 1973

Europe, Middle East and North Africa  
Projects Department

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### CURRENCY EQUIVALENTS

Currency Unit	-	Jordan Dinar (JD)
US\$ 1	-	JD 0.321
JD 1	-	US\$ 3.111
JD 1 million	-	US\$ 3.111 million
JD 1	-	1000 Fils

### MEASURES AND EQUIVALENTS

kilometer (km)	-	0.62 mile
square kilometer (km <sup>2</sup> )	-	0.386 square mile
millimeter (mm)	-	0.03937 inch
centimeter (cm)	-	0.3937 inch
meter (m)	-	39.37 inches
cubic meter (m <sup>3</sup> )	-	220 Imperial gallons or 264 US gallons
cubic meters per second (m <sup>3</sup> /sec)	-	19.1 million Imperial gallons per day or 22.8 million US gallons per day
liter (l)	-	0.22 Imperial gallon or 0.264 US gallon
liters per second (l/sec)	-	19,100 Imperial gallons per day or 22,800 US gallons per day
liters per capita per day (lpcd)		

### ACRONYMS USED

AWSA	-	Amman Municipal Area Water and Sewerage Authority
MLF	-	Municipal Loan Fund
NRA	-	Natural Resources Authority
NWSB	-	National Water and Sewerage Board
ODA	-	Overseas Development Administration (UK)
UNRWA	-	United Nations Relief and Works Agency
VBB	-	Vattenbyggnadsbyran (Stockholm, Sweden)

### FISCAL YEAR

January 1 - December 31

JORDAN  
APPRAISAL OF THE  
AMMAN WATER SUPPLY AND SEWERAGE PROJECT - II

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This report was prepared by Messrs. A. Al-Khafaji, W. Hayden, P. C. Kapur and A. Saravanapavan, and is based on information provided by the Government, the consulting engineers' reports and the findings of the field mission of September/October 1972.

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JORDAN

APPRAISAL OF THE

AMMAN WATER SUPPLY AND SEWERAGE PROJECT - II

SUMMARY AND CONCLUSIONS

i. This report covers the appraisal of a project to increase water supply and extend the water distribution and sewage disposal systems in Amman, the capital and commercial center of Jordan. The project is part of an updated master plan for water supply and sewerage for Amman, whose existing facilities are inadequate for meeting the needs of the rapidly growing population, now exceeding half a million. Studies for the development of Aqaba are also included in the project.

ii. An IDA credit of US\$8.70 million is proposed and would finance 75% of the estimated project cost of US\$11.55 million equivalent. The borrower would be the Hashemite Kingdom of Jordan and the main beneficiary would be the Amman Municipal Area Water and Sewerage Authority (AWSA), an autonomous entity established to take over from Amman Municipality the responsibility for water supply, sanitary sewerage and storm-water drainage. The Government would employ consultants for the Aqaba development studies.

iii. The proposed credit would be the third IDA credit for water supply in Jordan and the first for sewerage. Credit 18-JO (US\$1.5 million) was extended to the Government in December 1961 to finance the foreign exchange cost of Amman's first water supply project; Credit 43-JO (US\$2.5 million) was extended to the Government in December 1963 to help finance the development of water supplies in other urban centers. The closing date of Credit 18-JO was extended two years and the credit was fully disbursed by January 1968. A major objective of Credit 18-JO -- to develop the Amman Municipal Water Department into an efficient organization -- was not fully achieved.

iv. The objectives of this project are to (a) extend piped water supply and sewerage services to all parts of the project area; (b) reduce the percentage of unaccounted-for water, currently 64%; and (d) develop AWSA as a viable entity responsible for Amman's water supply and sewerage systems.

v. The project includes the construction of pumping stations, trunk mains, a reservoir, general system improvements, and water distribution extensions and replacements. These facilities, along with the existing ones, will be adequate to meet Amman's requirements until 1982. Unplanned emergency works will be rationalized; they were undertaken in 1970 to overcome a serious water shortage resulting from the mass immigration of over 100,000 refugees into the city in mid-1967. The project also provides for new sewer laterals and service connections to make better use of the existing sewerage facilities. As part of the project, hydrological equipment will be installed to collect storm-water data, and AWSA staff will be given training in administration, operations, maintenance and leak detection/repair.

vi. Of the estimated total project cost of JD 3.71 (US\$11.55) million, JD 2.33 million is for water supply, JD 1.24 million is for sewerage and JD 0.14 million is for the Aqaba development studies. The proposed credit would cover the US\$7.75 million estimated foreign exchange component and a small portion (US\$0.95 million) of the local costs. The remaining JD 0.91 (US\$2.85) million would be financed by the Government and internal cash generation.

vii. Except for some minor civil works, all contracts would be awarded on the basis of international competitive bidding. The construction contracts would be grouped to attract foreign bidders. Most of the equipment for the project is expected to be imported.

viii. An increase of 10 fils/m<sup>3</sup> in the water rate to 75 fils/m<sup>3</sup> was authorized in October 1972, effective January 1, 1973, and an additional 10 fils/m<sup>3</sup> increase is projected from 1977 onwards to cover operating costs (including depreciation) and provide a reasonable surplus to meet the costs of minor improvements and extensions to the distribution network. Provision is made for a study of the tariff structure to assess its suitability under prevailing socio-economic conditions. An amendment to the sewerage law in October 1972 increased the sewerage user charge on water consumption from 20 fils/m<sup>3</sup> to 30 fils/m<sup>3</sup> and raised the sewerage tax from 3% to 4% of net rental value.

ix. The economic rate of return on the water supply component of the project is estimated to be at least 10%.

x. AWSA's return on average net fixed assets is estimated at about 2% during the project construction period, 1973-76, and is projected to increase to about 6% by 1980. The individual rates of return on water supply and sewerage in 1977 are estimated at about 6% and 0.6%, respectively, rising to about 10% and 2% in 1980.

xi. It was agreed that the Government relend US\$8.33 million of the proceeds of the credit to AWSA at an annual interest rate of 6% over a term of 29 years, including a grace period of four years. A Government loan to AWSA to meet part of the local costs of the water supply and sewerage project and interest during construction will be made on the same terms.

xii. Agreement having been reached on the principal issues discussed in Chapters II, III, IV and VI, the project is suitable for an IDA credit of US\$8.70 million.

## JORDAN

### APPRAISAL OF THE

### AMMAN WATER SUPPLY AND SEWERAGE PROJECT - II

#### I. INTRODUCTION

1.01 The Hashemite Kingdom of Jordan has requested an IDA credit to help finance a project for improving and extending the water supply and sewerage facilities in Amman, and for development studies in Aqaba. The project is estimated to cost JD 3.71 (US\$11.55) million. A credit of US\$8.70 million would cover 75% of the project costs; the remaining 25% would be financed by internal cash generation and the Government.

1.02 In 1961, IDA extended Credit 18-JO to Jordan to cover the foreign exchange costs of improving and expanding Amman's water supply system. After initial delays in carrying out this first water supply project for Amman, the credit amount of US\$1.5 million was fully disbursed by January 1968.

1.03 An IDA reconnaissance mission which visited Amman in April 1971 confirmed that the water supply system cannot cope with the needs of the city's rapidly growing population, which increased sharply in mid-1967. The Municipality of Amman engaged consultants, Vattenbyggnadsbyran (VBB) of Stockholm, to prepare a master plan and feasibility studies for water supply and sewerage facilities and to draw up a proposal for an organization that could successfully undertake the new works. Two pre-appraisal missions visited Jordan, in November 1971 and May 1972, and agreed on the scope of the project, its basic design criteria and proposals for an Amman Municipal Area Water and Sewerage Authority (AWSA). A tourism reconnaissance mission visited Aqaba in January 1973 to review the development prospects of the region.

1.04 An appraisal mission composed of Messrs. P. C. Kapur, A. Al-Khafaji, A. Saravanapavan and A. Domenge visited Amman in September/October 1972. Following a review by the mission, the project components were defined and the construction program was rescheduled. This report is based on information provided by the Government, VBB's draft feasibility study and the mission's findings.

#### II. THE SECTOR

##### General

2.01 Jordan, situated in the arid zone of the Middle East, has an area of about 87,000 km<sup>2</sup>, of which all but 6,000 km<sup>2</sup> lie on the East Bank of the Jordan River. The population is estimated at 2.4 million, growing at an annual rate of 3.5%. Approximately 75% of the people live on the East Bank

and about half of them are refugees. The East Bank population is concentrated in the areas with the best water supply -- the Governorates of Amman, Balqa and Irbid in northern Jordan.

2.02 Amman, located at the center of the country's natural and industrial resources, is not only the capital but also the preeminent economic center of Jordan and the main East Bank communications center. The development of Jordan's economy would be handicapped without adequate water supply and sewerage for the rapidly growing population of its capital city and commercial center. Twice in the past two decades Amman's population has doubled; the main factors underlying this phenomenal growth were the political events of 1948 and 1967. In mid-1967 the city experienced a sudden influx of some 100,000 refugees. Since then its population has increased at a rate of about 5% a year. The resident population in 1971 was estimated at 521,000 and is projected to reach 850,000 by 1982 (Annex 1). The municipal boundaries have expanded along with the population increases; within the present boundaries there are two refugee camps established before 1965 and administered by the UN Relief and Works Agency (UNRWA).

#### Water Resources

2.03 Jordan has no sizable sources of surface water. There are only a few suitable dam sites for storage of surface water, one of these being Wadi Zerqa where a dam is under construction. The most important aquifer is the Amman-Wadi Sir system, which outcrops extensively in the central part of Jordan; wells served by this aquifer are the main source of Amman's water supply. Another important aquifer system, in northern Jordan, has been identified recently and is under development. Flowing artesian water has been discovered in limestones near Amman.

#### Sector Needs and Development

2.04 Chronic water shortages have adversely affected living conditions in the country's main urban centers and prevented the improvement of sanitation. The present per capita consumption of water is very low everywhere -- about 35 lpcd in the main towns and 12 lpcd in the smaller towns and the refugee camps. During peak demand in the summer months the municipalities often resort to either rationing water or hauling it by truck.

2.05 Only three cities -- Amman, Aqaba and Salt -- have sewer systems and sewage treatment facilities. Because of the small number of premises connected to the system in Amman, it serves only a small percentage of the city's population. At Aqaba and Salt the treatment facilities are reported to be overloaded and require essential improvements. Throughout the country, including the main urban centers, waste disposal is unhygienic and the sanitation standards are unsatisfactory.

2.06 Because of the limited sources of surface water, the country's urban and industrial development depends on groundwater supplies. The Government is taking steps to improve and expand these supplies and also to meet the most urgent sewerage requirements. Funds for the Amman water supply and sewerage project are included in the three-year development plan (1973-75). The need for water supply projects in other urban centers and in about 20 large villages is under study by the National Planning Council. Consideration is also being given to meeting regional water needs, so that there will be an integrated development of the country's scarce water resources. Recently, the Government formulated a rehabilitation and development program for the East Bank, the water supply component of which includes five water resource schemes and associated distribution systems (zonal projects) with a total cost of JD 2.25 (US\$7.00) million. The Ministry of Rural and Municipal Affairs, which gives the municipalities technical advice on water supply and sewerage, has proposed new sewerage systems for Zerqa, Irbid and Jerash and improvement of Salt's sewer system.

2.07 It is anticipated that the Government will seek IDA assistance in financing a Jordan Valley Rehabilitation and Development Program which is now being prepared as well as several urban and rural water supply projects currently under review by the National Planning Council. With respect to Amman, further investments for new water production facilities and expansion of its water supply and sewer systems will be needed in 1977/1978.

2.08 IDA has extended two credits to Jordan for water supply: Credit 18-JO in 1961 for US\$1.5 million to help finance the first Amman water supply project, and Credit 43-JO in 1963 for US\$2.5 million to help finance water supply projects in the Ramallah-El Bira (Jerusalem) and Azraq-Irbid areas and in Zerqa.

#### Sector Organization

2.09 The Natural Resources Authority (NRA) is the government agency responsible for constructing water supply schemes for all municipalities except Amman. After the facilities are commissioned, NRA turns them over to the respective municipalities, which are responsible for operating them. NRA also provides bulk water supplies for four towns and some 150 villages in the northern and central parts of the country, and operates and maintains four small water supply systems in southern Jordan. The other towns have their own water supplies.

2.10 To improve the organization of the sector, the Government is considering setting up a National Water and Sewerage Board (NWSB) and currently has under review a preliminary draft of the enabling legislation. In consultation with IDA, a law was enacted recently that created the Amman Municipal Area Water and Sewerage Authority (AWSA), which will continue to be responsible for water supply, sewerage and storm-water drainage in Amman Municipality after creation of NWSB.

2.11 NRA's Water Department is expected to be the core of the proposed NWSB. It is important that the relationship between NWSB and AWSA should be set out clearly in the legislation. Agreement was reached during negotiations that the Government will furnish to the Association the proposed legislation for establishing NWSB sufficiently in advance for the Association to comment on any matter that may affect AWSA.

### III. THE MAIN BENEFICIARY

3.01 As in Credit 18-JO for Amman's first water supply project, the Hashemite Kingdom of Jordan would be the borrower in the proposed new credit. Under a subsidiary loan agreement the Government would relend US\$8.33 million of the proceeds of the credit to the Amman Municipal Area Water and Sewerage Authority (AWSA).

3.02 AWSA has been established, on the recommendations of Foretagsadministration AB (management consultants sub-contracted by VBB), to take over from Amman Municipality all water supply, sanitary sewerage and storm-water drainage functions. AWSA is an autonomous local authority with powers to borrow funds and will be organized and operated in accordance with the consultants' recommendations (para. 3.17-3.20). To give an indication of the tasks facing AWSA, the municipal water supply and sewerage operations are described below.

#### Existing Facilities

3.03 Amman gets its water from boreholes varying in depth from 50 to 450 meters and from a few springs. The water is normally of good chemical quality, but recent bacteriological analyses have indicated possible contamination from the infiltration of sewage from cesspools, etc. The distribution network is divided into four pressure zones; however, the physical separation of the zones is only partially completed. Several emergency arrangements for pumping were made in 1970 to supply water to the high-pressure zones and to areas outside the city. There are about 34,000 water service connections, all of them metered. The meters are owned and maintained by the consumers. Residents of the refugee camps generally obtain their water from public standpipes, although some are provided with individual meters. Details of Amman's existing water supply facilities are given in Annex 3.

3.04 Water supply facilities constructed under Credit 18-JO included new boreholes, two pumping stations, two service reservoirs and about 40 km of trunk mains and distribution network. Construction of the project was completed in 1968 except for one pumping station, which was re-sited, built underground for security reasons and completed in 1972.

3.05 In the past 11 years the percentage of unaccounted-for water has exceeded 40% every year except 1963 (37%) and has risen to 64% in 1972 (Annex 3, para. 15). The high water losses are attributable to a number of unresolved problems: leakages in the water distribution network, illegal connections, inaccurate metering, overflowing reservoirs, and inefficient billing and collection procedures. But the basic cause has been poor operating management, which in turn is due to the shortage of trained staff, inadequate supervision and an unreliable water supply.

3.06 Due in part to the large increases in Amman's population in recent years (para. 2.02) and in part to the large water losses (para. 3.05), the existing water supply facilities are not adequate to cope with present demand. Since 1968 Amman has been experiencing such acute water shortages that water is supplied to the various sections of the city on a cyclical basis; furthermore, some of the newly built-up areas are served by inadequate temporary arrangements. This situation tends to encourage illicit measures to ensure individual supplies.

3.07 A first-stage sewerage project, comprising construction of a sewage treatment plant, main sanitary sewers and storm-water sewers, was completed in 1969. Sewer laterals and house connections, covering the central part and three main hills (Jabels) of the city, are under construction. Although the treatment plant and main sewer network were designed to serve a population of about 300,000, only some 1,500 premises are connected to the network and the predominant method of sewage disposal in Amman is by use of cesspools. Few health or other benefits have been realized thus far from the large investment (more than JD 2.0 million) in the sewerage system. Modest additional investment is needed so that more sewer laterals and house connections can be constructed and greater use made of the existing facilities. Many of the system's present problems stem from inadequate planning and the lack of an effective organization to stimulate corrective action. Details on Amman's existing sewerage facilities are given in Annex 4.

#### Administration

3.08 A major objective of the first IDA credit -- to establish an efficient Water Department within Amman Municipality -- was not fully achieved. The engineering and accounting units in the Municipality's Water and Sewerage Departments remained very weak. The operation and maintenance of facilities have suffered from a shortage of trained supervisory, operational and maintenance Staff, caused in part by the low salary structure. Both departments were also handicapped by poor organization and lack of delegation of authority. The Director for Water was also Director for Markets and devoted little time to water supply.

#### Accounting and Finance

3.09 The departments' accounting systems were inadequate, provided little information for management control and were not audited (except for a

prepayment examination of vouchers exceeding a certain limit). The accounts of the Sewerage Department formed part of those of the Municipality. The Water Department, however, has functioned since 1965 as a semi-autonomous municipal department, with its finances and accounts maintained separately in accordance with the Project Agreement in Credit 18-JO. They were maintained mostly on a cash basis and depreciation of fixed assets was not included; however, the accounts receivable were entered on an "accruals" basis. In both departments there was no inventory control and the estimated value of assets was not shown in the accounts.

3.10 The financial performance of the Water Department was unsatisfactory. In the period 1967-71 the operating costs (excluding depreciation) increased by about 73% but revenues increased by only 38%; if depreciation is included, the rise in operating costs was 77%. In 1971 water production increased by about 35% over that of the previous year but sales increased by only 1%. In 1972, despite an estimated increase of 33% in production, sales were not expected to rise by more than 21%. Consequently, the earnings of the Water Department and its rate of return on average net fixed assets have been marginal in recent years. The rate of return was 2.6% in 1970, 1.4% in 1971, and is estimated at 2% in 1972 (Annex 12).

3.11 All investments in both sanitary sewerage and storm-drainage have been financed by loans or by the city's general funds. Recurring costs have been met from the Municipality's general revenues, which include a sewerage tax and other collections for sanitary sewerage services; no separate fees are charged for storm-water drainage.

3.12 At the end of 1971 the long-term debt of the Water Department amounted to JD 1.2 million. In April 1972 the department borrowed JD 150,000 from the Jordan National Bank and to meet the cash requirements in 1972, another loan of about JD 100,000 was under negotiation. In 1966-67 the Government made loans of JD 2.5 million for construction of sewers and storm-drainage works; these loans are interest free and repayable over a term of ten years commencing in October 1976.

3.13 The water rate of 65 fils/m<sup>3</sup>, in effect for 12 years, was not adequate and a new rate of 75 fils/m<sup>3</sup> was implemented on January 1, 1973 (Para. 6.04). Although most of the connections are metered, the billing procedures are unsatisfactory. Bills are prepared quarterly on manual accounting machines and delivered by the meter readers on their next reading visit. The consumer can either pay the meter reader on the basis of the meter reading or upon receipt of the bill, or he can make payment at the Municipality's main cash office. The meter readers collect a substantial amount of the water revenues but there is no internal control over their work.

3.14 Those connected to the sewer system pay a user charge on water consumption of 30 fils/m<sup>3</sup> (increased from 20 fils in October 1972), a one-time fee of 25% of annual rental value of premises, and a connection fee

based on the type of building to be connected. In addition, a law enacted in 1964 required payment of a sewerage tax at 3% of annual rental value of all premises for five years (1965-1969). The law also provided for the tax to continue for fifteen more years on premises connected to the sewer system. However, no sewerage tax was collected after 1969. In October 1972 an amendment to this law raised this tax to 4% and made it applicable to all householders whether or not their premises are connected to the sewer system. The sewerage tax is collected as part of the general property tax by the Ministry of Finance, which transferred to the Municipality its share after retaining a 10% collection charge. The efficiency of collection has averaged 70% in recent years.

3.15 The Water and Sewerage Departments did not insure their property against risks other than war risks, for which compulsory insurance was recently introduced.

3.16 The deficiencies of the present water and sewerage operations in Amman have been highlighted in order to point up the need for corrective action. Yet it should be noted that the water operation has a number of achievements to its credit; they include meeting the essential water needs of Amman after a sudden increase of 25% in the city's population in 1967 and maintaining water supply during the emergencies of the past five years.

#### Amman Municipal Area Water and Sewerage Authority (AWSA)

3.17 Recognizing the need to reorganize the water supply and sewerage operations in Amman, the Government and the Municipality, in consultation with IDA, engaged management consultants (para. 3.02) to examine the problems and propose solutions. The consultants recommended the establishment of AWSA and prepared the draft legislation, an organizational structure and a staffing plan. Most of the consultants' recommendations have been accepted by the Municipality and are to be implemented by AWSA. IDA reviewed the draft legislation and found it acceptable. Law 19 of 1973 establishing AWSA was approved by the Jordanian National Assembly in April 1973.

3.18 AWSA is an autonomous local authority and has acquired the assets and liabilities of both the Water and Sewerage Departments of Amman Municipality. Control of AWSA is vested in a seven-member Board of Directors, composed of the Lord Mayor as chairman, three members from the Amman Municipal Council, one member from the National Planning Council, one from the Natural Resources Authority, and one from the private sector. The Lord Mayor is responsible to the Prime Minister for the activities of the Board.

3.19 A chart showing AWSA's organization is in Annex 9. Under the General Manager there are five departments: Administration, Finance, Water Operations, Sewerage Operations, and Engineering. The General Manager, appointed by the Board, is responsible for implementing Board policy and for

day-to-day control. A competent General Manager was appointed in March 1973 and has assumed his post. The former Director of the Sewerage Department and the Chief Engineer of the Water Department have been appointed as Chief Engineer (Sewerage) and Chief Engineer (Water) respectively. The municipal staff formerly assigned to the Water Supply and Sewerage Departments have been transferred to AWSA. Agreement was reached during negotiations that AWSA will at all times carry out its operations under the supervision of a competent General Manager and other competent senior staff.

3.20 Municipal and Government agencies are experiencing considerable difficulty in recruiting and retaining qualified staff partly because of poor salary scales and unattractive career prospects. Many are lost to the private sector and to neighboring rich Arab countries. Agreement was reached during negotiations that AWSA will upgrade its salary structure to provide salaries and career development prospects that will enable it to attract and retain sufficient qualified staff in competition with other organizations, authorities and corporations in Jordan.

3.21 The UK's Overseas Development Administration (ODA), under its technical assistance program, has agreed to provide AWSA with four advisors to assist, respectively, the General Manager, Chief Engineer (Water), Chief Engineer (Sewerage) and Finance Manager. The Advisors to the General Manager and the Finance Manager have been recruited and have assumed their posts in Amman. During construction of the first water supply project (Credit 18-JO) similar assistance was provided but not used effectively. The importance of implementing the recommendations of the ODA advisors was emphasized during negotiations and agreement reached that management and accounting consultants, acceptable to IDA, will be engaged if the ODA assistance is terminated before a satisfactory management and accounting system has been set up.

3.22 As mentioned heretofore, AWSA has taken over the assets and liabilities of the Municipality's Water and Sewerage Departments. The gross value of the fixed assets as of January 1, 1973, is estimated at JD 6.5 million and the net value (after depreciation) at JD 5.7 million. These estimates are based on the consultants' computations and are acceptable. Most of the assets have been constructed in the past six years. The gross value of water supply assets built prior to 1966 is only about JD 450,000 and that of sewerage assets is JD 478,000. AWSA's total long-term debt as of January 1, 1973, is estimated at JD 3.8 million (Annex 10).

3.23 The accounting staff, at both supervisory and operating levels, do not have the necessary knowledge and experience to develop AWSA's accounting system. A provision of JD 10,000 for training of the staff, either locally or overseas, in modern methods of accounting and budgetary control has been included in the project. During negotiations agreement was reached that ASWA will employ a qualified accountant experienced in utility accounting, budgeting and costing; and that before September 30, 1973, AWSA will submit for IDA's approval a training program for the accounting staff.

3.24 It is essential that AWSA, with the assistance of the ODA financial expert, establish a proper accounting system as soon as possible. Agreement was reached during negotiations that AWSA will prepare in draft form (a) a chart of accounts and accounting procedures and rules; (b) an inventory control system; and (c) a timetable for the new accounting system's implementation, to be submitted before September 30, 1973, to IDA for comment; and that the financial accounts will be prepared in accordance with generally accepted accounting principles.

3.25 The legislation creating AWSA provides that its accounts and all of its financial affairs will be audited annually by qualified auditors. Agreement was reached during negotiations that an annual audit will be made of AWSA's accounts by independent auditors acceptable to IDA, and that AWSA will send the auditors' report and the annual accounts to IDA not later than four months after the end of each fiscal year.

3.26 The problem of unaccounted-for water (para. 3.05) needs to be solved as soon as possible. Establishment of AWSA with adequate and competent staff should contribute toward a solution. The project includes provisions for a meter repair shop and the supply of water production and domestic meters (para. 4.03). Agreement was reached during negotiations that before January 1, 1974, AWSA will (a) employ a leak detection specialist to undertake a leakage survey; (b) establish a leak detection and repair section; (c) undertake a house-to-house survey to detect illegal connections and to update records; and (d) submit to IDA for comment proposals for reorganizing the billing and collection system to establish proper internal control and implement a mutually agreed system.

3.27 A conservative reduction of 4% per year in unaccounted-for water has been assumed in making the financial projections. By 1982 this loss is projected to decrease to a reasonable level of 24% of water production.

3.28 The management consultants have proposed that billing and the monthly accounts be computerized. The economics of launching such a program for a comparatively small organization such as AWSA are questionable. Assurances were obtained during negotiations that computerization will not be introduced without prior consultation with IDA.

3.29 The establishment of AWSA, appointment of experienced staff and improvement of administrative procedures are expected to remedy many of the managerial shortcomings of the old administration and, under normal conditions, should result in satisfactory implementation of the project and efficient operation and maintenance of the expanded water supply and sewerage systems.

#### Aqaba Development Studies

3.30 In recent years, the Jordanian Government has concentrated growing attention on Aqaba, one of the few areas in the country with real prospects for multi-sectoral development. The region has considerable tourism potential; situated on the nearest shore to Europe where winter swimming is possible, near the carved-stone city of Petra and the scenic Wadi Ram desert. The

availability of a good transportation network, abundant labor and the geographic situation of the town also enhances the region's prospects for gradual industrialization.

3.31 The proposed development studies, which will be supervised by an inter-disciplinary committee set up within the National Planning Council, will be aimed at establishing a comprehensive design for future regional development. The present plans for the area are fragmented as they were conceived in different periods and prepared independently by different agencies.

#### IV. THE PROJECT

##### Description of the Project

4.01 The project includes water supply and sewerage facilities for Amman and development studies for the Aqaba region. The water supply and sewerage components are part of an updated master plan for Amman. The proposed facilities together with the existing ones will be adequate to meet Amman's requirements until 1982. The water demand forecasts (Annex 1) are based on population projections prepared by VBB, an increase in the connected population's consumption by 2 lpcd annually from 1974, and reduction of unaccounted-for water (4% annually) to 24% of water production by 1982. Sewage flows and loading are based on water consumption figures.

4.02 The principal elements of the project are listed below; for details see Annexes 5 and 19 and Maps 2 and 3.

##### (A) Water Supply

- (i) A new pumping station at Tadj (capacity of about 360 l/sec) including aeration and chlorination facilities, a new booster station and additional pumps for Ras el Ain pumping station.
- (ii) Expansion and replacement of the water distribution network, including the installation of about 20 km of large diameter pipes (trunk mains), 80 km of medium and small diameter pipes (distribution network including house connections), one service reservoir with a capacity of 4,000 m<sup>3</sup>, and an improved communications system between key reservoirs and pumping stations. Also included are about 12,000 water meters some of which will be used for replacement.
- (iii) Two new boreholes and improvement of the existing installations, including new submersible pumps, water production meters, chlorination facilities and pumphouses.

- (iv) Provision for employing a specialized firm to undertake a leak detection survey, the mapping of leaks in the network and preparation of a repair/replacement program.
- (v) Office building, garage, store and meter repair shop for AWSA and supply of hydrological equipment.

(B) Sewerage

- (i) A 2-km sewer main (500 mm) in the city's center and about 100 km of sewer laterals and house connections. Also, about 8 km of sewer laterals to complete the ongoing program of laterals construction.
- (ii) Minor improvements to the sewage treatment plant.

(C) Consulting Services

- (i) Consulting services for management studies, master plan and preliminary engineering and for detailed design and supervision of construction of the project.
- (ii) External assistance for training of AWSA's administrative staff in accounting methods and engagement of a qualified firm for operation and maintenance training.

(D) Aqaba Development Studies

Consulting services to:

- (i) Review existing studies and prepare recommendations for the basic infrastructure development of the Aqaba region, including a proposed free industrial and commercial zone.
- (ii) Elaborate on the existing Aqaba tourism development plan.

Cost Estimates

4.03 The estimated costs of the project are summarized below and detailed in Annex 6.

<u>Item</u>	<u>Local</u> -----	<u>Foreign</u> JD (000)	<u>Total</u> -----	<u>Local</u> -----	<u>Foreign</u> US\$ (000)	<u>Total</u> -----	<u>% of Total</u> <u>Expenditure</u>
<u>Water Supply</u>							
Pumping stations	36	256	292	112	796	908	8
Distribution system extensions & re- placements	242	784	1,026	753	2,439	3,192	27
Development & im- provement of bore- holes	23	72	95	72	224	296	3
Leak survey	2	37	39	6	115	121	1
Office bldg, meter repair shop, etc.	42	70	112	131	218	349	3
Sub-total, Water Supply	<u>345</u>	<u>1,219</u>	<u>1,564</u>	<u>1,074</u>	<u>3,792</u>	<u>4,866</u>	<u>42</u>
<u>Sewerage</u>							
Sewer extensions	510	440	950	1,587	1,369	2,956	26
Plant improvements	2	2	4	6	6	12	-
Sub-total, Sewerage	<u>512</u>	<u>442</u>	<u>954</u>	<u>1,593</u>	<u>1,375</u>	<u>2,968</u>	<u>26</u>
<u>Land Aquisition</u>	46	-	46	143	-	143	1
<u>Consulting Services</u>							
Engineering	85	233	318	264	725	989	8
Training	12	58	70	37	180	217	2
<u>Contingencies</u>							
Physical - Water supply (15%)	52	183	235	162	569	731	6
Physical - Sewerage (10%)	51	44	95	159	137	296	3
Price (7% per annum)	93	192	285	289	598	887	8
TOTAL WATER SUPPLY AND SEWERAGE	<u>1,196</u>	<u>2,371</u>	<u>3,567</u>	<u>3,721</u>	<u>7,376</u>	<u>11,097</u>	<u>96</u>
<u>Aqaba Development Studies</u>	26	119	145	80	370	450	4
TOTAL PROJECT COST	1,222	2,490	3,712	3,801	7,746	11,547	100

4.04 The cost estimates were prepared by the consultants and are based on detailed designs for the sewerage component and preliminary designs for the water supply component. The estimates are derived from current quotations for equipment and materials and from experience gained in construction of the ongoing sewerage project and the Ras el Ain pumping station. The cost of the Aqaba development studies was estimated by the Government, assisted by IDA staff.

4.05 Physical contingencies of 10% for the sewerage and 15% for the water supply works have been added for both materials and civil works. The higher contingency for water supply is to cover unforeseen conditions during detailed design and construction of the project. The price contingencies -- an average annual increase of 7% in both foreign and domestic prices -- reflect the increase in the cost-of-living index in Jordan over the past few years, and allow for possible increases in insurance and freight rates for shipment to a country like Jordan which has difficult access. In recent years, price increases of up to 20% on pipe shipments were reported when access to Mediterranean ports was restricted.

4.06 The foreign exchange component of the project costs was estimated on the basis of expected direct imports, plus the estimated import content of those domestic production sectors whose materials could be used in the project.

#### Amount of IDA Credit

4.07 An IDA credit of US\$8.70 million (75% of the total costs) is proposed to cover all of the project's foreign exchange costs (US\$7.75 million) and part of the local costs (US\$0.95 million).

#### Procurement and Disbursement

4.08 All equipment supply and civil works contracts, except minor contracts for well drilling and scattered sewer laterals to complete the ongoing program (amounting to about JD 100,000), would be awarded on the basis of international competitive bidding in accordance with the Association's Guidelines for Procurement. Except for sewer pipes and some minor items, the equipment and materials to be used in the project are not produced in Jordan. However, it was agreed to give the usual margin of preference of 15% or custom duties whichever is the lower. There are no government restrictions on importing goods, and according to the Law establishing AWSA the authority is exempted from all custom duties and taxes.

4.09 The construction contracts would be combined as far as practicable but bids will also be invited for components of the packages. This should enable local contractors to compete as well as encourage bids from foreign contractors. Local firms are expected to obtain civil works contracts for sewerage service connections and several sub-contracts.

4.10 The proposed IDA credit would be disbursed as follows:

(i) Civil Works

60% of the cost of construction contracts.

(ii) Equipment and Materials

The CIF cost of imported equipment and the ex-factory cost (excluding taxes) of locally-produced equipment;

(iii) Consulting Services

100% of the foreign exchange costs of consulting services for engineering, management studies, and training.

4.11 Retroactive financing not exceeding US\$250,000 is proposed in respect of expenditures incurred after December 1971 for consulting services for the management studies, master plan, preliminary engineering for water supply and final engineering for sewerage.

4.12 A proposed allocation of the IDA credit is shown in Annex 6 and a quarterly disbursement forecast is shown in Annex 8.

Administration of the Project

4.13 AWSA will be responsible for carrying out the water supply and sewerage components of the project, whereas the Government will be responsible for the Aqaba development studies. As AWSA will not have adequate staff for some time, however, it would have to engage engineering consultants to prepare detailed designs and tender documents, evaluate bids and supervise construction. A contract with VBB to undertake final engineering and supervision of construction of the project has been concluded. During negotiations it was agreed that AWSA will continue to employ an engineering consultant satisfactory to IDA during the project construction period, that NRA will ensure the proper installation and maintenance of the hydrological equipment and that AWSA will submit to IDA for comment before January 1, 1974 the work program and data to be gathered by NRA. It was also agreed that the Government will engage consultants for the Aqaba development studies on terms satisfactory to IDA.

4.14 Under the proposed organization, AWSA's Chief Engineer (Engineering) would be responsible for project administration. Agreement was reached during negotiations that an experienced senior engineer will be appointed to this position before September 30, 1973.

4.15 The mechanical and electrical equipment at the Amman sewage treatment plant and pumping stations is not functioning satisfactorily. The present staff is not fully acquainted with its operation and maintenance. The Municipality has been discussing with Oy Yleinen Insinööriliitto (YIT),

the Finnish firm that erected most of the equipment, the prospects of bringing a team of experienced personnel to Amman to train the staff in the proper operation and maintenance of the equipment. Agreement was reached during negotiations that before January 1, 1974 AWSA will contract with YIT or some other qualified firm for staff training in operation and maintenance of the existing facilities under terms of reference satisfactory to the Association.

4.16 The Amman Public Sewerage Law requires all premises in areas provided with sewer laterals to have their service connections made and cess-pools closed within three months following official notification by the Municipality. If connections are not made within the specified period the Sewerage Department is authorized by the Law to install the service connections and to collect from the owners the incurred costs plus an additional 20% penalty fee. However, these requirements have not been enforced to date. Agreement was reached during negotiations 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 within six months and in any case not later than nine months following completion of the sewer laterals.

4.17 Project execution, from design through commissioning, is expected to begin in 1973 and be completed in 1976. The construction schedule is shown in Annex 7.

#### Land Acquisition and Wayleaves

4.18 Land for the Tadj pumping station and the new reservoir will have to be acquired. Also, on the transmission pipeline, wayleaves may have to be obtained for passing through private property. No special problems are foreseen in this respect. During negotiations assurances were obtained that AWSA will take appropriate action on land acquisition and wayleaves to avoid delays in project implementation.

#### Water Rights

4.19 Amman Municipality has an agreement with Wadi Sir Municipality to pump water from Wadi Sir spring into the Amman water supply system and, in return, to provide water free of charge to meet their local needs and also make an annual payment of JD 3,200 to Wadi Sir Municipality. Thus, as the latter's needs are expected to increase, smaller quantities of water would be available to Amman. Agreement was reached during negotiations that the Government will assist AWSA and Wadi Sir Municipality in establishing equitable allocation of Wadi Sir spring water between each other by not later than June 30, 1974 or such other date as shall be agreed upon between the Government and the Association.

### Ecological Implications

4.20 The Amman Seil, the principal stream flowing through Amman, receives most of the city's liquid wastes. During the dry summer months the stream is grossly polluted and becomes a source of contamination to several water supply wells on its banks. As almost every household has a cesspool or septic tank, in the congested sections of the city the environment is degraded by overflowing cesspools or seepage of sewage effluent into backyards and onto roads. The ongoing sewerage scheme to improve the condition of the Amman Seil, enhance the quality of the environment and remove the danger to the city's water supplies has not had any impact because of poor planning and the slow rate of making sewerage service connections. With the completion of the proposed project, however, sanitary conditions in the city and the quality of the sewage effluent would be improved and associated ecological and health benefits realized. Also, the danger of contamination of the Amman-Wadi Sir aquifer would be reduced.

## V. JUSTIFICATION

5.01 Amman is the country's major economic center as well as its capital city. Despite the area's importance, the municipal water supply and sewage disposal facilities are inadequate and the management and organization unsatisfactory; hence the necessity of the project. As the Amman water system is not continuously under pressure, the water cannot be considered as safe; waterborne diseases such as typhoid and paratyphoid have a high incidence in the city. The deficiencies of the municipal system force those consumers to install roof tanks and construct and clean cesspools.

5.02 Projections of population and water demand are shown in Annex 1. The city's high population growth rate (12%) in recent years is to a large extent due to the influx of over 100,000 refugees in 1967. The normal growth rate, excluding refugees, is about 5%. The design forecasts were based on projections of a natural growth of 3% and a normal immigration of 2%, giving a total growth of 5%. This rate is assumed to decrease gradually to 3% toward the end of the century. Per capita consumption in 1971 was only 30 lpcd (40 lpcd for connected population). The projected demand has assumed that increased consumption will parallel population growth plus an increase in per capita consumption of connected population of 2 lpcd each year from 1973, to give an annual increase in water sales of 9.5% up to 1980. The annual increase in sales for the previous ten years -- a period of severe water shortages -- was 7%. The present demand projections are conservative; if demand were to increase more rapidly, the installation of additional pumps, now timed for 1978, could be advanced.

5.03 The facilities included in the project were selected from among several alternatives as the least-cost solution for meeting the city's

requirements. The major elements of the project are the least cost solution at discount rates of 8%, 10% and 15%. No shadow pricing was used; there is full employment in the construction industry and the foreign exchange rate of the Jordanian Dinar is stable. The sewer extensions were designed by consultants, using adequate design criteria. Detailed design of the water supply component will also be undertaken by consultants.

5.04 The measurable benefits of the water supply component will come from the supply of additional water, which will provide an economic rate of return of at least 10.1%. An economic rate of return of 7.6% would be achieved even if the benefits decreased by 25%. It was not possible to calculate a meaningful economic rate of return for sewerage as the major benefits in public health are difficult to quantify. The sewerage component is the least-cost solution for providing adequate waste-disposal facilities in Amman at discount rates of up to 23.7% (Annex 11). The only feasible alternative is the construction and proper maintenance of private cesspools.

5.05 The supply of potable water to people not hitherto served, the improvement in water quality resulting from continuous and adequate pressure throughout the Amman water system, and the improvements in waste disposal and sanitation will bring about public health benefits. They were not quantified because of the lack of adequate data and also because part of the benefits are reflected in the consumers' willingness to pay for water supply and sewerage services.

5.06 At present the investment plans for Aqaba are fragmented and uncoordinated. The Aqaba development studies, by establishing a comprehensive plan, would ensure optimum use of the resources allocated for Aqaba.

## VI. FINANCING PLAN AND TARIFFS FOR AWSA

### Financing Plan

6.01 The projected sources and applications of funds for the project construction period, 1973-76, are shown in Annex 15. The capital requirements of AWSA total JD 4.6 (US\$14.3) million, of which 83% will be financed by borrowings (including 59% by the proposed IDA credit) and 17% by internal cash generation, as outlined below.

<u>Period 1973-76</u>			
<u>Sources of Funds</u>	<u>JD (millions)</u>	<u>US\$ (millions)</u>	<u>%</u>
Proposed IDA Credit	2.68	8.33	59
Government Loan	<u>1.08</u>	<u>3.36</u>	<u>24</u>
Total Borrowings	<u>3.76</u>	<u>11.69</u>	<u>83</u>
Internal Cash Generation	1.71	5.32	37
Less: Debt Service	<u>0.89</u>	<u>2.76</u>	<u>20</u>
Net Cash Generation	<u>0.82</u>	<u>2.56</u>	<u>17</u>
Total Sources	<u>4.58</u>	<u>14.25</u>	<u>100</u>
 <u>Applications of Funds</u>			
<b>Project Expenditures</b>			
Water Supply	2.33	7.25	51
Sewerage	<u>1.24</u>	<u>3.86</u>	<u>27</u>
	<u>3.57</u>	<u>11.11</u>	<u>78</u>
 Other Capital Expenditures			
Water Supply	0.25	0.78	5
Sewerage	<u>0.18</u>	<u>0.56</u>	<u>4</u>
	<u>0.43</u>	<u>1.34</u>	<u>9</u>
 Total Capital Expenditures			
Interest Capitalized	4.00	12.45	87
During Construction	0.50	1.55	11
Increase in Working Capital	<u>0.08</u>	<u>0.25</u>	<u>2</u>
Total Requirements	<u>4.58</u>	<u>14.25</u>	<u>100</u>

6.02 During negotiations agreement was reached that (a) the two existing interest-free Government loans, amounting to JD2.5 million, for sanitary sewerage and storm-water drainage will be converted to Municipal equity; and (b) the relending of the IDA credit and lending of Government funds will be for a term of 29 years, including four years grace, at an annual interest rate of 6%, comparable to the rate currently charged by commercial banks to Government agencies in Jordan<sup>1/</sup>. A higher relending rate would tend to defeat the stabilising effect of the measures mentioned in (a) above.

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<sup>1/</sup> Credit 18-JO was relent at 4% in 1961.

6.03 The projected financial statements of AWSA for the period 1973 through 1980 are shown in Annexes 12 - 16 and the assumptions for the projections are in Annex 17. The return on net fixed assets of the water supply system is projected at 3% to 5% during the project construction period (1973-76), increasing to 10% in 1980. The sewerage system is projected to break even on operating costs during the period 1973-76 and to earn a rate of return of 2% by 1980. The rate of return on the joint water and sewerage operations is projected at about 2% during the project construction period, increasing to 6% in 1980.

#### Tariffs

6.04 In order to provide adequate funds to meet depreciation and increased operating and maintenance costs and provide a reasonable contribution toward the future expansion of the water supply system, the Government has agreed to increase the water rate to 75 fils/m<sup>3</sup>, effective January 1, 1973. Agreement was reached during negotiations that AWSA will charge not less than an average rate of 75 fils/m<sup>3</sup> for water sold to the general public during the period up to December 31, 1976. Also, agreement was reached that, except as the Association shall otherwise agree, AWSA shall take all necessary steps to establish and maintain water tariffs at a level sufficient to yield an annual rate of return on the value of water supply net fixed assets in operation of not less than 6% in 1977 and not less than 7-1/2% from January 1, 1978 onward. An increase of 10 fils/m<sup>3</sup> is projected after completion of the project to cover the increased debt service and generate sufficient funds for minor improvements and extensions to the system. However, should the percentage of unaccounted-for water be reduced to a level of about 32% by 1977 instead of by 1980 as conservatively projected, this increase may not be required.

6.05 The revised rate of 75 fils/m<sup>3</sup> (US\$0.90/1,000 gal) 1/, together with the minimum quarterly charge of 780 fils, bears very heavily on the poorer members of the community. Agreement was reached during negotiations that AWSA will complete a study of the water tariff structure before June 30, 1974, to assess its suitability under prevailing socio-economic conditions and submit the findings to IDA and thereafter promptly implement such recommendations as shall have been mutually agreed upon.

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1/ For comparison, water rates in other cities in the area are:

Damascus, Syria	US\$0.19/1,000 gal
Istanbul, Turkey	US\$0.52/1,000 gal
Rabat, Morocco	US\$0.54/1,000 gal
Tunis, Tunisia	US\$0.56/1,000 gal

6.06 During negotiations the implementation of the revised sewerage rate (para. 3.14) was confirmed and agreement was reached that rates for sewerage and storm-water drainage will be fixed so as to yield sufficient revenue to meet operating and maintenance costs, provision for depreciation, and debt service requirements to the extent they exceed the provision for depreciation.

6.07 During negotiations agreement was reached that AWSA would not incur debts without IDA's consent unless net income before interest and depreciation is at least 1.5 times the maximum debt service in any future year.

#### VII. AGREEMENTS REACHED AND RECOMMENDATION

7.01 Agreement having been reached on the principal issues discussed in chapters II, III, IV and VI, the project is recommended for an IDA credit of US\$8.70 million to the Hashemite Kingdom of Jordan.

JORDAN

AMMAN WATER SUPPLY AND SEWERAGE PROJECT - II

POPULATION PROJECTIONS AND WATER DEMAND

Growth of Amman

1. Modern Amman dates back to 1878 when Circassian refugees settled on the ancient site of Roman Philadelphia. When the city was selected as the capital of the newly formed State of Jordan in 1921, it had a population of only 5,000, which increased rapidly to 10,000 in 1930 and 60,000 in 1945.
2. The political events of 1948 and 1967 are the main factors underlying Amman's recent phenomenal growth, twice causing the city's population to double in the last two decades:

<u>Census Year</u>	<u>Population</u>	<u>Annual Growth Rate</u>
1952	108,000	-
1961	246,000	9.6%
1967	330,000	5.2%
1967 (estimate)	430,000	-
1971 /1	521,000	5.0%

/1 The 1971 census was made by Amman Municipality and Government statistics Department for the purpose of the project.

3. The annual growth rate for Amman between 1961 and 1967 was 5.2%. An accurate figure for the annual growth rate between 1967 and 1971 is difficult to determine. The 1967 Middle East conflict resulted in an immediate influx of about 100,000 1/ refugees into the city, which since then has increased its population at an annual rate of about 5.0%.
4. VBB has prepared the following three population projections for Amman based on the Department of Statistics' natural growth forecasts for Jordan of 2.94% for the years 1970-1980 and 3.61% for the years 1980-1985.

<u>Year</u>	<u>Low-level Projection</u>	<u>Design-level Projection</u>	<u>High-level Projection</u>
1971	521,000	521,000	521,000
1972	540,000	550,000	550,000
1977	640,000	690,000	710,000
1982	760,000	850,000	910,000
1987	900,000	1,000,000	1,200,000
2002	1,400,000	1,700,000	2,300,000

1/ Estimated by UNRWA and Amman Municipality.

The "design level" forecasts for Amman assume a natural growth rate of 3% a year and normal immigration of 2% a year, giving a total annual growth rate of 5%. This rate is assumed to gradually reduce to 3% a year toward the end of the century, initially from decreasing immigration as a result of the Government's resettlement policies, and subsequently from decreasing birth rates resulting from family planning. The "high-level" projection assumes a growth rate of 5.2% a year (the rate for 1961-1967) for the first 15 years, decreasing to 4.7% a year toward the end of the century. The "low-level" projection assumes a growth rate of 3.5% a year initially, decreasing to 3% a year toward the end of the century.

5. The mission believes that VBB's assumption of growth rates for the "design level" projection is reasonable and compares favorably with the growth rates experienced by the city during periods of normal migration (1961 to May 1967 and late 1967 to 1971).

6. The municipal boundaries of Amman have expanded over the years. Within the present boundaries are two refugee camps established before 1965 and administered by UNRWA. No refugee camps were established in 1967 and newcomers are believed to have settled with relatives and friends. The resident population of Amman within the present city limits is projected to be 850,000 by 1982, and the project was designed accordingly.

#### Population Connected

7. According to a UN survey in 1966, about 82% of all dwellings in Amman had potable water inside. No study has since been carried out on this matter. There are very few private water supplies in Amman. The residents of Amman who are not connected to the distribution network, or for some reason do not get sufficient supply, have to get their water from municipal or private lorries or directly from private wells. The amount of water delivered by tankers during the past two years was insignificant -- 15,000m<sup>3</sup> in 1970 and 63,000m<sup>3</sup> in 1971.

8. VBB determined the percentage of population connected from Department of Statistics data showing 1.9 families per dwelling and 6.5 persons per family, and from the Water Department's record of 32,000 house connections for 1971. Accordingly, the population connected was estimated to be 390,000, which is about 75% of Amman's 1971 population. This percentage is lower than the one reported in the 1966 UN survey; however, expansion of the refugee camps and the presence of several uncontrolled settlements of refugees within Amman make it difficult to compare the two figures.

#### Water Consumption

9. The water consumption in Amman consists mainly of domestic consumption, which includes consumption in the refugee camps, army camps and

commercial establishments such as hotels and restaurants. There is no significant industrial consumption within the city. Municipal consumption for street cleaning, sewer flushing, fire fighting, etc., is very limited.

10. During the past decade water production in Amman increased at an average rate of about 13% per year. Unaccounted-for water has also increased during the decade from 42% to 60% and is expected to be around 64% in 1972. Water consumption, assumed equal to water sales, was an average of 33 lpcd with little variation during the past decade (Annex 3). This is very low compared with some other countries in the region (e.g., Damascus with 112 lpcd and Istanbul with 93 lpcd). In 1972, with the increased supply due to the commissioning of the Ras el Ain pumping station and several new boreholes, consumption is expected to rise to over 34 lpcd.

11. Assuming a connected population of 390,000 (para. 8 above) for 1971 and a total accounted-for consumption of 5.7 million m<sup>3</sup>, VBB has calculated the per capita consumption to be about 40 lpcd. This approach for determining the consumption of the connected population in Amman is justifiable, since most of the unconnected population receive their water supply from public taps, tankers and private water sources.

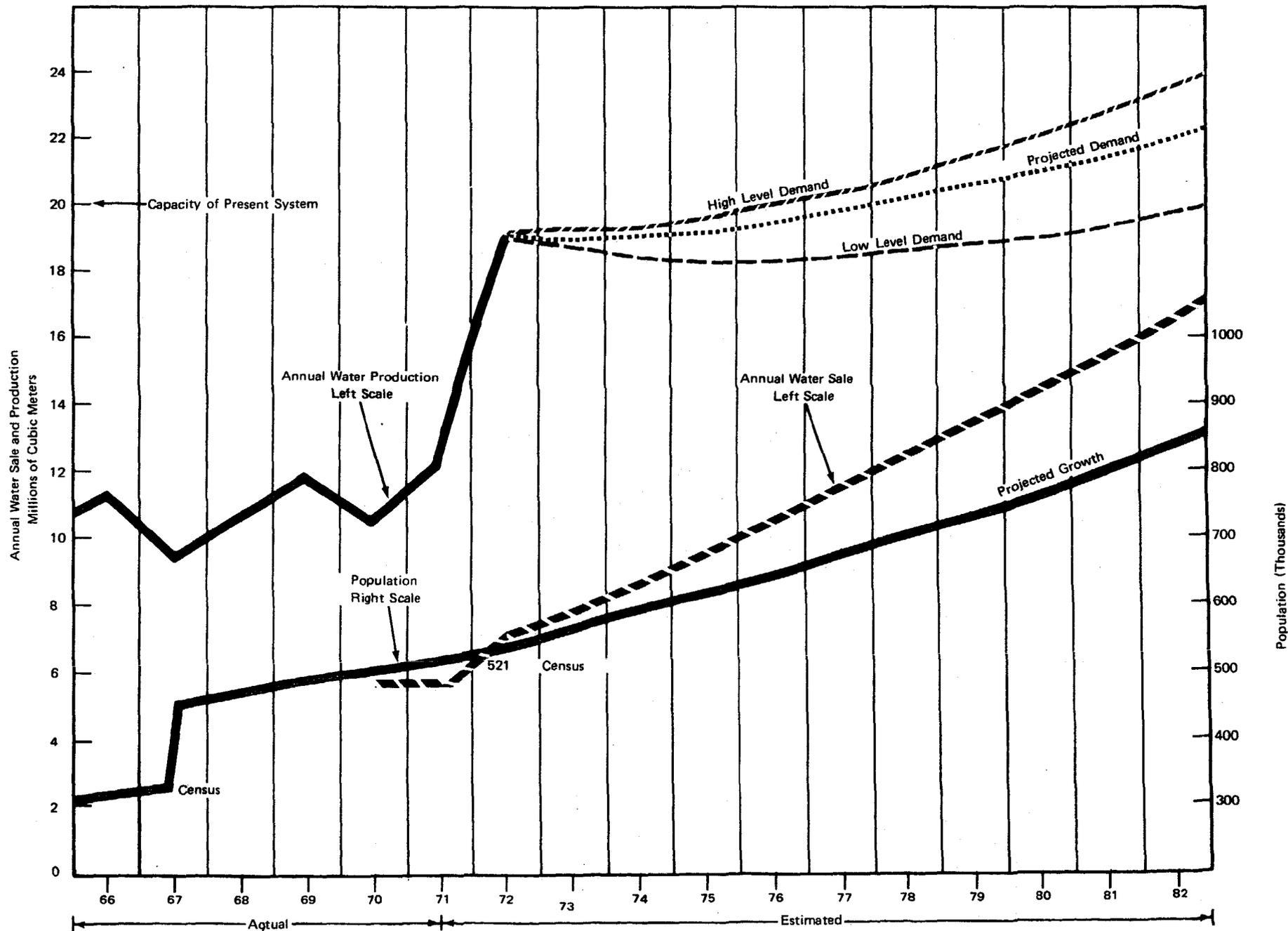
#### Future Water Demand

12. With a raised standard of living and the expected improvement of water metering and water availability, measured consumption per capita should be steadily increasing. An annual increase of 2 lpcd from 1974 is reasonable. Reduction of unaccounted-for water should be given top priority; a 4% annual reduction in the 1972 high percentage (64%) is possible. Accordingly, estimated future water demand in Amman for 1977 and 1982 is shown below.

Year	Population		Water Consumption		Unaccounted-	Total water demand 1000m <sup>3</sup> /yr
	total (1000)	connected %	lpcd	1000m <sup>3</sup> /yr	for water %	
1971	521	75	40	5,689	60	14,300
1972	550	78	44	6,900	64	19,000
1977	690	85	52	11,000	44	20,000
1982	850	88	62	17,000	24	23,000



**JORDAN**  
**AMMAN WATER SUPPLY AND SEWERAGE PROJECT - II**  
**POPULATION, WATER SALE AND WATER PRODUCTION PROJECTIONS**





JORDAN

AMMAN WATER SUPPLY AND SEWERAGE PROJECT - II

EXISTING FACILITIES - WATER SUPPLY

Water Production

1. Amman's water supply is based on groundwater from two aquifers, one overlapping the other. The upper aquifer is the Amman-Wadi Sir formation, the lower one the Hummar formation. The Amman-Wadi Sir system is the country's most important aquifer; according to a Food and Agriculture Organization (FAO) report, <sup>1/</sup> it has a total direct recharge of 312 million m<sup>3</sup>/year and a further indirect recharge of 23 million m<sup>3</sup>/year. However, only about 10% flows eastward to the Amman area, of which around 6 million m<sup>3</sup>/year percolates into the Hummar system. Present withdrawal from these two aquifers is estimated by NRA to be 16 and 6 million m<sup>3</sup>/year, respectively; this means that no more water can be taken from the Hummar system.
2. Wells varying in depth from 50 to 450 meters penetrate the two aquifers. Those belonging to Amman Municipality and their yield, based on NRA estimates of safe yield, are summarized below.

<u>Existing Wells</u>	<u>Estimated yield l/sec.</u>
(i) 10 wells supplying Ain Ghazal pumping station	- <sup>2/</sup>
(ii) 5 wells connected directly to the distribution network	230
(iii) 2 wells supplying Ras el Ain pumping station	190
(iv) 7 wells out of service	-
(v) 5 wells under construction	210

Amman is also supplied from springs at Ras el Ain, within the built-up area of the city, and at Wadi Sir village, seven kilometers to the west of Amman. In 1971 the average production of these springs was 80 l/sec and 50 l/sec,

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<sup>1/</sup> "Sandstone aquifers of East Jordan" (FAO, 1970).

<sup>2/</sup> Due to lack of working water meters, production in the wells connected to the pumping station at Ain Ghazal is not known for each well but the total production of these wells during 1971 (equal to the output from the pumping station) was 160 l/sec on average and 210 l/sec during the maximum month.

In 1971 the average production of these springs was 80 l/sec and 50 l/sec, respectively, while the maximum month figures were 104 l/sec and 70 l/sec. Total production in 1971 for Amman was 14.3 million m<sup>3</sup>, equal to an average of about 500 l/sec.

3. Five private wells used for industrial and water supply purposes are known to withdraw water from the same aquifers. Two of these are used to supply water via tankers to areas outside Amman where piped water supply is not available. Total yield of these wells is estimated by NRA to be less than 140 l/sec. Furthermore, NRA supplies water directly to some villages south of Amman from two boreholes within the Amman Municipality. A third borehole is also under construction by NRA. The capacity of these boreholes together is of the order of 100 l/sec.

#### Water Treatment

4. The water supplied to Amman is normally of high quality from a chemical point of view, with a low color, low content of organic matter and low turbidity. Total dissolved solids range from 320 to 525 ppm and the water is slightly alkaline. Recent bacteriological analyses by VBB and NRA indicate a possible contamination owing to the infiltration of sewage from cesspools, etc.

5. At the request of the Jordanian authorities, funds were provided under Credit 18-JO for water treatment, in addition to aeration and chlorination, if required by the quality of water produced. However, it was found that such additional treatment is not necessary and this element of the credit was cancelled. Presently the raw water is aerated at Ain Ghazal and Ras el Ain to release carbon dioxide. Chlorination is carried out at the pumping stations and also at boreholes directly connected to the Amman distribution network. A recent VBB investigation (April 1972) showed that the chlorine residual at the pumping stations varied between 1.0 and 4.0 ppm. The chlorine residual in the distribution network was found to vary from 0 to 0.25 ppm.

#### Pumping Stations

6. The topography of Amman is characterized by steep hills and deep valleys, with elevations varying between 690 and 996 meters above sea level. In VBB's report of 1964 on the Amman Water Supply it was proposed to divide the distribution network into four different pressure zones to lower the pressure in the network and reduce pumping costs. Physical separation of the zones is partially completed and several temporary arrangements for pumping have been made.

7. The wells and springs of Amman are, with some exceptions, connected to three main pumping stations at Ain Ghazal, Ras el Ain and Wadi Sir. Submersible pumps in five wells pump water directly to the distribution network. Three small booster stations lift water to the high pressure zones and to areas outside the city.

Existing Pumping Station Capacities

<u>Pumping Station</u>	-----Approximate capacity in l/sec-----				
	<u>Total</u>	<u>Zone I</u>	<u>Zone II</u>	<u>Zone III</u>	<u>Zone IV</u>
Ain Ghazal					
Old Station	180	-	60	120	-
New Station	320	280	40	-	-
Ras el Ain New Station	570	70	280	220	-
Wadi Sir	50	-	-	-	50
Sub-Total	<u>1,120</u>	<u>350</u>	<u>380</u>	<u>240</u>	<u>50</u>
Direct from wells	230	-	230	-	-
Total	<u>1,350</u>	<u>350</u>	<u>610</u>	<u>340</u> /1	<u>50</u>

/1 Two booster stations of about 30 l/sec capacity pump water from Zone III to Zone IV and places outside Amman.

8. The Ain Ghazal station gets water from boreholes along the Amman Seil, the main drainage channel in the city, and from other boreholes in the Eastern part of Amman. The collecting main is in bad condition. Water is pumped to three distribution reservoirs via trunk mains (200-300 mm in diameter) and also to Ras el Ain, via the new 600-mm trunk main, for further distribution.

9. The Ain Ghazal pumping station consists of an old diesel station and an electric station, the latter completed in 1969 under Credit 18-JO. Due to lack of maintenance and proper operation, the new electrical station is in poor condition and has been operating on a limited scale. At present only a few pumps from the old diesel station are still in operation, but when the electrical station is fully operational the old diesel pumps could be phased out.

10. There are at present three pumping sets in operation at Ras el Ain -- the old diesel station and two temporary boosters. These could be abandoned when the new electrical pumping station is put into full operation, which is expected soon. The new station is built in rock for greater protection against aerial attacks, and has a chlorine contact basin, an aeration tank, a low reservoir and a pump room. Water is taken from the Ras el Ain spring and from a reservoir fed by Ain Ghazal station and also from some wells via the 600-mm trunk main.

11. The Wadi Sir pumping station gets water from an adjacent well and pumps it to the Wadi Sir Village and to Amman. The feasibility of electrification of the existing diesel-driven station was studied by VBB and they recommended that it is economical to maintain the diesel-operated pumps.

Distribution Network

12. The old distribution system consists mainly of steel pipes with diameters between 75 and 200 mm. External corrosion of these pipes is extensive and a major cause of substantial leakage in the network (see para.

16 (a) below). Two 300-mm main feeders serving northwest Amman are laid on the surface and subject to frequent damage. Since 1966 about 50 km of ductile cast iron mains, ranging in dimension from 200 to 600 mm, have been laid.

13. There are about 34,000 water service connections, all of them metered. The meters are owned and maintained by the consumers. Meter installations as well as service connections are not standardized and are made by contractors under supervision of the Municipality. Until recently, service connections were either welded or directly screwed into the steel distribution pipes and were laid without adequate cover. Such connections are often damaged and are a further cause of the network's large water losses. Meter repairs are also made by private contractors. The Municipality tests the meters after they have been repaired and before they are installed.

14. There are nine distribution reservoirs with a total capacity of 17,500 m<sup>3</sup>. All reservoirs are of reinforced-concrete construction. The reservoirs are not maintained properly and a few are extremely dirty, not having been cleaned for several years. Communications between the reservoirs and the pumping stations are almost non-existent and level recorders are non-operative, resulting in considerable wastage through overflows. In addition, almost every house in Amman has a roof tank (1 to 2 m<sup>3</sup> volume) to balance the variations in local consumption caused by the intermittent water supply.

#### Unaccounted-for Water

15. Almost 50% of the water produced in the last ten years was unaccounted-for. Even though some reduction of water losses has been achieved, from a high of 63% in 1965 to 47% in 1970, a marked increase to 60% in 1971 was reported. Water produced, water sold and the balance (unaccounted-for) for the 10-year period 1962-71 and the estimates for 1972 are shown below.

Year	Population	Water		Water unaccounted-for		
		Produced 1000m <sup>3</sup>	Water Sold 1000m <sup>3</sup> lpcd	1000m <sup>3</sup>	%	
1962	260,000	5,400	3,152	33	2,248	42%
1963	274,000	5,615	3,535	35	2,080	37%
1964	288,000	9,020	3,659	35	5,361	59%
1965	302,000	10,806	4,046	38	6,760	63%
1966 <sup>/1</sup>	-	8,516	3,301	-	5,215	61%
1967	330,000	9,280	4,219	35	5,061	55%
1968	456,000	10,558	5,318	31	5,240	50%
1969	472,000	11,857	6,287	34	5,570	47%
1970	492,000	10,597	5,611	31	4,986	47%
1971	521,000	14,260	5,860	30	8,573	60%
1972 (estimate)	550,000	19,000	6,860	34	12,140	64%

<sup>/1</sup> Nine months' figures.

16. VBB gives the following reasons for Amman's high percentage of unaccounted-for water:

(a) Leakage

Parts of the existing water distribution network are in bad condition. The large leakages are caused by external corrosion of steel pipes in the old network and the many improper service connections all over the city. Field studies carried out by VBB on the hydraulic properties and the extent of water losses in different parts of the network indicate that leakage is responsible for about 40% of the total unaccounted-for water. Most of these leakages are located within the central part of the city. One reason for this could be that the zonal system is not fully implemented, giving high pressures in this zone.

(b) Illegal house connections

A recent limited survey (April 1972) carried out by VBB revealed a comparatively high number of water meters which are not registered by the Municipality's Water Department (12 out of 61). Although it is difficult to draw conclusions from such a limited investigation, the existence of a substantial number of illegal connections is suspected by the consultants and officials of the Water Department.

(c) Inaccurate water metering

A recent survey by a meter manufacturer indicated that 1971 production might have been over-estimated by 6%. However, it is not possible to obtain accurate figures on production, as many water meters are out of service and several boreholes and wells do not have water meters. A test of consumer water meters (turbine type) was carried out in June 1972 by VBB using 32 positive displacement meters. The consumer water meters were found to under-estimate the flow by about 9%.

(d) Overflowing reservoirs

Because of the lack of direct communications between the reservoirs and pumping station, the reservoirs overflow from time to time. This means that the pumping is not carried out in an optimal manner and that occasionally water is pumped for hours into an overflowing reservoir or the particular reservoir can also be empty for many hours.

In addition, the mission found that the functions of meter reading, preparation of bills and collection of money are not clearly separated under the present management system. With hardly any check on the work of the meter readers, the possibility of under-registration must be assumed.



JORDAN

AMMAN WATER SUPPLY AND SEWERAGE PROJECT - II

EXISTING FACILITIES - SEWERAGE

1. The present predominant method of sewage disposal in Amman is to let the sewage percolate into the ground through a cesspool -- i.e., a concrete or rock tank with open bottom. Usually a building has its own cesspool; however, some large buildings do have more than one cesspool while other small houses in areas of less space share a cesspool. For the camps at Hussein and Wahdat, UNRWA has provided and is in charge of public latrines and cesspools at public installations such as schools and clinics. In addition, 5,600 family latrines within these camps serve a population of about 72,000 refugees.
2. Construction of a sewerage system for Amman started in 1963 and was completed around 1969. It comprises 38 km of main sanitary sewers, 17 km of storm-water sewers and culverts, and a sewage treatment plant. The secondary system of sanitary and storm-water sewers covering the city's central section and three main hills or Jabels (Jabel Amman, Jabel Webdeh and Jabel Hussein) is under construction. In addition, a sewer line serving Jordan University, about 4 km northwest of Amman, and the Amman Grand Hospital, enroute, has been built recently.
3. The sewage treatment plant and trunk sewers are still very much under-utilized. The number of premises connected to the sewer network is small. By the end of 1972 there will be only about 1,500 sewer service connections. The reasons for the slow rate of connections are the high cost of construction (due to the use of large-diameter pipes and provision of an excessive number of manholes); the requirement for all Municipal back taxes to be paid before a connection permit is issued; the voluntary nature of the program; and the political unrest that followed the 1967 war. In recent months, construction methods resulting in substantially lower costs have been adopted. Furthermore, the newly enacted sewerage law will eliminate the requirement for payment of back taxes and will make house connections compulsory within specified areas. These new developments substantiate projections of future connections at a rate of 2,000 per year.
4. The condition of the sewer network is good. However, as several lines presently receive only small quantities of sewage, some of them need to be cleaned. Equipment for sewer flushing has been ordered and is expected to be put to use early in 1973. At present, the conventional activated-sludge treatment plant receives the septic contents of cesspools, discharged by vacuum trucks into the inlet of the works, and only small quantities of fresh sewage. No activated sludge has been formed in the aeration tank and the final effluent has a high B.O.D. This situation has led to maintenance and operational difficulties. The staff responsible for the sewerage facilities requires training.

5. Storm-water is discharged into the Amman Seil or adjoining valleys. The Seil also receives the chlorinated final effluent of the sewage treatment plant. The possibility of using the effluent for crop irrigation and the digested sludge for soil conditioning is under consideration.

JORDAN

AMMAN WATER SUPPLY AND SEWERAGE PROJECT - II

DESCRIPTION OF THE PROJECT

WATER SUPPLY COMPONENT

1. The water supply component of the project consists of the construction of a pumping station at Tadj in east-central Amman, connection of eight existing and two proposed new boreholes to the pumping station, trunk mains, a booster station at Smisani, a new reservoir for northwest Amman, and water distribution extensions and replacements in priority areas of the city, including service connections and meters. Improvement of the existing submersible pumping installations, additional pumps for the Ras el Ain pumping station, improvement of communications between key reservoirs and pumping stations, and provisions for hydrological equipment and for leakage surveys are also included, as well as an office building for AWSA, garage, store and meter repair shop.

2. In general, the project elements are designed to meet water demand in 1982. The existing water production facilities would be adequate to meet demand in 1977 if the percentage of unaccounted-for water can be brought down to projected levels. The two new boreholes should then provide for the increasing demand up to 1982. The water supply and sewer networks are part of a master plan being prepared by VBB to meet the city's needs in the year 2002. The major elements of the water supply component are described below.

Tadj Pumping Station

3. The new pumping station at Tadj was recommended by VBB after a detailed study of water demand and future population distribution of various sections of the city, coupled with an optimum solution for collecting and transmitting water from the existing and proposed boreholes. The study indicated that the most economic alternative would be to construct a new pumping station at Tadj, close to most of the boreholes. The demand projections indicated that over the next decade the increased water demand would be mostly in Pressure Zone IV (northwest and north Amman), with some increase in the areas covered by Pressure Zones II and III. Tadj pumping station would provide most of this increased demand. As the case in the existing pumping stations, the station would be provided with aeration and chlorination facilities.

Collecting Pipelines and Wells

4. Collector pipelines, with diameters ranging from 200 to 500 mm, would convey water from seven existing boreholes and one proposed borehole to a 600-mm main collector leading to the Tadj station. Another collector pipeline would similarly connect an existing borehole and another proposed

one. The total length of the collector pipelines would be about 4 km. An existing collector pipeline, presently connected to Ain Ghazal pumping station, would become redundant and be salvaged by AWSA. More boreholes are planned for future construction near the Tadj station. When the project is completed, the three major pumping stations will receive an additional 280 l/sec from boreholes under construction and the proposed new ones, as follows:

	<u>l/sec</u>
(i) Two boreholes under construction at Rossaife to be connected to Ain Ghazal pumping stations	140
(ii) One existing borehole to be connected to Tadj pumping station	40
(iii) Two proposed boreholes to be connected to Tadj pumping station	100
	280

Smisani Booster Station

5. To meet future demand in Zone IV, water would be pumped northwest from the Tadj station to the existing Smisani reservoir. A new booster station at the reservoir would lift the water to a new reservoir with a capacity of 4,000 m<sup>3</sup>. This station would also supply a limited quantity to areas on the northwest of Amman, outside its boundaries.

Pumps

6. New submersible pumps are required for four of the boreholes that would then be serving Tadj pumping station through the collector pipelines. As the boreholes have varying yields and an increased draw-down during the dry season, the capacities of the pumps would be determined at the time of detailed design.

7. Preliminary designs for the Tadj station to meet demand up to about 1982 indicate the need for the following pumps:

<u>Pumps</u>	<u>Capacity</u> <u>l/sec</u>	<u>Head</u> <u>meters</u>	<u>Zone</u>
2 duty, 1 standby	140	140	III and IV
1 duty, 1 standby	80	140	III and IV
1 duty,	80	140	III and IV
1 duty, 1 standby	30	55	II

The second duty pump of 80 l/sec for Zones III and IV would not be required until 1978 and is not included in the project. Additional pumps at the Ras el Ain station, similar to the existing pumps for Zones II and III, would supplement the supply to these zones.

8. There would be two groups of pumps at the proposed booster station at Smisani reservoir, as follows:

<u>Pumps</u>	<u>Capacity l/sec</u>	<u>Head meters</u>	<u>Zone</u>
2 duty, 1 standby	140	100	IV
1 duty, 1 standby	15	150	Outside Amman

Additional pumps would be needed in 1978 as the demand in Zone IV increases.

#### Trunk Mains

9. A 500-mm diameter trunk main, decreasing to 400-mm diameter, of approximately 6.9 km would convey water from the Tadj station to the Smisani booster station. A short, 700-meter take-off distribution pipeline (300 mm in diameter) is also provided. From Smisani booster station a 400-mm diameter pipeline of about 2.9 km would serve the proposed 4,000 m<sup>3</sup> capacity reservoir to service Zone IV.

10. A second trunk main about 2.6 km long and 400 mm in diameter, decreasing to 250 mm diameter, would convey water from the Tadj station to Ashrafia reservoir and Zone III.

11. A third trunk main, 300 mm in diameter and about 1.4 km long, would convey water from the Tadj station to Jofa reservoir. This would provide operational flexibility against any failure of the Ras el Ain spring or the Racing Club well now serving Zone II in the central and eastern sections of Amman.

#### Service Reservoir

12. The existing service reservoir for Zone IV is located to the west of the city, making it unsuitable for meeting demand in north and northwest Amman. The proposed 4,000 m<sup>3</sup> capacity reservoir is sited to the northwest and is adequate to meet demand to about 1987. The existing and proposed reservoir capacities in the Amman water system are as follows:

<u>Pressure Zone</u>	<u>Existing</u>	<u>Proposed</u>	<u>Total</u>
	-----cubic meters-----		
I	4,000	-	4,000
II	4,910	-	4,910
III	7,900	-	7,900
IV	620	4,000	4,620

The top water level of the proposed reservoir would be +996.3 meters, similar to the existing reservoirs. At present an in-line booster serves a small area above this elevation and this supply would be retained. The proposed reservoir would be of reinforced-concrete construction, with pre-stressed concrete construction as a possible alternative.

13. An improved communications system between reservoirs and pumping stations is included to ensure better coordination and more economical pumping.

#### Distribution Network

14. Some 78 km of pipes, ranging in diameter from 80 mm to 300 mm, are included in the project to provide for extensions to the high-growth areas such as Zone IV and the replacement of old leaky pipes and service connections. These include areas within Nuzha, Nazal and Smisani. There is also a provision for replacing a 300 mm main in the city's congested center if the leak detection survey indicates that this is warranted. For the purpose of preparing cost estimates, all pipes included in the project are assumed to be ductile iron, the predominant pipe material now used in Amman.

#### Borehole Improvements

15. As most of the borehole installations are in the open, with little security and a potential for contamination, the project provides for improvements, including replacement of worn-out or unsuitable equipment, and for chlorinators and bulk water meters, as needed.

#### Leakage Survey and Repair

16. The project has a provision for engaging a specialized firm to undertake a leak detection survey, mapping of leaks, and preparation of a repair or replacement program. The replacement of corroded pipes and repair of major leaks would be done by contractors, while minor repair work would be done by AWSA staff with pipes and fittings presently in the inventory or those provided under the project. Leak-detection equipment for AWSA to continue the detection and repair work is also included.

#### House Connections and Water Meters

17. As AWSA is expected to assume ownership of the system's water meters, some unserviceable meters and leaking house connection would require repair or replacement. Water meters and materials for new service connections would be required during the 1973-76 project period. All these requirements are included in the project and summarized below.

	<u>Project Area</u>	<u>Other Areas</u>	<u>Total Number</u>
1. Replacement of house connections (excluding water meters)	1,600	200	1,800
2. Replacement of water meters only	1,000	600	1,600
3. New house connections (including water meters)	5,500	5,000	10,500

18. AWSA would be responsible for the work outside the project area for which materials would be procured under the project.

#### Hydrological Equipment

19. On NRA's recommendation and in order to obtain reliable hydrological data for future projects, a lump sum of JD 5,000 is included for hydrological equipment. The equipment would be specified by NRA and when procured would be installed under NRA's supervision in the Abdoun catchment on the western outskirts of the city. NRA would be responsible for collecting the data and making it available to AWSA for analysis and use in system planning.

#### Office, Garage, Store and Meter Repair Shop

20. No office building is available for AWSA as yet and suitable rented accommodations in Amman would be uneconomical. Nor is there a meter repair shop, which would be an important facility when AWSA assumes ownership of the water meters. Therefore, the project provides for construction of an office building, with a small garage, store and meter repair shop.

#### Land

21. Land owned by Amman Municipality would be transferred to AWSA for the Smisani booster station and for AWSA's office building, garage, store and meter repair shop. Land would also have to be acquired for the Tadj pumping station and the new reservoir. Suitable sites for the former are available and the costs are included in the project. The trunk mains are mainly on roads and no difficulty is anticipated in obtaining wayleaves wherever private property has to be crossed.

#### SEWERAGE COMPONENT

22. The sewerage extension program for Amman is in three parts and aims to achieve the maximum number of sewerage service connections, as follows:

	<u>200 mm</u> -----meters-----	<u>150 mm</u> -----meters-----	<u>Sewerage Service</u> <u>Connections</u>
<b>I. <u>Sewer Extensions in New Areas</u></b>			
City's Center, Wadi Haddada, Naur, Qusor, Nadif, Massarweh, Mahata, Wadi Surour, parts of Hashemi, Tadj, Jofa and Ashrafia	17,000	53,000	7,500
<b>II. <u>Sewers at Road Crossings</u></b>			
Mahata Road, Khalid Ben Walid Street, Madaba Road, Naur Road, Wadi Sakkrat Road, Salt Road, Wasfi-el-Tal Street and Prince Mohammed Street		7,000	850
<b>III. <u>Sewers to Complete Ongoing Program</u></b>			
Jabel Amman, Jabel Hussein and Jabel Webdeh	<u>17,000</u>	<u>8,000</u> 68,000	<u>850</u> 9,200

23. The sewerage extension program is limited by AWSA's capacity to execute new service connections, presently projected to 2,000 per year. Areas where there is a potentiality of contamination of Amman's groundwater sources were selected for execution during the project period.

24. Included in the project area a 2-km main sewer (500 mm in diameter) and about 25 km of 100 mm and 150 mm diameter sewers for making the sewerage service connections. A lump sum of JD 15,000 is included for the repair and replacement of leaking or corroded water pipes encountered in excavations when laying the sewers. Another small lump sum of JD 4,200 is included for improvements at the sewage treatment plant.

#### Aqaba Development Studies

25. The Aqaba development studies component of the project comprises the review of existing studies, surveys, plans, etc. for basic infrastructure development for the town of Aqaba and for the surrounding region, taking into account the likely development of industry, including a proposed free industrial and commercial zone, transport and tourism in the area; and making recommendations for the development of roads, water, sewerage, and electric power in the area. The studies would also elaborate on the existing Aqaba Tourism Development Plan by (i) reintegrating into said plan some essential works including recreational facilities, (ii) adding a hotel training center; and (iii) undertaking new studies to revise, up-date and complement the existing plan and studies.

JORDAN  
AMMAN WATER SUPPLY AND SEWERAGE PROJECT - II

COST ESTIMATES OF THE PROJECT

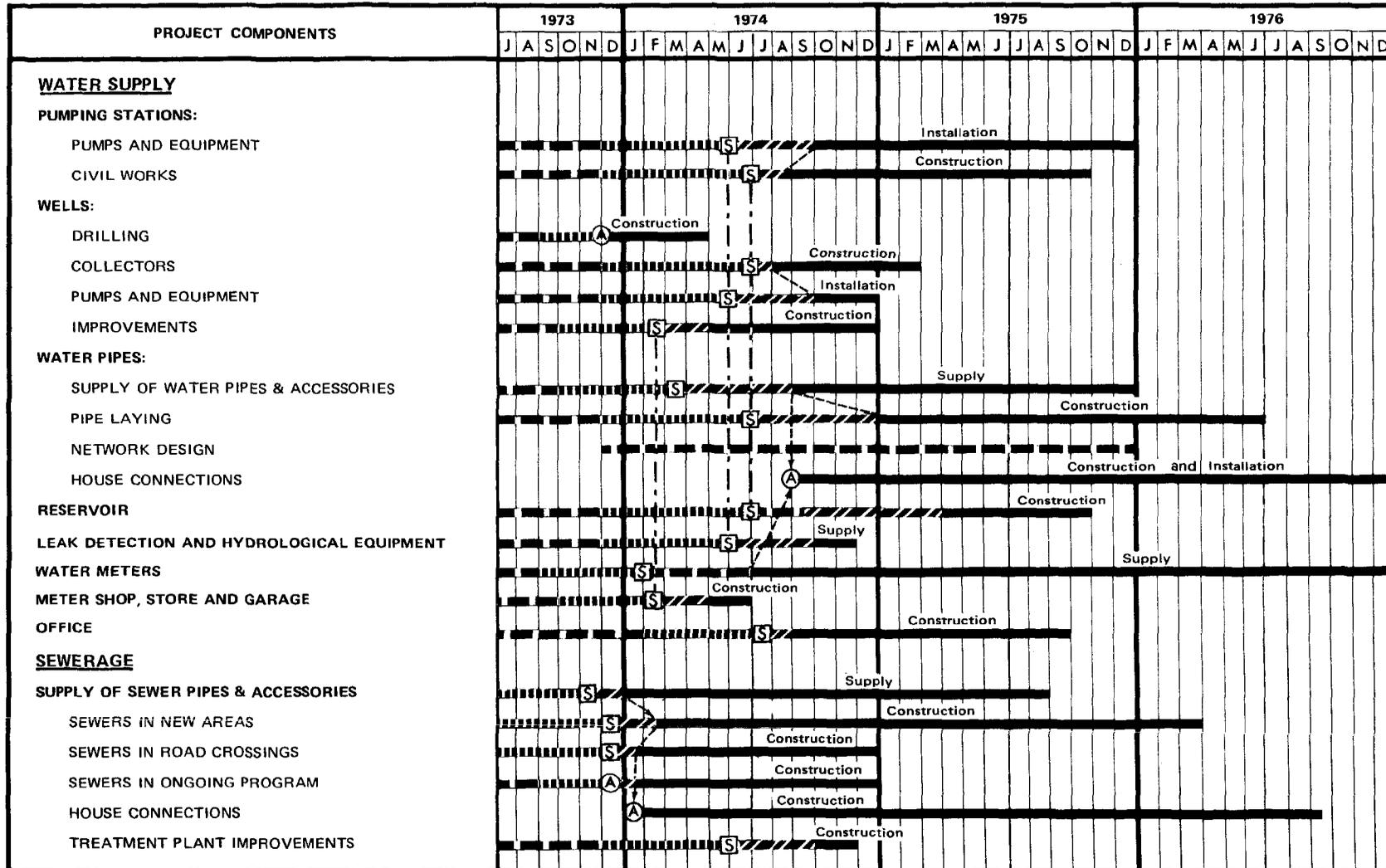
	---Cost Estimates---						---Proposed Allocation of TDA Credit---		
	Local JD (000)	Foreign JD (000)	Total	Local US\$ (000)	Foreign US\$ (000)	Total	Percentage basis	Amount JD (000)	Amount US\$ (000)
<b>WATER SUPPLY</b>									
(a) <b>CIVIL WORKS</b>									
Pumping stations	36	42	78	112	131	243	60	47	146
Service reservoir	16	16	32	50	50	100	60	19	59
Network extension and replacement	143	96	239	445	299	744	60	144	448
Water meters and house connections	9	6	15	28	19	47	60	9	28
Development and improvement of boreholes	23	24	47	71	75	146	60	28	87
Leak survey	2	22	24	6	68	74	60	15	47
Office bldg., meter repair shop, etc.	42	65	107	131	201	332	60	64	199
Sub-total, Civil Works	271	271	542	843	843	1,686		326	1,014
(b) <b>EQUIPMENT SUPPLY</b>									
Pumping stations	-	214	214	-	666	666	100	214	666
Network extension and replacement	60	534	594	187	1,661	1,848	100	594	1,848
Water meters and house connections	14	132	146	44	411	455	100	146	455
Development and improvement of boreholes	-	48	48	-	149	149	100	48	149
Leak survey and hydrological equipment	-	20	20	-	62	62	100	20	62
Sub-total, Equipment	74	948	1,022	231	2,949	3,180		1,022	3,180
Total Water Supply	<u>345</u>	<u>1,219</u>	<u>1,564</u>	<u>1,074</u>	<u>3,792</u>	<u>4,866</u>		<u>1,348</u>	<u>4,194</u>
<b>SEWERAGE</b>									
(a) <b>CIVIL WORKS</b>									
Sewer extensions	510	440	950	1,587	1,369	2,956	60	570	1,773
Plant improvements	2	2	4	6	6	12	60	3	9
Total Sewerage	<u>512</u>	<u>442</u>	<u>954</u>	<u>1,593</u>	<u>1,375</u>	<u>2,968</u>		<u>573</u>	<u>1,782</u>
<b>LAND ACQUISITION</b>	46	-	46	143	-	143		-	-
<b>CONSULTING SERVICES</b>									
Engineering	85	233	318	264	725	989	100 1/2	233	725
Training	12	58	70	37	180	217	100 1/2	58	180
<b>CONTINGENCIES</b>									
Physical-water supply (15%)	52	183	235	162	569	731	75	180	560
Physical-sewerage (10%)	51	44	95	159	137	296	75	70	217
Price (7% per annum)	93	192	285	289	598		75	216	672
TOTAL WATER SUPPLY AND SEWERAGE	<u>1,196</u>	<u>2,371</u>	<u>3,567</u>	<u>3,721</u>	<u>7,376</u>	<u>11,097</u>	75	<u>2,678</u>	<u>8,330</u>
<b>AQABA DEVELOPMENT STUDIES</b>	26	119	145	80	370	450	100 1/2	119	370
<b>TOTAL PROJECT COST</b>	1,222	2,490	3,712	3,801	7,746	11,547	75	2,797	8,700

1/ 100% of foreign exchange costs.

April 9, 1973



**JORDAN**  
**AMMAN WATER SUPPLY AND SEWERAGE PROJECT – II**  
**CONSTRUCTION SCHEDULE**



**ACTIVITY**

- DESIGN
- ..... TENDERING
- ////// MOBILIZATION OR MANUFACTURE
- ===== SUPPLY, INSTALLATION OR CONSTRUCTION

- [S] - - - - [S] GROUPED INTERNATIONAL COMPETITIVE BIDDING CONTRACTS
- [S] INTERNATIONAL COMPETITIVE BIDDING CONTRACTS
- (A) FORCE ACCOUNT OR LOCAL CONTRACTS
- > PRINCIPAL INTERCONNECTIONS BETWEEN ACTIVITIES



JORDAN

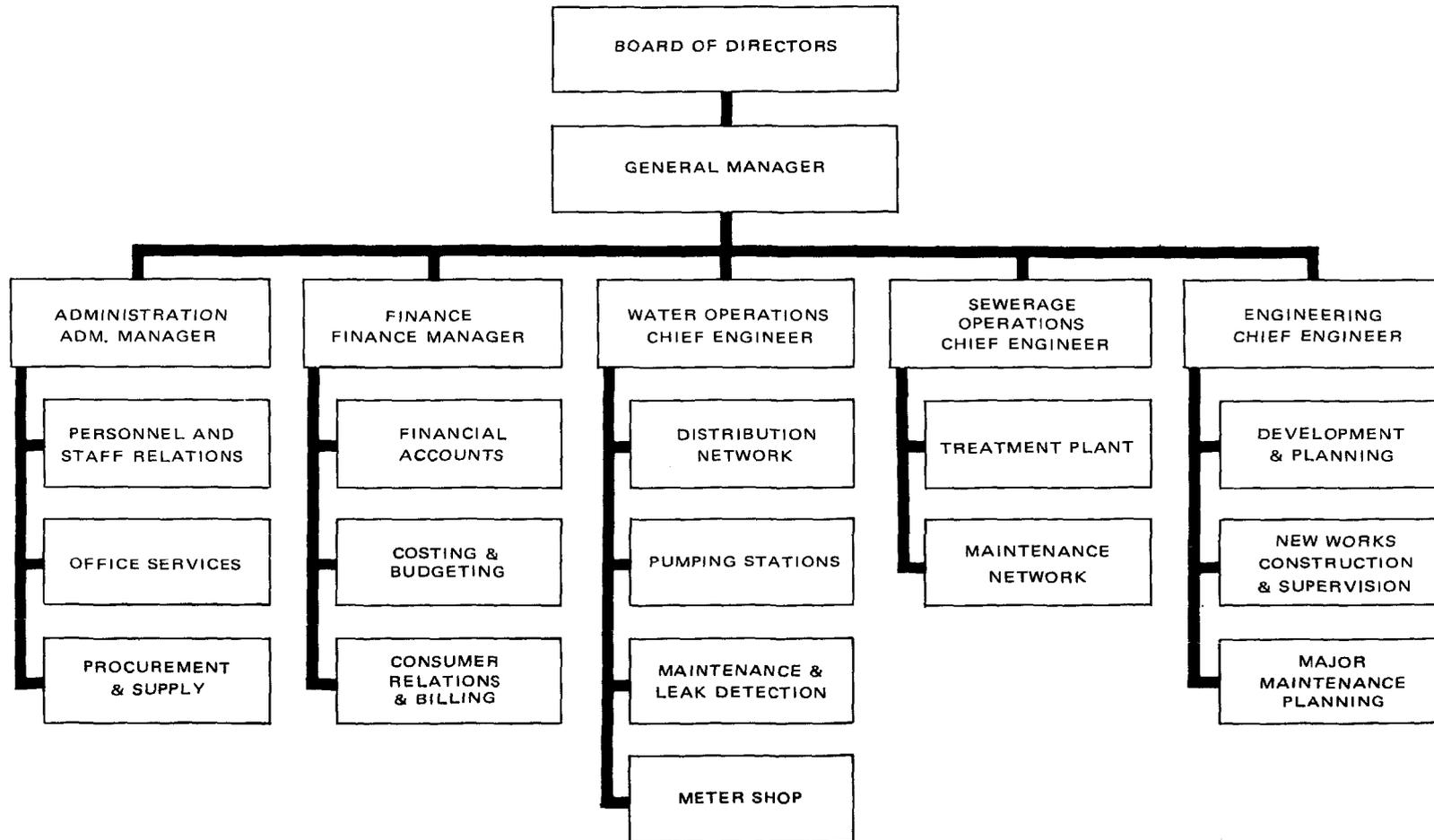
AMMAN WATER SUPPLY AND SEWERAGE PROJECT - II

ESTIMATED SCHEDULE OF DISBURSEMENTS

<u>IBRD/IDA Fiscal Year and Quarter</u>	<u>Cumulative Disbursement at end of Quarter</u> US\$ (000)
<u>1974</u>	
1st quarter ending September 30, 1973	300
2nd quarter ending December 31, 1973	900
3rd quarter ending March 31, 1974	1,500
4th quarter ending June 30, 1974	2,200
<u>1975</u>	
1st quarter ending September 30, 1974	3,200
2nd quarter ending December 31, 1974	4,200
3rd quarter ending March 31, 1975	5,100
4th quarter ending June 30, 1975	6,000
<u>1976</u>	
1st quarter ending September 30, 1975	6,400
2nd quarter ending December 31, 1975	6,800
3rd quarter ending March 31, 1976	7,200
4th quarter ending June 30, 1976	7,600
<u>1977</u>	
1st quarter ending September 30, 1976	8,200
2nd quarter ending December 31, 1976	8,700



**JORDAN**  
**AMMAN WATER SUPPLY AND SEWERAGE PROJECT - II**  
**ORGANIZATION CHART OF AMMAN WATER AND SEWERAGE AUTHORITY**





JORDAN

AMMAN WATER SUPPLY AND SEWERAGE PROJECT - II

EXISTING LONG-TERM DEBT OF WATER AND SEWERAGE SERVICES

<u>Lender</u>	<u>Year of Loan Agreement</u>	<u>Period Years</u>	<u>Rate of Interest %</u>	<u>Total Amount of Loan</u>	<u>Estimated Amount Outstanding On Dec. 31, 1972</u>
					JD 000-----
<u>WATER</u>					
IDA	1961	20	4.0	535.6	401.7
Municipal Loan Fund	1967	10	5.0	40.0	24.0
" "	1967	10	5.0	50.0	30.0
" "	1967	10	5.5	70.0	49.0
" "	1968	10	5.5	245.0	147.0
" "	1969	10	5.5	50.0	35.0
" "	1970	10	5.5	100.0	80.0
" "	1970	10	5.5	50.0	45.0
" "	1971	10	5.5	100.0	90.0
" "	1971	10	5.5	150.0	135.0
Jordan National Bank	1972	4	7.0	150.0	150.0
Estimated further borrowing in 1972					<u>100.0</u>
Total Water					<u>1,286.7</u>
<u>SEWERAGE (INCLUDING STORM-WATER DRAINAGE)</u>					
Arab Bank	1967	6	6.5	150.0	45.0
Government of Jordan <u>1/</u>	1966	10	-	1,500.0	1,500.0
"	1967	10	-	1,000.0	<u>1,000.0</u>
Total Sewerage					2,545.0

1/ According to an agreement between the Government and the Municipality of Amman, repayment of these loans commences in October 1976 and October 1977. It was assumed that the loans will be converted into Government equity; therefore, the debt service projections do not include any repayment of these loans.



JORDAN

AMMAN WATER SUPPLY AND SEWERAGE PROJECT - II

JUSTIFICATION OF PROPOSED PROJECT

Water Supply

1. The 1967 influx of refugees into Amman -- estimated at over 100,000 persons, mostly families with many young children -- upset the demand projections made in 1961 for the first water supply project appraisal. A water crisis in 1970 was averted by drilling about 10 new boreholes and making emergency connections to the network. The proposed project is essential to regularize the action taken during the emergency, reduce the water losses and unaccounted-for consumption, and expand the distribution networks to service northwest Amman.
  
2. During the past decade, water production in Amman has been increasing at an average rate of 13% per year, mostly for domestic consumption with some consumption by the Municipality and an insignificant industrial consumption. This rapid growth is attributable mainly to increased water losses, natural population growth and the influx of refugees in 1967. The percentage of unaccounted-for water is expected to be reduced gradually, from the 1972 level of 64% to 24% by 1982 as a result of AWSA's proposed program for a leak detection survey, repairs, and replacements, installation of production and domestic meters, and improvement in the billing system. Future population projections assume a natural population growth of 3% per year and normal immigration of 2% per year; giving a total annual growth of 5%, gradually decreasing to 3% toward the end of the century. Per capita consumption is only about 40 lpcd at present, although most houses have metered water connections and there are few public standpipes. In the forecast of consumption it has been assumed that increases in consumption will parallel population growth, plus an increase in measured per capita consumption of 2 lpcd per year to account in part for the improvement in metering and billing. It is also assumed that there will be no significant increase in industrial consumption. The demand projections are realistic. If demand were to increase more rapidly than projected, the purchase of additional pumps could be advanced as needed.
  
3. The main elements of the water supply component are the construction of facilities to supply northwest Amman (Zone IV). VBB compared the alternatives of extending the existing collection and pumping facilities with the construction of a new pumping station. At discount rates of 8%, 10% and 15%, a new pumping station was more economical. No shadow pricing was used; there is full employment in the construction industry and the foreign exchange rate of the Jordanian Dinar is stable.

4. The measurable benefits from the water supply component will come from the sale of additional and safer water at the projected water rates. The projected rates are in real terms considerably lower than prices consumers were willing to pay in 1961 (date of the last rate increase). The project's water supply investment, using incremental revenues as benefits, <sup>1/</sup> would yield an economic rate of return of at least 10.1% (Table A). If the benefits decreased by 25%, the economic rate of return would be at least 7.6%.

#### Sewerage

5. The new activated-sludge treatment plant, designed to treat 60,000 m<sup>3</sup>/day of domestic sewage, currently receives about 2,000 m<sup>3</sup>/day of sewage and septic tank wastes. Thus far activated sludge has not formed in the plant. Construction of the project's sewerage component, which would increase the number of sewerage service connections, will provide adequate flow for the plant's proper operation. The areas selected for sewer extensions are those which have the worst sanitary conditions and are a potential danger to the water supply sources. House connections to existing laterals will also be provided.

6. An economic rate of return for sewerage was not calculated as the major environmental and public health benefits are difficult to quantify.

7. The sewerage component is the least-cost solution for providing adequate sanitary conditions in Amman. The only alternative is to construct and maintain individual cesspools. It is estimated that half of the new residential buildings to be constructed in the next ten years will be sited in areas sewered by the project's facilities. At present, about 1,000 new residential buildings are constructed in Amman every year. The construction cost of a cesspool for a one-family residence is JD 150 and for a six-family building JD 700. The residential buildings in Amman consist of between three- and four-family units on average. The cost of construction of a cesspool for this size building is estimated at JD 400. To provide acceptable sanitary conditions in Amman, where the soil has low percolation capacity (mostly rock), the cesspool operating costs per installation would be JD 11.0 per year.

8. The sewerage component is the least-cost solution at discount rates up to 23.7%. Details are given in Table B of this Annex. If the costs of the cesspool alternative were 25% lower than estimated, the proposed solution would be the most economical alternative at discount rates up to 10.8%. Benefits of the proposed sewerage component that were not quantified include improvement of general sanitary conditions in Amman, more efficient operation of the existing treatment facilities, higher quality sewerage effluent discharged into the Amman Sea, and associated ecological and health benefits.

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<sup>1/</sup> Estimated revenues resulting from improved billing and reduction in the number of illegal connections were excluded from benefits as they are a mere transfer of benefits from consumers to the authority.

TABLE A  
INCREMENTAL ECONOMIC COSTS AND BENEFITS  
OF THE WATER SUPPLY COMPONENT

<u>Year</u>	<u>Construction Costs JD (000)</u>	<u>Net Benefits JD (000)</u>
1973	447	11
1974	1,005	14
1975	650	37
1976	225	56
1977	100	139
1978	100	205
1979	100	274
1980	100	345
1981-2002	-	345

Minimum economic rate of return = 10.1%

TABLE B

COMPARATIVE COST STATEMENT OF SEWERAGE  
DISPOSAL SYSTEMS

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Year	-----Proposed System----- Incremental			-----Alternative System----- Cesspool		
	Construction Costs	Operating Costs	Total Costs	Clearing Costs	Building Costs	Total Costs
	-----JD 00-----					
1973	457.9	34.3	492.2	28.6	200.0	228.6
1974	463.5	42.1	505.6	46.2	200.0	246.2
1975	190.9	50.1	241.0	68.2	200.0	268.2
1976	100.0	56.0	156.0	90.2	200.0	290.2
1977	100.0	61.1	161.1	112.2	200.0	312.2
1978	100.0	66.3	166.3	134.2	200.0	334.2
1979	100.0	71.6	177.6	156.2	200.0	356.2
1980	100.0	77.2	177.2	178.2	200.0	378.2
1981	100.0	77.2	177.2	200.2	200.0	400.2
1982	100.0	77.2	177.2	222.0	200.0	422.0
1983-2002	-	77.2	77.2	220.0	-	222.0

Discount rate which equates costs, 23.7%.

## AMMAN WATER SUPPLY AND SEWERAGE PROJECT - II

## ESTIMATED INCOME AND EXPENDITURE STATEMENTS/WATER SUPPLY

Year ending December 31	Actuals		Latest Estimate 1972	Projections							
	1970	1971		1973	1974	1975	1976	1977	1978	1979	1980
Water production m <sup>3</sup> 000	10,597	14,260	19,000	19,000	19,000	19,000	19,500	19,800	20,100	20,500	21,000
Water sales m <sup>3</sup> 000	5,611	5,687	6,860	7,540	8,340	9,200	10,130	11,050	12,050	13,120	14,250
% Water unaccounted for	47	60	64	60	56	52	48	44	40	36	32
Total population 000	492	521	547	574	601	630	659	688	718	749	781
% population connected	-	75	78	82	83	83	84	85	86	86	86
Consumption of population connected lpcd	-	40	44	44	46	48	50	52	54	56	58
No. of water connections	30,414	31,996	34,000	36,500	39,000	41,500	44,000	46,500	49,000	51,500	54,000
Average rate fills/m <sup>3</sup> 1/	62	63	63	73	73	73	73	83	83	83	83
<b>REVENUE</b>											
	-----JD 000-----										
Water sales	350.3	357.6	432.2	550.0	609.0	672.0	739.0	917.0	1,000.0	1,089.0	1,183.0
Other revenue	6.2	26.2	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
TOTAL	<u>356.5</u>	<u>383.8</u>	<u>472.2</u>	<u>590.0</u>	<u>649.0</u>	<u>712.0</u>	<u>779.0</u>	<u>957.0</u>	<u>1,040.0</u>	<u>1,129.0</u>	<u>1,223.0</u>
<b>OPERATING COSTS</b>											
Salaries and wages	84.6	104.5	120.0	149.6	154.1	158.7	163.4	168.4	173.4	178.6	184.0
Power and fuel	89.4	108.9	145.0	153.5	158.1	162.8	172.1	178.2	186.3	195.6	206.2
Chemicals	6.6	4.3	5.0	5.2	5.4	5.6	5.9	6.2	6.5	6.8	7.2
Materials for maintenance	29.1	33.5	36.7	41.0	48.7	61.1	78.7	82.2	83.7	86.7	91.2
Other expenses	17.9	21.2	18.0	25.0	27.5	30.3	33.3	36.6	40.2	44.2	48.7
TOTAL	<u>227.6</u>	<u>272.4</u>	<u>324.7</u>	<u>374.3</u>	<u>393.8</u>	<u>418.5</u>	<u>453.4</u>	<u>471.6</u>	<u>490.2</u>	<u>512.0</u>	<u>537.3</u>
Surplus before depreciation & interest	128.9	111.4	147.5	215.7	255.2	253.5	325.6	485.4	549.8	617.0	685.7
Depreciation	73.8	76.6	94.3	90.1	107.0	134.3	173.1	180.7	184.0	190.6	200.5
TOTAL OPERATING COSTS	<u>301.4</u>	<u>349.0</u>	<u>419.0</u>	<u>464.4</u>	<u>500.8</u>	<u>552.8</u>	<u>626.5</u>	<u>652.3</u>	<u>674.2</u>	<u>702.6</u>	<u>737.8</u>
Surplus before interest	55.1	34.8	53.2	125.6	148.2	159.2	152.5	304.7	365.8	426.4	485.2
<b>NON-OPERATING EXPENSES</b>											
Interest (Net)	31.4	41.5	58.7	63.3	55.1	47.0	38.8	180.7	173.0	165.7	160.0
Non-operating receipts	(10.0)	(28.1)	(20.0)	-	-	-	-	-	-	-	-
TOTAL NON-OPERATING EXPENSES	<u>21.4</u>	<u>13.4</u>	<u>38.7</u>	<u>63.3</u>	<u>55.1</u>	<u>47.0</u>	<u>38.8</u>	<u>180.7</u>	<u>173.0</u>	<u>165.7</u>	<u>160.0</u>
Net Surplus	<u>33.7</u>	<u>21.4</u>	<u>14.5</u>	<u>62.3</u>	<u>93.1</u>	<u>112.2</u>	<u>113.7</u>	<u>124.0</u>	<u>192.0</u>	<u>260.7</u>	<u>325.2</u>
Average net value of fixed assets in operation	2,097	2,428	2,511	2,567	3,139	4,020	4,747	4,913	4,831	4,793	4,898
Rate of Return on Average Net Fixed Assets	2.6%	1.4%	2.1%	4.9%	4.7%	4.0%	3.2%	6.2%	7.6%	8.9%	9.9%
Operating ratio after depreciation	85.0%	91.0%	89.0%	79.0%	77.0%	78.0%	80.0%	68.0%	65.0%	62.0%	60.0%

1/ Small quantities of water are sold to institutions at discount rates.

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ESTIMATED INCOME AND EXPENDITURE STATEMENT/SEWERAGE (INCLUDING STORM-WATER DRAINAGE)

Year ending December 31	Approximate <sup>1/</sup> Actuals		Latest Estimate 1972	Projections							
	1970	1971		1973	1974	1975	1976	1977	1978	1979	1980
Total no. of sewered connections	73	483	1,500	3,100	4,700	6,700	8,700	10,700	12,700	14,700	16,700
Average annual water consumption per connection m <sup>3</sup>	-	228	200	210	221	232	244	256	268	281	295
Total water consumption m <sup>3</sup> 000	-	110	300	651	1,038	1,554	2,123	2,739	3,404	4,133	4,926
No. of additional connections during the year	73	390	1,017	1,600	1,600	2,000	2,000	2,000	2,000	2,000	2,000
2% of average annual rental value of each additional connection (JD)	258	183	140	75	60	40	35	35	35	35	35
<b>REVENUE</b>											
-----JD 000-----											
Water consumption	-	2.2	7.6	20.0	31.0	47.0	64.0	82.0	102.0	124.0	148.0
Connection fees	24.0	71.4	142.4	120.0	96.0	80.0	70.0	70.0	70.0	70.0	70.0
Sewerage tax	-	-	-	114.0	117.0	121.0	125.0	129.0	133.0	137.0	141.0
Other revenue	-	-	-	20.0	20.0	19.0	18.0	18.0	17.0	17.0	16.0
<b>TOTAL</b>	<b>24.0</b>	<b>73.6</b>	<b>150.0</b>	<b>274.0</b>	<b>264.0</b>	<b>267.0</b>	<b>277.0</b>	<b>299.0</b>	<b>322.0</b>	<b>318.0</b>	<b>375.0</b>
<b>OPERATING COSTS</b>											
Salaries and wages	28.7	45.6	50.4	70.0	72.1	74.3	76.5	78.8	81.2	83.6	86.1
Power and fuel	0.4	1.3	3.7	12.0	12.4	12.8	13.2	13.6	14.0	14.4	14.8
Chemicals	-	-	-	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5
Materials	0.4	0.1	-	27.0	31.0	35.0	36.8	37.6	38.3	39.0	39.8
Other expenses	1.7	6.8	31.6	8.0	8.8	9.7	10.7	11.8	13.0	14.3	15.7
<b>TOTAL</b>	<b>31.2</b>	<b>53.8</b>	<b>85.7</b>	<b>120.0</b>	<b>127.8</b>	<b>135.8</b>	<b>141.7</b>	<b>146.8</b>	<b>152.0</b>	<b>157.3</b>	<b>162.9</b>
Surplus (deficit) before depreciation and interest	(7.2)	19.8	64.3	154.0	136.2	131.2	135.3	152.2	170.0	190.7	212.1
Depreciation	90.9	100.1	110.8	90.0	102.8	116.5	122.8	125.3	127.8	130.3	132.8
Total operating costs	122.1	153.9	196.5	210.0	230.6	252.3	264.5	272.1	279.8	287.6	295.7
Surplus (deficit) before interest	(98.1)	(80.3)	(46.5)	64.0	33.4	14.7	12.5	26.9	42.2	60.4	79.3
Interest	8.7	6.8	4.9	3.0	1.0	-	-	75.6	73.4	71.1	68.8
Net Surplus (deficit)	(106.8)	(87.1)	(51.4)	61.0	32.4	14.7	12.5	(48.7)	(31.2)	(10.7)	10.5
Average net value of fixed assets in operation	2,672	2,940	3,114	3,421	3,870	4,201	4,313	4,319	4,292	4,263	4,232
Rate of Return on Average Net Fixed Assets	-	-	-	1.9%	0.9%	0.3%	0.3%	0.6%	1.0%	1.4%	1.9%
Operating Ratio after depreciation	508%	209%	131%	77%	87%	94%	95%	91%	87%	83%	79%

<sup>1/</sup> Extracted from Municipality accounts.

April 9, 1973

JORDAN

AMMAN WATER SUPPLY AND SEWERAGE PROJECT - II

ANNEX 14

CONSOLIDATED INCOME AND EXPENDITURE STATEMENTS

	Approximate		Latest Estimates	Projections							
	Actuals			1973	1974	1975	1976	1977	1978	1979	1980
	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
	JD 000										
<b>REVENUE</b>											
Water	356.5	383.8	472.2	590.0	649.0	712.0	779.0	957.0	1,040.0	1,129.0	1,223.0
Sewerage	<u>24.0</u>	<u>73.6</u>	<u>150.0</u>	<u>274.0</u>	<u>264.0</u>	<u>267.0</u>	<u>277.0</u>	<u>299.0</u>	<u>322.0</u>	<u>348.0</u>	<u>375.0</u>
TOTAL	380.5	457.4	622.2	864.0	913.0	979.0	1,056.0	1,256.0	1,362.0	1,477.0	1,598.0
<b>OPERATING COSTS</b>											
Water	227.6	272.4	324.7	374.3	393.8	418.5	453.4	471.6	480.2	512.0	537.3
Sewerage	<u>31.2</u>	<u>53.8</u>	<u>85.7</u>	<u>120.0</u>	<u>127.8</u>	<u>135.8</u>	<u>141.7</u>	<u>146.8</u>	<u>152.0</u>	<u>157.3</u>	<u>162.9</u>
TOTAL	258.8	326.2	410.4	494.3	521.6	554.3	595.1	618.4	632.2	669.3	700.2
<b>Surplus before depreciation and interest:</b>											
Water	128.9	111.4	147.5	215.7	255.2	293.5	325.6	485.4	549.8	617.0	685.7
Sewerage	<u>( 7.2)</u>	<u>19.8</u>	<u>64.3</u>	<u>154.0</u>	<u>136.2</u>	<u>131.2</u>	<u>135.3</u>	<u>152.2</u>	<u>170.0</u>	<u>190.7</u>	<u>212.1</u>
TOTAL	121.7	131.2	211.8	369.7	391.4	424.7	460.9	637.6	719.8	807.7	897.8
<b>Depreciation:</b>											
Water	73.8	76.6	94.3	90.1	107.0	134.3	173.1	180.7	184.0	190.6	200.5
Sewerage	<u>90.9</u>	<u>100.1</u>	<u>110.8</u>	<u>90.0</u>	<u>102.8</u>	<u>116.5</u>	<u>122.8</u>	<u>125.3</u>	<u>127.8</u>	<u>130.3</u>	<u>132.8</u>
TOTAL	164.7	176.7	205.1	180.1	209.8	250.8	295.9	306.0	311.8	320.9	333.3
<b>Total Operating Cost:</b>											
Water	301.4	349.0	419.0	464.4	500.8	552.8	626.5	652.3	674.2	702.6	737.8
Sewerage	<u>122.1</u>	<u>153.9</u>	<u>196.5</u>	<u>210.0</u>	<u>230.6</u>	<u>252.3</u>	<u>264.5</u>	<u>272.1</u>	<u>279.8</u>	<u>287.6</u>	<u>295.7</u>
TOTAL	423.5	502.9	615.5	674.4	731.4	805.1	891.0	924.4	954.0	990.2	1,033.5
<b>Surplus before interest:</b>											
Water	55.1	34.8	53.2	125.6	148.2	159.2	152.5	304.7	365.8	426.4	485.2
Sewerage	<u>(98.1)</u>	<u>(80.3)</u>	<u>(46.5)</u>	<u>64.3</u>	<u>33.4</u>	<u>14.7</u>	<u>12.5</u>	<u>26.9</u>	<u>42.2</u>	<u>60.4</u>	<u>79.3</u>
TOTAL	(43.0)	(45.5)	6.7	189.6	181.6	173.9	165.0	331.6	408.0	486.8	564.5
<b>Non-operating Expense:</b>											
Water	21.4	13.4	38.7	63.3	55.1	47.0	38.8	180.7	173.0	165.7	160.0
Sewerage	<u>8.7</u>	<u>6.8</u>	<u>4.9</u>	<u>3.0</u>	<u>1.0</u>	-	-	<u>75.6</u>	<u>73.4</u>	<u>71.1</u>	<u>68.8</u>
TOTAL	30.1	20.2	43.6	66.3	56.1	47.0	38.8	256.3	246.4	236.8	228.8
<b>Net Surplus:</b>											
Water	33.7	21.4	14.5	62.3	93.1	112.2	113.7	124.0	192.8	260.7	325.2
Sewerage	<u>(106.8)</u>	<u>(87.1)</u>	<u>(51.4)</u>	<u>61.0</u>	<u>32.4</u>	<u>14.7</u>	<u>12.5</u>	<u>(48.7)</u>	<u>(31.2)</u>	<u>(10.7)</u>	<u>10.5</u>
TOTAL	(73.1)	(65.7)	(36.9)	123.3	125.5	126.9	126.2	75.3	161.6	250.0	335.7
<b>Average net value of fixed assets in operation:</b>											
Water	2,097	2,428	2,511	2,567	3,139	4,020	4,747	4,913	4,831	4,793	4,898
Sewerage	<u>2,672</u>	<u>2,940</u>	<u>3,114</u>	<u>3,421</u>	<u>3,870</u>	<u>4,201</u>	<u>4,313</u>	<u>4,309</u>	<u>4,292</u>	<u>4,263</u>	<u>4,232</u>
TOTAL	4,769	5,368	5,625	5,988	7,009	8,221	9,060	9,222	9,123	9,056	9,130
<b>Rate of Return On Average Net Fixed Assets</b>											
Water %	2.6	1.4	2.1	4.9	4.7	4.0	3.2	6.2	7.6	8.9	9.9
Sewerage %	-	-	-	1.9	0.9	0.3	0.3	0.6	1.0	1.4	1.9
TOTAL	-	-	-	3.2	2.6	2.1	1.8	3.6	4.5	5.4	6.7
Operating Ratio after Depreciation %	111	110	99	78	80	82	84	74	70	67	65

April 9, 1973

JORDAN

AMMAN WATER SUPPLY AND SEWERAGE PROJECT - II

ANNEX 15

ESTIMATED SOURCES AND APPLICATIONS OF FUNDS

	Approximate Actuals		Latest Estimate 1972	Projections - Total Project Period								
	1970	1971		1973	1974	1975	1976	1973-76	1977	1978	1979	1980
<b>SOURCES OF FUNDS</b>												
Surplus before Depreciation:												
Water	128.9	111.4	147.5	215.7	255.2	293.5	325.6	1,090.0	485.4	549.8	617.0	685.7
Sewerage	(7.2)	19.8	64.3	154.0	136.2	131.2	135.3	556.7	152.2	170.0	190.7	212.1
TOTAL	121.7	131.2	211.8	369.7	391.4	424.7	460.9	1,646.7	637.6	719.8	807.7	897.8
Interest received	9.6	2.2	-	-	-	-	-	-	-	-	-	-
Other non-operating receipts	10.0	28.1	20.0	-	-	-	-	-	-	-	-	-
Funds provided by Municipality 1/	415.1	275.7	270.6	-	-	-	-	-	-	-	-	-
Capital contributions	-	50.0	-	15.0	15.0	15.0	15.0	60.0	15.0	15.0	15.0	15.0
Decrease in working capital	-	154.3	15.0	-	-	-	-	-	-	-	-	-
Borrowings:												
IDA Credit	-	-	-	600.0	1,200.0	800.0	75.0	2,675.0	-	-	-	-
Local Loans	109.0	270.4	270.6	295.0	400.0	180.0	200.0	1,075.0	-	-	-	-
TOTAL	109.0	270.4	270.6	895.0	1,600.0	980.0	275.0	3,750.0	-	-	-	-
Total Sources of Funds	665.4	911.9	788.0	1,279.7	2,006.4	1,419.7	750.9	5,456.7	652.6	734.8	822.7	912.6
<b>APPLICATION OF FUNDS</b>												
New assets												
Project expenditures:												
Water	-	-	-	438.1	1,108.4	754.7	30.8	2,332.0	-	-	-	-
Sewerage	-	-	-	484.8	521.9	226.3	-	1,235.0	-	-	-	-
TOTAL	-	-	-	922.9	1,630.3	981.0	30.8	3,567.0	-	-	-	-
Other capital expenditures:												
Water	357.7	555.2	280.0	26.0	10.0	10.0	200.0	246.0	100.0	100.0	200.0	400.0
Sewerage	369.2	258.7	300.0	25.0	25.0	25.0	100.0	175.0	100.0	100.0	100.0	100.0
TOTAL	626.9	813.9	580.0	51.0	35.0	35.0	300.0	421.0	200.0	200.0	300.0	500.0
Total New Assets	626.9	813.9	580.0	973.9	1,665.3	1,018.0	330.8	3,988.0	200.0	200.0	300.0	500.0
Debt Service												
Amortization of Loans:												
Existing IDA Credit	26.8	26.8	26.8	26.8	26.8	26.8	26.8	107.2	26.8	26.8	26.0	26.0
Proposed IDA Credit	-	-	-	-	-	-	-	-	48.3	51.2	54.1	57.0
Existing Local Loans	61.4	85.5	120.5	163.0	148.0	133.0	133.0	577.0	95.5	95.5	62.0	50.0
New Local Loans	-	-	-	-	-	-	-	-	19.8	21.0	22.4	23.6
TOTAL	88.2	112.3	147.3	189.8	174.8	159.8	159.8	684.2	190.4	194.5	165.3	157.4
Interest:												
Existing IDA Credit	19.0	17.9	16.8	15.7	14.6	13.5	12.4	56.2	11.3	10.2	9.1	8.0
Proposed IDA Credit	-	-	-	15.0	70.0	140.0	150.0	375.0	159.7	156.8	153.9	151.0
Existing Local Loans	30.7	32.6	46.8	50.6	41.5	33.5	26.4	152.0	21.1	16.4	12.2	9.4
Proposed Local Loans	-	-	-	5.0	30.0	40.0	50.0	125.0	64.2	63.0	61.6	60.4
TOTAL	49.7	50.5	63.6	86.3	156.1	227.0	238.8	708.2	256.3	246.4	236.8	228.8
Total Debt Service	137.9	162.8	210.9	276.1	330.9	386.8	398.6	1,392.4	446.7	440.9	402.1	386.2
Increase in Working Capital (excluding cash)	73.6	-	-	25.7	2.0	2.0	17.0	46.7	25.0	15.0	6.0	16.0
Total Application of Funds	838.4	976.7	790.9	1,275.7	1,998.2	1,406.8	746.4	5,427.1	671.7	655.9	708.1	902.2
Net Cash Generation	(173.0)	(64.8)	(2.9)	4.0	8.2	12.9	4.5	29.6	(19.1)	78.9	114.6	10.6
Cash Balance End of Year	106.4	41.6	38.7	42.7	50.9	63.8	68.3	-	49.2	128.1	242.7	253.3
Debt Service Coverage	0.9	0.8	1.0	1.4	1.7	2.0	2.3	1.8	1.4	1.6	2.0	2.3

1/ For sewerage and storm drainage assets

JORDAN  
AMMAN WATER SUPPLY AND SEWERAGE PROJECT - II

ANNEX 16

ESTIMATED BALANCE SHEETS

As on December 31,	Approximate -----Actuals-----		Latest Estimate 1972	-----Projections-----							
	1970	1971		1973	1974	1975 JD 000	1976	1977	1978	1979	1980
<b>ASSETS</b>											
<b>Current Assets:</b>											
Cash	106.4	41.6	38.7	42.7	50.9	63.8	68.3	49.2	128.1	242.7	233.3
Inventories	-	-	300.7	310.0	310.0	310.0	310.0	310.0	310.0	310.0	310.0
Accounts Receivable	188.3	70.7	75.0	95.0	105.0	118.0	131.0	164.0	187.0	201.0	225.0
<b>Total Current Assets</b>	<b>294.7</b>	<b>112.3</b>	<b>414.4</b>	<b>447.7</b>	<b>465.9</b>	<b>491.8</b>	<b>509.3</b>	<b>523.2</b>	<b>625.1</b>	<b>753.7</b>	<b>788.3</b>
<b>Fixed Assets:</b>											
Water Supply	2,471.0	3,026.2	2,729.3	3,242.9	4,071.3	5,246.0	5,831.8	5,931.8	6,031.8	6,231.8	6,631.8
Less Accumulated Depreciation	282.0	358.6	374.1	464.2	571.2	705.5	878.6	1,059.3	1,243.3	1,433.2	1,634.4
<b>Net</b>	<b>2,189.0</b>	<b>2,667.6</b>	<b>2,355.2</b>	<b>2,778.7</b>	<b>3,500.1</b>	<b>4,540.5</b>	<b>4,953.2</b>	<b>4,872.5</b>	<b>4,788.5</b>	<b>4,797.9</b>	<b>4,997.4</b>
Work-in-progress	-	-	179.5	145.0	505.0	225.0	10.0	10.0	10.0	10.0	10.0
<b>Total water supply</b>	<b>2,189.0</b>	<b>2,667.6</b>	<b>2,534.7</b>	<b>2,923.7</b>	<b>4,005.1</b>	<b>4,765.5</b>	<b>4,963.2</b>	<b>4,882.5</b>	<b>4,798.5</b>	<b>4,807.9</b>	<b>5,007.4</b>
Sewerage (including storm drainage)	3,043.5	3,302.2	3,602.2	4,117.0	4,693.9	4,997.2	5,157.2	5,257.2	5,357.2	5,457.2	5,557.2
Less Accumulated Depreciation	182.7	282.8	393.6	483.6	586.4	702.9	825.7	951.0	1,078.8	1,209.1	1,341.2
<b>Net</b>	<b>2,860.8</b>	<b>3,019.4</b>	<b>3,208.6</b>	<b>3,633.4</b>	<b>4,107.5</b>	<b>4,294.3</b>	<b>4,331.5</b>	<b>4,306.2</b>	<b>4,278.4</b>	<b>4,248.1</b>	<b>4,215.3</b>
<b>Total Fixed Assets</b>	<b>5,049.8</b>	<b>5,687.0</b>	<b>5,743.3</b>	<b>6,557.1</b>	<b>8,112.6</b>	<b>9,059.8</b>	<b>9,294.7</b>	<b>9,188.7</b>	<b>9,076.9</b>	<b>9,056.0</b>	<b>9,222.7</b>
<b>TOTAL ASSETS</b>	<b>5,344.5</b>	<b>5,799.3</b>	<b>6,157.7</b>	<b>7,004.8</b>	<b>8,578.5</b>	<b>9,551.6</b>	<b>9,804.0</b>	<b>9,711.9</b>	<b>9,702.0</b>	<b>9,809.7</b>	<b>10,011.0</b>
<b>LIABILITIES AND EQUITY</b>											
<b>Current Liabilities:</b>											
Accounts Payable	55.9	86.0	103.0	99.0	99.0	102.0	90.0	90.0	90.0	90.0	90.0
Deposits	102.8	109.4	116.4	124.0	132.0	140.0	148.0	156.0	164.0	172.0	180.0
<b>Total Current Liabilities</b>	<b>158.7</b>	<b>195.4</b>	<b>219.4</b>	<b>223.0</b>	<b>231.0</b>	<b>242.0</b>	<b>238.0</b>	<b>246.0</b>	<b>254.0</b>	<b>262.0</b>	<b>270.0</b>
<b>Long Term Debt:</b>											
Existing IDA Credit (18-JD)	455.3	428.5	401.7	374.9	348.1	321.3	294.5	267.7	240.9	214.1	187.3
Proposed IDA Credit	-	-	-	600.0	1,800.0	2,600.0	2,675.0	2,626.7	2,575.5	2,521.4	2,464.4
Existing Local Loans	595.0	779.9	930.0	767.0	619.0	486.0	353.0	257.5	162.0	100.0	50.0
New Local Loans	-	-	-	295.0	695.0	875.0	1,075.0	1,055.2	1,034.2	1,011.8	988.2
<b>Total Long Term Debt</b>	<b>1,050.3</b>	<b>1,208.4</b>	<b>1,331.7</b>	<b>2,036.9</b>	<b>3,462.1</b>	<b>4,282.3</b>	<b>4,397.5</b>	<b>4,207.1</b>	<b>4,012.6</b>	<b>3,847.3</b>	<b>3,689.9</b>
<b>Equity:</b>											
Government advances for sewerage and storm water drainage	2,500.0	2,500.0	2,500.0	2,500.0	2,500.0	2,500.0	2,500.0	2,500.0	2,500.0	2,500.0	2,500.0
Other equity, retained earnings & capital contributions	1,635.5	1,895.5	2,106.6	2,244.9	2,385.4	2,527.3	2,668.5	2,798.8	2,935.4	3,200.4	3,551.1
<b>Total Equity</b>	<b>4,135.5</b>	<b>4,395.5</b>	<b>4,606.6</b>	<b>4,744.9</b>	<b>4,885.4</b>	<b>5,027.3</b>	<b>5,168.5</b>	<b>5,258.8</b>	<b>5,435.4</b>	<b>5,700.4</b>	<b>6,051.1</b>
<b>TOTAL LIABILITIES AND EQUITY</b>	<b>5,344.5</b>	<b>5,799.3</b>	<b>6,157.7</b>	<b>7,004.8</b>	<b>8,578.5</b>	<b>9,551.6</b>	<b>9,804.0</b>	<b>9,711.9</b>	<b>9,702.0</b>	<b>9,809.7</b>	<b>10,011.0</b>
Debt: Equity Ratio	-	-	22:78	30:70	41:59	46:54	46:54	44:56	42:58	40:60	38:62

April 9, 1973

JORDAN

AMMAN WATER SUPPLY AND SEWERAGE PROJECT - II

ASSUMPTIONS FOR FINANCIAL FORECASTS

INCOME AND EXPENDITURE STATEMENT

A. WATER

Revenues

1. Water sales are assumed to increase 2 lpcd annually, from about 44 lpcd in 1972 to 58 lpcd in 1980. The percentage of population connected is projected to increase from 78% in 1972 to 86% in 1980. Unaccounted-for water, defined as the difference between water produced and water sold, is assumed to decrease gradually (4% per year), from 64% in 1972 to 32% in 1980. A water rate of 75 fils/m<sup>3</sup> was assumed for 1973-76 and 85 fils/m<sup>3</sup> from 1977 onwards.
2. Other revenues reflect the charges for new connections, meter rentals (to be established) and miscellaneous items.

Operating Costs

3. Salaries and wages are adjusted to reflect organizational changes in 1973 and are thereafter projected to increase by 3% per year to cover salary and staff increases.
4. Power and fuel costs are estimated to increase in parallel with the increase in water production, plus an annual 3% increase to reflect increased pumping costs to higher altitudes. <sup>1/</sup>
5. Maintenance costs are calculated at 1.5% of the gross value of assets in operation at the beginning of each year.
6. Other expenses include such items as stationery, telephones, postage and insurance, and are estimated to increase by 10% annually.
7. Depreciation is calculated at the rate of 3.3% of the gross value of fixed assets at the beginning of each year.

B. SEWERAGE (INCLUDING STORM-WATER DRAINAGE)

Revenues

8. Water consumption for the sewered connections is assumed to increase by 5% annually.
9. Connection fees are calculated at 25% of the average annual net rental value of premises estimated to be connected each year.

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<sup>1/</sup> No increase in electricity rates is projected by the appraisal mission of "Jordan - Zerqa Power Project."

10. The sewerage tax is calculated at 4% of the annual net rental value of all premises in Amman, which is estimated at JD 4.54 million in 1973, rising by 2% annually to take account of the new construction. Collections are assumed at 70%. A collection charge of 10% made by the Finance Ministry is deducted.

11. Other revenues include application fees for new connections, cess-pool clearance fees, etc.

#### Operating Costs

12. Salaries and wages are adjusted to reflect organizational changes in 1973 and are projected to increase by 3% per year to cover salary and staff increases.

13. Power and fuel costs are based on the proposed 24-hour working of the treatment plant in 1973, increasing by about 3% annually to provide for increased volume.

14. Chemicals are assumed to increase marginally each year.

15. Materials for maintenance are calculated at 0.75% of the gross value of assets in operation at the beginning of each year.

16. Other expenses reflect the cost of stationery, forms, telephones, postage, insurance, etc., and are projected to increase by 10% annually.

17. Depreciation is calculated at 2.5% of the gross value of fixed assets at the beginning of each year.

#### Sources and Applications of Funds Statement

18. Capital contributions represent the cost of new and replacement meters to be collected from consumers.

19. Other capital expenditures in 1973-1975 represent the costs of minor extensions outside the project. Expenditures from 1976 onward represent the capital expenditures on the expansion of the secondary water distributions network, the secondary sewer network, and house connections.

#### Balance Sheet

20. The value of fixed assets and the accumulated depreciation as of December 31, 1972, are based on a reasonable valuation by the consultants.

21. Accounts receivable represents about two months' billing for water sales and include the sewerage surcharge for sewer connections.

22. Customers' deposits are assumed to increase by JD 8,000 per year.

JORDAN

AMMAN WATER SUPPLY AND SEWERAGE PROJECT - II

WATER AND SEWERAGE TARIFFS

Water

1. Water Consumption:

Existing rate - 65 fils/m<sup>3</sup>, subject to a minimum of 780 fils per quarter. (This rate will be raised to 75 fils/m<sup>3</sup> effective January 1, 1973.)

The following categories of consumers get free/concessional supply:

Free - Central Mosque and Youth Organization

90% Concession - Municipal Gardens

50% Concession - Mosques, schools and charitable institutions

The amount of rebate involved for the free/concessional supply during 1971 was about JD 17,000.

2. Connection and Reconnection Fees:

Connection Fee JD 1.275

Reconnection Fee - after meter repair  
or meter change JD 0.150

- in respect of meters  
disconnected for non-  
payment of bills or  
for sanitary reasons JD 0.375

3. Customers' Contributions for New Connections:

	<u>JD</u>
Preparation of a plan -	1
Surveying -	1
Connections to old pipes (1/2-2") -	1
Connections to old pipes (2-15") -	15
Connections to new pipes (2-4") -	15
Connections to new pipes (6" and above) -	25
Installation of bronze Ferule (1/2-1") -	8
Installation of bronze Ferule (1 1/2-2") -	15

Sewerage

4. Water Consumption Surcharge - 30 fils/m<sup>3</sup>.
5. Connection Fees - 25% of annual net rental value of premises to be connected
6. Application Fees:

	<u>JD</u>	
Class A buildings	-	10
Class B buildings	-	5
Class C & D buildings	-	3
Commercial and Industrial Buildings	-	25
7. Sewerage Tax - 4% of annual net rental value of premises, payable annually by all householders in Amman (irrespective of whether connected to the sewer system).

JORDAN

AMMAN WATER SUPPLY AND SEWERAGE PROJECT - II

AQABA DEVELOPMENT STUDIES

Background

1. The region of Aqaba is located on the Jordanian shore of the Red Sea, the southernmost tip of the country. This shore, to which 17 km were added in 1966 when Jordan and Saudi Arabia decided to redefine their borders, extends for 25 km between Saudi Arabia and Israel. The terrain is generally rugged and mountainous, except behind the town of Aqaba, where lies a relatively large plain. Situated at the same latitude as Florida, the region enjoys a favorable climate -- with air and water monthly temperatures seldom below 20° C, low relative humidity (37.8% yearly average) and a high number of sunshine hours (ranging from a minimum of six to a maximum of 12 in December and August, respectively). Originally a small fishing village, the town of Aqaba -- the region's only urban center -- is experiencing rapid growth; last year, its population was estimated to have reached 15,000.
2. The region of Aqaba has considerable tourism potential. The nearest shore to Europe where swimming is possible in the middle of the winter, the 17 km Red Sea coastline acquired from Saudi Arabia includes splendid beaches along a sea noted for the limpidity of its waters, the range of its colors, the richness of its coral seabed and the abundance of its marine life. A range of barren hills running parallel to the coast, and the view of the mountains on the opposite side of the gulf, combine to render the surrounding landscape particularly dramatic. Within a 60-mile radius are the world-famous attractions of Petra, the carved-stone town founded by the Nabataeans in 2000 B.C., and the Wadi Ram desert with its contrasting plains and mountains. Assuming political stability in the country, this combination of tourism resources should have a strong year-round appeal for international visitors -- particularly beach-based and water sport-oriented vacationers, a segment of the international tourism market which has continuously increased in importance over recent years.
3. Aqaba's development prospects are not limited to tourism, however. Because of its geographic situation as a border and coastal town, Aqaba is a natural transportation center. The combination of favorable orographic, soils and climate conditions render some of its surrounding areas developable for agriculture. The availability of a good transportation network and of abundant labor enhances the region's prospects for gradual industrialization. Anticipating the progressive tapping of these resources, the new master plan predicts accelerated urban growth for Aqaba, with its population reaching 40,000 by 1990.

### Past and Current Development Plans

4. In recent years, the Jordanian Government has concentrated growing attention on Aqaba, one of the few areas in the country with real prospects for multi-sectoral development. Conceived in different periods and with the advice of various countries' technical assistance programs, Government's plans appear to be too fragmented, however. Projects are being considered in isolation with too little consideration of their interrelations. This has led in the past, and threatens to lead in future, to a type of uncoordinated development with consequent waste of efforts and economic resources.

#### A. Tourism

5. In 1966, the Jordanian Government engaged Doxiadis, A Greek consulting firm, for the preparation of a master plan for the development of the 17 km coastline south of Aqaba. Completed early in 1967, the Doxiadis Master Plan recommended that the Aqaba coast be developed in three phases -- 1968-1972, 1972-1985 and 1985-2000 -- through the implementation of both infrastructure and superstructure programs.

6. The infrastructure program includes the construction of a main coastal highway and of secondary roads serving individual accommodation facilities; as well as sewerage, water, electricity and telecommunication works. The program also envisages landscaping and general reforestation of the area, beach improvement works, the construction of artificial lakes to offer swimming options for visitors, and the building of docks, piers, and sport centers, including an 18-hole golf course.

7. The superstructure program calls for the construction, by the year 2000, of 16,000 beds in hotels, tourism villages, campings and residential villas, with individual targets for the first, second and third phases of 1,080, 3,250 and 11,670 beds, respectively. To provide a basis for regulating this accommodation build-up, the Master Plan presents a set of building standards.

8. The Doxiadis Master Plan is generally well-prepared. The program for infrastructure improvements is well-coordinated with that for superstructure development, and the proposed land and beach uses are based on internationally-accepted standards. The Plan has some drawbacks, however. Costs of several project components, such as beach improvements, landscaping, and reforestation are underestimated, and the market justification for the build-up of 16,000 beds is not thoroughly investigated. The estimates of prospective tourist traffic are based upon extrapolations of past trends which were influenced by too small a number of accommodations to be meaningful.

9. Upon completion by Doxiadis of the preliminary engineering for the first and second phase infrastructure works, the Government instructed (February 1968) the Ministry of Public Works to proceed with the detailed engineering and implementation of the coastal highway (which is now almost completed). However, political uncertainty and financial constraints dissuaded the Government from taking any further action with regard to the other components of the infrastructure program.

B. Transportation

10. The Government is dedicating special efforts to the expansion of Aqaba's transportation system. Improvement works to the port, which can now accommodate about 300 ships and handle 1.6 million tons of freight a year, are in progress with the assistance of the Federal Republic of Germany. When these works are completed by the end of 1973, the port will be able to handle over 3 million tons of freight annually.

11. Also with German financial assistance, work is continuing for extending the Amman-Hittieh railway to Aqaba. Completion of this project will provide a viable alternative to road transportation of Amman merchandise unloaded in the port of Aqaba, and improve the distribution of freight throughout Jordan.

12. A new international airport, located a few miles to the north of the town, was completed in early 1972 with UK assistance. It has a 3,000-meter runway and a terminal to accommodate some 200,000 passengers per year. Scheduled flights are in operation by Royal Jordanian Airlines and planned in-flight assistance and night-use equipment will be brought into service by mid-1973.

C. Other Sectors

13. The Government has various plans for agricultural development. Some of them are aimed at developing dry farming in the desert areas more remote from the town -- where specialized cultures (particularly vegetables and fruits) can be grown and a permanent farming population settled.

14. Government plans for industrialization propose to establish in the region an industrial and commercial free zone as well as an industrial estate where chemical, ship-building, and small food processing plants can be developed. A phosphate fertilizer plant has been planned for a site 15 km inland, although recently the Government began exploring the feasibility of locating the plant on the coast in order to reduce transportation costs.

15. Within the context of Aqaba's new master plan, works are being carried out for the construction of a new spur road connecting Aqaba with the southern highway. At the same time, a project is being implemented to provide the town with a new street and sewerage system together with expanded housing. Further, the Government is in the process of entrusting to Doxiadis the study for a supplement to the master plan of the coastal stretch from the port to the national border.

Need for additional studies

16. To foster economic development in the Aqaba region, the Government should undertake two distinct sets of additional studies - the first of a general, regional nature, and the second focusing specifically on tourism.

A. General studies

17. These studies should be aimed at establishing a more comprehensive overall design for future regional development - one which would eliminate the risk of uncoordinated economic growth and ensure that resources allocated for Aqaba be put to their best use.

18. Reviewing the plans elaborated for the various sectors and relating them one to the other, the studies should:

- (i) revise regional infrastructure needs in the light of prospective overall development, including tourism, industrial, agricultural and urban growth: e.g. studies should determine whether the Wadi Yatun water resources are sufficient to meet the prospective requirements (to 1985) of both Aqaba proper and the tourist accomodation planned along the 17 km coastline acquired from Saudi Arabia; and whether residual water would be left for irrigation purposes:
- (ii) detect possible contradictions: e.g. the studies should review the proposed location of both heavy and light industrial plants, in order to ensure that industrial development is not detrimental to other types of development (e.g. tourism and urban);
- (iii) identify all possible areas of savings; towards this end, the studies should (a) carefully look into the feasibility of multipurpose infrastructure projects (that might lead to economies of scale); and (b) submit proposed individual works to least-cost solution tests; e.g. the studies should investigate whether the establishment of an autonomous plant on the 17 km coastline, acquired from Saudi Arabia, to treat sewage effluent from prospective tourism development there, would not be a more viable proposition than channeling this sewage into the treatment plant existing at Aqaba.
- (iv) review current development plans, having regard to their interrelationships and complementarities: e.g. the studies should revise current agricultural plans in the light of both the conclusions of the investigation on expansion of regional water supply and on the likely growth of the population of the area, both permanent population and tourists.

B. Tourism Studies

19. These studies should be aimed at revising, updating and complementing the tourism development scheme the Government is preparing for the 17 km coastline acquired from Saudi Arabia. More specifically, the studies should include:

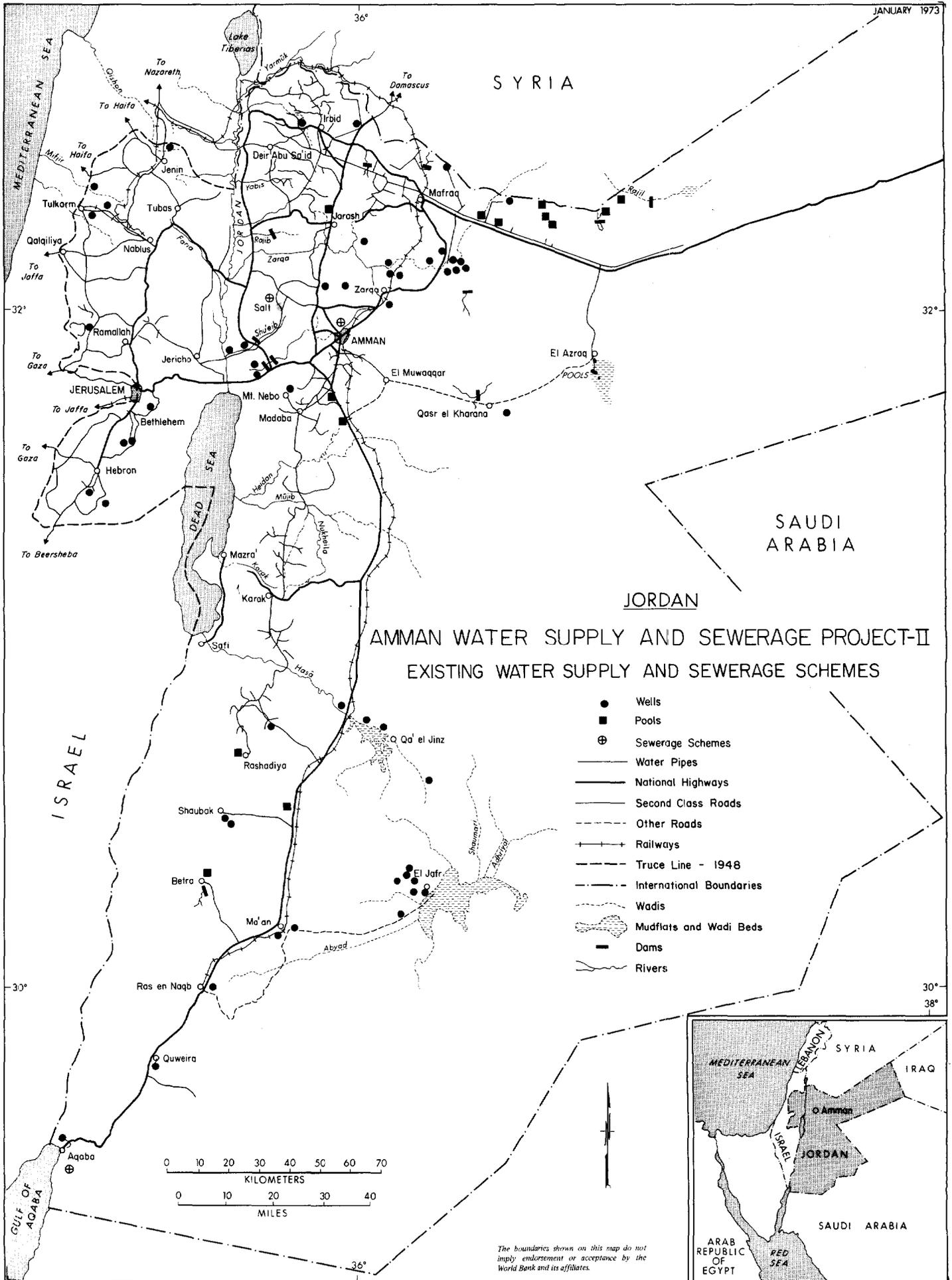
- (i) recommendations on how to reintegrate in the scheme works recommended by Doxiadis, but subsequently excluded by the interdepartmental committee;
- (ii) feasibility studies for a hotel training center, to meet prospective hotel personnel requirements in the region;
- (iii) detailed building codes and zoning ordinances to ensure orderly development in the project area;
- (iv) revision and updating of cost estimates of scheme's various infrastructure components;
- (v) strengthening and updating of the market and economic justification prepared by Doxiadis.

20. The appeal of the region for international tourism would substantially increase if the tourism resources being developed along the 17 km coast south of Aqaba could be "sold" with the attractions at Wadi Ram and Petra in the same "package". To provide easy access and better stop-over facilities in these two sites, the Government should undertake an independent study for improving the alignment and design standards of the road which runs from Aqaba to Petra and Wadi Ram, as well as for establishing minor infrastructure to serve the construction of an additional rest-house in Petra and of camping facilities in Wadi Ram.

Cost of the Additional Studies

21. It is expected that the above studies (paras. 18-20) would be carried out over an 18-month period and cost about US\$450,000, including a foreign exchange component of approximately US\$370,000 (i.e. 82% of total cost). The work would be coordinated and supervised by an inter-disciplinary committee set up within and directly responsible to the National Planning Council.





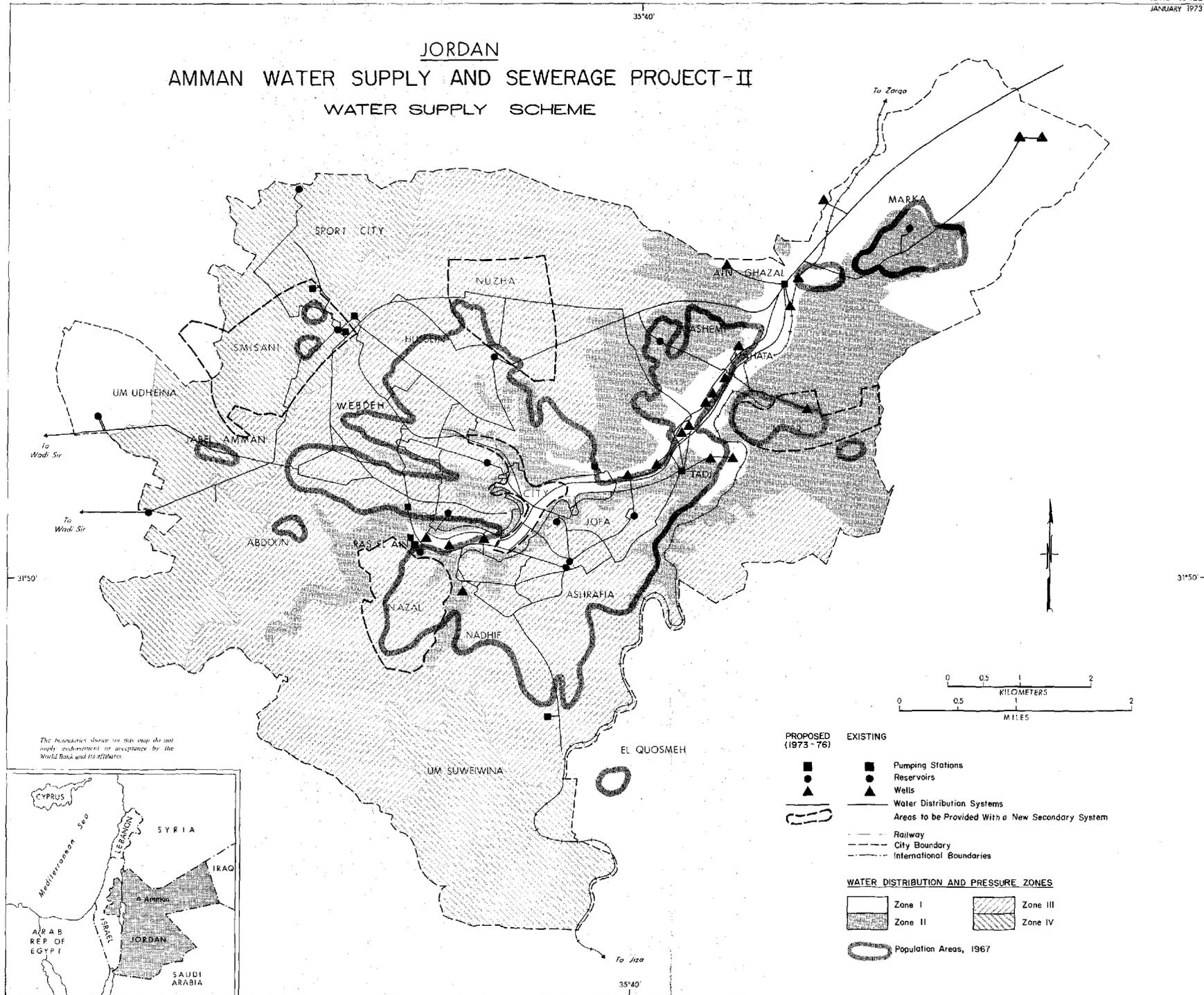
The boundaries shown on this map do not imply endorsement or acceptance by the World Bank and its affiliates.



# JORDAN

## AMMAN WATER SUPPLY AND SEWERAGE PROJECT-II

### WATER SUPPLY SCHEME



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

- |                           |  |
|---------------------------|--|
| <b>PROPOSED (1973-76)</b> | <b>EXISTING</b>                                    |
| ■                         | ■ Pumping Stations                                 |
| ●                         | ● Reservoirs                                       |
| ▲                         | ▲ Wells  |
| —                         | — Water Distribution Systems                       |
| —                         | — Areas to be Provided With a New Secondary System |
| —                         | — Railway  |
| —                         | — City Boundary                                    |
| —                         | — International Boundaries                         |

**WATER DISTRIBUTION AND PRESSURE ZONES**

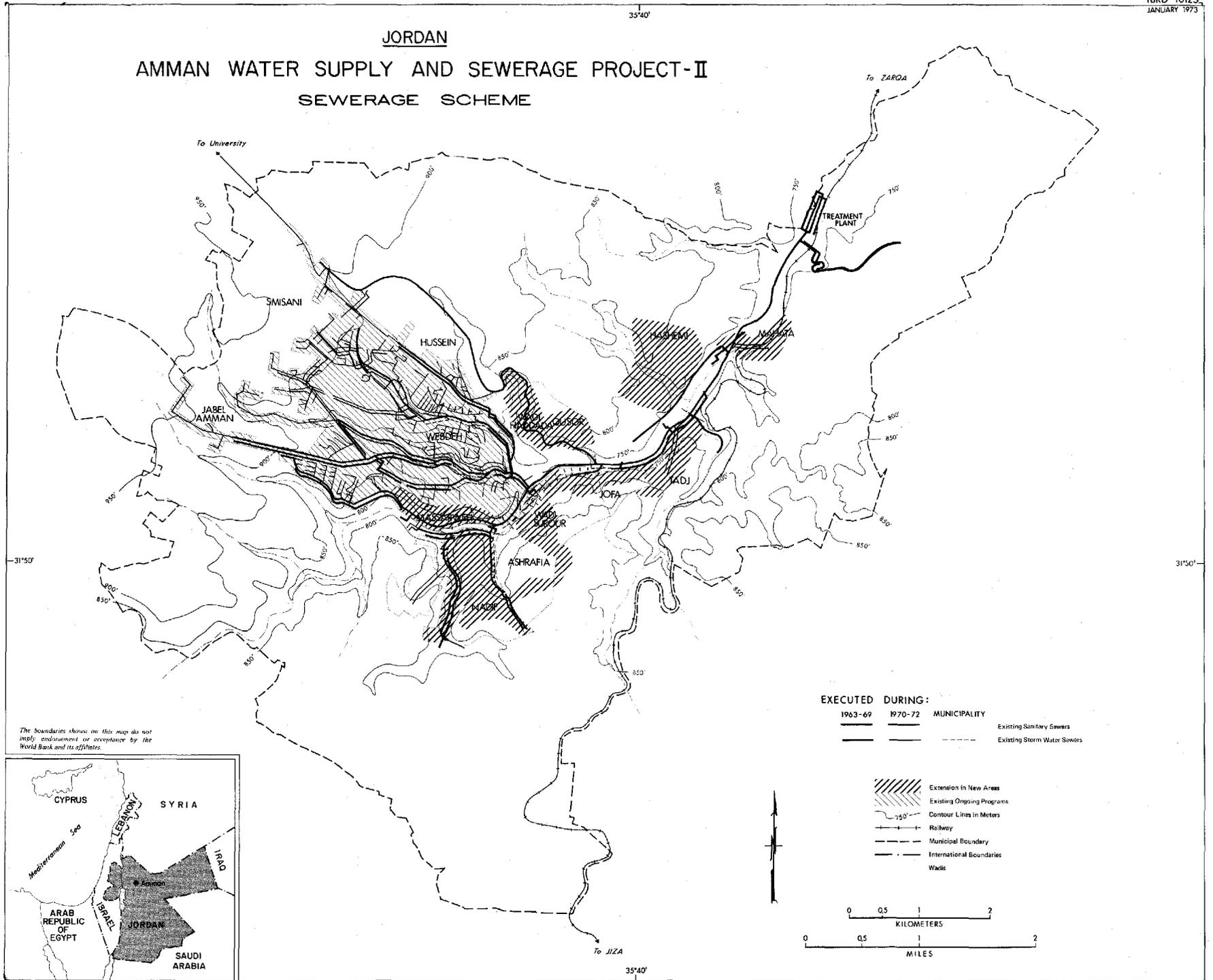
- |           |                          |
|-----------|--------------------------|
| □ Zone I  | ▨ Zone III               |
| ▨ Zone II | ▩ Zone IV                |
| ○         | ○ Population Areas, 1967 |



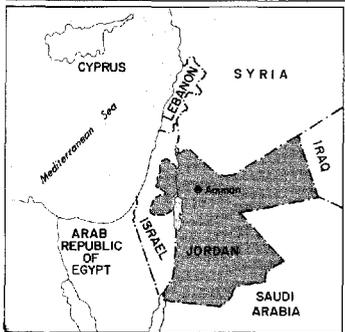
# JORDAN

## AMMAN WATER SUPPLY AND SEWERAGE PROJECT-II

### SEWERAGE SCHEME



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EXECUTED DURING:

1963-69	1970-72	MUNICIPALITY	Existing Sanitary Sewers
			Existing Storm Water Sewers

Extension in New Areas  
 Existing Ongoing Programs  
 Contour Lines in Meters  
 Railway  
 Municipal Boundary  
 International Boundaries  
 Wadis

